



AECOPD research in the past ten years: a bibliographic analysis based on Web of Science

Jie Xu, Xudong Wang, Zhihai Li, Yingjun Shi, Weitao Shi, Yawen Liu, Yun Zhao, Yuliang Zhao

Department of Critical Care Medicine, 1st People's Hospital of Xuzhou City, Xuzhou, China

Contributions: (I) Conception and design: J Xu, Y Zhao; (II) Administrative support: X Wang; (III) Provision of study materials or patients: Z Li, Y Shi; (IV) Collection and assembly of data: W Shi, Y Liu; (V) Data analysis and interpretation: J Xu; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Yuliang Zhao. Department of Critical Care Medicine, 1st People's Hospital of Xuzhou City, Xuzhou, China. Email: xj20210924@163.com.

Background: Acute exacerbations of chronic obstructive pulmonary disease COPD (AECOPD) can cause a significant decrease in patient lung function, and are the main reason for hospitalization and death of patients with COPD. This study aims to use bibliometric methods to analyze the characteristics of AECOPD related research in the past 10 years [2010–2020] and provide references for future research.

Methods: This study used subject terms to search AECOPD-related documents published in 2010–2020 in the Science Citation Index Expanded (SCI-E) database. The search terms were “AECOPD” or “acute exacerbation of chronic obstructive pulmonary disease.” We use the CiteSpace software to analyze the target literature records. The analysis includes: the annual distribution of literature publications, the distribution of published literature sources (including countries, institutions, journals, and authors), and using keywords.

Results: A total of 3,785 articles on AECOPD were published between 2010 and 2020, with 62,162 citations. Both the number of published documents and the number of citations has increased with time. The literature mainly comes from several developed countries, including European and North American countries, and the cooperation between institutions and authors in these countries is relatively close. The main journals are the top journals of respiratory specialty and the top comprehensive journals. The results of the keyword analysis show that the current research is on risk factors, biomarkers, and AECOPD management.

Conclusions: AECOPD research tends to focus on a precise diagnosis and treatment, and prevention of AECOPD in patients with COPD should be paid more attention.

Keywords: AECOPD; chronic obstructive pulmonary disease (COPD); bibliometrics; risk factors; precision medicine

Submitted Jul 12, 2021. Accepted for publication Oct 19, 2021.

doi: 10.21037/apm-21-2756

View this article at: <https://dx.doi.org/10.21037/apm-21-2756>

Introduction

Chronic obstructive pulmonary disease (COPD) is currently one of the main diseases affecting the health of adults, especially the elderly, and can increase the risk of lung cancer (1,2). According to statistics, COPD caused more than 3 million deaths worldwide in 2015, accounting for 5% of all deaths. Compared to 1990, the number of deaths from COPD in 2015 increased by 10% and the prevalence

increased by 44%. Furthermore, due to insufficient diagnosis and treatment of COPD, the morbidity and mortality of COPD can be underestimated (3). In China, there are approximately 100 million patients with COPD. The prevalence of COPD varies from 1.20% to 8.87% in different regions. The prevalence rate of people over 40 years old is as high as 13.7%. Males (7.76%) are higher than females (4.07%). Rural areas (7.62%) are higher than urban areas (6.09%) (4,5).

Acute exacerbations of COPD (AECOPD) can cause a significant decrease in lung function of patients and seriously affect the health and life of patients. It is the main reason for the hospitalization and death of COPD patients and places a heavy burden on the patient's family and the medical system (6,7). Therefore, AECOPD has been the focus of research in respiratory diseases in recent years (8-12). The main cause of AECOPD is respiratory viral infection and the main pathogenesis includes viral-bacteria coinfection, microbiome changes in the respiratory tract and host response to bacteria and bacterial susceptibility (8,9). Especially in recent 2 years, COVID-19 infection can cause AECOPD which is very dangerous (12). However, in recent decades, the diagnosis, evaluation, and management of AECOPD have not made significant progress. Recent clinical and translational studies have shown that the heterogeneity of the mechanisms and outcomes of acute exacerbations can be resolved by grouping them into etiological groups (13). It is expected that this will help better understand the pathophysiological process behind each type of exacerbation, thereby facilitating the intervention of precision medicine in AECOPD (13).

