International Journal of Chronic Obstructive Pulmonary Disease

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Research Status and Direction of Chronic Obstructive Pulmonary Disease Complicated with Coronary Heart Disease: A Bibliometric Analysis from 2005 to 2024

Hupo Bian[1,*], Shaoqi Zhu[2,*], Wenjian Xing[3], Luying Qi[1], Jingnan Xue[1], Xiuhua Peng[1], Zanhui Jin[1], Hongxing Zhao[1,4]

[1]Department of Radiology, The First Affiliated Hospital of Huzhou University, Huzhou, Zhejiang, People's Republic of China; [2]Department of Endocrinology, The First Affiliated Hospital of Huzhou University, Huzhou, Zhejiang, People's Republic of China; [3]Department of Radiology, The Linghu People's Hospital, Huzhou, Zhejiang, People's Republic of China; [4]Huzhou Key Laboratory of Precise Diagnosis and Treatment of Urinary Tumors, Huzhou, Zhejiang, People's Republic of China

*These authors contributed equally to this work

Correspondence: Hongxing Zhao, Department of Radiology, Huzhou First People's Hospital, The First Affiliated Hospital of Huzhou University, No. 158, Plaza Back Road, Wuxing District, Huzhou City, Zhejiang Province, People's Republic of China, Email 50073@zjhu.edu.cn

Objective: There is increasing evidence that chronic obstructive pulmonary disease (COPD) is associated with coronary heart disease (CHD). In this study, we provide valuable insights in the field by examining the evolution of the relationship between COPD and CHD over the past 20 years.

Methods: A comprehensive computer search was conducted in the Web of Science (WOS) core dataset, covering literature on COPD combined with CHD from January 1, 2005, to August 20, 2024. Visual analyses were performed using VOSviewer, CiteSpace, and Bibliometrix to assess countries, institutions, the centrality of institutional intermediaries, authorship patterns, including co-cited authors and references, and keywords; Excel (version 2021) software was utilized for generating relevant descriptive analysis tables.

Results: A total of 2420 publications sourced from WOS were included in this study. Since 2005, there has been a continuous increase in the literature about COPD combined with CHD; polynomial fitting yielded an R^2 value of 0.7758. The volume of literature in this domain is projected to continue growing steadily. The United States emerged as the leading country by publication count; Lin Cheng-li ranked first among authors, while China Medical University topped institutional contributions. Notably, Sin dd, Mannino dm, and Helvaci Mr were identified as the top three authors based on citation frequency. The Journal of Vascular Surgery recorded the highest number of publications, whereas The Lancet was recognized as the most influential among the top ten co-cited journals. The most frequently cited reference pertains to systemic inflammation's role in increasing cardiovascular risk among patients with COPD. Through keyword clustering analysis, we categorized all keywords into three distinct groups: management strategies for COPD and CHD; diseases associated with both conditions; and epidemiological characteristics concerning their burden—current hotspots include multimorbidity factors such as hypertension and obesity alongside outcomes like diagnosis during COVID-19 pandemic implications within societal contexts are highlighted here too.

Conclusion: Presently focused research on COPD coupled with CHD primarily revolves around five key areas: pathogenesis exploration, early diagnostic techniques, COVID-19 infection, dynamics intervention, methodologies, and treatment protocol development efforts. To improve the early detection rate of COPD complicated with CHD, the main development direction in the future is to extract computed tomography (CT) features using imaging omics and establish an early prediction model. The results of this study will provide new ideas and directions for subsequent related research.

Keywords: chronic obstructive pulmonary disease, COPD, coronary heart disease, CHD, inflammation, bibliometrics, visual analysis

Received: 9 September 2024
Accepted: 29 December 2024
Published: 7 January 2025

Introduction

Chronic obstructive pulmonary disease (COPD) is a condition characterized by alterations in airway structure or emphysema, while coronary heart disease (CHD) arises from atherosclerotic lesions within the coronary arteries. As both are significant chronic diseases globally, their correlation has been extensively studied over time. The incidence of coronary heart disease in COPD patients is much higher than that in normal people, In addition to shared risk factors such as smoking, air pollution, and physical inactivity,[1] there is an increasing body of evidence supporting an epidemiological and pathophysiological relationship between COPD and CHD.[2] Clinically, patients suffering from both conditions exhibit distinct characteristics, including heightened respiratory symptoms alongside chest tightness, diminished overall health status, and elevated medication costs.[3–5] Both diseases adversely affect patients' quality of life and contribute to increased mortality rates;[6,7] furthermore, the concurrent occurrence of these two conditions in a single patient exacerbates prognosis significantly.[2] A study conducted by Andell P et al revealed that the incidence and mortality rates associated with CHD combined with COPD among older people have shown an upward trend, The mortality rate was almost twice that of patients without COPD.[8] Therefore, enhancing research on CHD and COPD is crucial for optimizing disease management strategies and clinical treatment decisions to improve patient outcomes.Bibliometrics represents a scientific methodology employing statistical analysis and mathematical techniques to explore large datasets across disciplines while generating visual maps that elucidate research trends and hotspots within specific fields.[9] Numerous researchers have applied bibliometric analyses across various medical domains such as oncology,[10] radiology,[11] and cardiovascular diseases;[12] however, systematic bibliometric analysis focusing on the intersection of COPD with CHD remains unexplored. Consequently, this study utilizes the Web of Science Core Collection (WoSCC) database to gather pertinent scientific publications spanning the last 20 years (2005–2024), employing tools like CiteSpace, VOSviewer 1.6, and Bibliometrics for comprehensive bibliometric evaluation and visualization aimed at delineating current research landscapes along with emerging topics in this domain—thereby providing substantive guidance for relevant scholars.

Data and Methods

Data Sources

On August 20, 2024, a comprehensive search was conducted using computer-based methods in the WoSCC database. The search strategy employed was TS=("COPD" OR "chronic obstructive pulmonary disease*") AND ("coronary heart disease" OR "CHD" OR "Coronary Diseases" OR "Coronary Vessel*" OR "Coronary Arteries" OR "Coronary Artery"). The literature language was restricted to English, and the retrieval method encompassed keywords, subject terms, and free-text searches.[13] Initially, 2898 articles were identified; however, after limiting the period from 2005 to 2024, 2571 articles remained. Ultimately, by restricting the types of literature to "article" and "review", we included a final count of 2420 articles. A flow chart illustrating the selection process for included articles is presented in Figure 1.

Statistical Methods

This study's bibliometric and visual analyses were performed utilizing VOSviewer (version 1.6.20), CiteSpace (version 6.3.1), and R software packages. Before data analysis, de-duplication processes were applied to include all relevant literature totaling 2420 items. In both VOSviewer and CiteSpace visualization analyses, nodes represent research entities such as countries or authors; node size correlates with publication volume or influence; citation rings around nodes indicate citation frequency—thicker rings denote more citations while lighter colors reflect more recent citations; lines connecting nodes illustrate existing collaborative relationships where thicker lines signify closer associations between entities. Additionally, descriptive analysis charts were generated using Microsoft Excel (version 2021) and Draw.io.

Results

Analysis of the Volume and Trends in Published Literature

Among the 2420 publications, 2151 were dissertations (88.88%), and 269 were reviews (11.12%). From 2005 to the present year, the number of published papers has consistently grown, with a significant surge observed between 2020 and

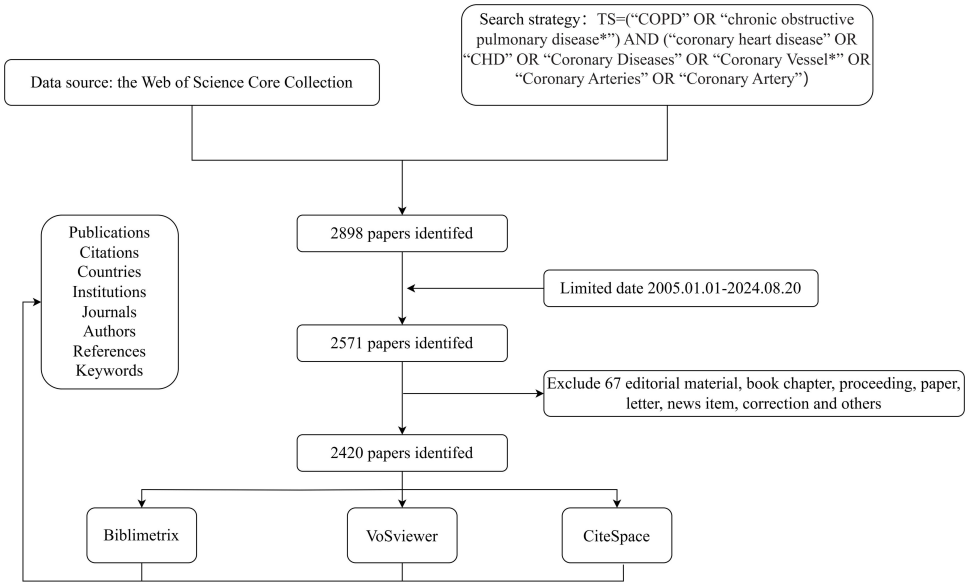

Figure 1 Includes the flow chart of the article.

2022 (Figure 2). As of August 2024, 116 articles had been published. The results from polynomial fitting indicate an R^2 value of 0.7758, suggesting that literature in this field is expected to continue to increase and stabilize.

Analysis by Issuing Country/Region

Ninety-eight countries/regions have contributed publications in this domain; 36 countries/territories have each published more than ten papers. Only the United States, China, and the United Kingdom have surpassed two hundred publications each. Table 1 presents a summary of the top ten countries/regions ranked by publication volume from 2005 to 2024: The United States leads with a total of 847 articles, followed by China (244), the United Kingdom (242), Germany (167), and Italy (155) occupying second through fifth positions respectively. Cumulatively, citations for these top five countries are

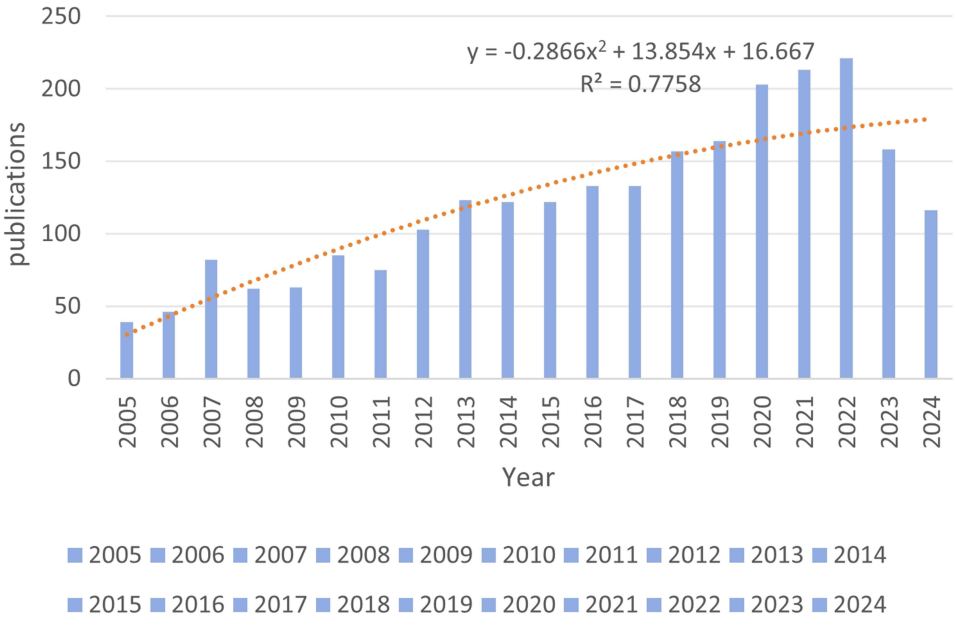

Figure 2 Literature trends of COPD combined with CHD from 2005 to 2024.

