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ORIGINAL RESEARCH

Study on Chronic Obstructive Pulmonary Disease and Lung Cancer: Web of Science-Based Bibliometric and Visual Analysis

LiHong Xu[1,*], Peng Wang[2,*], YaNi Zhang[3], MuQi Wang[1], YaPing Li[1], WenHui Dang[4]

[1]Department of Infectious Diseases, the Second Affiliated Hospital of Xi'an Jiaotong University, Xi'an, Shaanxi Province, People's Republic of China; [2]Division of Neurosurgery, Xian XD Group Hospital, Xi'an, Shaanxi Province, People's Republic of China; [3]Academic Affairs Library, the Second Affiliated Hospital of Xi'an Jiaotong University, Xi'an, Shaanxi Province, People's Republic of China; [4]Department of Pulmonary and Critical Care Medicine, Xi'an, Shaanxi Province, People's Republic of China

*These authors contributed equally to this work

Correspondence: LiHong Xu, Department of Infectious Diseases, the Second Affiliated Hospital of Xi'an Jiaotong University, Xi'an, Shaanxi Province, People's Republic of China, Tel +8613772549800, Email xulihong9800@xjtu.edu.cn; Peng Wang, Division of Neurosurgery, Xi'an XD Group Hospital, Xi'an, Shaanxi Province, People's Republic of China, Tel +8613772549800, Email wangpeng_0918@163.com

Purpose: Chronic obstructive pulmonary disease (COPD) is one of the main risk factors for lung carcinomas. This study aimed to analyze and construct a model to assess scientific publications on the relationship between COPD and lung carcinomas.

Patients and Methods: A literature search of the Web of Science database was performed for publications until November 2, 2021. Microsoft Excel and CiteSpace software were used to perform bibliometric and visual analysis of source journals, countries/regions, institutions, authors, research areas, and hot topics of selected publications.

Results: A total of 2175 publications on the relationship between COPD and lung carcinomas were identified. The annual number of papers published and the total annual citation frequency in the field of COPD and lung carcinoma show an upward trend, and the current research hot topics are health, disease risk factors, disease burden, prevention and serious complications. The top three countries/regions with the number of published articles are the United States, China, and the United Kingdom. The author with the most signatures was Castaldi PJ of USA, followed by Xian JF of China. The lack of multinational/regional multi-center research illustrated that the distribution of research forces is unbalanced.

Conclusion: According to this study, researchers can identify hot topics and explore new research directions in research of the relationship between COPD and lung carcinomas.

Keywords: lung neoplasms, lung carcinoma, chronic obstructive pulmonary disease, bibliometrics, visualization analysis

Introduction

Lung neoplasms, also known as bronchial carcinoma, is one of the common malignant tumors. The morbidity and mortality of lung neoplasms have increased significantly in the past decade, including small cell lung cancer (15–20%) and non-small cell lung cancer (80–85%). Non-small cell lung cancer is dominated by squamous cell carcinoma (20–30%) and adenocarcinoma (40–50%).[1] In the global cancer burden, the incidence and mortality of lung neoplasms in women are second only to those of breast tumors, and in men they are the highest among all tumors. The five-year overall survival rate is only 17%, and it is estimated that there will be 2 million new lung cancer cases and 1.76 million lung cancer deaths each year.[2] The incidence and mortality of lung cancer increase with age, and peak at the age of 80–84 years.[3] The disease burden associated with lung neoplasms impairs the quality of life and functional status of patients,[4] so it is important to understand the multidisciplinary research results of lung medical oncology, molecular biology, and radiology for clinicians to precisely treat patients.

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Chronic obstructive pulmonary disease (COPD) remains the most prevalent health problem worldwide. More than 10 million COPD cases have been diagnosed in the United States, with about 12 million people still missed. Moreover, the mortality rate of COPD ranks third among people over 65 years old, and fourth among those 5–65 years old.[5] COPD has a high morbidity, hospitalization rate, and mortality rate in developed countries,[6,7] which is an independent risk factor of lung neoplasms. The incidence of lung neoplasms among COPD patients is 2–4 times that of non-COPD subjects, and more than 50% of newly identified lung neoplasms are associated with COPD.[8] The coexistence of these two diseases can lead to poorer prognosis and lower survival in patients.[9] Based on the above, this study intends to visually analyze the current status and trends of research on COPD and lung neoplasms, hoping to provide a reference for exploring the prevention and treatment of these two diseases.

Research trends can be analyzed and observed using bibliometrics, a type of quantitative statistical analysis.[10] In information science, bibliometrics plays an important role in both theoretical and practical research. A bibliometric method enables us to rapidly identify the features of literature, analyze and understand development processes, and identify research hotspots.[11] There is a wide application of bibliometric analysis today in a number of fields, including depressive disorder, pyroptosis, and electrochemiluminescence sensing technology.[12–14] There are, however, no summaries and evaluations of literature characteristics, research directions, research depth, and hotspots on the relationship between COPD and lung carcinomas. In order to provide a reference for future research, it is necessary to determine the current status of the relationship between COPD and lung carcinomas as a whole. In the present study, we analyzed the bibliometrics of the relationship between COPD and lung carcinomas publications until 2021 using CiteSpace software. And we have outlined the achievements, future research trends, and hotspots in this research area.

Materials and Methods

Data Sources

The Web of Science core collection database developed by Thomson Scientific Information Group in the United States was used to perform a publication search until November 2, 2021. Indexes: SCI-expanded, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-Expanded, IC.

