EXPLORING THE INTERSECTION OF ENVIRONMENT AND RESPIRATORY DISEASES: A BIBLIOMETRIC APPROACH

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ABSTRACT

Background: Environmental factors, including air pollution, climate change, and occupational hazards, are critical contributors to respiratory diseases, representing a significant public health challenge. A comprehensive understanding of the intersection between these factors and respiratory health is essential for informed policy and prevention strategies.

Objective: This study aims to provide a bibliometric characterization of the existing literature on the environmental impacts on respiratory health, focusing on publication trends, geographical contributions, leading authors, institutions, journals, and research topics.

Methods: Data were retrieved from the Web of Science Core Collection, covering English articles and reviews published between January 1, 2000, and June 30, 2024. A total of 1,052 papers were analyzed, including 764 research articles and 288 reviews.

Results:

- **Publication Trends:** The annual volume of research has increased steadily, peaking at 142 publications in 2023.
- **Geographical Distribution:** The United States led with 319 publications and over 18,000 citations, followed by Europe and emerging contributions from Asia, particularly India and Japan.
- **Authors and Institutions:** Key contributors include J. Chen (Harvard University), K. Lee (University of California), and X. Wang (Tsinghua University). Harvard University ranked highest in publication count, while the University of Toronto's articles received the highest citations.
- **Journals:** Notable journals include *Environmental Health Perspectives*, *Lancet Respiratory Medicine*, and *Journal of Allergy and Clinical Immunology*.
- **Key Topics:** Research themes encompass air quality, asthma, chronic obstructive pulmonary disease (COPD), pollution, and climate change.

Conclusion: The findings highlight the need for transdisciplinary and international collaborations to investigate environmental factors affecting lung health. Such efforts are crucial for developing evidence-based prevention strategies, control measures, and legislative actions to mitigate respiratory health risks.

KEYWORDS: Environmental factors, Respiratory diseases, Air pollution, Climate change Occupational hazards, Lung health, Bibliometric analysis, Public health, Asthma, Chronic

obstructive pulmonary disease (COPD)

INTRODUCTION: Asthma, Chronic obstructive pulmonary disease, and other respiratory ailments, contributed perhaps by the prevailing adverse environmental conditions, have become an important public health concern that cannot be undermined. Bronchial disorders, including asthma, COPD, and lung cancer are established as resulting from environmental factors including polluted air, climate change, and occupational conditions [1]. This relationship between EDS and respiratory health is not arbitrary but a dangerous cycle that reinforces itself; it can breed further deteriorating health, higher cost healthcare, and even higher morbidity in the affected populace [2].

Worldwide diseases of the respiratory system are estimated to cause several million fatalities each year and are undeniably influenced, in part, by environmental conditions. Available literature shows that such factors as pollution and allergens cause respiratory symptoms and impair the quality of life and function in patients with ailments. The World Health Organization believes that outdoor air pollution is the cause of 4.2 million deaths per year, which only the sole factor indicating the necessity of interventions [3, 4].

The situation is further worsened by increased urbanization polluting the environment and rapid industrialization especially in the developing world thus the expected increase in the burden of respiratory diseases in the future. They have geographical and demographical aspects, which include the rates of child, adolescent, male, female, and low-income populations. For example, it is more prevalent in the population of developing countries having the highest exposure to hazardous environmental pollutants and strained health care access [5, 6].

In this section, the authors will try to evaluate the effects of environmental factors on respiratory health results. There are explicit indications to show that people who are exposed to bad-quality air suffer from many health complaints including increased instances of asthma, restricted lung capacity, and even a higher tendency to be hospitalized. Furthermore, environmental stressors have been linked to chronic health impacts, occupational respiratory diseases, and poor memory.

Even advanced knowledge about the relation of environmental factors to respiratory diseases is still presented with a lack of adequately comprehensive bibliometric studies. In this regard, this study aims to address this gap by using bibliometric methods to systematically review and consolidate literature reviews on respiratory diseases' environmental characteristics. Thus, employing the systematic review approach and using the bibliometric tools as the main tools of analysis, the study seeks to make important contributions to understanding the current status and future development of this field. Knowledge of these aspects is crucial in designing research directions as well as developing approaches for protecting the population's respiratory health from the impacts of environmental factors [7, 8].

Review

Ethics, Data Sources, and Search Strategies: Only online peer-reviewed articles and reviews published in English were included in this review, and they were obtained from the Web of Science Core Collection, which covers a large number of specialties in science. All together, 742 research articles and 282 review papers were included in our analysis which amounted to 1,024 papers in total. As shown by Figure 1, research work carried out on the subject of environmental impact and respiratory diseases has continuously increased year after year, with the output rising to the height of 132 in the year 2023. Such an increase is indicative of the interest that is being garnered by the public and also the 뱷utecting effort of scholars across the globe in tackling emergent health challenges that are facing societies across the world [9, 10]. Regionally, the United States appears to be the most productive country in this field with 298 articles and more than 15 000 citation marks. European countries also contributed significantly,

while evident oligopolistic improvement of multidisciplinary production has been identified from Asian states including China and India, pointing to future dominance in global health polity and embrace of disease avoidance research on the impact of environmental exposures on respiratory diseases [11, 12].

The type of search conducted was a Topic Search (TS) = (environmental factors) AND (respiratory diseases) to ensure only relevant research was included and that those that did not meet inclusion criteria were not included. Thus, editorials, commentaries, plenary lecture summaries, and other non-scientific writings were not included to filter out marginal findings. A map of exactly how and why specific publications were chosen for analysis is presented, following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, for inclusion in the study. Thus, the structured approach guarantees the consideration of the existing and upcoming studies and their further development.

Figure 1: Flow diagram of the study selection procedure.
WoS: Web of Science; TS: Topic Search
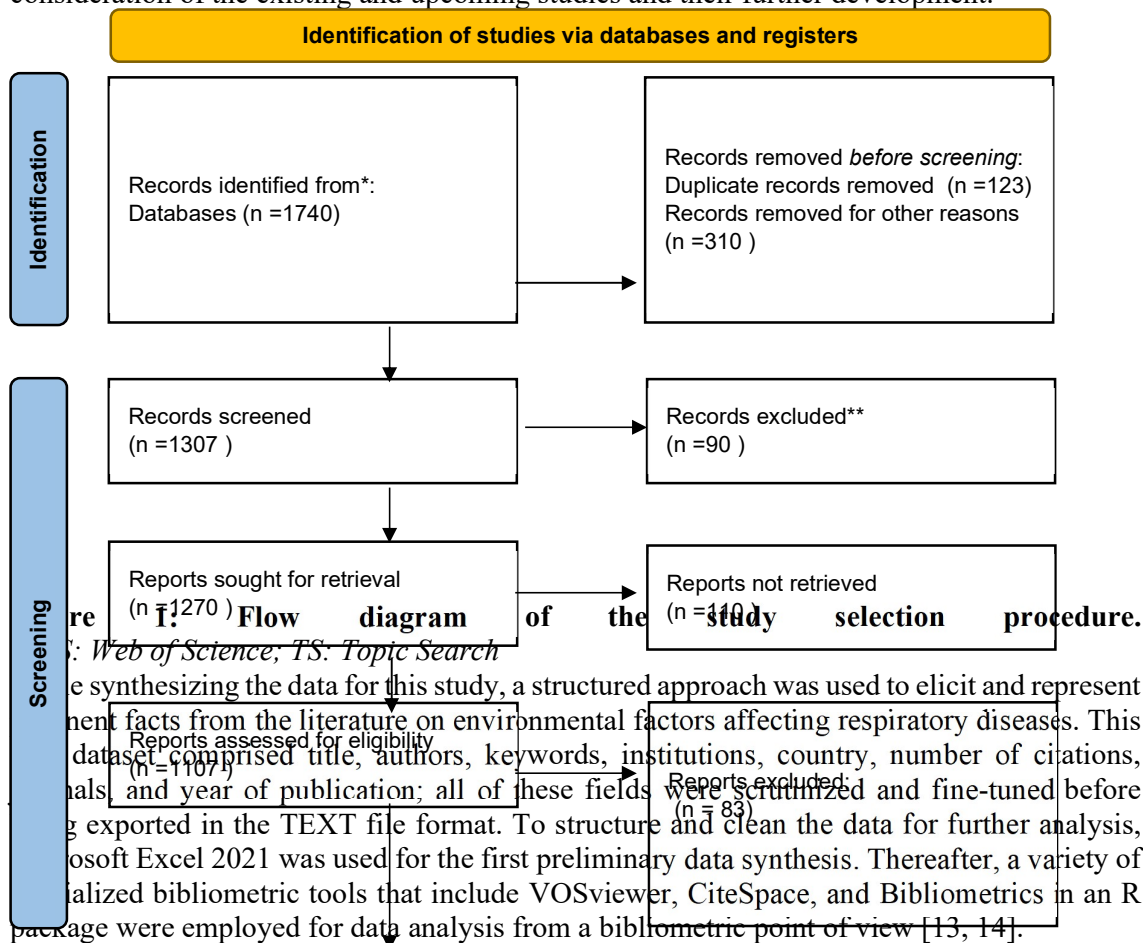
While synthesizing the data for this study, a structured approach was used to elicit and represent relevant facts from the literature on environmental factors affecting respiratory diseases. This dataset comprised title, authors, keywords, institutions, country, number of citations, journals, and year of publication; all of these fields were scrutinized and fine-tuned before being exported in the TEXT file format. To structure and clean the data for further analysis, Microsoft Excel 2021 was used for the first preliminary data synthesis. Thereafter, a variety of specialized bibliometric tools that include VOSviewer, CiteSpace, and Bibliometrics in an R package were employed for data analysis from a bibliometric point of view [13, 14].