https://doi.org/10.2147/COPD.S495326

Table 1 The Top 10 Countries by Number of Publications from 2005 to 2024

Ranking	Country (region)	Number of Publications (articles)	Total Citations (times)	Average Citations (times)	TLS
1	America	847	36,697	43.33	435
2	China	244	7871	32.26	136
3	England	242	13,800	57.02	417
4	Germany	167	7095	42.49	277
5	Italy	155	7069	45.61	254
6	Turkey	139	1444	10.39	23
7	Canada	133	6838	51.41	201
8	Netherlands	115	6528	56.77	277
9	Taiwan	107	1755	16.4	15
10	Australia	85	4050	47.65	123

as follows: United States (36,697), United Kingdom (13,800), China (7871), Germany (7095), and Italy (7069). VOS viewer software was employed to analyze international collaboration among these nations, as illustrated in Figure 3; thicker lines between nodes represent closer cooperation, indicated by more excellent Total Link Strength (TLS). Figure 4 depicts a global collaborative map illustrating COPD co-CHD relationships from years spanning from 2005 to 2024 where color saturation intensity corresponds to article counts per country while arrow thickness symbolizes inter-country cooperative strength.

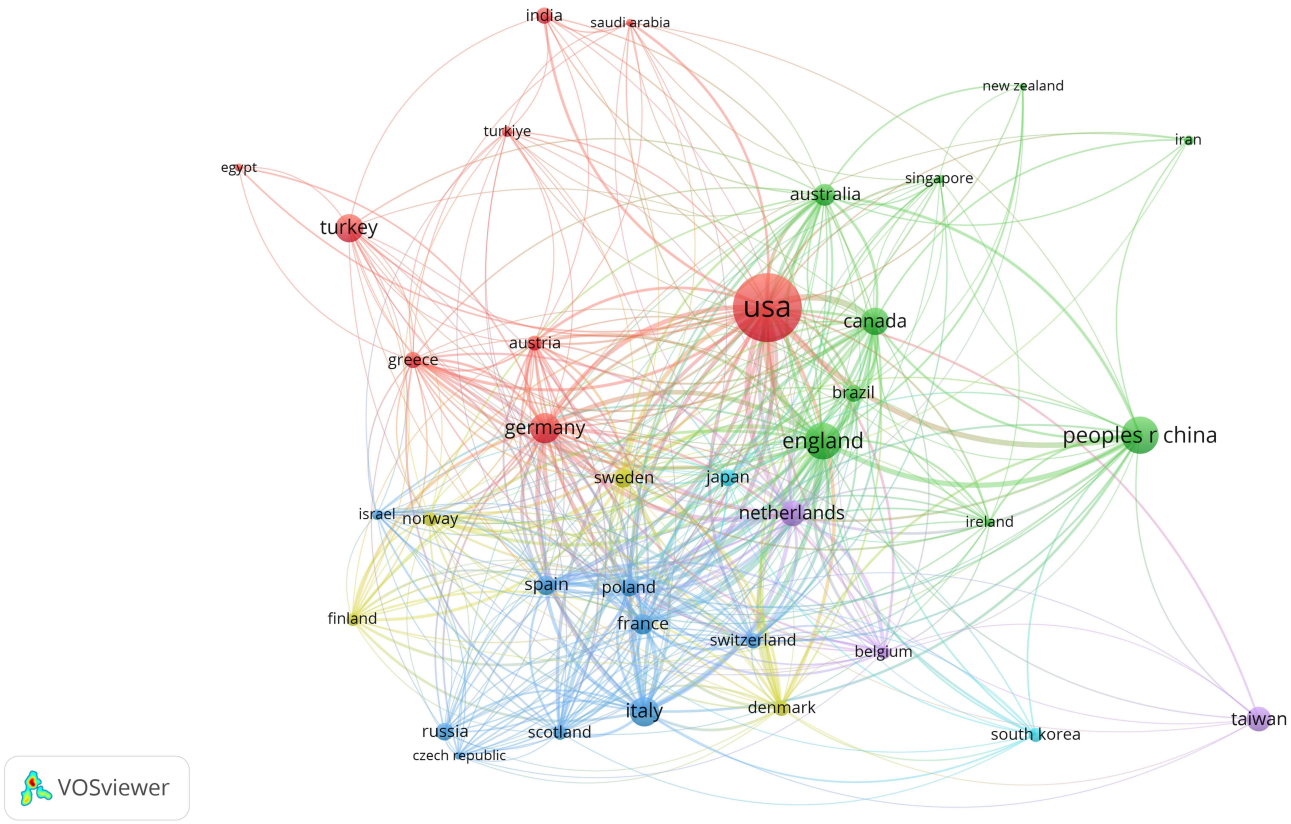

Figure 3 Cooperation among countries (regions).

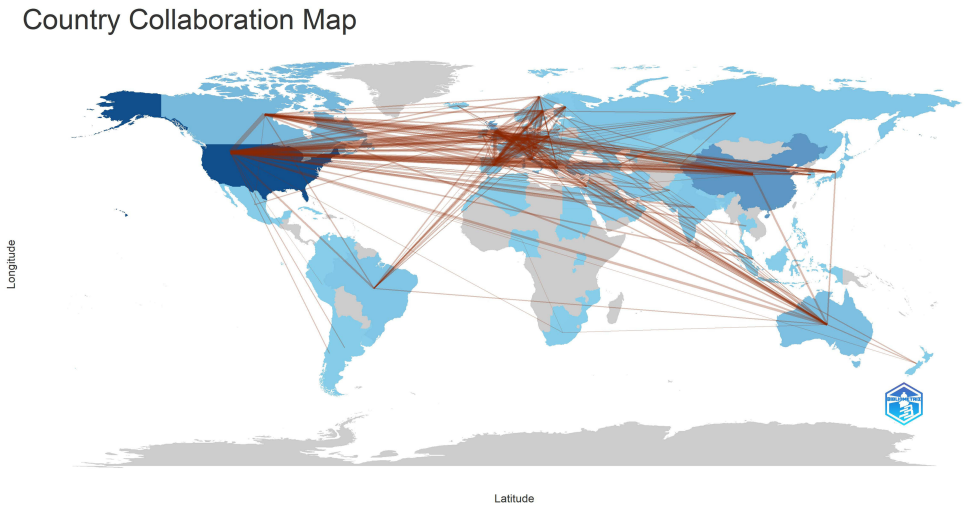

Figure 4 Global collaborative map of COPD and CHD relationships from 2005 to 2024.

Institutional Publication Analysis

In totality, there are approximately 3742 institutions engaged in research on COPD and CHD, out of which 34 institutions recorded over 20 published articles each. The leading three institutions based on publication count include China Medical University(48 articles), Columbia University(44 articles), and Harvard Medical School(41 articles)(refer to Table 2). Figure 5 illustrates institutional collaboration networks featuring those with more than twenty publications wherein Brigham & Women's Hospital(TLS:84) and Columbia University(TLS:84) are tied for first place, followed closely by The University Of Alabama at Birmingham(TLS:60); Harvard Medical School(TLS:53); Johns Hopkins University (TLS:51). Betweenness centrality serves as an indicator measuring node importance within networks.[14] In Figure 6, we observe intermediary centrality across various institutions involved within this field, highlighting National Yang Ming Chiao Tung University(0.18), University Of Manchester(0.18), and Liverpool's University London(0.15) as critical players contributing significantly towards advancing research efforts here.

Table 2 The Top 10 Organizations by Number of Publications from 2005 to 2024

Ranking	Institution	Nation	Number of Publications (articles)	Total Citations (times)	Average Citations (times)	TLS
1	China Medical University	China	48	709	14.77	42
2	Columbia University	America	44	1882	42.77	65
3	Harvard Medical School	America	41	1967	47.98	53
4	The University of Alabama at Birmingham	America	40	1903	47.58	60
5	China Medical University Hospital	Taiwan of China	39	543	13.92	39
6	Mayo Clinic	America	39	1597	40.95	27
7	University of British Columbia	Canada	39	2404	61.64	34
8	Brigham and Women's Hospital	America	38	2528	66.53	84
9	Johns Hopkins University	America	32	1327	41.47	51
10	Emory University	America	30	2557	85.23	21

https://doi.org/10.2147/COPD.S495326

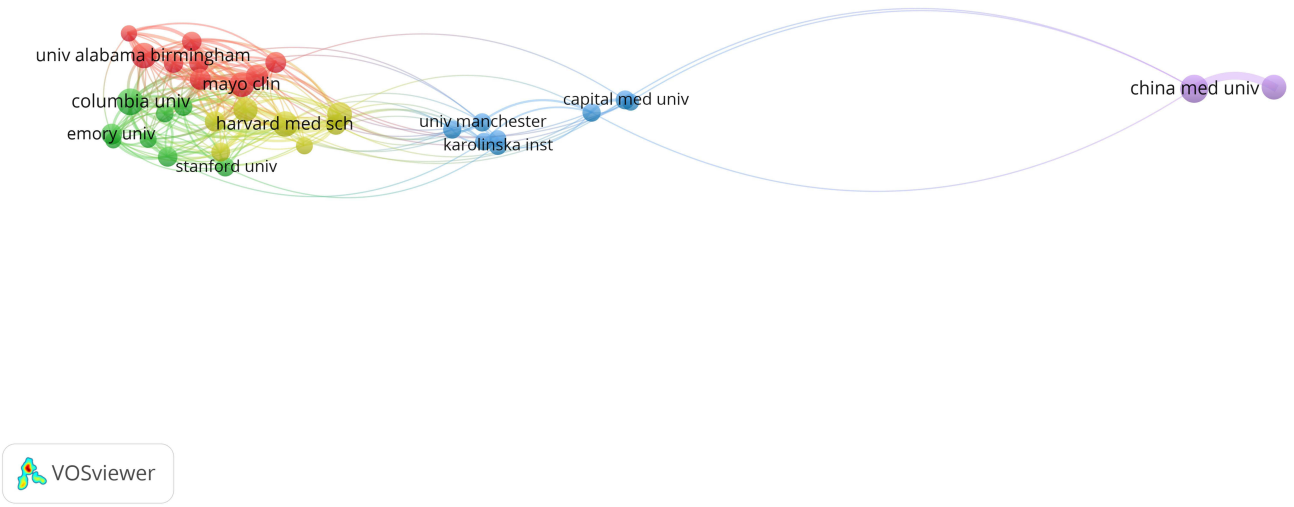

Figure 5 Inter-agency cooperation chart.