Search Strategy

The first author searched published studies on the relationship between COPD and lung cancer. Each downloaded study included fully documented and cited references, and search strategies were developed by referencing literature.[15–19]

Search Term

TS=["lung neoplasms"or "bronchogenic carcinoma" or "carcinoma, bronchogenic" or "carcinomas, bronchogenic" or "small cell lung carcinoma" or "primary bronchogenic carcinoma" or "carcinoma, non-small cell lung" or "lung carcinoma, non-small-cell" or "non-small cell lung carcinoma" or "non-small-cell lung carcinoma" or "carcinoma, small cell lung" or "non-small cell lung cancer" or "cancer of lung" or "cancer of the lung" or "lung cancer" or "oat cell lung cancer" or "small cell cancer of the lung" or "small cell lung cancer" or "carcinoma, lewis lung" or "lewis lung carcinoma" or "lung carcinoma, lewis" or "carcinoma, small cell lung" or "oat cell carcinoma of lung"]AND["chronic pulmonary disease" or "chronic obstructive pulmonary disease" or "chronic obstructive lung diseases" or "pulmonary disease, chronic obstructive"].

Search Condition

Time span: Database establishment to November 2, 2021.

Literature type: ARTICLE.

Inclusion and Exclusion Criteria

After reading the title and abstract of the literature, we included the original published literature on the relationship between COPD and lung cancer. The plain text file from the W0S database was uploaded into the bibliographic co-occurrence software. Then, we extracted the "title". And to confirm whether they are two different documents or duplicate documents, we checked

the titles in the database with a result greater than or equal to 2. After automatic sequencing, two researchers read, identified and deleted the repeatedly published literatures, proceedings papers, meeting abstracts, editorial materials, letters, book chapters, early access, notes, book reviews, corrections, news items, reprints, retracted publications, retractions.

Literature Quantity

A total of 60,796 references were identified by November 2, 2021, and 2175 original studies, which related to COPD and lung cancer, were identified after excluding nonconforming and duplicates.

Analysis Methods

The distribution of collected publications in countries/regions, institutions, authors, journals and research fields was retrospectively analyzed. Descriptive data and bar charts were analyzed with Microsoft Excel 2019 for references, and bibliometric analysis was conducted.[20–22] The collected data were named download_xxx.txt, and the copied files were put in the created "Data" folder. Citespace5.8. R3 software was used to read and perform visual analysis. We show the research status of this field by country/region, institution and author co-occurrence, explore the hotspots and cutting-edge contents through a keyword emergence map, figure out the evolution path of this field through keywords timeline chart analysis, and predict the research prospect and future development by co-citation network analysis and cluster analysis. The text about software parameter settings is displayed in the upper left corner of the figures.

In the scientific knowledge graph, the node size is proportional to the frequency of co-occurrence/co-citation of the node. The node intermediary centrality of the purple outer circle is greater than or equal to 0.10, which plays a bridge role in the network structure and has the strongest explosive force in the future research process. The change process of node color from cold color to warm color represents the time sequence of its appearance from far to near. In the cluster analysis atlas, nodes with the same color are in the same cluster, and the cluster with high efficiency has greater than 0.7 of the average contour, and if the average contour of the cluster is 0.5~0.7, the cluster structure is reasonable. The diameter of the connection between nodes is directly proportional to the degree of cooperation, while the length of the connection between nodes is inversely proportional to the degree of cooperation.

Results

Distribution by Time

A total of 90,726 citations were reported in 2175 original research publications related to COPD and lung cancer, with an H index of 125, and an average of 41.71 citations per article. The first paper was published in 1976, and 5 papers were published during 1976–1990, 4–16 papers per year during 1991–2000 (99 papers in total), and 21–190 papers per year since 2001(2070 papers in total). As can be seen in Figure 1, the research heat related to COPD and lung cancer has increased with fluctuations since 2007. 162 original papers have been published in this research field this year, with a total citation frequency of 8920. It is predicted that the number of annual papers and total citation frequency in this research field will show a trend of continuous growth in the next five years.

Distribution by Journal

2175 papers are distributed in 808 journals, and most are published in respiratory and cardiothoracic surgery journals in the United States and Europe. The top 10 journals in total number of articles are shown in Table 1.

Distribution by Country/Region

The papers are from 91 countries/regions except 4 papers missing information of source countries/regions, and the top 10 countries/regions of papers published and intermediary centers are shown in Table 2. Several countries/regions with a large number of publications have a mediating centrality of 0 in the map of national/regional scientific research cooperation network, while URUGUAY with a small number of publications has the highest mediating centrality (1.31). The same condition also happens in countries with fewer publications but high intermediary centrality, such as SAUDI ARABIA, ICELAND, PAKISTAN and ESTONIA, which reflects the important reference value of relevant researches