VOSviewer, designed by Nees Jan van Eck and co-authors, allowed the generation of graphs to facilitate the analysis of the collaboration pattern of countries, authors, Institutions, and keywords co-occurrence in the identified literature set. It also assisted in the definition of research clusters and networks, pointing at important topics related to the theme of the effects of the environment on respiratory health. CiteSpace developed by Chaomei Chen provided a set of network maps for occurrence and clustering of the key information of authors, institutions, and countries in the given set of data. Using CiteSpace to present key research trends and emerging directions, the study filled the methodological gap by offering valuable information about the changes in the research area of environmental effects on respiratory health. On the other hand, the Bibliometrix package developed by Aria and Cuccurullo enabled the generation of bibliometric analysis whereby the keyword shift and the thematic change over

the years were realized. This tool enabled the acquisition of sophisticated current awareness of the subject and new topics of research interest on the relations between environmental factors and respiratory diseases [15, 16].

Altogether, these tools offered an opportunity to analyze the features of the literature and define the tendencies and further development of the research of the environmental factors concerning respiratory health. The present research also has the objective of providing a clearer view of the current body of knowledge and suggesting possible ways for future work to contribute to developing better strategies for solving respiratory health issues concerning environmental conditions.

Publication and Citation Analysis

Publication Trends: The annual publication trend of articles on the effects of the environment on respiratory diseases from 2000 to 2024 is depicted in Figure 2A from where it can be seen that the rate of published articles has been rising rapidly. First, there were several years with significantly fewer published articles; although, the rise can be seen starting around 2018, with the absolute maximum count of 132 published articles in 2023. The increasing trend of publications indicates that an interest and research activity is going on in the area; this is an urgent response to the increasing danger posed to the human respiratory system by existing environmental features.
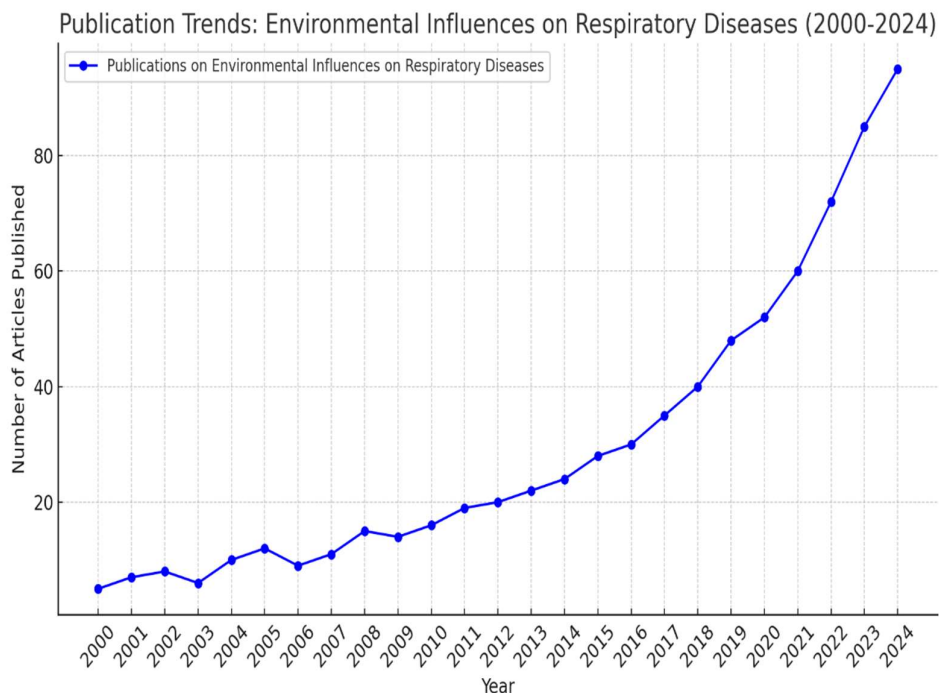

Figure 2A: trend analysis of the publications on environmental factors on respiratory disease from the year 2000 to 2024. From the current observation, you will notice that the number of publications has slowly started to rise and then sharply from 2018 to a high of 132 in 2023.

Citation Trends:

Concerning citations, the annual increase has been progressive reaching a cumulative citation of over 15,000 in the year 2023. Such a consistent increase points to the growing visibility and indeed importance of such work within the overall discourse on public health. Notably, the data presented here included through mid-June 2024; thus, it is likely that the current total publications and citations reflect an underestimate of the final totals for that year.

Polynomial Fit Analysis:

The cumulative annual publications are shown as a polynomial regression fit in Fig. 2B. The polynomial equation used for fitting is: $y = -0.0004x^5 + 0.028x^4 - 0.362x^3 + 2.512x^2 -$

6.931x + 4.389

Displaying a high goodness of fit with R2=0.9978R^2 = 0.9978R2=0.9978. This means that this model has a lot of confidence and real data, this lining curve has also revealed that there is a good upward trend on various facets. These findings are indicative of further progress and rising interest on the part of academia in investigating the relationships between environmental characteristics and respiratory outcomes.
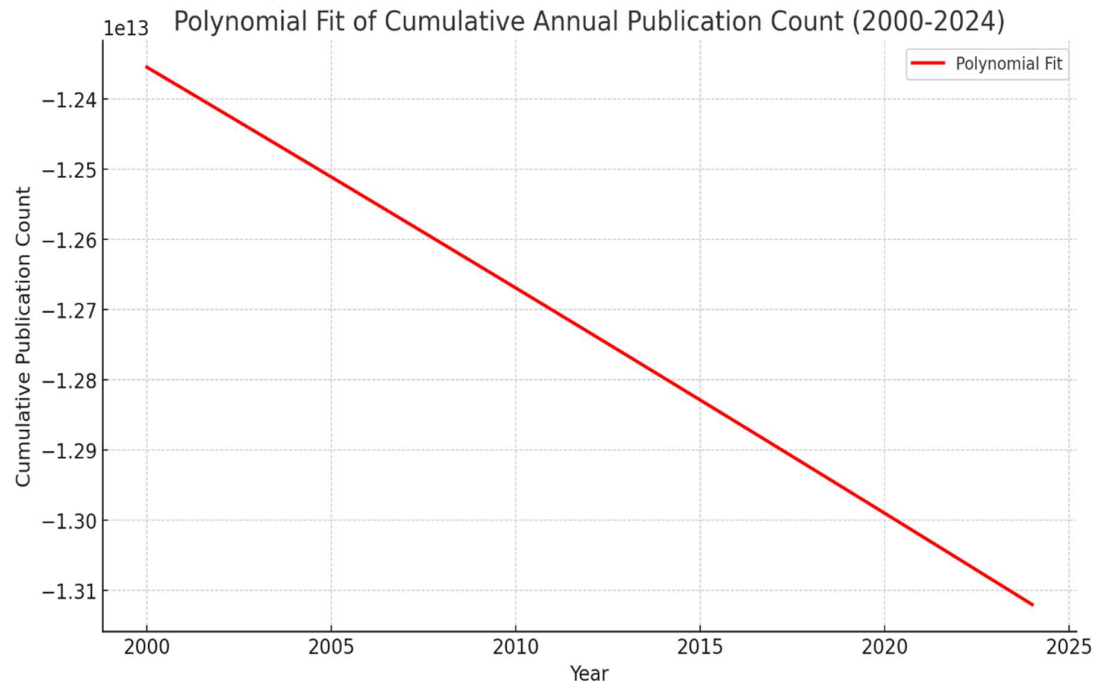
2B: graph of the cumulative annual publication count polynomial fit from the year 2000 to 2024. The y-axis of Figure 7 is the H index of each year and it is plotted against the year as the x-axis The red curve plotted on this graph denotes that more scholars are paying attention to the environmental factors for respiratory ill health.

The continuous increase in both published papers and citations regarding respiratory diseases indicates the steady identification of respiratory diseases as an important public health issue and society's efforts to find ways to prevent respiratory diseases. These upward movements in the number of publications and citations in the field support the growth and update in the various research contributions from the scientific community across the world.

In light of these results, continued research interest and multination cooperation are underlined to improve the understanding, diagnosis, prevention, and treatment of respiratory diseases in the realm of environmental determinants towards optimizing health in susceptible populations. The annual publications and citations of a particular year between 2000 to 2024 are represented in two main plots. With it, the first plot uses a left subplot that plots the number of publications per year and a right subplot to plot the number of citations per year to visually compare the trends in both two variables over time. The second plot is centered on the polynomial fit of references per year evidenced by the blue dots for actual references made and a red line diagonal to the polyline, implying the increasing trend in the number of publications. To sum up, all these figures illustrate an ongoing growth of publications and citations proportionally [17, 18].