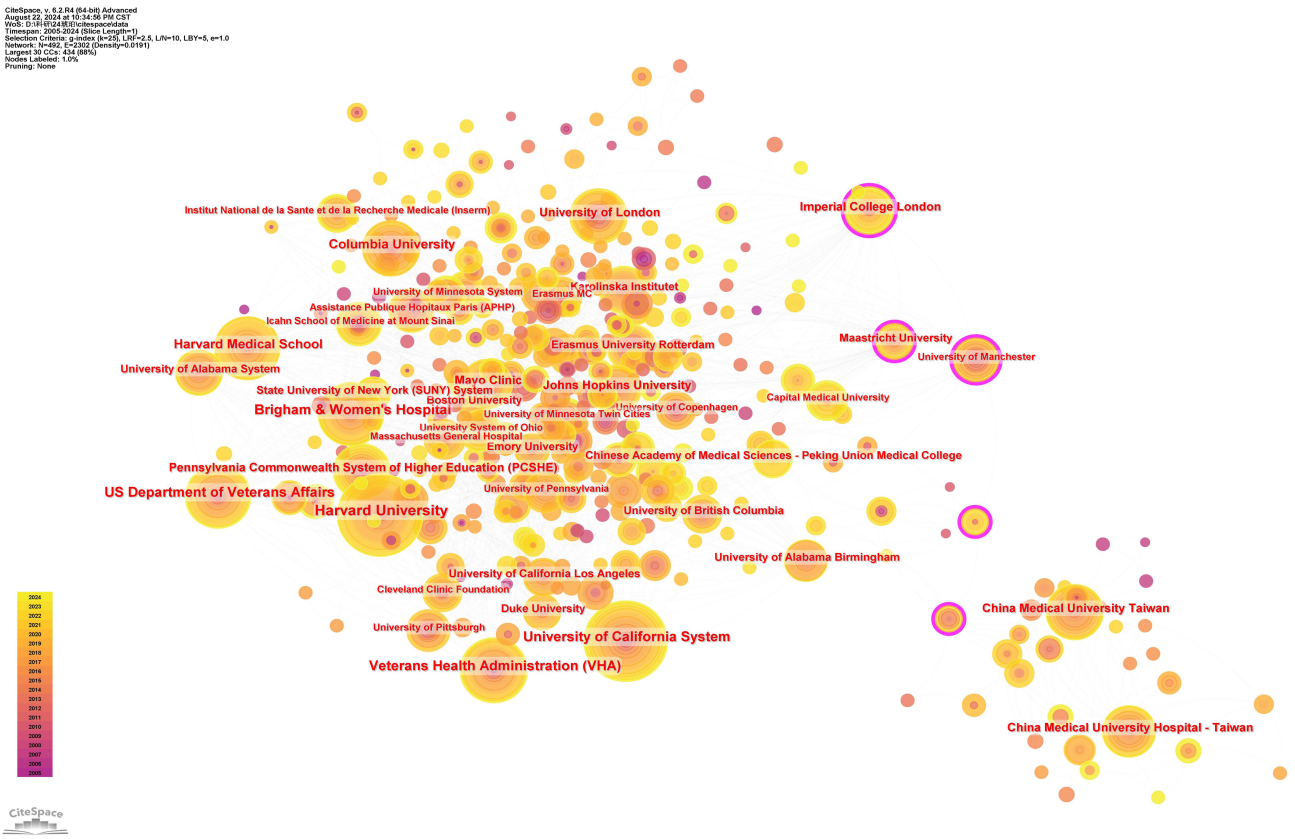

Figure 6 Map of interinstitutional intermediation centrality.

Journal Publication Count & Co-Citation Analysis

A cumulative sum reveals that 2419 articles appeared across 878 journals, with 41 journals publishing 10 or more pieces. Figure 7 showcases inter-journal collaborations among these entities. Ten leading journals collectively accounted for 415 papers, representing 17.15% of overall totals. Journal Of Vascular Surgery emerged as dominant, having released 95 publications. The average citation rate noted within the Annals of Thoracic Surgery was 34.98 per article. Despite Cureus Journal exhibiting high output figures, its low citation metrics suggest inferior quality standards relative to other sources.

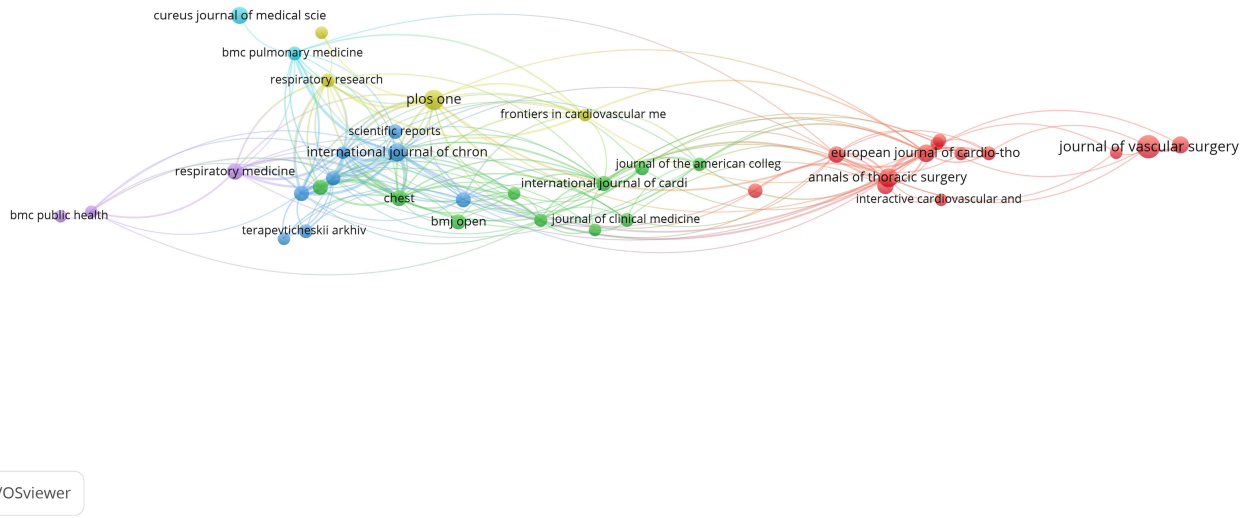

Figure 7 Cooperative relationship between journals.

Details can be found listed in Table 3. Top cited journals included Circulation (with 2990 citations), Am J Resp Crit Care (with 2496 citations and New Engl J Med(with 2467 citations); these statistics appear summarized in Table 4. Network diagrams depicting journal citations can be seen visually through Figure 8. Dual-map coverage analysis (Figure 9) provides insights regarding disciplinary distribution patterns along citation trajectories revealing gravitational shifts.[15] The left cluster represents citing journals, whereas the right signifies cited ones. Green pathways illustrate connections originating primarily from Health/Nursing /Medicine alongside Molecular Biology /Genetics, referencing Medicine / Medical /Clinical literature predominantly, indicating convergence trends emerging therein.

Analysis Regarding Authors and Co-Cited Authors

The research conducted yielded contributions from 13924 authors alongside 51932 co-cited authors. In terms of publication frequency/citations received, details about the top ten contributors outlined under Table 5 reveal Lin Cheng-li led pack producing 23 pieces. Kao Chia-hung follows suit, generating 20 works, while Helvaci Mehmet Rami produces 15 items. Authors receiving the highest citation counts comprised Sin Dd(248 times), Mannino Dm(194 times) and

Table 3 The Top 10 Journals by Number of Publications from 2005 to 2024

Ranking	Periodical	Nation	Number of Publications (articles)	Total Citations (times)	Average Citations (times)	TLS	IF
1	Journal of vascular surgery	America	95	3113	32.77	13	4.3
2	PLoS one	America	57	1642	28.81	43	3.7
3	Annals of thoracic surgery	Japan	49	1714	34.98	42	1.3
4	International journal of chronic obstructive pulmonary disease	England	39	669	17.15	74	2.8
5	European journal of cardio-thoracic surgery	Netherlands	35	798	22.8	41	3.4
6	Annals of vascular surgery	America	30	392	13.07	10	1.5
7	Cureus journal of medical science	America	30	87	2.9	1	1.2
8	Respiratory medicine	England	28	787	28.11	34	4.3
9	Journal of thoracic and cardiovascular surgery	America	26	757	29.12	21	6
10	Medicine	America	26	467	17.96	20	1.6

https://doi.org/10.2147/COPD.S495326

Table 4 The Top 10 Journals in Total Cited Times from 2005 to 2024

Ranking	Periodical	Nation	Number of Co-Citations	TLS	IF	JCR
1	Circulation	America	2990	111,632	37.8	Q1
2	Am j resp crit care	America	2496	116,016	24.7	Q1
3	New engl j med	America	2467	101,204	158.5	Q1
4	Chest	America	2386	102,749	9.6	Q1
5	Lancet	England	1946	79,124	168.9	Q1
6	J am coll cardiol	Netherlands	1896	67,758	24	Q1
7	Eur respir j	England	1858	83,052	24.3	Q1
8	Ann thorac surg	Netherlands	1664	27,795	4.6	Q1
9	J vasc surg	Italy	1613	22,991	1.4	Q1
10	Jama-j am med assoc	America	1543	62,333	120.7	Q1

Helvaci Mr(159 times). Collaborative dynamics among authors are depicted graphically in Figure 10. Additionally, Figure 11 highlights cooperative relations established between co-cited individuals.