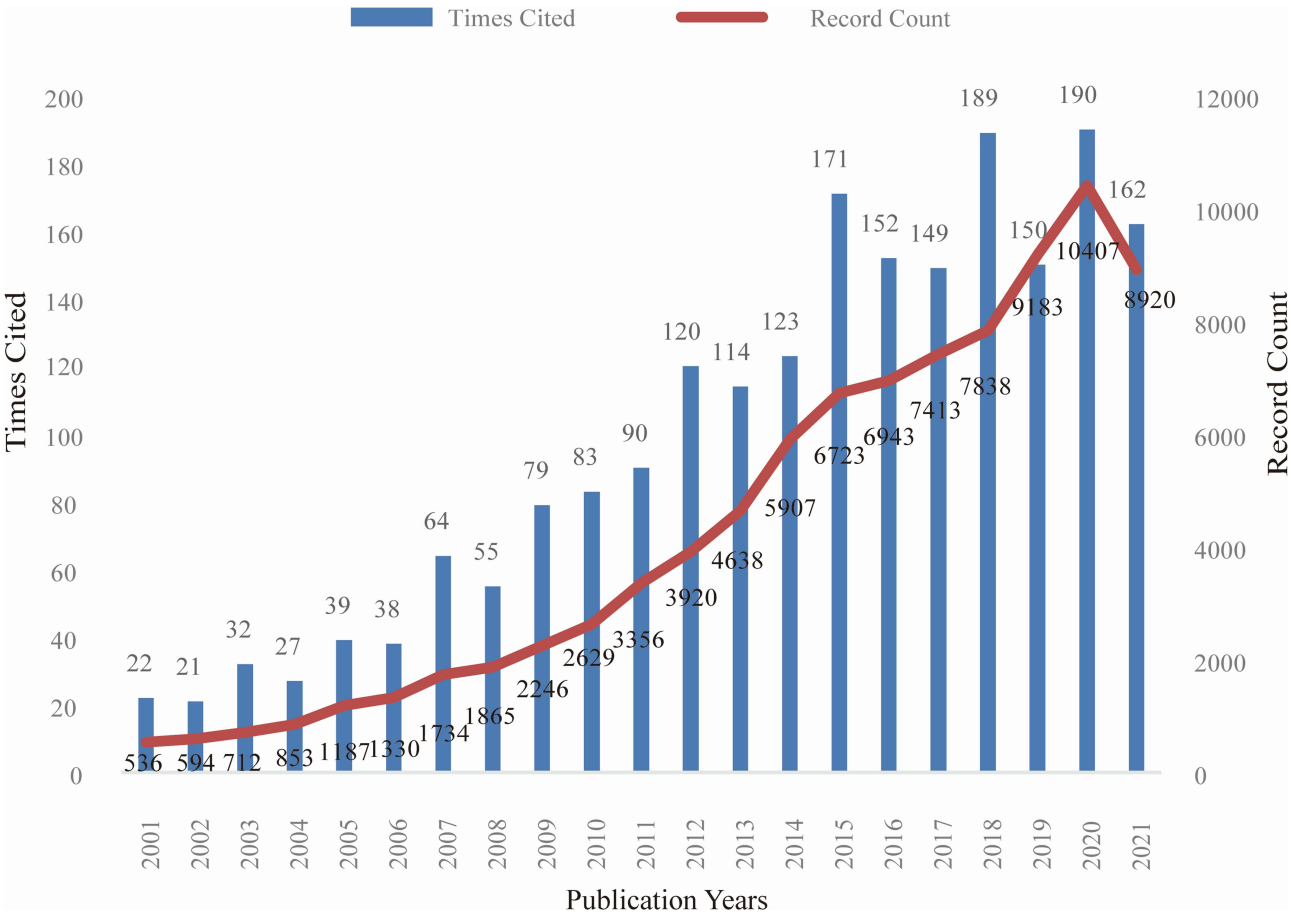

Figure 1 Time sequence of relevant papers on COPD and lung cancer published and citations from 2001 to 2021 in Web of Science.

carried out by the above countries/regions, and it may be related to the higher incidence of COPD in these countries such as URUGUAY (Figure 2).

In addition, Figure 2 shows 4 research teams, centered on URUGUAY, 12 countries including VENEZUELA, SOUTH AFRICA, BRAZIL, etc.; centered on SLOVAKIA, 5 countries including CZECH REPUBLIC, ROMANIA, HUNGARY; centered on BOLIVIA, PERU, COLOMBIA, ARGENTINA; centered on INDIA, including MALAWI, NIGERIA, MEXICO. China has a large number of publications but less cross-country/regional scientific research cooperation, which may also be related to the low bridging role of Chinese literature.

Table 1 Top 10 Productive Journals in Field of COPD and Lung Cancer

No.	Journals	Counts	IF2020
1	*PLoS ONE*	62	2.74
2	*European Respiratory Journal*	56	12.339
3	*American Journal of Respiratory and Critical Care Medicine*	50	17.452
4	*European Journal of Cardio Thoracic Surgery*	45	3.486
5	*International Journal of Chronic Obstructive Pulmonary Disease*	42	2.772
6	*Annals of Thoracic Surgery*	29	3.639
7	*Lung Cancer*	27	4.702
8	*Respiratory Medicine*	27	3.095
9	*Journal of Pain and Symptom Management*	26	3.077
10	*Journal of Thoracic Oncology*	26	13.357

Table 2 Top 11 Countries/Regions in Terms of Number of Publications and Intermediary Centrality

Rank.	Country/Region	Counts	Centrality	Year	Country/Region	Counts	Centrality	Year
1	USA	675	0.23	1976	URUGUAY	2	1.31	2012
2	PEOPLES R CHINA	256	0	1997	SWEDEN	57	0.59	1995
3	ENGLAND	222	0.04	1995	SAUDI ARABIA.	7	0.41	2010
4	JAPAN	168	0.04	1998	NEW ZEALAND	19	0.4	2007
5	SPAIN	147	0	1997	ICELAND.	4	0.34	2012
6	GERMANY	122	0.1	2000	FINLAND	18	0.33	1998
7	CANADA	121	0	2001	PAKISTAN.	7	0.3	2015
8	ITALY	112	0	1994	ISRAEL	16	0.29	2001
9	NETHERLANDS	111	0.1	1997	SINGAPORE.	10	0.23	2008
10	SOUTH KOREA	97	0	2000	ESTONIA.	4	0.2	2011
11	AUSTRALIA	75	0.04	1994	FRANCE	67	0.2	1997