Bibliometrics is a quantitative analysis of published documents, analyzing the authors, research institutions, countries from which they come from, journals, etc., reflecting the current research status of a certain topic, and analyzing the frequency of use of keywords to reveal the changes of research hotspots (14,15). This study aims to use bibliometric methods to analyze the status and characteristics of AECOPD related research in the past 10 years [2010–2020] and provide references for future research.

Methods

Database

Similar to the previous bibliometric studies, we used the Science Citation Index Expanded (SCI-E) database as a data source to search. The SCI-E database is an open database in the Core Collection of the Web of Science (WOS) that provides literature citation data from the literature. It is currently an important data source for bibliometric research and scientific paper evaluation. The SCI-E database was founded and published by the American Institute of Scientific Information in 1957. The documents included in it are from 1900 to the present, and it is constantly updated and supplemented. The data provides various retrieval

methods. Currently, subject retrieval is mainly used to obtain target documents in a specific field or topic quickly.

Search strategy

The subject search strategy was used and the search terms were: “AECOPD” or “acute exacerbation of chronic obstructive pulmonary disease.” Since this research aims to analyze the research hotspots of AECOPD and other related situations in the past 10 years, the period of the retrieval target is: 2010–2020. The final search time is May 24, 2021.

Data processing

After the search is completed, we export all the records of the results and the cited references in text format as the original data set and use CiteSpace software to analyze the original data set. The analysis content includes the annual distribution of the published documents, the source of the published documents (including countries, institutions, journals, authors), and the use of keywords, cooperation (centrality) between countries, institutions, and authors.

Statistical analysis

This research mainly describes the number of papers published in different years, countries, institutions, journals, and related information of authors, the number of papers cited, the frequency of the keywords used, and its relationship with time. Therefore, the number and percentage used in the study to represent data centrality scores are automatically generated by CiteSpace software. This study did not perform a comparative analysis, so it is not necessary to set a P value.

Results

General information

The search results have a total of 3,806 records, including 2,610 original articles, 628 reviews, 437 meeting abstracts, 55 editorial materials, 46 letters, 12 proceeding papers, 9 corrections, 5 early access, 3 book chapters, and 1 retracted publication (*Tables 1,2, Figure 1*). After 21 duplicate records were removed, the final number of AECOPD-related research documents published from 2010 to 2020 was 3,785. It can be seen that the number of AECOPD documents

Table 1 Document type analysis of search results

Literatures	Records	% of 3,785
Article	2,610	68.96
Review	628	16.59
Meeting Abstract	437	11.55
Editorial Material	55	1.45
Letter	46	1.22
Proceedings Paper	12	0.32
Correction	9	0.24
Early Access	5	0.13
Book Chapter	3	0.08
Retracted Publication	1	0.03

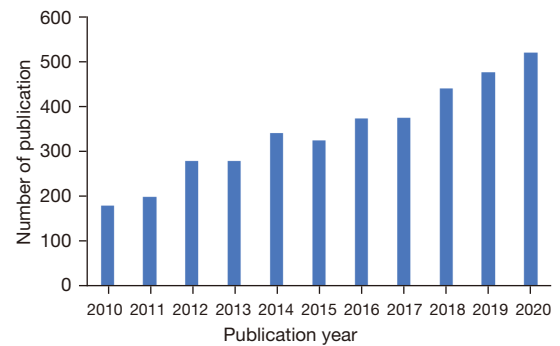
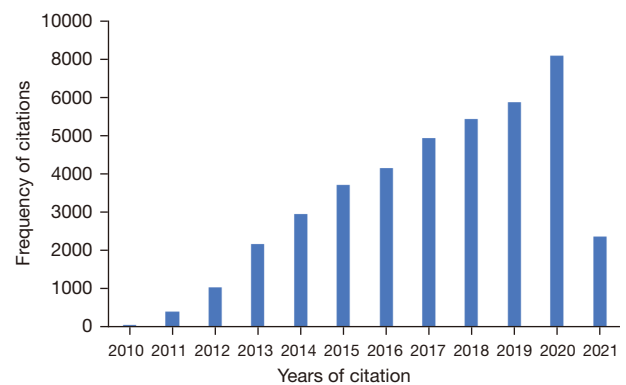
Table 2 Annual number of publications on AECOPD

Years	Records	% of 3,785
2020	520	13.74
2019	475	12.55
2018	440	11.62
2017	375	9.91
2016	373	9.85
2015	325	8.59
2014	341	9.01
2013	279	7.37
2012	279	7.37
2011	199	5.26
2010	179	4.73

has shown a steady increase in the past 10 years (*Figure 1*); 3,785 articles have been cited 62,162 times, and the number of citations each year has also shown a significant increase. The average number of citations per article is 16.42, and the h-index is 97 (*Figure 2*).