Reference Analysis

A total of 75,457 references were identified, among which 91 have been cited more than 20 times. Detailed information is presented in Table 6, listing the top ten references based on their co-citation frequency. The most frequently cited reference is 'Why are Patients With Chronic Obstructive Pulmonary Disease at Increased Risk of Cardiovascular Diseases? Potential Role of Systemic Inflammation in Chronic Obstructive Pulmonary Disease (89 citations). Following closely are 'Association between Chronic Obstructive Pulmonary Disease and Systemic Inflammation: A Systematic Review and Meta-Analysis' (77 citations) and 'Global Strategy for the Diagnosis, Management, and

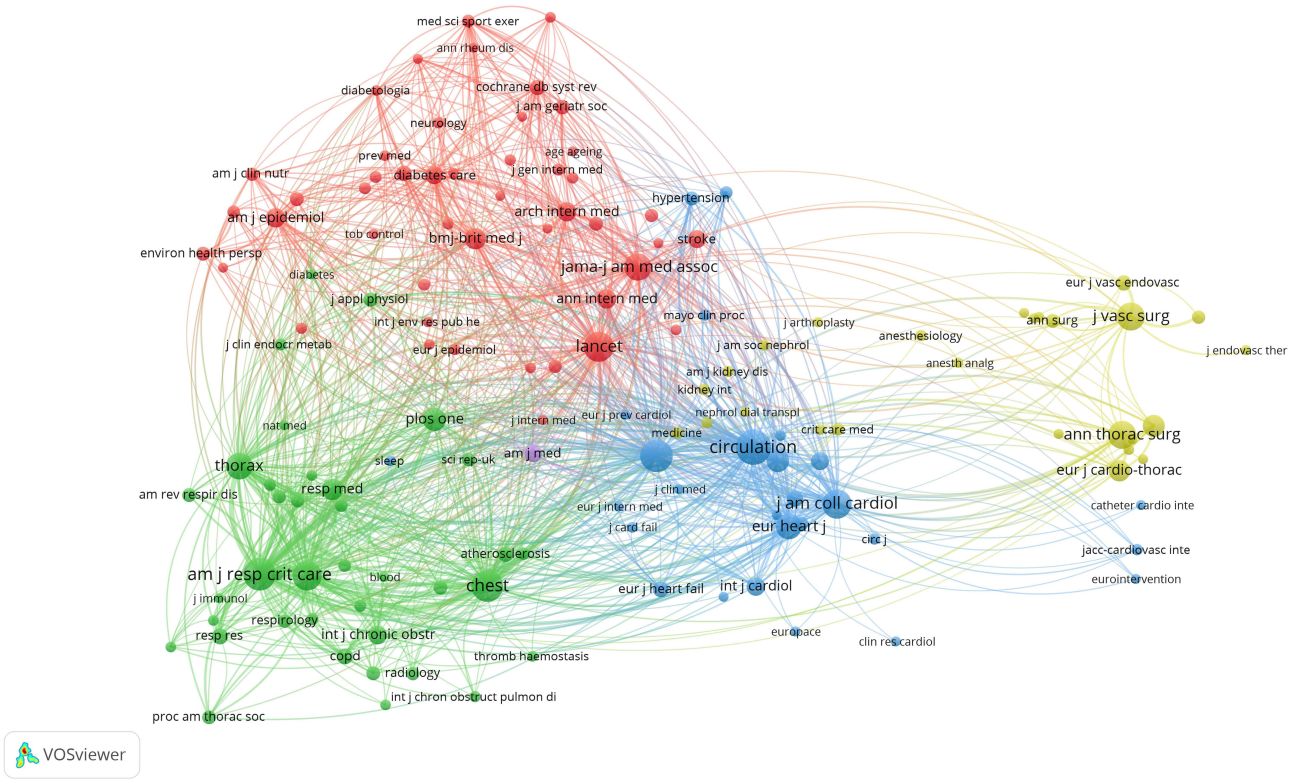

Figure 8 Network diagram of co-cited journals.

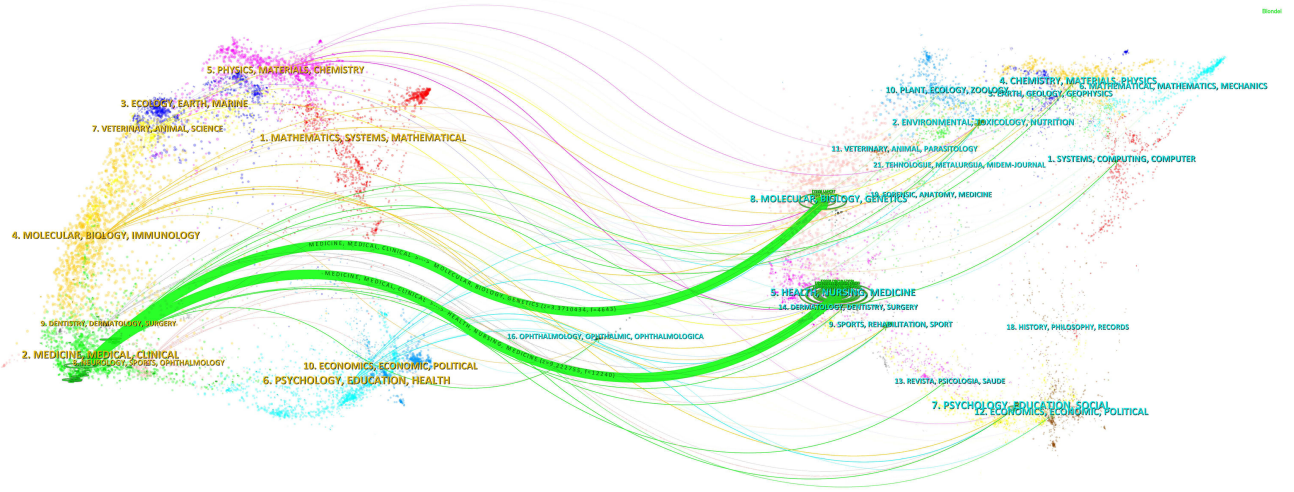

Figure 9 Dual map overlay of related publications and periodicals.

Prevention of Chronic Obstructive Pulmonary Disease GOLD Executive Summary' (77 citations). We conducted a cluster analysis on literature co-cited over the past two decades, categorizing them into nine clusters: chronic obstructive pulmonary disease patients; systemic inflammation; lung cancer; coronavirus disease alongside chronic obstructive pulmonary disease; therapeutic response; concomitant chronic conditions; contemporary concise reviews; and revascularization strategies (refer to Figure 12). The clustering time graph indicates that current research predominantly focuses on lung cancer, coronavirus disease, and contemporary concise reviews. Systemic inflammation emerged as one of the earliest research hotspots (see Figure 13). Over time, burst detection analyses reveal shifts in research focus across different periods. Figure 14 illustrates the top 25 references that stand out within this field. Fei Zhou et al's study titled 'Clinical Course and Risk Factors for Mortality of Adult Inpatients with COVID-19 in Wuhan, China: A Retrospective Cohort Study' exhibits a burst intensity of 13.54 while W. Guan's team's publication "Clinical Characteristics of Coronavirus Disease 2019 in China" shows an intensity score of 13.09—both articles delineate early clinical manifestations associated with COVID-19.[16,17] These two studies have garnered significant attention recently as scholars investigate the interconnections between COVID-19 and its implications for COPD combined with coronary heart disease.

Table 5 The Top 10 Authors in the Number of Publications and Co-Citations from 2005 to 2024

Ranking	Author	Number of Publications (articles)	Co-Cited Author	Number of Co-Citations
1	Lin Cheng-li	23	Sin dd	248
2	Kao Chia-Hung	20	Mannino dm	194
3	Helvaci Mehmet Rami	15	Helvaci mr	159
4	Dransfield Mark T	13	Rabe kf	132
5	Macnee william	13	Celli br	130
6	Wouters emiel f m	13	Vestbo j	128
7	Zhou maigeng	13	Barnes pj	117
8	Vestbo jorgen	12	World health, organization	113
9	Washko george r	12	Anthonisen nr	105
10	Lip gregory y h; Yin peng	11	Barr rg	98

https://doi.org/10.2147/COPD.S495326

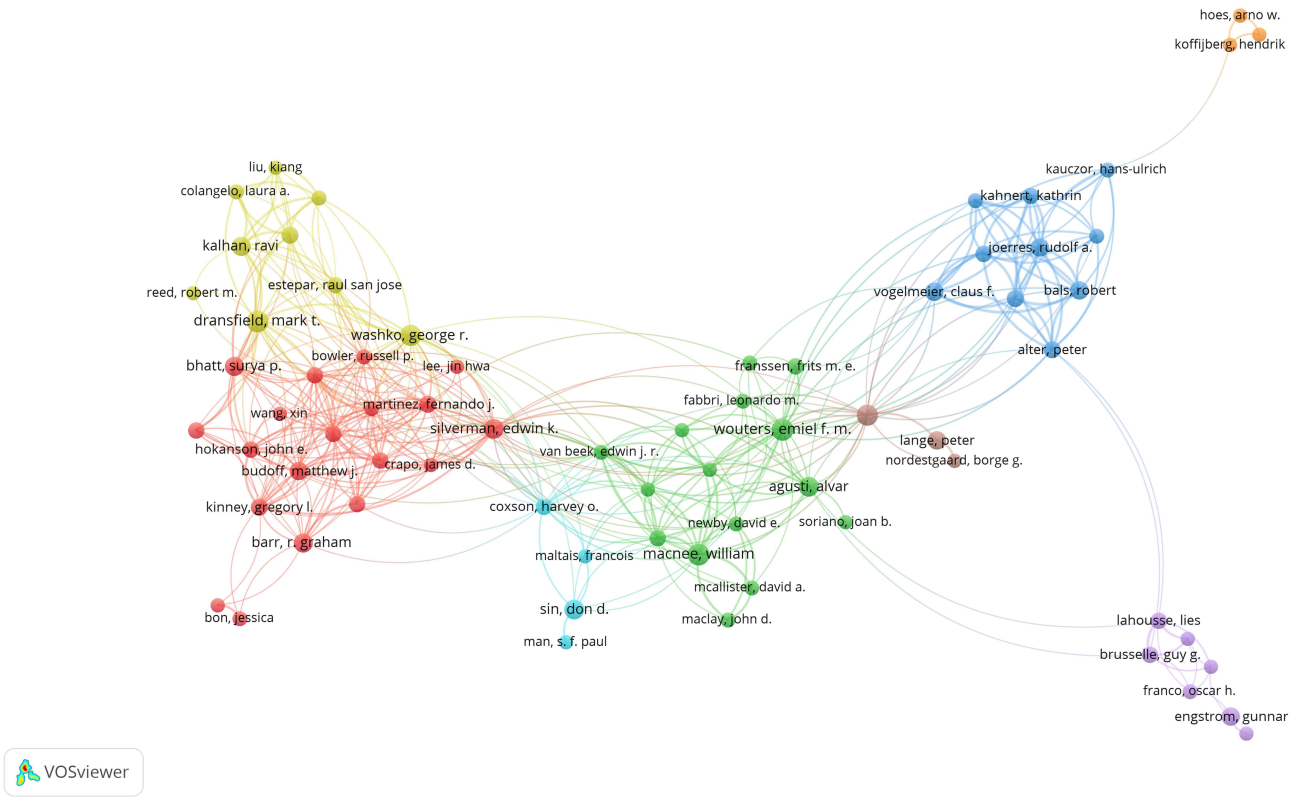

Figure 10 Cooperation between authors.