Distribution by Institutions

Except for the lack of institutional signatures for 4 articles, 2171 articles were signed by 2993 institutions. The top 10 institutions in terms of the number of articles published and intermediary centers shows in Table 3. European and American universities such as Boston University, Harvard Medical School have close cooperation with scientific research institutions of other countries, and play a more important role in guiding academic research direction in the research field related to COPD and lung cancer (Figure 3).

Distribution by Author

Of the 12,196 authors, 29 authors signed 10 or more articles, led by Castaldi PJ (USA, 19 articles), of Brigham & Womens Hosp, Channing Div Network Med, followed by Xian JF (China, 16 articles) of State Key Lab Resp Dis, Inst Chem Carcinogenesis, Collaboration Innovat Ctr Environm Tox, Guangzhou Med Univ, and Weingartner V (German, 15 articles) of Dept Palliat Med, Univ Hosp Cologne. In addition, the mediating centrality of published papers by Bakke Per (Norway, 13 papers) of Univ Bergen of Bakke Per of Dept Clin Sci and Zanen Pieter (the Netherlands, 7 papers) of Univ

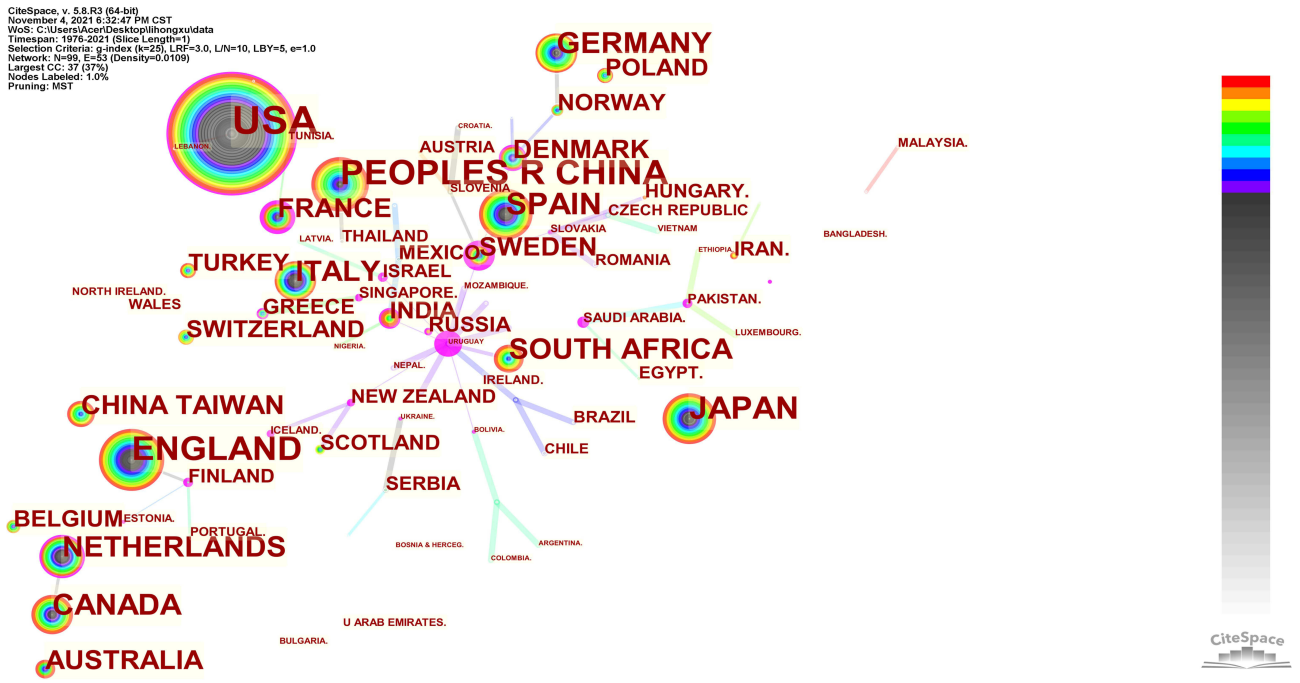

Figure 2 Map of country/region related to COPD and lung cancer research.

Table 3 Top 10 Institutions in Terms of Number of Publications and Intermediary Centrality

Rank.	Institution	Counts	Institution	Centrality
1	Harvard University	90	Boston Univ	0.34
2	University of California System	67	Harvard Med Sch	0.3
3	University of London	64	Univ Edinburgh	0.3
4	US Department of Veterans Affairs	59	Harvard Univ	0.26
5	Veterans Health Administration Vha	58	Univ British Columbia	0.25
6	Brigham Women S Hospital	53	Brigham & Womens Hosp	0.24
7	National Institutes of Health NIH USA	52	Univ Liverpool	0.14
8	Johns Hopkins University	48	Hlth Effects Inst	0.14
9	Ciber Centro De Investigacion Biomedica En Red	47	Mayo Clin	0.11
10	Pennsylvania Commonwealth System of Higher Education (PASSHE)	46	Cambridge Biomed Res Ctr	0.11

Med Ctr Utrecht are both 0.01, and which by other authors are all 0. Three main author clusters are shown in Figure 4, and cluster 2 (1.000) is centered on Bakke Per, consisting of 30 scholars including Crapo JD and Castaldi PJ; cluster 3 (0.989) is centered on Zanen Pieter, composed of 29 scholars including Van Klaveren RJM GAGA and GAGA M; cluster 4 (0.991) is composed of 19 scholars including Wenzlaff AS, Gadgeel SM and Schwartz AG, but there is little cooperation between them and the outside world.