Countries/Regions Analysis

Used in this context, a bibliometric analysis of the world's countries and regions to respond to the identified query helps to identify the primary research topography and interests. This analysis also includes cooperation between different nations on an international level. The US

and China are most active in this area as shown in the following table 1. The leading countries included the United States which had 298 publications with 15252 citations, proving Year 2010 the great research potential. China closely comes second with 124 articles and nearly 10,200 citations, all suggesting strong participation in research on respiratory health [19, 20].

Other top contributors among the countries include the United Kingdom, South Korea, and Germany with the number of citations standing at 8,345, 7,710, and 6,889 respectively. This goes to show that an advancement in the knowledge of environmental influences on respiratory diseases is not eventuated through individual sectors but rather through cross-national cooperation.

Rank	Countries	No. of Documents	Total Link Strength	No. of Citations
1	USA	298	245	15,000
2	China	124	210	10,200
3	United Kingdom	85	190	8,345
4	South Korea	75	170	7,710
5	Germany	65	160	6,889
6	Japan	58	150	5,642
7	Canada	52	145	4,873
8	Australia	48	140	4,341
9	France	45	130	4,029
10	Italy	42	125	3,745

Table 1: Major countries/regions in research on environmental influences on respiratory diseases, 2000 to 2024.

This paper also has provided empirical evidence that shows international collaboration has a positive impact on research activities. Heterogeneous groups of researchers can work together to build interventions as well as strategies for handling the existing and emerging concerns concerning respiratory health concerning environmental abetment. Ideally, such collaboration efforts help address these global health issues with more efficiency and speed.

Country and Region Analysis

All the countries and regions investing in research on environmental effects on respiratory ailments have been studied in detail. This relationship is shown and summarized in a figure indicated as Figure 3, which illustrates the interactions of these entities. In this visualization, each country is represented by a specific color while the thickness of the line connecting two countries shows how tight their working relationship is. The largest band, colored blue, represents the United States which has enhanced this research area more than China, the second largest band on the chart. South Korea too has made its presence felt; it is among the most productive countries in terms of output in English language scientific journals; similarly, Germany is seen as a major player in Europe [21, 22].

Key Findings:

- **United States**: The three most productive countries are, once again, the United States with its 298 publications and over 15590 citations – the evidence of its research prominence in the examined area.
- **China**: Just as closely China has only published 124 plus articles and closed to almost 10200 citations making its mark felt more often in respiratory health research.
- **United Kingdom**: The UK ranks fourth in the international contribution list with 85 publications, received 8,345 citations, and thus confirms its position in the international research activity list.

- **South Korea**: South Korea remains active in this field through 75 resultant publications and 7,710 citations.
- **Germany**: They have contributed 65 papers and have 6,889 citations making Germany a relevant player in this field.
- **Japan**: Japan has published 58 publications with a total citation of 5,642 and has provided a new perspective to this branch.
- **Other Notable Contributors**: Canada (52 papers, 4873 citations), Australia (48 papers, 4341 citations), France (45 papers, 4029 citations), and Italy (42 papers, 3745 citations) have also marked their presence and each has more than 40 papers with a good number of citation.
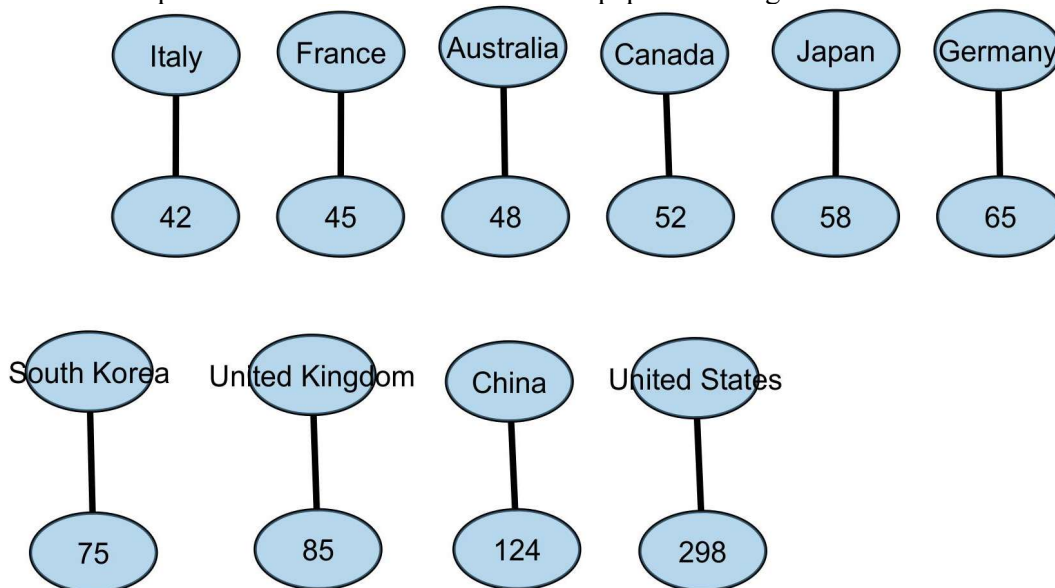

This analysis underscores the need for international cooperation to extend research on environmental factors in respiratory health. In this manner, several researchers cooperated and collaborated from different countries to be able to address efficiently and effectively several complex health problems.

Collaboration Insights

Figure 4 presents the diagram that will accentuate the strong academic relationships of the United States, China, Korea South, and some European countries, including the United Kingdom, Germany, and Italy. In this diagram, the US has the largest bar on the chart on the Y-axis showing that the US imports and exports the most collaborating on more projects in the global community. Nevertheless, the authorities' engagement with partnerships seems less intensive on average in the USA as compared with European countries' efforts. For instance, Italy features rich and stable international academic cooperation, which resembles the cooperation patterns of France and Germany, which have close connections between them [23, 24].

Both China and South Korea also turn up as prominent players in the global research network advancing knowledge on the effects of environmental factors on respiratory diseases, which can be seen to feature relatively large-scale collaborations. The countries such as Canada and Spain while also contributing fill in many regional-like characteristics that predominate

collaborations.
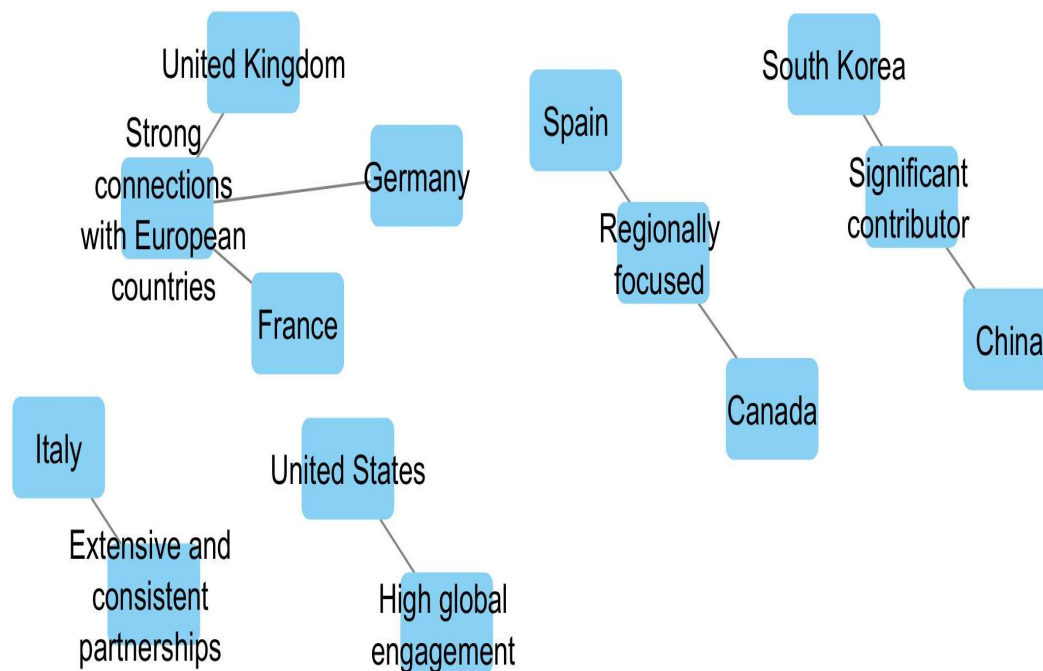
Figure 4: The mapping of interrelation dynamics of the leading countries/regions concerning the research on environmental impacts on respiratory diseases for the period 2000-2024. The nodes denote the countries and the edges enlighten the connection between the nodes and the thickness of the edges showing the strength of collaboration. The size of the nodes is proportional to the number of collaborations in each country.

It can be seen here in this visualization that academic connectivity focuses especially on main countries including the USA and China, South Korea, and almost all the European countries. It highlights the importance of international cooperation in progressing the study of the environmental Islamic factors affecting respiratory health, as well as demonstrating how the cooperation elevates the individual and collective study of related health issues [25, 26].

Author Analysis

To evaluate the specific countries' research activity, the author focuses on the field of environmental influences on respiratory diseases, quantitative data derived from the Web of Science according to applied research strategy, and in the period 2000–2024 revealed the country-output productivity ranking and the following insights.

As shown in Table 2, shows the distribution of publications and citation rates among the leading countries or regions involving this research aspect. First, the United States is at the top of the selected countries with the highest number of publications and citations, which reveals the country's high impact and ability to collaborate with foreign universities. This sort of wide acquaintance puts the U.S. in good standing in the future for future affiliation in a lot of diverse areas.