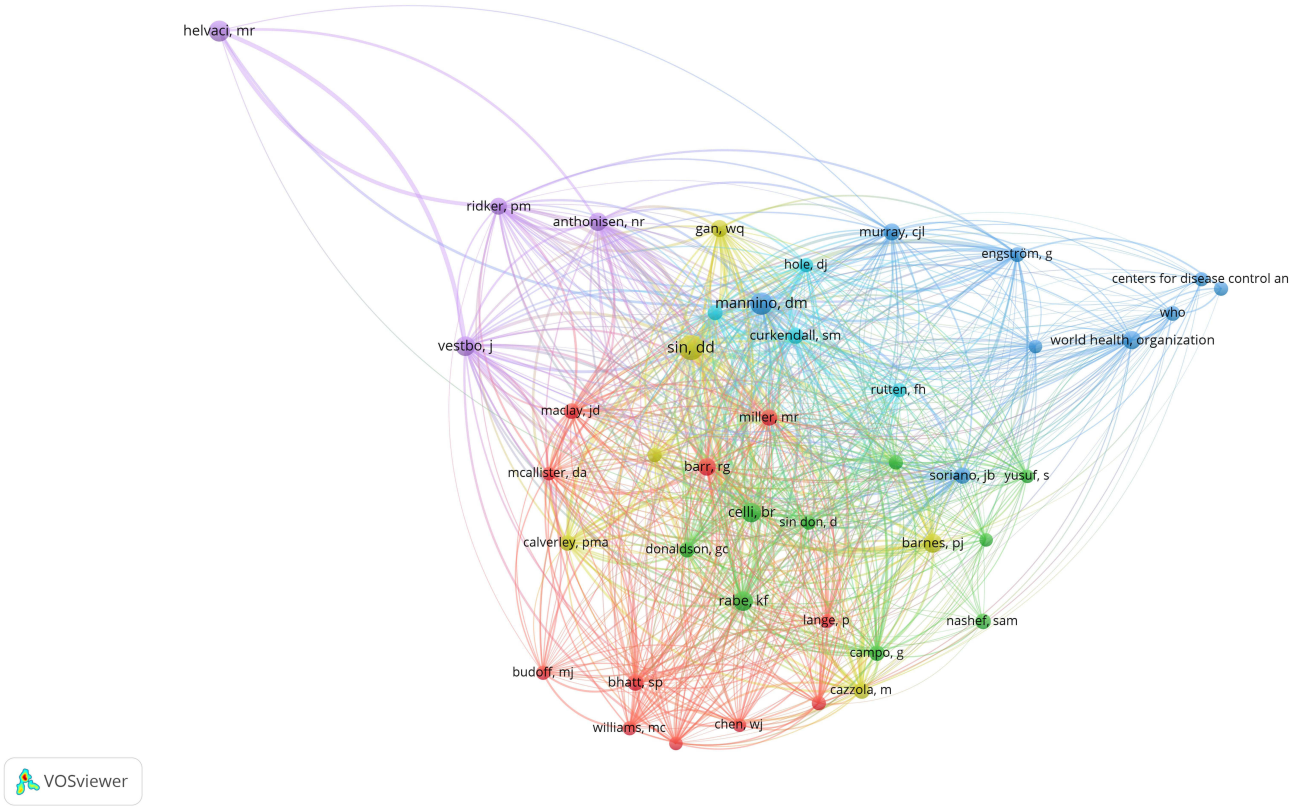

Figure 11 Cooperation diagram among co-cited authors.

Table 6 References with the Top 10 Cited Times

Ranking	Article	Periodical	Author	Number of Co-Citations	TLS
1	Why are Patients With Chronic Obstructive Pulmonary Disease at Increased Risk of Cardiovascular Diseases? The Potential Role of Systemic Inflammation in Chronic Obstructive Pulmonary Disease	Circulation	Sin dd	89	650
2	Association between chronic obstructive pulmonary disease and systemic inflammation: A systematic review and a meta-analysis	Thorax	Gan wq	77	495
3	Global Strategy for the Diagnosis, Management, andPrevention of Chronic Obstructive Pulmonary Disease GOLD Executive Summary	Am j resp crit care	Rabe Kf	77	359
4	Cardiovascular Disease in Patients with Chronic Obstructive Pulmonary Disease, Saskatchewan Canada Cardiovascular Disease in COPD Patients	Ann epidemiol	Curkendall Sm	74	589
5	ATS/ERS TASK FORCE: STANDARDISATION OF LUNG FUNCTION TESTING	Eur respir j	Miller Mr	73	356
6	Prevalence and outcomes of diabetes, hypertension and cardiovascular disease in COPD	Eur Respir j	Mannino dm	66	414
7	COPD and Incident Cardiovascular Disease Hospitalizations and Mortality: Kaiser Permanente Medical Care Program*	Chest	Sidney s	60	406
8	Impaired lung function and mortality risk in men and women: findings from the Renfrew and Paisley prospective population study	Brit med j	Hole Dj	56	401
9	The Relationship Between Reduced Lung Function and Cardiovascular Mortality*	Chest	Sin dd	55	393
10	Chronic Obstructive Pulmonary Disease as a Risk Factor for Cardiovascular Morbidity and Mortality	Proc am thorac soc	Sin don	52	393

Keyword Co-Occurrence and Overlay Analysis

In total, 7605 keywords were identified, with eighty appearing more than 40 times each. After excluding common terms such as COPD and CHD from consideration, Table 7 presents the top ten keywords ranked by frequency, where "mortality", "risk", and "outcomes" occupy the top three positions, respectively. Utilizing VOSviewer software generated a keyword co-occurrence network map (Figure 15), classifying keywords into three distinct categories represented by color coding: red signifies management aspects related to COPD and CHD diseases including cohort studies or complications like death or follow-up guidelines; blue denotes epidemiological characteristics encompassing multimorbidity prevalence along with quality-of-life assessments within populations affected by these conditions while green highlights diseases associated specifically with COPD/CHD such as asthma associations or cardiovascular issues linked through factors like obesity/smoking/inflammation etcetera. The keyword timeline graph depicted in Figure 16 reveals emerging trends indicated by yellow nodes suggesting potential future hotspots, including burden, multimorbidity, comorbidities, hypertension, obesity, risk factors, impacting, outcomes, heart failure, diagnosis, covid −19, societal, prevalence rates likely shaping upcoming investigations moving forward. Furthermore, Figure 17 showcases prominence rankings amongst the leading twenty-five key terminologies reflecting evolving focal points throughout this domain, wherein COVID-19 remains a pivotal topic intersecting both COPD/CHD realms anticipated continuing relevance ahead.

Discussion

Intellectual Foundations of Studies on COPD and CHD

Utilizing VOSviewer (version 1.6.20) and CiteSpace (version6.3.1), a comprehensive visual analysis was conducted on a total of 2420 publications from the years 2005 to 2024 to investigate the research landscape, emerging trends, and developmental trajectories in the intersection of COPD and CHD. Statistical analyses reveal an explosive growth in literature within this domain from 2020 to 2022, likely correlated with the COVID-19 pandemic's onset. Although the

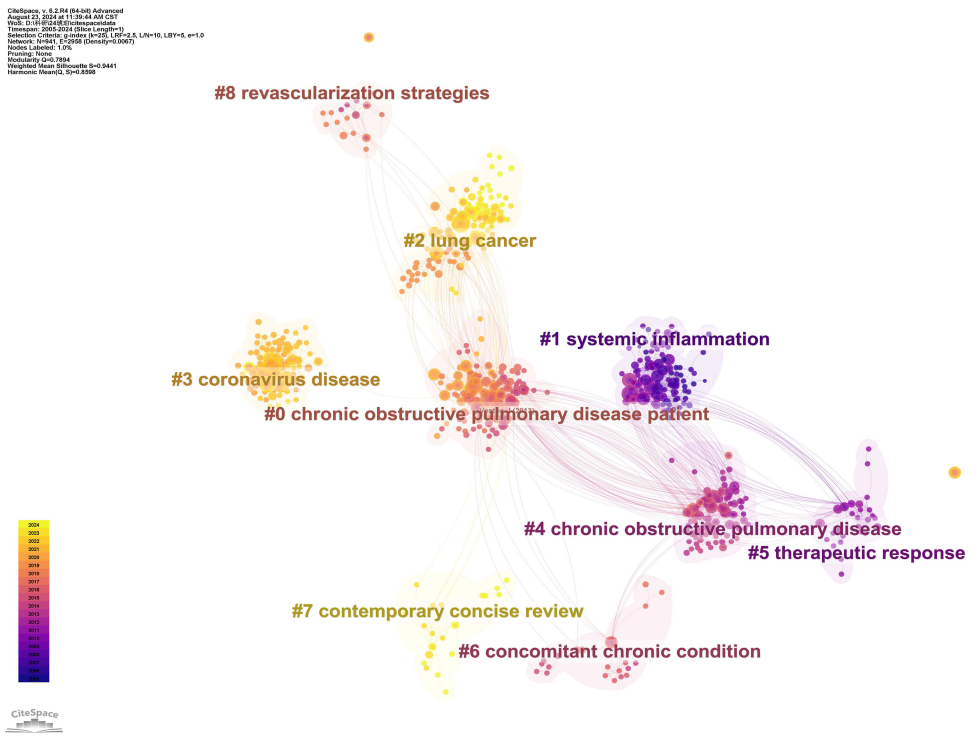

Figure 12 Cluster analysis of literatures cited in recent 20 years.

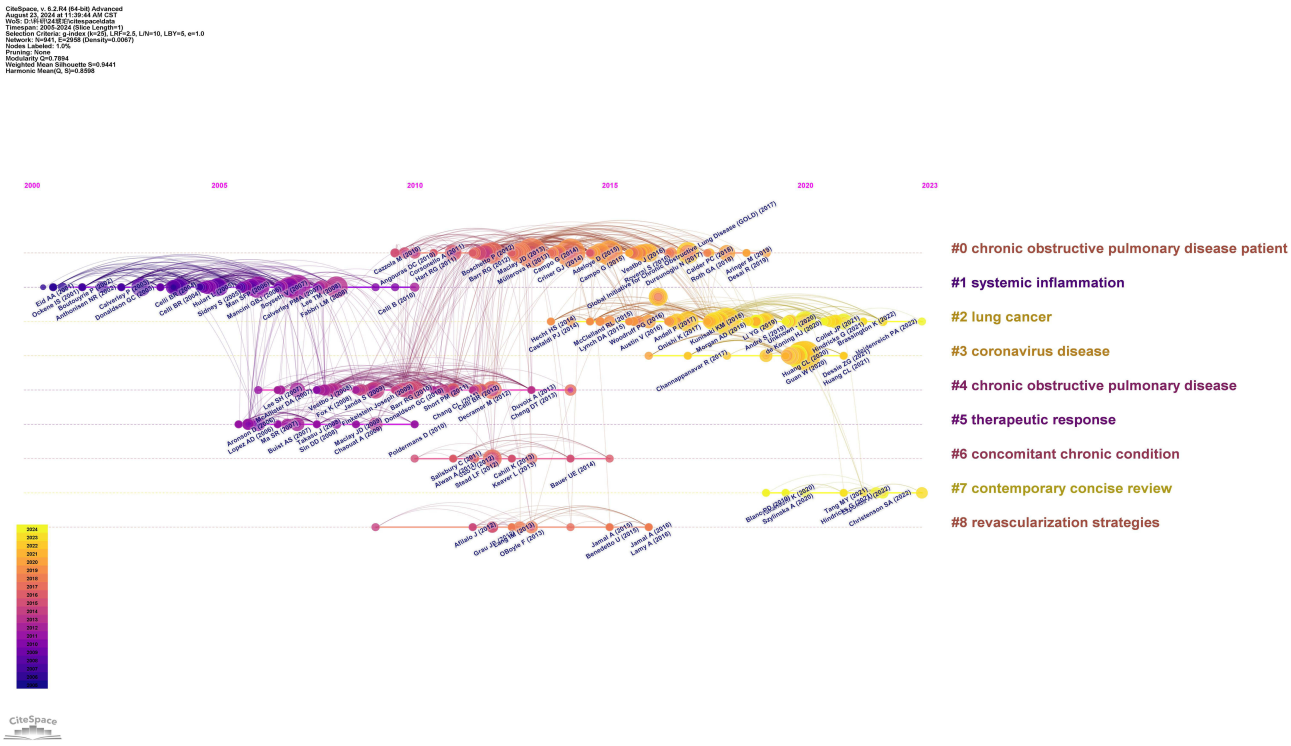

Figure 13 Clustering time diagram of co-cited references.