Distribution by Discipline

2175 articles covered 120 subdisciplines, including Respiratory System (672, 30.897%), Oncology (347, 15.954%), Medicine General Internal (281, 12.92%), Public Environmental Occupational Health (229 articles, 10.529%), Cardiac Cardiovascular Systems (159 articles, 7.31%), Surgery (144 articles, (6.621%), Biochemistry Molecular Biology (106, 4.874%), etc.

Figure 3 Map of institutions' collaborations related to COPD and lung cancer research.

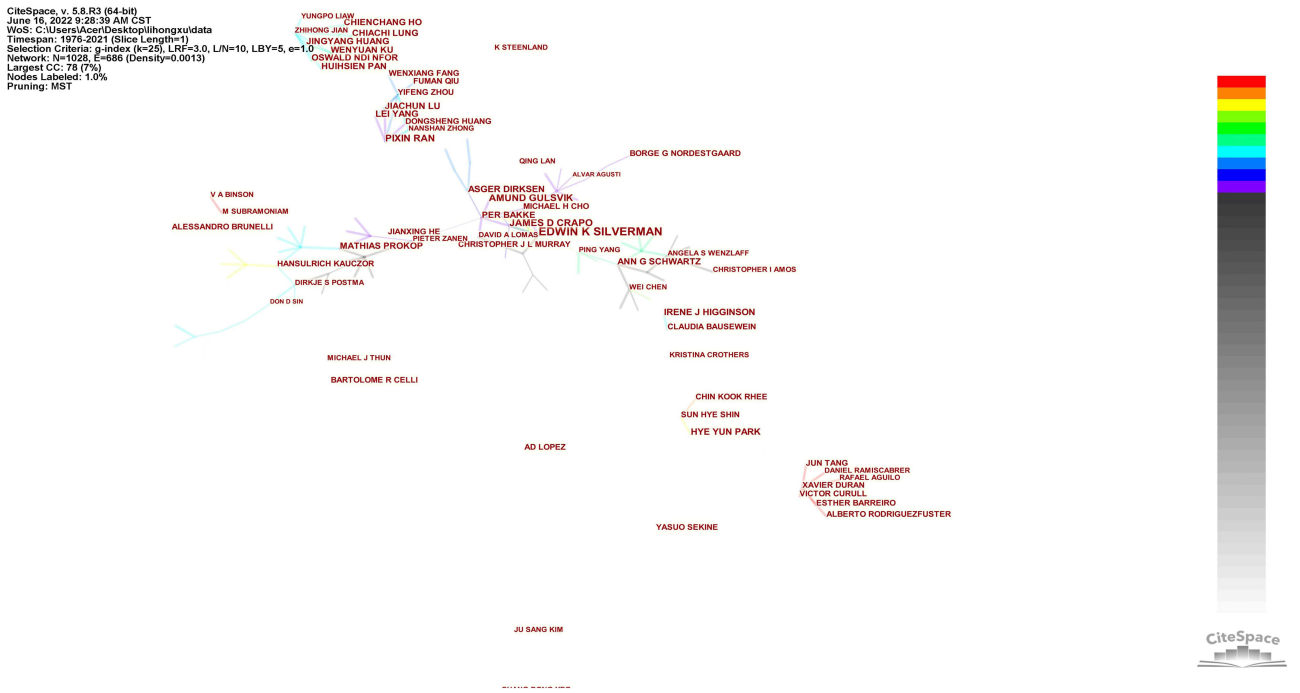

Figure 4 Map of authors' collaborations related to COPD and lung cancer research.

Distribution by Others

Most of the 2175 literatures are written in English (2102, accounting for 96.664%), followed by Spanish (34) and German (15). No Chinese literatures were included, which was related to the data source. In addition, 952 literatures are not funded by the fund project. Among the literatures funded by the fund project, the United States Department of Human Health funded the most (336 literatures, accounting for 15.448%), followed by National Institutes of Health NIH USA (321 papers, 14.759%), NIH National Cancer Institute NCI (144 papers, 6.621%), 104 papers funded by NSFC of National Natural Science Foundation of China, accounting for 4.782%, ranking the sixth in the world.

Co-Occurring Keywords Analysis

The top 10 keywords with co-occurrence frequency and betweenness centrality in the fields of COPD and lung cancer are shown in Table 4, which together with the ID tags in the keyword clustering map (Figure 5, Table 5) reflect the hotspots and topics of the research field. Among the 24 clusters obtained, except for #0, #4, #8, and #12 whose contour values are all within the range of 0.7–0.8, the remaining contour values are all greater than 0.9, indicating that the cluster map results are relatively reliable and referable. A keyword timeline diagram (Figure 6) was drawn based on the clustering results, showing the longest research cycles (#3, #16) and the current research hotspots (#0, #1).