Countries and institutions distribution of literature

From a quantitative analysis, the top five countries that have published related articles are the United States, China, the United Kingdom, Spain, and Italy (*Table 3*). The top 5 countries with centrality scores reflecting the cooperation in the research are: the United Kingdom, Australia, the United

**Figure 1** Annual changes in the number of papers published.**Figure 2** Annual changes of the citation frequency.**Table 3** Top 10 countries in terms of publication

Rank	Countries	Records
1	USA	770
2	China	762
3	England	460
4	Spain	275
5	Italy	259
6	Australia	256
7	Canada	214
8	Germany	154
9	France	144
10	Netherlands	143

States, Spain, and France (*Table 4*). The top 5 institutions by the number of publications are: Kings Coll London, Univ British Columbia, Fudan Univ, Univ Alabama Birmingham, and Univ Barcelona (*Table 5*). The top 5 institutions by

Table 4 Top 10 countries in terms of centrality

Rank	Countries	Centrality
1	England	0.23
2	Australia	0.19
3	USA	0.18
4	Spain	0.18
5	France	0.09
6	Greece	0.09
7	Russia	0.09
8	China	0.08
9	Germany	0.08
10	Turkey	0.07

Table 5 Top 10 institutions in terms of number of papers published

Rank	Institutions	Records
1	Kings Coll London	65
2	Univ British Columbia	55
3	Fudan Univ	49
4	Univ Alabama Birmingham	47
5	Univ Barcelona	45
6	Guangzhou Med Univ	42
7	Peking Univ	42
8	Univ London Imperial Coll Sci Technol & Med	41
9	Capital Med Univ	41
10	Maastricht Univ	37

Table 6 Top 10 institutions in terms of centrality

Rank	Institutions	Centrality
1	Univ British Columbia	0.21
2	Harvard Univ	0.17
3	Monash Univ	0.13
4	Univ Barcelona	0.11
5	Hanyang Univ	0.11
6	Kings Coll London	0.10
7	Hosp Clin Barcelona	0.09
8	Maastricht Univ	0.08
9	Univ Manchester	0.08
10	Univ Alabama Birmingham	0.07

**Figure 3** The visual map of the countries, showing that the cooperation between countries is relatively limited in several countries.

centrality score are the following: Univ British Columbia, Harvard Univ, Monash Univ, Univ Barcelona, and Hanyang Univ (Table 6). CiteSpace V software was used to generate a visualization map of countries (Figure 3). The number of nodes is 143, representing 143 countries and regions that have participated in AECOPD research in the past 10 years. The number of connections between nodes is 636, indicating that there is not much cooperation between countries in this field. Cooperation is mainly concentrated in a few countries, including the United States, the United Kingdom, Australia, Canada, Germany, Italy, Spain, and China. In the institution visualization map (Figure 4), the number of nodes is 237, and the number of connections between nodes is 776, suggesting that there is not much

cooperation between institutions. As can be seen in Figure 4, cooperation is mainly concentrated between a few institutions.

Authors

Author analysis results show that the top 6 authors with published papers are: Sethi S, Yoo KH, Miravittles M, Dransfield MT, Sin DD, and Rhee CK (Table 7). The top 3 authors by centrality scores are Sethi S, Torres A, and Anzueto A (Table 8, Figure 5). It can be seen that although Chinese and South Korean researchers have published