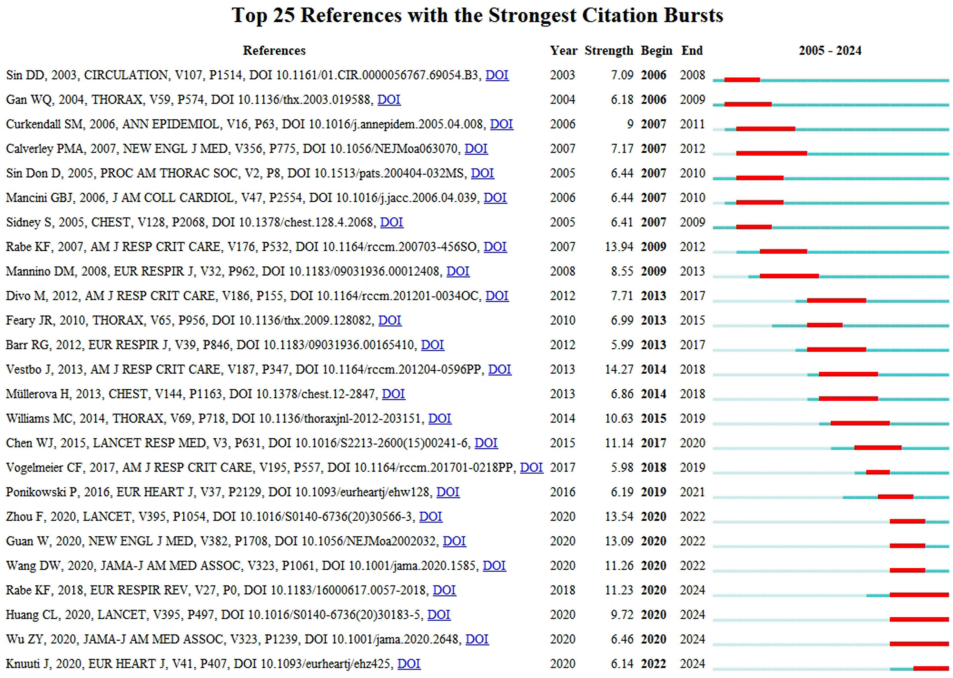

Figure 14 The top 25 references for explosive power in 2005–2024.

Netherlands ranks eighth in publication volume, it leads globally in average citation counts, underscoring the high caliber of research produced by its scholars. The Journal Citation Reports (JCR) classification for the ten most-cited journals falls within the Q1 tier. A VOSviewer author analysis identifies Professor Lin Cheng-li from Taiwan as the foremost contributor; his work primarily addresses risk assessments associated with COPD alongside various comorbidities. Following him is Professor Kao Chia-hung from Taiwan, whose expertise encompasses epidemiological studies related to clinical diseases, systematic reviews, and integrative analyses. The top ten cited works illuminate prevailing research trends concerning COPD coexisting with CHD; notably, "Why are patients with chronic obstructive pulmonary disease at increased risk of cardiovascular diseases?" emerges as a frequently referenced article that discusses systemic inflammation's pivotal role in elevating CHD incidence among COPD patients.[18]

Table 7 Top 10 Keywords with Frequency from 2005 to 2024

Ranking	Keyword	Occurrence Frequency	TLS
1	Mortality	642	4856
2	Risk	380	2790
3	Outcomes	329	2245
4	Prevalence	244	1917
5	Risk-factors	207	1523
6	Association	175	1440
7	Management	165	1145
8	Surgery	159	944
9	Impact	156	1142
10	Epidemiology	129	941

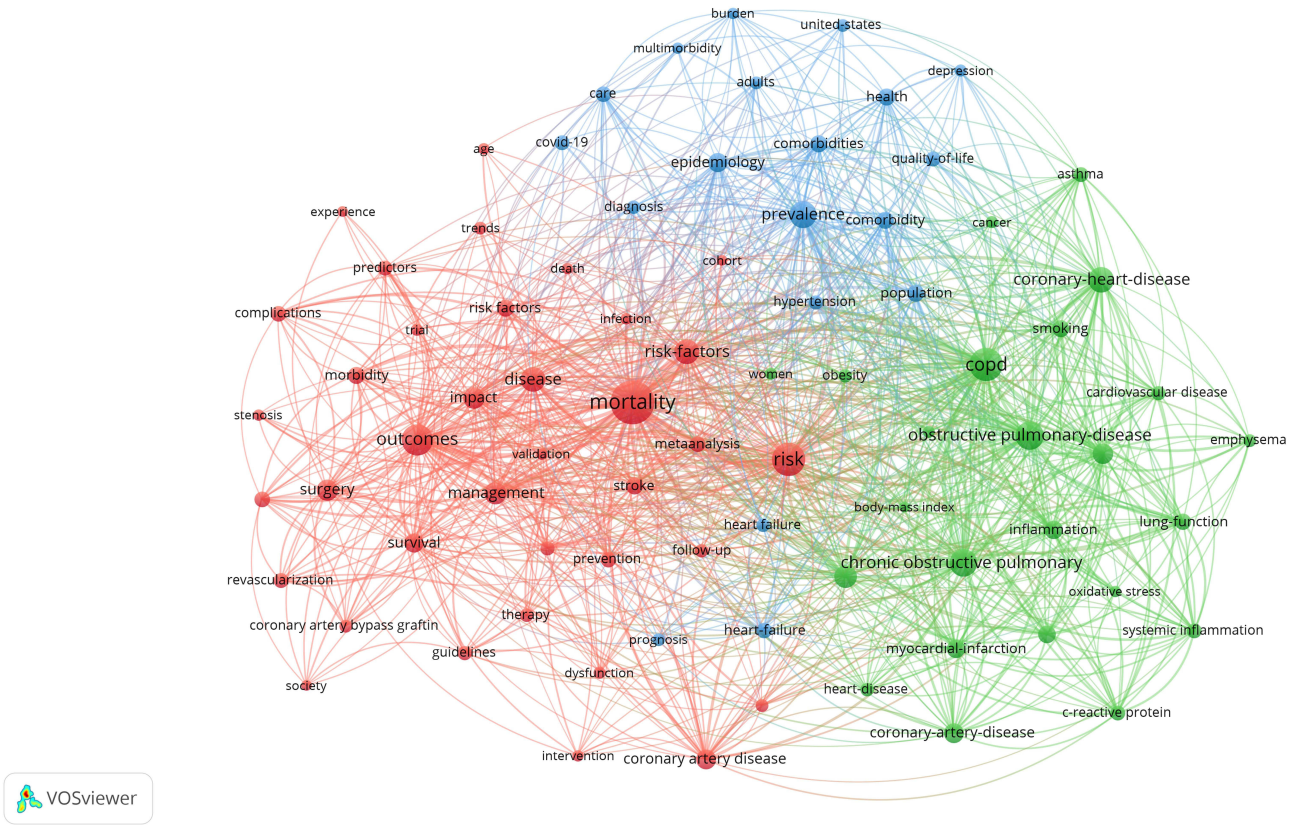

Figure 15 Keyword co-occurrence map.

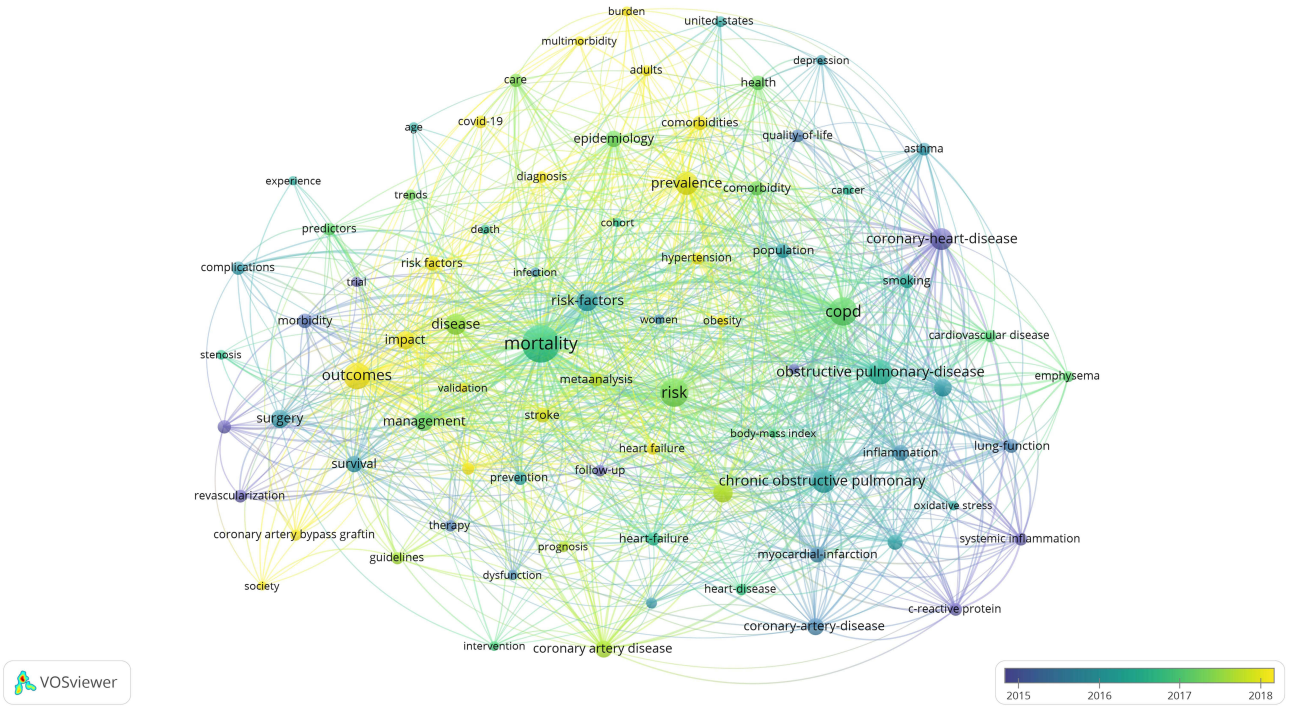

Figure 16 Time diagram of keywords.