Keywords with Citation Bursts

Table 6 shows the keyword emergence map in the fields of COPD and lung cancer. The outbreak period in the figure is the red segment on the blue timeline, which means the current research hotspots are as follows: long-term exposure, global burden, fine particulate matter, PM2.5, air pollution, biomarker, impact and emphysema. The first time when the explosive keyword (bronchogenic carcinoma) appeared was in 1991, and the strongest keyword (carcinoma) appeared in 1996. The latest keywords that broke out in 2019 so far are impact and emphysema, and keywords that were previously largest are cigarette smoking and coronary heart disease (1992–2007).

Table 4 Top 18 Keywords in Terms of Frequency and Centrality of COPD and Lung Cancer Research

Rank.	Keyword	Frequency	Year	Centrality	Keyword	Frequency	Year	Centrality
1	Copd	560	1991	0.03	Asthma	75	1994	0.31
2	Lung cancer	440	1992	0.09	Adenocarcinoma	20	1997	0.22
3	Obstructive pulmonary disease	377	1999	0.07	Heart failure	12	2011	0.21
4	Risk	351	1992	0.15	Bronchogenic carcinoma	12	1991	0.2
5	Mortality	270	1994	0.13	Care	27	1998	0.19
6	Disease	180	1991	0.18	Cancer	135	1992	0.19
7	Expression	157	1996	0.05	Disease	180	1991	0.18
8	Prevalence	156	1997	0.01	risk	351	1992	0.15
9	Association	145	1999	0.05	Population	67	1999	0.14
10	Survival	141	2000	0.05	Alveolar macrophage	5	1996	0.13
11	Smoking	140	1997	0.08	Death	48	1996	0.13
12	Cancer	135	1992	0.19	Mortality	270	1994	0.13
13	Inflammation	134	2007	0.02	Air flow obstruction	47	1997	0.11
14	Emphysema	117	1997	0.05	Smoker	82	1992	0.1
15	Diagnosis	111	2002	0.04	Breast cancer	25	1995	0.09
16	Impact	110	2005	0.04	Air pollution	33	1997	0.09
17	Management	103	2006	0.01	Gene expression	34	2006	0.09
18	Risk factor	100	1997	0.04	Biomarker	42	1999	0.09

Discussion

COPD is a common respiratory disease, and patients with COPD are at increased risk of lung tumors,[23] but the potential link between them is not yet clear. In this study, CiteSpace was used to perform bibliometric analysis on the literature related to COPD and lung cancer, and to visualize the research status and trends, which will help us to systematically understand the evolution path and development trend of the relationship between COPD and lung cancer.

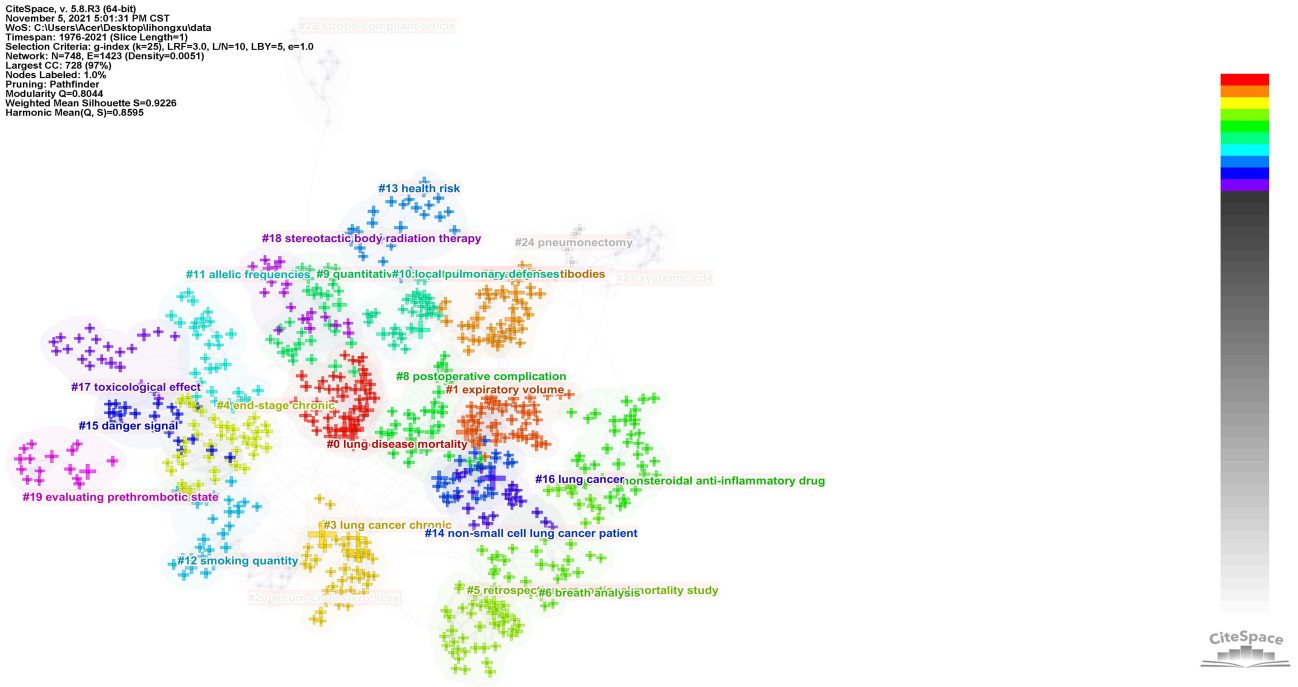

Figure 5 Co-occurrence cluster atlas in the research of COPD and lung cancer.