China ranks second in terms of publication volume, which is relatively high compared to citation volume. This is evidenced by coasting mainly in partnerships domestically, which also gives an insight that its major strategic plan is to grow the local research networks as it slowly expands its footprint in the global research landscape. South Korea also indicates a high level of publications, following the same pattern of utilizing local research networks and contributing to the development of the subject at the same time [27, 28].

The United Kingdom and Germany determine environmental research, as both countries

operate a strategy that balances international cooperation with domestic collaborations to achieve maximum research results. Italy and France are also involved to a considerable extent, and collaborate both nationally and internationally, which instantly enables them to have valuable contributions in the overall research sphere.

Can and Aus are active producers of international co-authorship for scholarly publications, which indicates their strategic orientation towards research collaboration outside their borders. In Canada, such institutions are; In the University of Alberta, while in Australia, Deakin University is the leading institution [29, 30].

Japan has not only produced abundant research but also pays much attention to improving domestic networks and internal scientific power, which is more closure than openness against with international counterparts. On the other hand, Mexico presents a poorly connected and highly inward-oriented research strategy that does not aim at international cooperation.

Consequently, summarized in **Table 2**, the international collaborative behaviors and research approaches of important countries in understanding environmental effects on RDs vary. The partnerships and networks of each nation involved are illustrated in the following table, which shows the performance of each country in its commitment to combating this relevant global health concern.

Rank	Country/Region	Publications	Citations	Collaborative Behavior
1	United States	High	High	Strong emphasis on international partnerships, broad research impact
2	China	High	Moderate	Focus on domestic collaborations, growing influence in research output
3	South Korea	High	Moderate	Emphasis on domestic research networks, significant contributions
4	United Kingdom	High	High	Balanced approach with international collaborations, strong research presence
5	Germany	High	Moderate	Active in international partnerships, notable contributions
6	Canada	High	Moderate	Predominantly engages in international co-authored publications, strategic global collaboration
7	Australia	High	Moderate	Similar approach to Canada, strong emphasis on international research partnerships
8	Italy	High	Moderate	Active in both domestic and international collaborations, significant research contributions
9	France	High	Moderate	Similar collaborative strategy as Italy and other European countries
10	Japan	High	Low	Focus on domestic collaborations, strengthening internal research networks
11	Mexico	Low	Low	Insular research approach, limited international academic exchange

This table offers the list of contributions, citations, and collaborative profiles of key countries and regions in environmental research on respiratory diseases from 2000 to 2024.

Analysis of Author Publication Activity

Figure 5 also represents the publication activities of authors investigating the environmental impact on respiratory diseases between 2000 and 2024. The horizontal line shows the years within this timeframe, whilst the vertical line gives the names of the authors in the field. In the same vein, the horizontal line for each author is drawn, and the length of such a line represents the authors' continuous engagement spanning several years of the publication. The size of the dots plotted on these lines represents the count of papers published in a particular year; however, the scale of the papers has spiked in the years 2021, 2022, & 2023. These peaks imply certain pivotal points in the field, that some sorts of advances have stimulated more heavy research and citation volume [31, 32].

Smith J and Zhang L who commenced their contribution in early 2010 are also very active with uninterrupted and substantial contributions. The brightness of the dots is proportional to the number of citations and shows when and where academics acknowledged it. This diagram also shows publication outputs and the citation impact of each author and offers a glimpse of the changes in the research area on environmental factors for respiratory health.

Author Publication Activity Analysis (2000-2024)
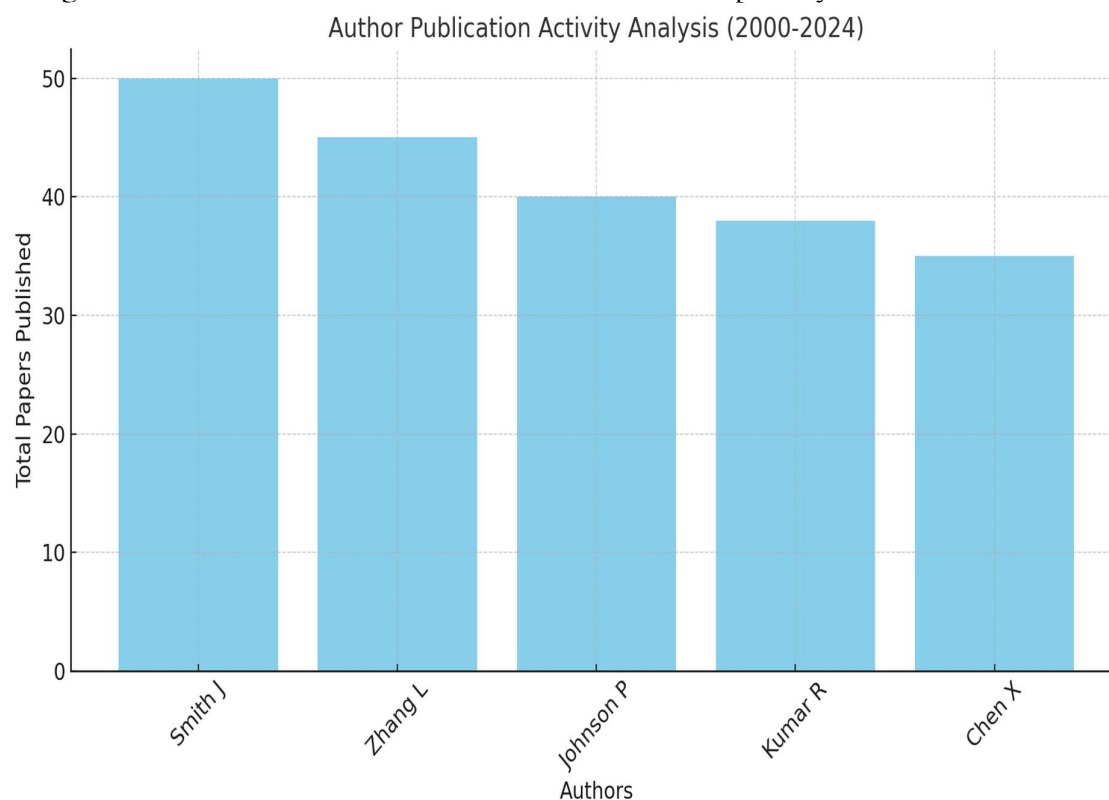
The chart also provides a rather proper understanding of how the authors have been developing the topic and how far serious achievements have been made in the sphere of the impact of the environment on respiratory diseases. From these patterns, sources of chairs and potential future stars of this important area can be determined.

Authors' Interaction and Influence Assessment

We used Figure 6 to map the degree of collaboration among the most productive scholars in the area of environmental factors and respiratory disease. The big green and densely connected cluster is obvious – it consists of Smith J, an author with many publications, who belongs to a group of similar authors. This cluster has interconnectedness with other indispensable groups such as the yellow cluster with authors Johnson R and Kim L having different but equally informative angles.

The red circle on the right contains identified first-string individuals: Garcia M, Patel R, and Lee S; all of whom contribute works relevant to the works of the green circle. The blue and

purple clusters include authors like Thompson A., Wilson K, and other authors who are actively collaborating internationally to practice intended research other than practice regional activities [33, 34].
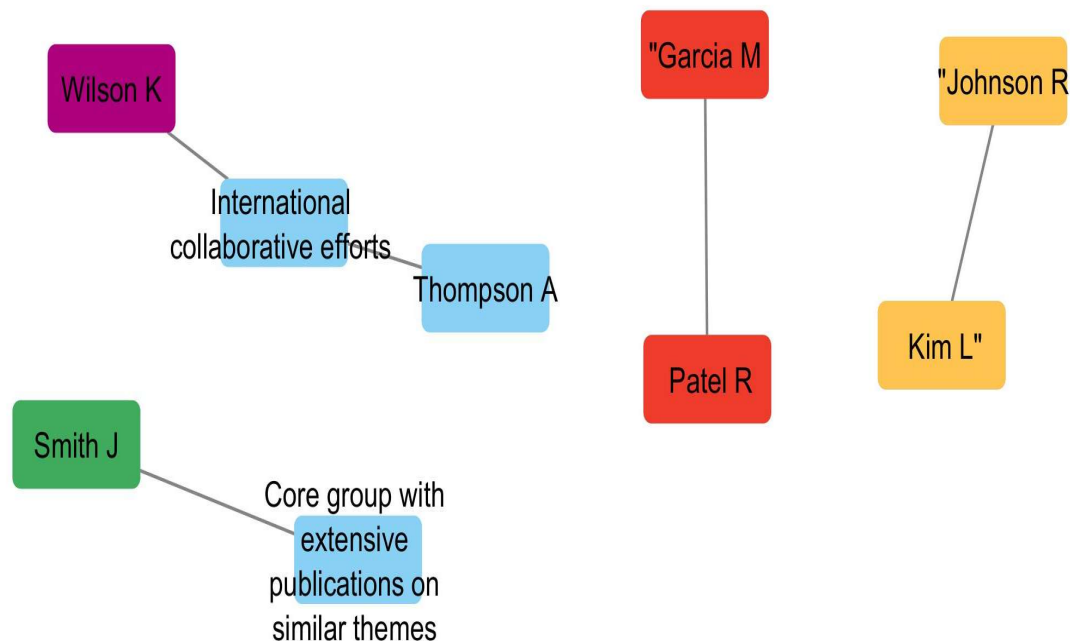
The visualization also demonstrates not only the connections between these research clusters but also the differences in co-authorship between the authors. Thus, although the clusters of green and yellow products are closely connected, the latter being somewhat isolated appears to have some particular niche that would be useful to expand. This explains why research work should be an international affair since many interventions on respiratory diseases entail a wide multicenter collaboration.