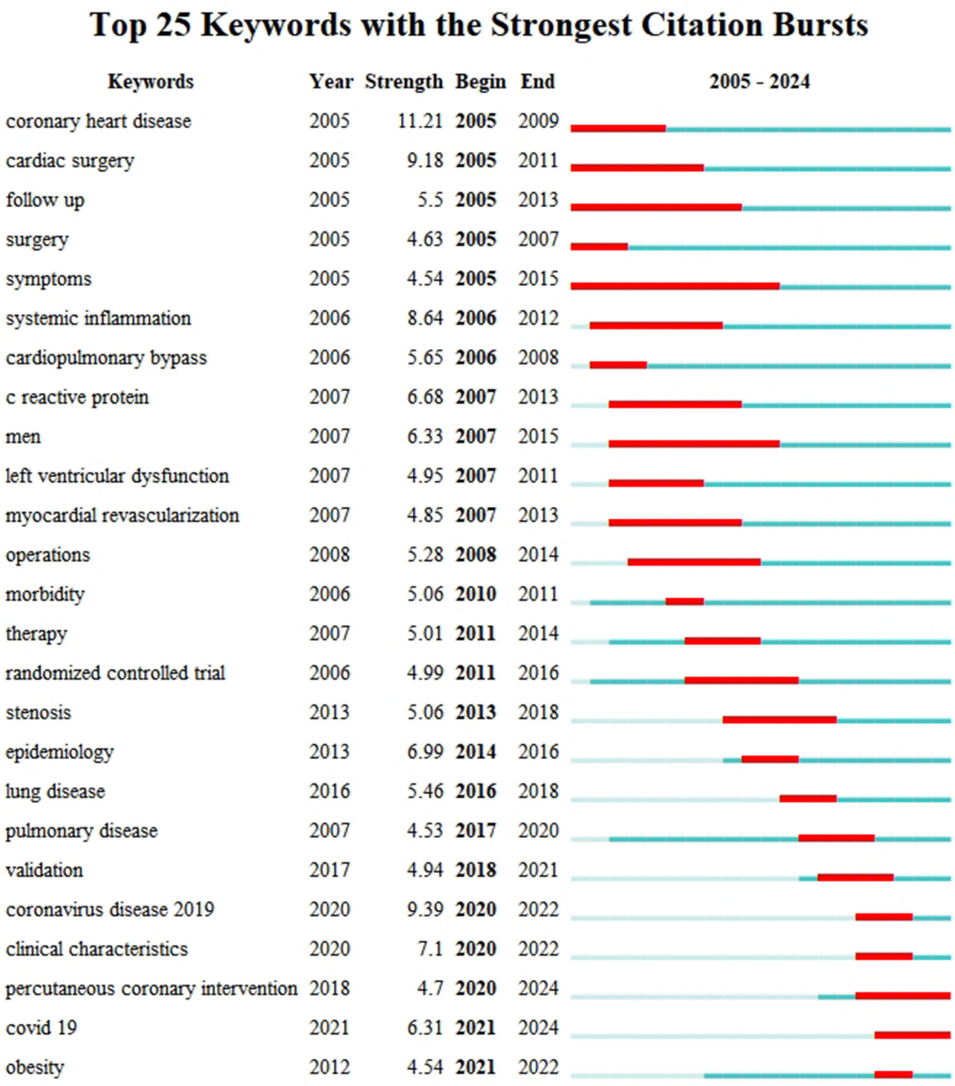

Figure 17 The top 25 keywords for explosive power in 2005–2024.

Analysis of Research Hotspots in COPD and CHD Field

Hotspot 1: Inflammation Associated with COPD and CHD

Extensive investigations have established that COPD serves as a primary risk factor for developing CHD; Lange P[19] and Schneider C[20] et al have demonstrated that airflow limitation correlates positively with heightened risks for CHD among individuals suffering from COPD—both conditions often coexist within affected patients' profiles. Chronic airway inflammation characterizes both disorders,[1] while inflammatory processes also significantly advance CHD.[21] Currently, there exists no consensus regarding specific mechanisms through which COPD precipitates CHD; however, it is evident that systemic inflammation stemming from COPD constitutes a critical pathway leading to increased incidences of coronary complications.[22] For instance, chronic hypoxia can induce endothelial dysfunction among those afflicted by COPD.[1] At the same time, diminished lung function may hinder clearance mechanisms for toxic substances, contributing further to elevated risks of developing heart disease.[23] Research conducted by Santus P[24] and Wang Y[25] has substantiated that anti-inflammatory therapies targeting individuals diagnosed with COPD can mitigate their likelihood of experiencing concurrent coronary events significantly. Rabe KF[26] and Neukamm A[27] et al found evidence suggesting statins not only enhance pulmonary function but also alleviate symptoms associated with COPP via anti-inflammatory pathways employed therein; additionally, C-reactive protein has been shown capable of stimulating IL-6 production along with

endothelin-1 synthesis—factors influencing prognostic outcomes amongst patients grappling simultaneously with both conditions.[28,29] Furthermore, studies indicate potential benefits arising from combined β-blocker/β-agonist treatments aimed at improving overall prognoses for those managing dual diagnoses involving both respiratory ailments alongside cardiac issues.[30] Presently under investigation remains how inflammatory mechanisms interrelate between these two pathologies alongside corresponding therapeutic interventions.

Hotspot 2: COPD Combined with CHD and COVID-19

Since the outbreak of COVID-19, due to its high infectivity and fatality rate, it has become the focus of global research.[31,32] The primary pathogenic mechanism of COVID-19 is that the S protein on its surface binds with ACE 2, which is mainly distributed in the lungs and heart.[33] Docherty AB's study showed that during the COVID-19 pandemic, about 18% of hospitalized patients with COVID-19 had COPD.[34] Wang B also indicated that the presence of comorbidities would increase the risk of COVID-19.[35] Therefore, COVID-19 is a common risk factor for COPD and CHD, and COVID-19 is still a research hotspot in this field. In the context of the novel coronavirus epidemic, the field of COPD and CHD will continue to integrate with COVID-19 to produce more academic achievements.

Hotspot 3: Intervention in COPD with CHD

With the increasing division of medical specialties, doctors in different fields will classify COPD and CHD as diseases in their field when encountering the typical manifestations of COPD and CHD, thus ignoring the differential diagnosis of another disease, resulting in missed diagnosis. Studies have shown that the current missed diagnosis rate of COPD among CHD patients is about 31%.[36] The missed diagnosis rate of CHD in patients with severe COPD is about 59%.[37] For the prevention of COPD combined with CHD, in addition to further strengthening education, early diagnosis is also essential. For COPD patients, it is necessary to improve the management of cardiovascular risk factors to reduce the incidence and mortality of CHD.[38] Therefore, it is essential to establish a risk prediction model for CHD in COPD patients.[39] The missed diagnosis of COPD and CHD is mainly because pulmonary function measurement and coronary angiography are not widely used in primary hospitals. At present, the diagnostic accuracy of coronary CTA for CHD is comparable to that of coronary angiography,[40,41] and the diagnosis rate of chest CT for COPD is also relatively high. Therefore, the current research focus is to use imaging omics to extract compelling features of CT images and establish an effective prediction model to make a precise diagnosis of COPD complicated with CHD.

Hotspot 4: Treatment of COPD Combined with CHD

There is no single global consensus on the treatment of COPD with CHD, but many guidelines recommend a comprehensive treatment strategy that typically includes medication, interventional therapy, and rehabilitation. Currently, the drugs under investigation mainly encompass glucocorticoids,[42] statins,[43] ACEI and ARB,[44] β1-blockers,[45] and β2-blockers.[46] At present, coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI) constitutes the primary interventional treatment for COPD patients with CHD.[8] However, for patients with poor lung function, PCI should be avoided or delayed as far as possible to reduce postoperative complications.[47] Additionally, pulmonary rehabilitation training has gradually emerged as a hot topic in treating patients with COPD and CHD in recent years, and studies have demonstrated that pulmonary rehabilitation training can effectively enhance the lung function of patients.[48]

Restrictions

The limitations of this paper encompass the possibility that recently published high-quality literature might be underestimated due to the timing of publication. The search date of this paper is August 20, 2024. Therefore, the number of citations and publications in 2024 is not precise, which might impact subsequent research. Additionally, this paper solely studied the relevant literature in the WOS core collection database, disregarding other databases, including non-English languages. Hence, the results might be biased. Nevertheless, we are convinced that the results of the analysis obtained in this study can still offer references for future researchers in this field.

Conclusions

Our bibliometric analysis presents an overview of the advancements in COPD with CHD over the past two decades. The survey outcomes indicate that the quantity of published papers has witnessed a steady increase over the past 20 years, and the growth rate is anticipated to persist in the future. The United States has the most significant number of publications, while China Medical University and Lin Cheng-li are the most productive institutions and authors, respectively. In recent years, as residents' quality of life has improved, increasing attention has been devoted to chronic diseases. The current research primarily focuses on the pathogenesis, early diagnosis, comprehensive intervention, and treatment of COPD combined with CHD. Nevertheless, there are still numerous deficiencies and challenges, such as the absence of a standardized diagnosis and treatment guideline for patients with COPD and CHD comorbidities. Our research results reveal the development trend and hot spots in the field of COPD complicated with CHD. For future researchers, it is a worthy direction to build an early risk prediction model of COPD complicated with CHD by using imaging omics. Through early diagnosis and timely intervention, further development of the disease can be effectively prevented and patients' pain can be alleviated. Reduce the overall economic and medical burden on society.

Funding

The study was funded by Science and Technology Project of Huzhou City, Zhejiang Province (2023GY33).

Disclosure

The authors report no conflicts of interest in this work.