Table 5 Basic Characteristics of the First 6 Main Clusters in the Keywords Cluster Atlas of Literature on COPD and Lung Cancer

Cluster ID	Sise	Silhouette	Mean (Year)	Cluster (LLR)	Main Keywords
#0	52	0.885	2003	Lung disease mortality	Obstructive pulmonary disease, prevalence, smoking, asthma, population, air flow obstruction, cardiovascular disease
#1	51	0.929	2003	Expiratory volume	Mortality, morbidity, therapy, lobectomy, predictor, acute exacerbation, exercise capacity, prediction, bronchogenic carcinoma
#2	49	0.956	2002	Anti-p53 antibodies	Expression, association, smoker, biomarker, breast cancer, adenocarcinoma, Pathway, mutation
#3	49	0.931	2004	Lung cancer chronic	COPD, risk, cancer, exposure, cell, computed tomography, cohort, volatile organic compound, dimension
#4	45	0.897	2010	End-stage chronic	Palliative care, burden, exacerbation, of life care, need, China, heart failure, cancer patient, life, China Taiwan
#5	43	0.941	2003	Retrospective proportional mortality study	Risk factor, cigarette smoking, United States, death, coronary heart disease, never smoker

Based on the characteristics of accumulation and inheritance, papers confirm the reliability of their own research by citing previous literature. The more frequently literature cited, the more important the content of the literature is. From 1976 to 2021, 2175 literatures on COPD and lung cancer were included in Web of Science. The annual number of published articles and total annual citation frequency showed a gradually increasing trend from 2001 to now (Table 1). It is predicted that the original research and total citation frequency in this field will continue to increase in the next five years. It indicates that the global disease patients in this field are still a non-negligible proportion, and the study of disease still needs further exploration. The research content of the literature mainly focuses on the following four disciplines: Respiratory System (672, 30.897%), Oncology (347, 15.954%), Medicine General Internal (281, 12.92%), and Public Environmental Occupational Health (229, 10.529%). These articles were published mainly in PLoS ONE, European Respiratory Journal, American Journal of Respiratory and Critical Care Medicine. Most of the publications came from American research institutions, and American researchers published the largest

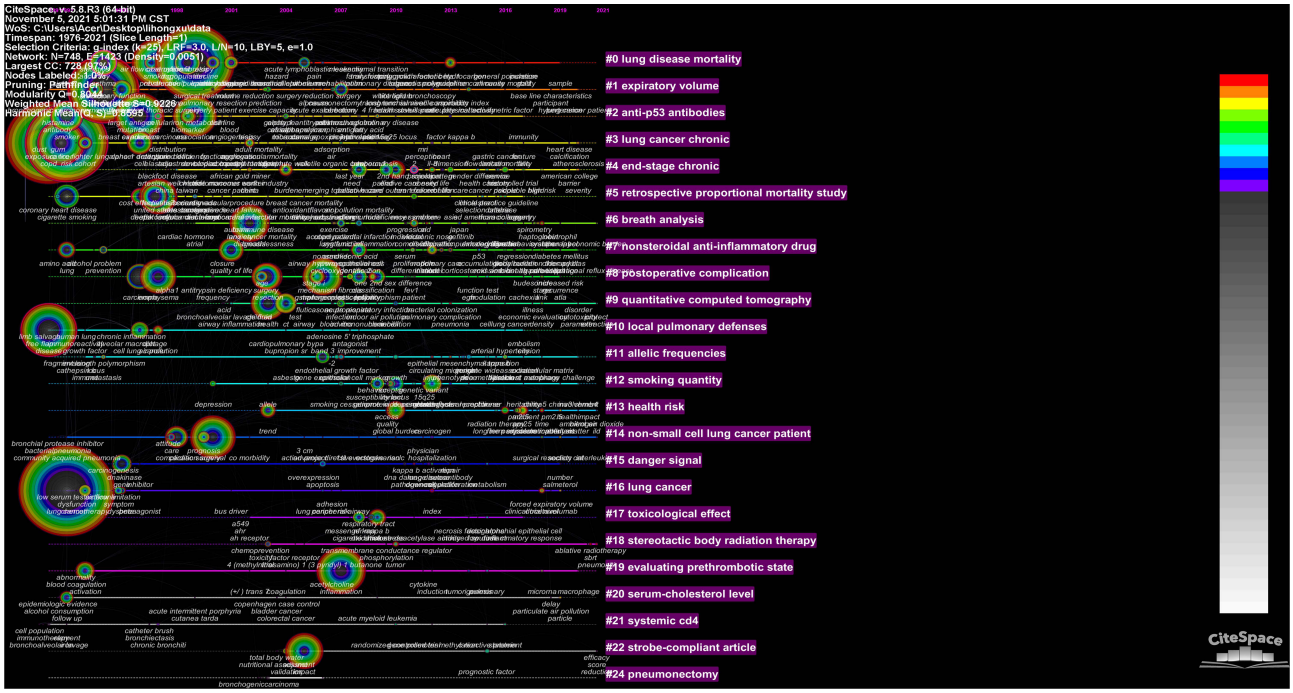

Figure 6 The critical time diagram based on the clustering results of Figure 5.