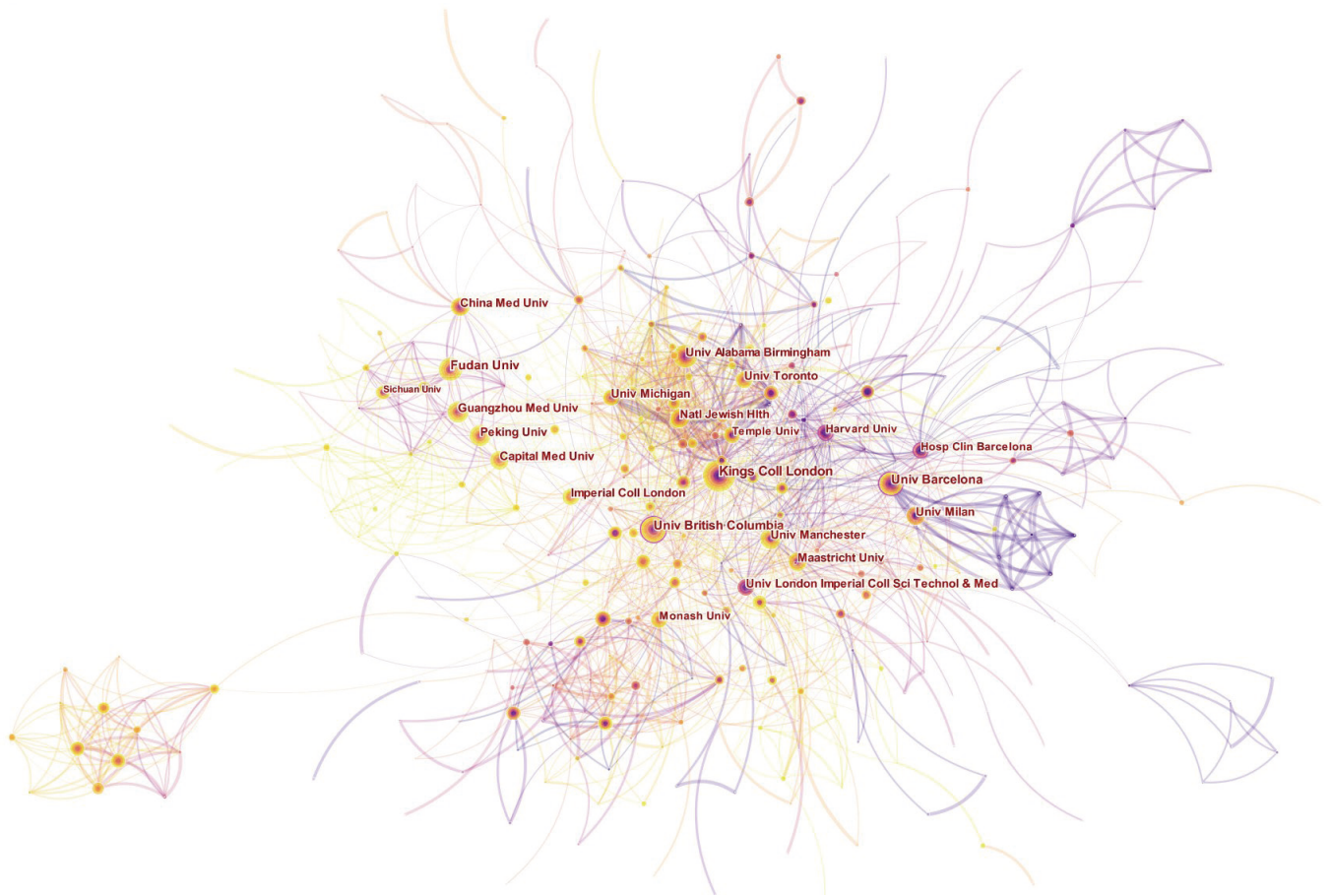


Figure 4 Institution visualization map. Cooperation is concentrated on some institutions in the United Kingdom and the United States (middle), and there is also some cooperation between several research institutions in China (middle left).