References

1. Bhatt SP, Dransfield MT. Chronic obstructive pulmonary disease and cardiovascular disease. *Transl Res*. 2013;162(4):237–251. doi:10.1016/j.trsl.2013.05.001
2. Sin DD, Anthonisen NR, Soriano JB, Agusti AG. Mortality in COPD: role of comorbidities. *Eur Respir J*. 2006;28(6):1245–1257. doi:10.1183/09031936.00133805
3. Yangui F, Touil A, Antit S, Zakhama L, Charfi MR. COPD prevalence in smokers with stable ischemic heart disease: a cross-sectional study in Tunisia. *Respir Med*. 2021;179:106335. doi:10.1016/j.rmed.2021.106335
4. Patel ARC, Donaldson GC, Mackay AJ, Wedzicha JA, Hurst JR. The impact of ischemic heart disease on symptoms, health status, and exacerbations in patients with COPD. *Chest*. 2012;141(4):851–857. doi:10.1378/chest.11-0853
5. Rysiak E, Prokop I, Zaręba I, Mróz RM. Estimates of medication expenditure for ischemic heart disease accompanying chronic obstructive pulmonary disease. *Adv Exp Med Biol*. 2018;1114:49–55. doi:10.1007/5584_2018_201
6. Tully PJ, Cosh SM, Baumeister H. The anxious heart in whose mind? A systematic review and meta-regression of factors associated with anxiety disorder diagnosis, treatment and morbidity risk in coronary heart disease. *J Psychosom Res*. 2014;77(6):439–448. doi:10.1016/j.jpsychores.2014.10.001
7. Jones PW, Brusselle G, Dal negro RW, et al. Health-related quality of life in patients by COPD severity within primary care in Europe. *Respir Med*. 2011;105(1):57–66. doi:10.1016/j.rmed.2010.09.004
8. Andell P, Sjögren J, Batra G, Szummer K, Koul S. Outcome of patients with chronic obstructive pulmonary disease and severe coronary artery disease who had a coronary artery bypass graft or a percutaneous coronary intervention. *Eur J Cardiothorac Surg*. 2017;52(5):930–936. doi:10.1093/ejcts/ezx219
9. Tian Z, Jiang Y, Zhang N, Zhang Z, Wang L. Analysis of the current state of COPD nursing based on a bibliometric approach from the web of science. *Int J Chron Obstruct Pulmon Dis*. 2024;19:255–268. doi:10.2147/COPD.S440715
10. Huang Z, Xie T, Xie W, Chen Z, Wen Z, Yang L. Research trends in lung cancer and the tumor microenvironment: a bibliometric analysis of studies published from 2014 to 2023. *Front Oncol*. 2024;14:1428018. doi:10.3389/fonc.2024.1428018
11. Boutet A, Haile SS, Yang AZ, et al. Assessing the emergence and evolution of artificial intelligence and machine learning research in neuroradiology. *AJNR Am J Neuroradiol*. 2024;45(9):1269–1275. doi:10.3174/ajnr.A8252
12. Zhang J, Ji C, Zhai X, Tong H, Hu J. Frontiers and hotspots evolution in anti-inflammatory studies for coronary heart disease: a bibliometric analysis of 1990-2022. *Front Cardiovasc Med*. 2023;10:1038738. doi:10.3389/fcvm.2023.1038738
13. Xu D, Wang YL, Wang KT, et al. A scientometrics analysis and visualization of depressive disorder. *Curr Neuropharmacol*. 2021;19(6):766–786. doi:10.2174/1570159X18666200905151333
14. Fang H, Dong T, Han Z, et al. Comorbidity of pulmonary fibrosis and COPD/emphysema: research status, trends, and future directions —- a bibliometric analysis from 2004 to 2023. *Int J Chron Obstruct Pulmon Dis*. 2023;18:2009–2026. doi:10.2147/COPD.S426763
15. Chen CM, Leydesdorff L. Leydesdorff L. Patterns of connections and movements in dual-map overlays: a new method of publication portfolio analysis. *J Assoc Inf Sci Technol*. 2014;65(2):334–351. doi:10.1002/asi.22968
16. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet*. 2020;395(10229):1054–1062. doi:10.1016/S0140-6736(20)30566-3
17. Guan WJ, Ni ZY, Hu Y, et al.; China Medical Treatment Expert Group for Covid-19. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med*. 2020;382(18):1708–1720. doi:10.1056/NEJMoa2002032

18. Sin DD, Man SF. Why are patients with chronic obstructive pulmonary disease at increased risk of cardiovascular diseases? The potential role of systemic inflammation in chronic obstructive pulmonary disease. *Circulation*. 2003;107(11):1514–1519. doi:10.1161/01.cir.0000056767.69054.b3
19. Lange P, Mogelvang R, Marott JL, Vestbo J, Jensen JS. Cardiovascular morbidity in COPD: a study of the general population. *COPD*. 2010;7(1):5–10. doi:10.3109/15412550903499506
20. Schneider C, Bothner U, Jick SS, Meier CR. Chronic obstructive pulmonary disease and the risk of cardiovascular diseases. *Eur J Epidemiol*. 2010;25(4):253–260. doi:10.1007/S10654-010-9435-7
21. Ali M, Girgis S, Hassan A, Rudick S, Becker RC. Inflammation and coronary artery disease: from pathophysiology to Canakinumab Anti-Inflammatory Thrombosis Outcomes Study (CANTOS). *Coron Artery Dis*. 2018;29(5):429–437. doi:10.1097/MCA.0000000000000625
22. Aisanov Z, Khaltaev N. Management of cardiovascular comorbidities in chronic obstructive pulmonary disease patients. *J Thorac Dis*. 2020;12(5):2791–2802. doi:10.21037/jtd.2020.03.60
23. Schroeder EB, Welch VL, Couper D, et al. Lung function and incident coronary heart disease: the Atherosclerosis Risk in Communities Study. *Am J Epidemiol*. 2003;158(12):1171–1181. doi:10.1093/aje/kwg276
24. Santus P, Radovanovic D, Di Marco S,et al. Effect of indacaterol on lung deflation improves cardiac performance in hyperinflated COPD patients: an interventional, randomized, double-blind clinical trial. *Int J Chron Obstruct Pulmon Dis*. 2015;10:1917–1923. doi:10.2147/COPD.S91684
25. Wang Y, Liu X, Shi H, et al. NLRP3 inflammasome, an immune-inflammatory target in pathogenesis and treatment of cardiovascular diseases. *Clin Transl Med*. 2020;10(1):91–106. doi:10.1002/ctm2.13
26. Rabe KF, Hurst JR, Suissa S. Cardiovascular disease and COPD: dangerous liaisons? *Eur Respir Rev*. 2018;27(149):180057. doi:10.1183/16000617.0057-2018
27. Neukamm A, Høiseth AD, Einvik G, et al. Rosuvastatin treatment in stable chronic obstructive pulmonary disease (RODEO): a randomized controlled trial. *J Intern Med*. 2015;278(1):59–67. doi:10.1111/joim.12337
28. Ukena C, Mahfoud F, Kindermann M, et al. The cardiopulmonary continuum systemic inflammation as 'common soil' of heart and lung disease. *Int J Cardiol*. 2010;145(2):172–176. doi:10.1016/j.ijcard.2010.04.082
29. Ridker PM, Rifai N, Rose L, Buring JE, Cook NR. Comparison of C-reactive protein and low-density lipoprotein cholesterol levels in the prediction of first cardiovascular events. *N Engl J Med*. 2002;347(20):1557–1565. doi:10.1056/NEJMoa021993
30. Bhatt SP, Wells JM, Kinney GL, et al. COPDGene Investigators. β-Blockers are associated with a reduction in COPD exacerbations. *Thorax*. 2016;71(1):8–14. doi:10.1136/thoraxjnl-2015-207251
31. Zhou P, Yang XL, Wang XG. Hu B, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*. 2020;579(7798):270–273. doi:10.1038/s41586-020-2012-7
32. Yang X, Yu Y, Xu J, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *Lancet Respir Med*. 2020;8(5):475–481. doi:10.1016/S2213-2600(20)30079-5
33. Zhou T, Tsybovsky Y, Gorman J, et al. Cryo-EM Structures of SARS-CoV-2 Spike without and with ACE2 Reveal a pH-dependent switch to mediate endosomal positioning of receptor-binding domains. *Cell Host Microbe*. 2020;28(6):867–879.e5. doi:10.1016/j.chom
34. Docherty AB, Harrison EM, Green CA, et al. Features of 20 133 UK patients in hospital with COVID-19 using the ISARIC WHO clinical characterisation protocol: prospective observational cohort study. *BMJ*. 2020;369:m1985. doi:10.1136/bmj.m1985
35. Wang B, Li R, Lu Z, Huang Y. Does comorbidity increase the risk of patients with COVID-19: evidence from meta-analysis. *Aging*. 2020;12(7):6049–6057. doi:10.18632/aging.103000
36. Franssen FM, Soriano JB, Roche N, et al. Lung function abnormalities in smokers with ischemic heart disease. *Am J Respir Crit Care Med*. 2016;194(5):568–576. doi:10.1164/rccm.201512-2480OC
37. Reed RM, Eberlein M, Girgis RE, et al. Coronary artery disease is under-diagnosed and under-treated in advanced lung disease. *Am J Med*. 2012;125(12):1228.e13–1228.e22. doi:10.1016/j.amjmed
38. Hawkins NM, Peterson S, Ezzat AM, et al. Control of cardiovascular risk factors in patients with chronic obstructive pulmonary disease. *Ann Am Thorac Soc*. 2022;19(7):1102–1111. doi:10.1513/AnnalsATS.202104-463OC
39. Ogan N, Gunay E, Ekici B, et al. Morphological overview of cardiovascular comorbidities in chronic obstructive pulmonary disease: frank's sign. *Heart Lung*. 2020;49(3):331–335. doi:10.1016/j.hrtlng.2020.01.008
40. Falk JA, Kadiev S, Criner GJ, Scharf SM, Minai OA, Diaz P. Cardiac disease in chronic obstructive pulmonary disease. *Proc Am Thorac Soc*. 2008;5(4):543–548. doi:10.1513/pats.200708-142ET
41. Nikolaou K, Knez A, Rist C, et al. Accuracy of 64-MDCT in the diagnosis of ischemic heart disease. *AJR Am J Roentgenol*. 2006;187(1):111–117. doi:10.2214/AJR.05.1697
42. Martinez FJ, Rabe KF, Ferguson GT, et al. Reduced all-cause mortality in the ethos trial of budesonide/glycopyrrolate/formoterol for chronic obstructive pulmonary disease. a randomized, double-blind, multicenter, parallel-group study. *Am J Respir Crit Care Med*. 2021;203(5):553–564. doi:10.1164/rccm.202006-2618OC
43. Chen YY, Li TC, Li CI, Lin SP, Fu PK. Statins associated with better long-term outcomes in aged hospitalized patients with COPD: a real-world experience from pay-for-performance program. *J Pers Med*. 2022;12(2):299. doi:10.3390/jpm12020299
44. Tejwani V, Fawzy A, Putcha N, et al. COPDGene investigators. emphysema progression and lung function decline among angiotensin converting enzyme inhibitors and angiotensin-receptor blockade users in the COPDgene cohort. *Chest*. 2021;160(4):1245–1254. doi:10.1016/j.chest.2021.05.007
45. Chung CM, Lin MS, Chang ST, Wang PC, Yang TY, Lin YS. Cardioselective versus nonselective β-blockers after myocardial infarction in adults with chronic obstructive pulmonary disease. *Mayo Clin Proc*. 2022;97(3):531–546. doi:10.1016/j.mayocp.2021.07.020
46. Rogliani P, Calzetta L, Matera MG, et al. Inhaled therapies and cardiovascular risk in patients with chronic obstructive pulmonary disease. *Expert Opin Pharmacother*. 2019;20(6):737–750. doi:10.1080/14656566.2019.1570133
47. Lizak MK, Nash E, Zakliczyński M, Sliwka J, Knapik P, Zembala M. Additional spirometry criteria predict postoperative complications after coronary artery bypass grafting (CABG) independently of concomitant chronic obstructive pulmonary disease: when is off-pump CABG more beneficial? *Pol Arch Med Wewn*. 2009;119(9):550–557. doi:10.20452/pamw.1279
48. Chen JO, Liu JF, Liu YQ, et al. Effectiveness of a perioperative pulmonary rehabilitation program following coronary artery bypass graft surgery in patients with and without COPD. *Int J Chron Obstruct Pulmon Dis*. 2018;13:1591–1597. doi:10.2147/COPD.S157967