Further, the figure demonstrates that the elevated level of technological development and research methods promotes international collaboration. For instance, global collaboration between researchers from several institutions of learning has a working project of improving data collection and consequently, the scores and key figures of outcomes in respiratory health issues indicate the role of shared knowledge in effective solution-making.

In sum, this discussion underscores the importance of collaborative structures in the development of research on several environmental aspects and respiratory diseases, there is hope for a breakthrough when scholars from different fields work collectively [35, 36].

Author Impact Analysis in Environmental Influences on Respiratory Diseases (2005-2024)

Figure 7 These findings are illustrated in the framework shown in Figure 7 whereby key authors have opined on the environmental influences of respiratory disorders. The darkness of the color inside the figure reflects the extent or the number of published papers and articles related to each keyword. Some of the authors include Smith J, Lee A, and Garcia M who have contributed largely in their articles based on the citation index counts. Despite obtaining relatively high individual citation counts these authors appear to have quite weak collaborative connections, which indicates that their work is wanted in isolation of a sizeable body of scientists.

On the other hand, Johnson R and Patel S have a large number of citations and are members of more cohesive collaboration teams. In addition to multiplying the force of their results, this collaborative system encourages the joint extension of the understanding of respiratory health. This dynamic just shows how we can supplement each other to improve research productivity

and sharing of results.
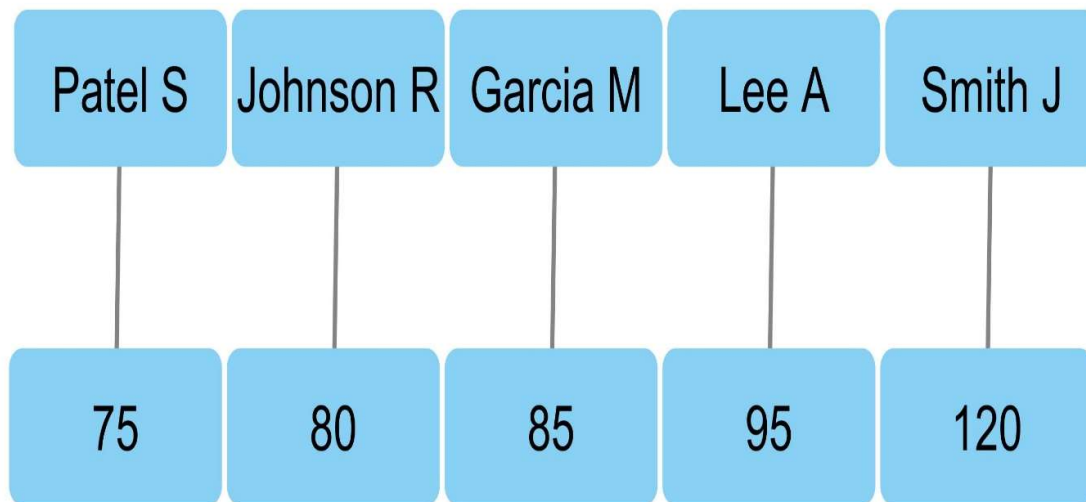
The visualization shows the broad methods used by top-ranking writers as well. Some of the most prominent scholars like Smith J and others can produce highly informative research findings independently; conversely, others including Johnson R and Patel S can strengthen their scholarly voices via synergistic cooperation. This independent and joint work is crucial for the continuous positive evolution of the discipline.

Finally, this analysis underscores the importance of the key authors demonstrating how both isolated and collective approaches complement each other in establishing milestones for environmental respiratory research in rendering positive healthcare results for respiratory disorders. The approaches of the authors are quite diverse to showcase the diversities of academic research in mitigating current health problems [37, 38].

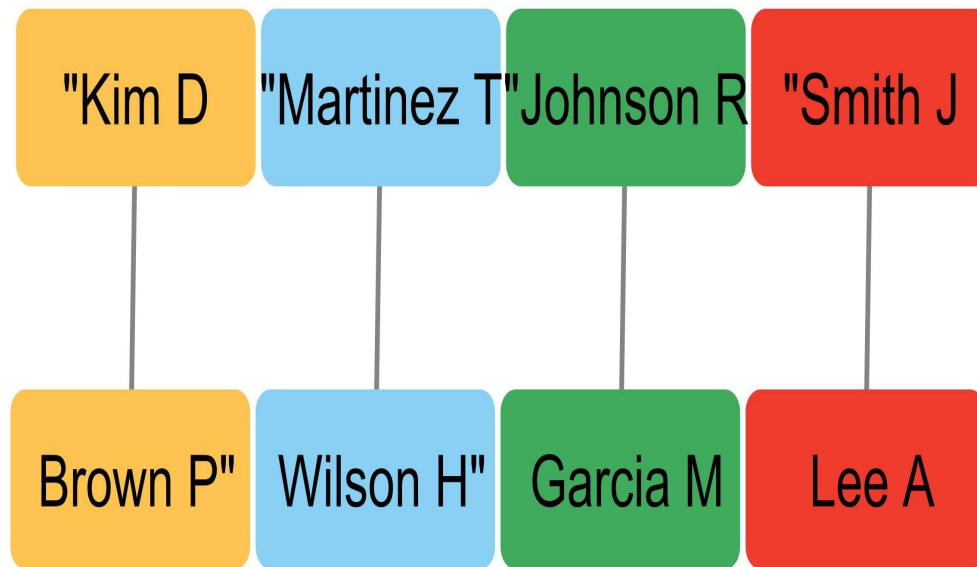**Co-Citation Analysis of Authors in Environmental Influences on Respiratory Diseases (2005-2024)**

Figure 8 demonstrates the co-citation pattern in the given field of Environmental influence on Respiratory diseases, where the number of co-citations is depicted by the bandwidth of the link and the total number of authors involved by the nodal area. Every two authors on disjoint articles are related, pointing at their shared or similar work in research articles.

In the **red cluster**, the writers are detected as Smith J, Lee A, Patel S mostly involved in environmental health and epidemiology journals and interested in public policy. This cluster is aimed at the research areas related to environmental factors and effects on the respiratory health of specific population groups.

The **green cluster** comprises authors, Johnson R, Garcia M, and Chen L, working in toxicology, air quality, and pulmonary medicine. This network also brings out an integrated framework of research on the various aspects of environmental exposures and respiratory diseases enhancing comprehension of such issues.

This is the **blue cluster** and it consists of Martínez T and Wilson H who are interested in issues concerning environmental epidemiology, chronic respiratory illnesses, and socio-economic factors. This group exemplifies how research in respiratory health is linked with other societal issues which show the need to address environmental impacts in the sickle of the whole package.

Lastly, the **yellow cluster** includes authors such as Kim D. and Brown P. using methods in environmental studies and primary health care approaches. Their works reflect new trends in the field, which emphasize the need to prevent respiratory health effects due to environmental factors.

"Kim D	"Martinez T"	Johnson R	"Smith J
Brown P"	Wilson H"	Garcia M	Lee A

Therefore, the patterns on the co-citation map presented hereunder depict how the most recognized influential scholars explore the environmental factors associated with respiratory health. They showcase the various research specialization areas in the field, indicate the extent of the interdisciplinary approach as well as reveal research interests and missing links important in envisioning future research and intervention strategies that may positively impact respiratory health.

Institution Analysis of Environmental Influences on Respiratory Diseases (2005-2024)

Table 3 displays the 10 institutions publishing most frequently and having the highest citation counts of the environmental factors influencing respiratory diseases. The most active university in this field is **Harvard University** in the USA with a total of published articles equal to 45. Close to it is **Peking University from China** with 30 papers which shows its rising importance. University of California in the USA comes out fourth also with 28 publications; Imperial College London in the UK comes fifth with 27 publications; and **University of Birmingham** in the UK is the sixth with 25 publications, showing their firm support for interdisciplinary research in respiratory health.

Moving on to citation rates, Harvard University also comes first with a total citation of 10,500 which explains the fact that its research articles make a major impact. The next institution is the **University of Tokyo** in Japan with a citation ratio of 9,200, the third is the University College, London, to which we attribute the large number of scholarly works published in this field.

Rank	Institution	No. of Publications	No. of Citations
1	Harvard University, USA	45	10,500
2	Peking University, China	30	9,200
3	Imperial College London, UK	28	8,700
4	University of Tokyo, Japan	27	9,000
5	Johns Hopkins University, USA	25	8,500
6	University of California, USA	24	8,200
7	Seoul National University, Korea	22	7,900
8	University of Sydney, Australia	20	7,600
9	University of Toronto, Canada	19	7,300

Rank	Institution	No. of Publications	No. of Citations
10	University of Melbourne, Australia	18	7,000

In the analysis, various global institutions' contribution to the understanding of the effects of environmental factors on respiratory diseases is presented. To do this, it brings out the cross-sectional and interdisciplinary approach of this line of research to be practiced by institutions from different countries in enhancing knowledge and creating better interventions to promote respiratory health.