Table 6 Top 25 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	1976–2021 Year
Bronchogenic carcinoma	1976	6.12	**1991**	2003	
Cigarette smoking	1976	7.82	**1992**	2007	
Coronary heart disease	1976	7.37	**1992**	2007	
Carcinoma	1976	15.15	**1996**	2007	
Resection	1976	7.36	**2003**	2010	
Chronic bronchiti	1976	4.63	**2004**	2012	
Women	1976	6.8	**2005**	2008	
Inflammation	1976	5.87	**2008**	2009	
Susceptibility locus	1976	11.26	**2009**	2012	
Population	1976	6.52	**2009**	2012	
Variant	1976	7.27	**2010**	2012	
Genome-wide association	1976	5.42	**2010**	2017	
Mice	1976	5.56	**2014**	2015	
Of life care	1976	5.26	**2016**	2018	
People	1976	4.94	**2016**	2019	
Long-term exposure	1976	4.91	**2016**	2021	
Global burden	1976	6.96	**2017**	2021	
Fine particulate matter	1976	6.2	**2017**	2021	
pm25	1976	5.58	**2017**	2021	
Validation	1976	5.41	**2017**	2019	
Metaanalysis	1976	5.22	**2017**	2018	
Air pollution	1976	4.67	**2017**	2021	
Biomarker	1976	5.05	**2018**	2021	
Impact	1976	5.6	**2019**	2021	
Emphysema	1976	5.04	**2019**	2021	

number of papers. It is worthy to mention that Chinese scholars published the second largest number of papers in the world. The high attention paid by the US and Chinese governments to the prevention and treatment of this disease would be the key reason for the large number of articles, and the epidemiological characteristics of this disease in the scholars' countries/regions would be another reason. Governments and relevant departments of countries/regions with high incidence of COPD and lung cancer have invested funds in the research related to this group of diseases, making a significant contribution to the scientific research progress in this field. According to the map of national/regional scientific research cooperation network, among the four initially formed research teams, URUGUAY had the highest intermediary centrality (2 articles), and formed the largest scientific research cooperation team with 12 countries, including VENEZUELA, SOUTH AFRICA and BRAZIL. China have not joined any international/regional team, we assume there are two reasons: the incidence and risk of COPD and lung cancer at countries/regions in the research team are always high so they pay more attention to explore how to improve, but China did not; the academic influence of the literature with Chinese scholars is not high enough.

Keywords change over time significantly according to the co-occurrence of keywords in this group of literatures. During 1991–2007, keywords mainly focus on bronchogenic carcinoma, cigarette smoking, coronary heart disease and carcinoma. The main reasons for the sharp increase of lung cancer in smokers are more intense smoking, deeper smoke inhalation and the increase of N-nitrosamine content in low-grade cigarette smoke.[24] From the perspective of public health, further reducing the toxicity and carcinogenicity of cigarette smoke is an urgent problem to be solved.[25] Keywords changed to resection, Chronic Bronchitis, women, inflammatory, susceptibility locus, population, variant, genome wide association, mice from 2003 to 2017. Host factors such as family history of lung cancer, history of chronic obstructive pulmonary disease and history of infection all increase the risk of lung cancer.[26] In addition, the severity of COPD affects the recurrence-free survival rate of patients with non-small cell lung cancer (NSCLC) after surgical resection, and moderate/severe COPD is an independent adverse prognostic factor.[27] From 2016 to now, keywords turn into life care, people, long-term exposure, global burden, fine particulate matter, PM2.5, validation, meta-analysis, air pollution, biomarker, impact, emphysema. In lung scintillation imaging of

patients with COPD, the degree of ventilation defects, ventilation heterogeneity and distribution of ventilator-perfusion ratio are correlated with the severity of the disease.[28] Smoking, severe airflow restriction, bronchiectasis, bacterial and viral infections, and comorbidities are factors that contribute to acute onset and worsening survival outcomes of COPD. It is also suggested that severe acute episodes of COPD should be treated with β-agonists, anticholinergic drugs and systemic corticosteroids, antibiotic treatment can be used in patients with bacterial infection, and non-invasive ventilation should be performed in patients with respiratory failure.[29] Virtual reality technology is used to implement personalized rehabilitation measures for patients with COPD, which proposed a technical perspective and outlined future research directions.[30] Therefore, the initial study on the etiology, risk factors and prognosis of COPD and lung cancer has been transformed to the study on biomarkers, gene expression, heart failure and other serious complications of COPD complicated with lung cancer.

Qualitative analysis and visualization description used in this research is a kind of exploratory attempt. We performed systemic analysis on the characteristics of published literature related to COPD and lung cancer by the visualization of scientific knowledge mapping, and present them objectively and honestly so that relevant personnel can understand the current situation and development trend in this field conveniently and formulate future research directions and strategies accurately. However, CiteSpace is a visual analysis software developed on the basis of Web of Science database, and the database is mainly composed of English literatures, so there are few non-English literatures included. In addition, such literatures in Chinese published in CNKI and Wanfang database could not be included because of limited software function caused by the different structure of the Chinese database and Web of Science database. The results of this study may be biased to some extent, but the extensibility of the results of this study will not be affected.

Conclusion

The annual number of papers published and the total annual citation frequency in the field of COPD and lung carcinoma show an upward trend, and the current research hot topics are health, disease risk factors, disease burden, prevention and serious complications. Developed regions such as Europe and the United States attach great importance to research in this field, and poor areas with high incidence of COPD and lung carcinoma are also paying more attention to relevant research now. The research depth and breadth of Chinese scholars in this field need to be further expanded.

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Disclosure

The authors declare that there are no potential conflicts of interest in this work.

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