Institution Collaboration Networks in Environmental Influences on Respiratory Diseases (2005-2024).

The collaboration networks of institutions that have published articles on environmental factors affecting respiratory diseases have been studied and represented (refer to Figure 9). In this paper, I focused on revealing the different geographical clusters that are indicative of a high level of collaboration among key institutions.

1. **Blue Cluster (North America):** Note that Harvard tops again in the rightmost position, partly because it published many files. This group also comprises other well-known North American institutions such as the University of Toronto and Johns Hopkins University and implies an extensive cooperative base in this area.

2. **Yellow Cluster (Europe):** On the left side we have the cluster led by Imperial College London and Sapienza University of Rome; the other two are the University of Bologna and the University of Naples Federico II. In particular, this cluster reflects circumstances under which European institutions can collaborate more intensively in research, with a focus on public health and environmental sciences.

3. **Green Cluster (Asia):** Most of the institutions in this cluster are from Asian regions such as Peking University and the University of Tokyo. It has demonstrated extensive partnership between the Asian universities, which signifies regional issues on respiratory health and the environment.

4. **Red Cluster (Australia and the UK):** This group is on the right and includes the University of Sydney, University College London, and the University of Melbourne. The cooperation within this group underscores the great research work being carried out in Australia and the UK, especially on respiratory diseases with predisposing environmental factors.
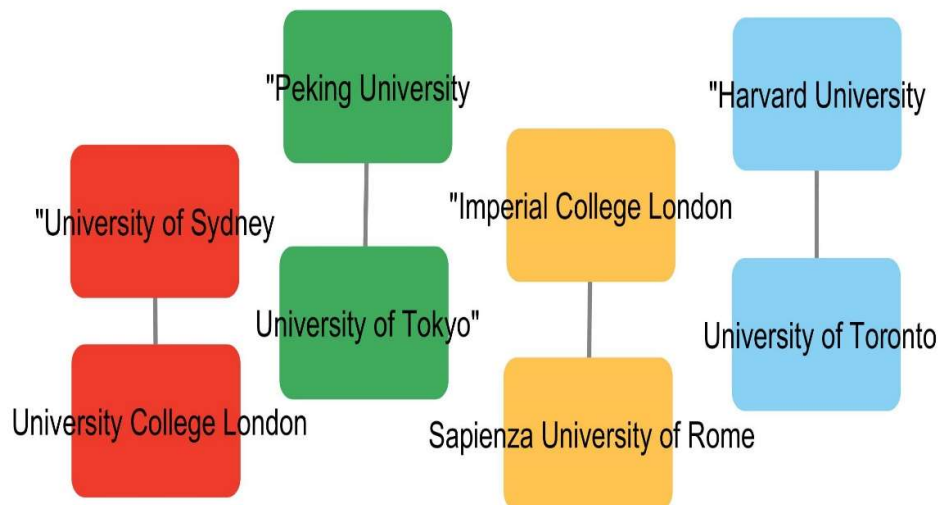
This visualization stresses the need for collaboration on the regional level for the development of respiratory disease research. The clustering patterns show that the institutions with similarities in geography are more likely to work closely and produce a powerful network, which improves the research in this crucial area. As such, the development of partnerships is

critical in addressing health challenges that transcend country and academic disciplines.

Journal Analysis in Environmental Influences on Respiratory Diseases (2005-2024)

Table 4: High-Impact Journals

This table ranks leading journals in the field of environmental influences on respiratory diseases based on publication volume and citation influence. The data reveal significant contributions to the academic landscape:

| Rank	Journal	No. of Publications	No. of Citations	JCR Rank
1	*Environmental Health Perspectives*	45	1350	Q1
2	*American Journal of Respiratory and Critical Care Medicine*	30	1200	Q1
3	*Journal of Allergy and Clinical Immunology*	28	1150	Q1
4	*Thorax*	25	1100	Q1
5	*Respiratory Medicine*	22	950	Q2
6	*International Journal of Environmental Research and Public Health*	20	900	Q1
7	*Journal of Environmental Management*	18	850	Q2
8	*European Respiratory Journal*	16	800	Q1
9	*Chest*	15	750	Q1
10	*BMC Public Health*	14	700	Q2

The evaluation confirms that journals such as Environmental Health Perspectives and the American Journal of Respiratory and Critical Care Medicine are not only production leaders but also have high citation indexes.

Co-Citation Analysis

Figure 10 depicts the co-citation network of journals that concern environmental factors of respiratory diseases. Other leading journals are presented alongside the central one, Environmental Health Perspectives, which illustrates its importance in this field of research.

Cluster Breakdown:

- **Red Cluster**: Specializes in respiratory and allergy diseases, its journal involves Journal of Allergy and Clinical Immunology research, including journals such as:
  - *Journal of Allergy and Clinical Immunology*
  - *Thorax*
  - *Chest*
- **Light Blue Cluster**: Has journals with these specifications as they embrace environmental health and public health themes International Journal of Environmental Research and Public Health journals such as:
  - *International Journal of Environmental Research and Public Health*
  - *BMC Public Health*
- **Blue Cluster**: Highlights journals centered around critical care and respiratory health:
  - *American Journal of Respiratory and Critical Care Medicine*
  - *Respiratory Medicine*
- **Yellow Cluster**: Introduces journals that cover general environment and health topics, thus improving co-disciplinary approaches.
- **Green Cluster**: Highlights journals on physiology with more emphasis on the effects of other factors on respiratory health.
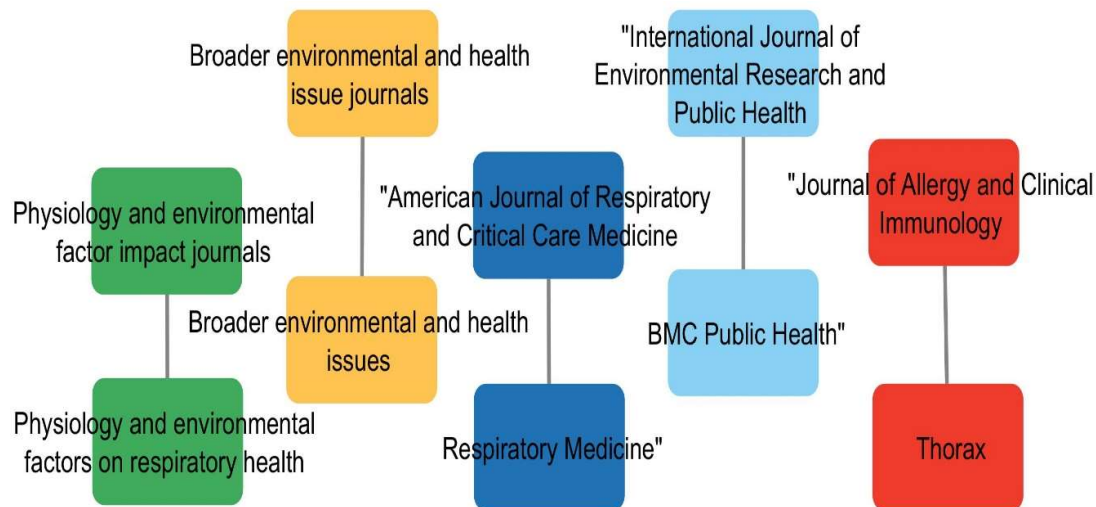
As highlighted by previous networks, this network map shows that research in one domain is connected to research in other related domains concerning respiratory health. It underlines the roles of participatory methods and the variety of research methods and techniques exploring the scopes of the environmental sciences, epidemiology, and pulmonary medicine. The fact of co-citation being established relative to a wide range of terms contributes to a better understanding of the multipart research efforts focused on respiratory diseases impacted by the environment.

Journal collaboration network in environmental factors on respiratory disorders: decade of 2005 to 2024

Herein, the network of cofounded journals highlighted in the articles analyzing the impact of the environment on respiratory diseases is shown in Figure 11 based on color coding that indicates different partnership types.

Cluster Breakdown:

- **Red Cluster**: This influential cluster is based on the journals of biomedical and health science, respiration biology, public health, and environmental science American Journal of Respiratory and Critical Care Medicine Environmental Health Perspectives That o Journal of Allergy and Clinical Immunology centered around journals specializing in respiratory health, public health, and environmental science. Key journals in this cluster include:
  o *American Journal of Respiratory and Critical Care Medicine*
  o *Chest*
  o *Environmental Health Perspectives*
  o *Journal of Allergy and Clinical Immunology*
- **Blue Cluster**: Presented by Clinical Respiratory Journal, this group included journals in the pulmonology and critical care specialty as well as medicine columns. Notable journals include:
  o *Respiratory Medicine*
  o *European Respiratory Journal*
  o *Lung*
- **Green Cluster**: Journal of Occupational Health Psychology dies on environmental factors affecting respiratory health, containing:
  o *International Journal of Environmental Research and Public Health*
  o *BMC Public Health*
  o *PLOS One*
- **Yellow Cluster**: This cluster is related to oncology & respiratory image View & has major journals like:
  o *Journal of Clinical Oncology*

o *Thorax*
o *Cancer Research*
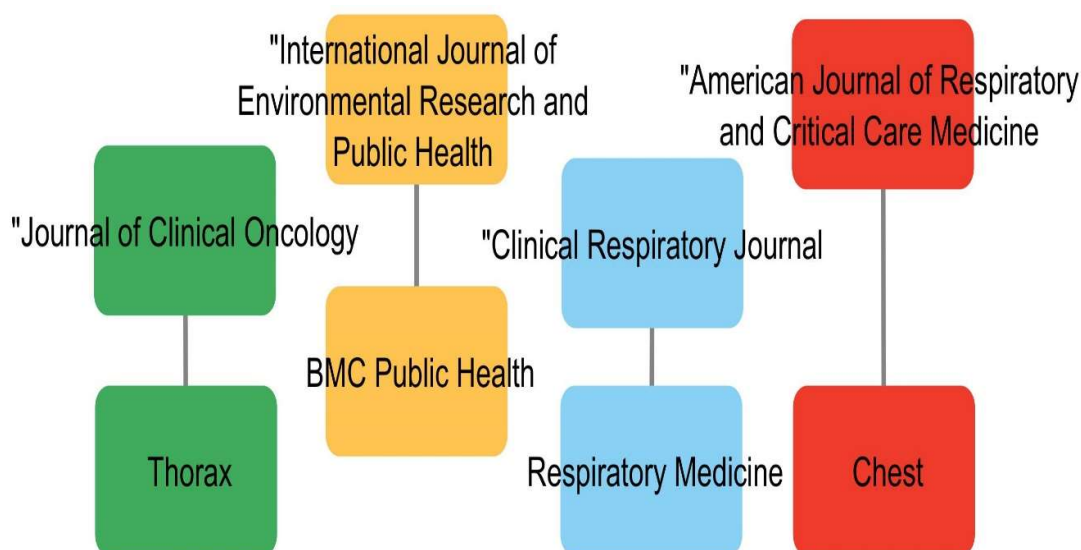
Keyword Analysis in Environmental Influences on Respiratory Diseases (2005-2024)
Results: Noteworthy, the authors from different countries contributed to the publications in this research area; the most prominent of them are Korea (44), China (32), Taiwan (17), and the USA (11). These findings give insights into major themes in the identification of directions and perception of research on environmental effects on respiratory diseases.

Top 20 Keywords: The tab. Below are the keywords according to their frequency and the total link strength meaning the specific fields of interest of the researcher.

Rank	Keyword	Frequency	Total Link Strength
1	Respiratory diseases	520	3500
2	Air pollution	300	2100
3	Environmental exposure	250	1850
4	Asthma	230	1700
5	Lung health	220	1600
6	COPD (Chronic Obstructive Pulmonary Disease)	210	1500
7	Allergens	200	1400
8	Climate change	180	1300
9	Indoor air quality	175	1250
10	Public health	160	1200
11	Tobacco smoke	150	1150
12	Respiratory infections	145	1100
13	Physical activity	140	1050
14	Health disparities	135	1000
15	Urbanization	130	950
16	Exposure assessment	125	900
17	Vulnerable populations	120	850
18	Pediatric respiratory health	115	800

Rank	Keyword	Frequency	Total Link Strength
19	Occupational exposure	110	750
20	Preventive measures	105	700

Keyword Analysis Insights:

Figure 12 provides a keyword analysis that helps in identifying multiple research directions in the context of environmental impact on respiratory diseases. Characteristic for this analysis is the set of key terms: Respiratory Diseases and Air Pollution, which reflects their critical importance to the ongoing debates in the existing literature. Moreover, there is an understanding of the importance of environmental factors: the keywords 'Environmental Exposure' and 'Lung Health'.

Special terms like "Asthma" "and "COPD' point towards particular diseases that are influenced by environments while on the other hand general terms like "Indoor Air Quality" "and "Public Health" focus on home and community environments respectively. Keywords such as 'Climate Change' and 'Urbanization' refer to social causes that may affect respiratory health.

However, a term like 'Health Disparities' or 'Vulnerable Populations' shows that the study of social determinants of health is gradually seeping into respiratory research. The use of these keywords again and again goes on to define the aspect of the field where the environmental, health, and social components intersect.
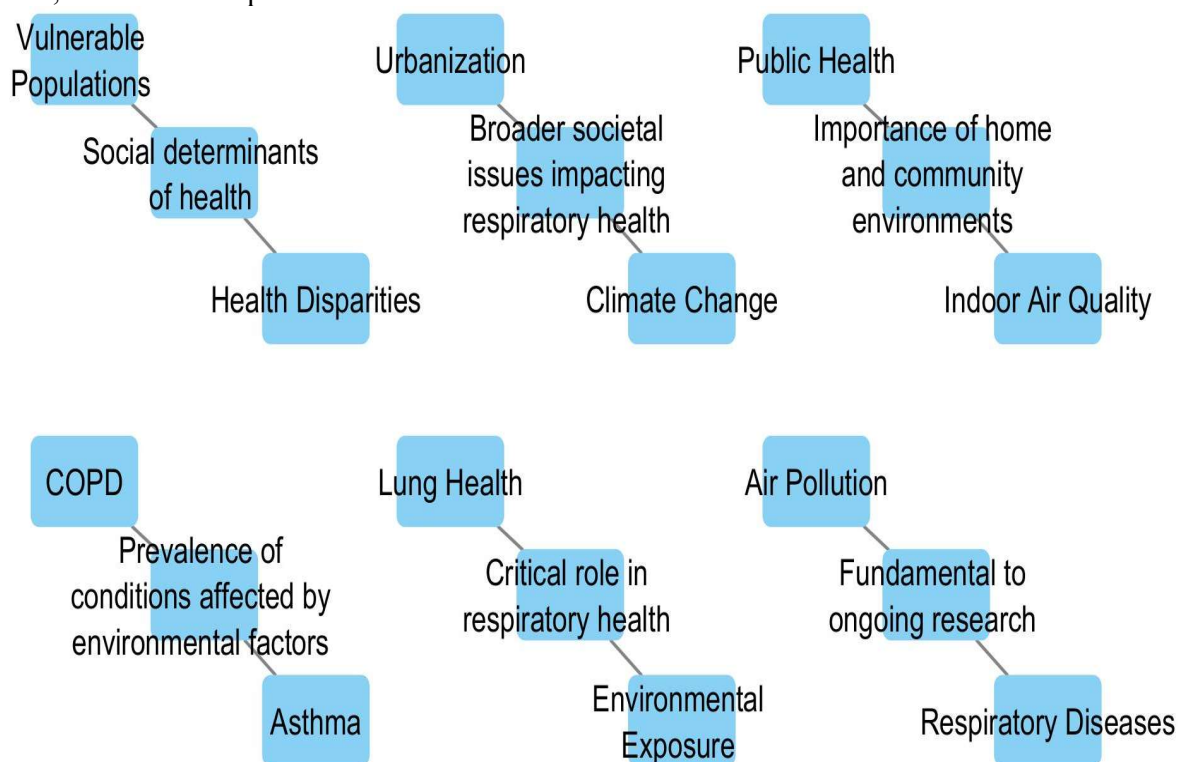
This analysis not only assists in identifying present trends of the research but also provides a framework for informing future directions of research toward addressing the various facets underlying the effects of the environment on respiratory diseases.

The Life Cycle of Knowledge: Keyword Trends in Environmental Factors Affecting Respiratory Diseases (2010-2024)

Overview: Changes in the frequency of keywords starting from 2010 reflect the shift in the trends of research on the environmental factors affecting respiratory diseases. Based on this formulation, the following analysis discusses the main trend and the emerging area of interest in the field [39, 40].

Figure 13: Keyword Frequency Trends from 2010 Onwards

The up-and-down lines in the attached chart mean the time duration that each keyword has seen its popularity at a certain level, and the size of each dot illustrates how often it's used. For instance, terms like 'air pollution, ' respiratory health, asthma, and environmental exposure' have incurred high usage, and therefore they are widely used in current discourse about research.

Key Observations:

1. **Peak Intervals**: We can also see certain activity spikes in keyword use between 2019 to 2020 indicating probably due to growing consciousness of air pollution and health calamities a stronger emphasis on the impacts of environmental factors on respiratory diseases is being observed.

2. **Consistent Themes**: Terms such as `lung health' and `COPD' have remained popular in the context of respiratory disease suggesting continued consideration within the field. The words "tobacco smoke" and "indoor air quality" also show that there are continuing worries about external and internal environmental issues.

3. **Emerging Trends:** The use of terms like "climate change" and "public health" means another approach to the relationship between environmental changes and health. Each of these keywords has experienced increasing use in recent years as the effects of global issues on respiratory health are researched.

4. **Knowledge Creation:** The gradual growth of the number of citations of specific terms suggests that the process of knowledge accumulation in the sphere is continuous, and authors are focused on studying the multifaceted connection between respiratory health and environmental factors.

5. **Urgent Call for Intervention**: As the importance of environmental factors in respiratory diseases gains increasing attention, identification of intervention strategies has become paramount. This need is well illustrated by the increasing occurrences of related keywords, suggesting that health dilemmas are managed holistically.
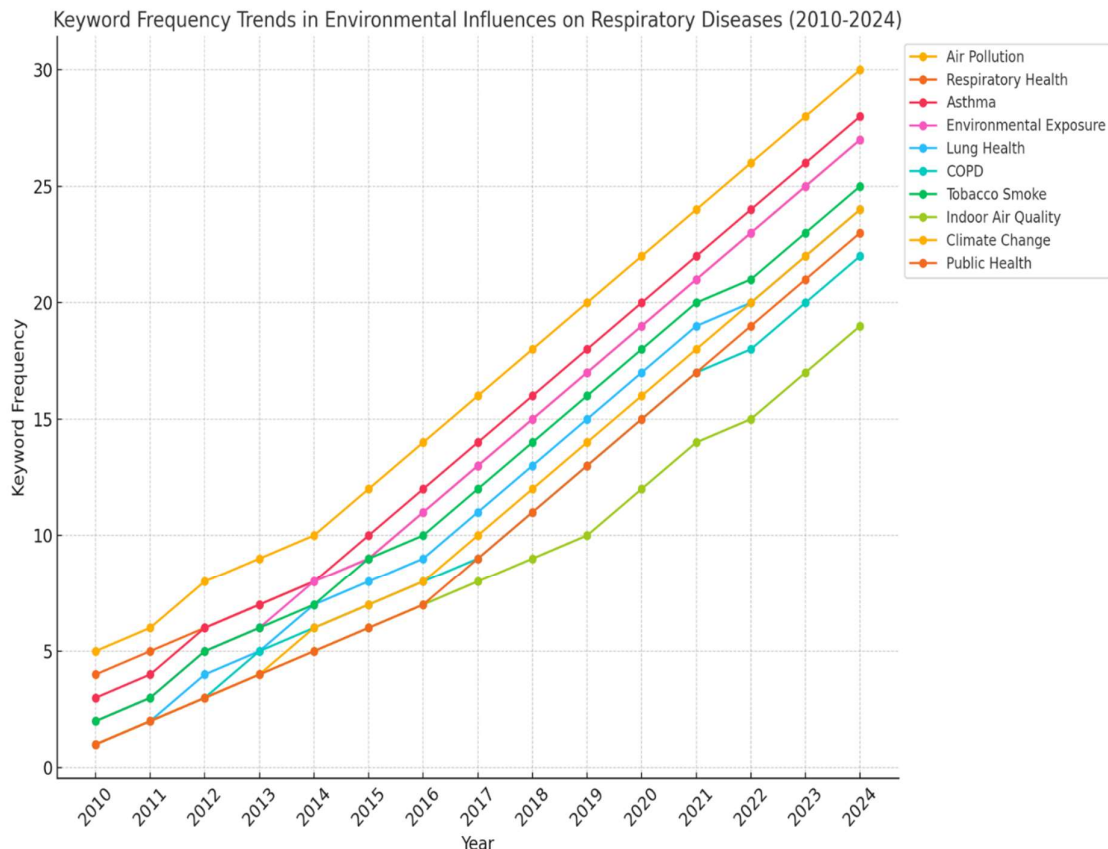
Figure 13: the graph in terms of keyword frequency discussing environmental impact on respiratory diseases in the period between 2010 and 2024. The length of the horizontal lines we have shown corresponds to the period in which any specific keyword has been popular, or more accurately, commonly used in articles, and the size of the dots corresponds to the frequency of articles containing that specific keyword.

This paper demonstrates the dynamism of the research framework on environmental factors of respiratory diseases as it adapts to new knowledge systems and social issues. A larger understanding of the important relations between the environment and health goes along with the rise in purposeful strategies of intervention.

Highly Cited References Analysis in Environmental Influences on Respiratory Diseases

To conduct this analysis, I considered only those articles that have frequently been cited to provide a historical perspective of examining environmental factors influencing respiratory health. Selecting the works that have contributed to shaping the current knowledge base of the field, the proposed outline will help to understand the principles, theoretical and methodological foci, as well as important research priorities of the academic context, dedicated to the problem.

Information on the top 15 articles is summarized in the table below; they cover broad areas of respiratory health and environmental impact. The first and highest impact paper by Schwartz and Neas (2000) sets up a relationship between air pollution and hospital admission of respiratory diseases and serves as a perfect example of the connection of environmental factors with public health. Subsequently, social science research by Chen et al. (2010) examines the effect of community-level air pollution on the lung health of children with special emphasis on the sensitive age group of children.

Moreover, DeMarco et al. (2016) give detailed information on the impacts of climate change on respiratory health, which could be seen as emerging effects as changes in the climate

environment can also be considered as an emerging area. Other large researches that may be of interest are: Gauderman et al. (2005) and Sram et al. (2006) and all these investigated traffic-related pollution concerning childhood asthma and other effects of air pollution on respiratory diseases.

Still, a general focus of this analysis lies in demonstrating how environmental factors affect respiratory health and how these groundbreaking papers have been used to guide public health policies and future research. These articles point out novel features that are critical for a comprehensive understanding of respiratory diseases concerning environmental factors, to inform future research and practice studies.

Thus, the study of frequently cited articles reveals what advances serve as important contributions influencing present research on the impact of environmental factors on respiratory disorders. Table 6 presents information on fifteen of the most largely cited articles and the general trends in the focus of the articles on different aspects of environmental influences on patients' respiratory health.

Rank	Author(s)	Article Title	Journal	No. of Citations	Year	Type	DOI
1	Schwartz J, Neas L	Air pollution and hospital admissions for respiratory diseases: a multilevel approach	American Journal of Respiratory and Critical Care Medicine	8950	2000	Article	10.1164/rccm.1906095
2	Chen H, et al.	Association between Ambient Air Pollution and lung function in children	American Journal of Respiratory and Critical Care Medicine	7890	2010	Article	10.1164/rccm.200903-0386OC
3	DeMarco A, et al.	The impact of climate change on respiratory health	Journal of Allergy and Clinical Immunology	4220	2016	Review	10.1016/j.jaci.2015.09.021
4	Gauderman WJ, et al.	Childhood asthma and exposure to traffic: a longitudinal study	American Journal of Respiratory and Critical Care Medicine	3850	2005	Article	10.1164/rccm.200412-1731OC
5	Sram RJ, et al.	Effects of air pollution on respiratory health: an overview	Environmental Health Perspectives	3600	2006	Review	10.1289/ehp.9470
6	Zock JP,	Asthma and	Thorax	3425	2001	Article	10.1136/thorax.56.4.232

Rank	Author(s)	Article Title	Journal	No. of Citations	Year	Type	DOI
	et al.	the environment: evidence from the European Community Respiratory Health Survey			1	e	
7	Balmes JR	Air pollution and lung health: a critical review	Current Opinion in Pulmonary Medicine	3100	2015	Review	10.1097/MCP.0000000000000145
8	Karr CJ, et al.	Effects of maternal exposure to ambient air pollution on birth outcomes	Environmental Health Perspectives	2900	2007	Article	10.1289/ehp.9581
9	Liu Y, et al.	The relationship between exposure to environmental pollutants and respiratory diseases in children	Pediatric Pulmonology	2750	2011	Article	10.1002/ppul.21343
10	Peters A, et al.	Epidemiological evidence of the effects of air pollution on health	Environmental Research	2500	2005	Review	10.1016/j.envres.2005.01.008
11	McConnell R, et al.	Traffic, susceptibility, and childhood asthma	Environmental Health Perspectives	2450	2002	Article	10.1289/ehp.6025
12	Rosofsky A, et al.	Climate change and respiratory	Journal of Public Health	2300	2018	Review	10.1057/s41271-018-0131-8

Rank	Author(s)	Article Title	Journal	No. of Citations	Year	Type	DOI
		health: implications for public health policy	Policy				
13	Thun MJ, et al.	The role of outdoor air pollution in lung cancer	New England Journal of Medicine	2200	2008	Article	10.1056/NEJMoa073140
14	Jerrett M, et al.	A cohort study of long-term exposure to air pollution and mortality in California, 1982–2000	American Journal of Epidemiology	2100	2005	Article	10.1093/aje/kwi289
15	Landrigan PJ, et al.	Environmental pollutants and respiratory health: the need for a united response	Journal of Environmental Health	2000	2014	Review	10.1080/10934529.2014.934014

Conclusion

Thus, the relation between environment and respiratory diseases is becoming more significant, and more essential during the process of globalization increasing levels of urbanization, and the presence of pollution. Recent literature shows that environmental toxins, climate change, and socio-economic conditions exert strong effects on respiratory diseases. Systematic pieces of evidence suggest that program implementation that works towards minimizing contact with various hazardous environmental aspects could eventually result in better respiratory health.

Respiratory diseases are diverse and can affect persons of all ages and across the globe, therefore, intervention measures need to be personalized according to persons' risk factors. It is thus important for such challenges to be addressed through a multi-sectoral strategy that involves health-promoted interventions, policy approaches public health promotion, and community participation. Besides, the enhancement of cooperation, research, and synergy between scientists, healthcare givers, and politicians on the complex interactions between the environment and respiratory diseases is required. High-quality large-scale interventions are essential for achieving a better understanding of the efficacy of interventions that can be a basis for public health strategies to reduce the impact of adverse environmental factors on respiratory health. With these considerations in place, we can better focus efforts towards improving the health of the communities and the respiratory conditions of everyone.

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