Table 7 Top 10 authors in the number of papers published

Rank	Authors	Records
1	Sethi S	22
2	Yoo KH	21
3	Miravittles M	20
4	Dransfield MT	20
5	Sin DD	18
6	Rhee CK	18
7	Zhang J	17
8	Vestbo J	17
9	Criner GJ	17
10	Anzueto A	16

Table 8 Top 10 authors of centrality

Rank	Authors	Centrality
1	Sethi S	0.05
2	Torres A	0.04
3	Anzueto A	0.03
4	Miravittles M	0.02
5	Dransfield MT	0.02
6	Vestbo J	0.02
7	Criner GJ	0.02
8	Stolz D	0.02
9	Aaron SD	0.02
10	Martinez FJ	0.01

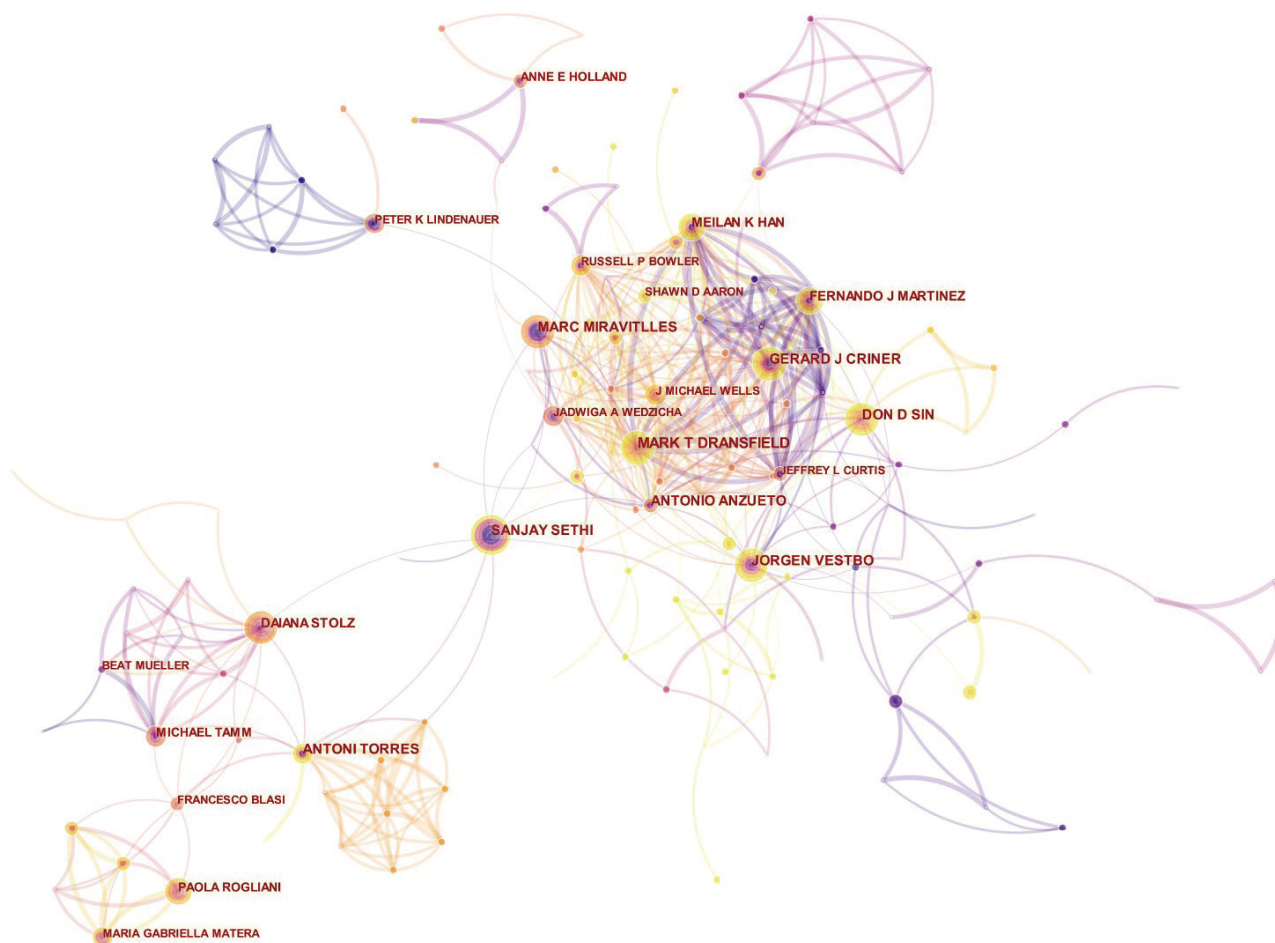


Figure 5 The authors' co-authored visualization map.

Table 9 The top 10 most co-cited authors

Rank	Authors	Citations
1	Celli BR	583
2	Hurst JR	561
3	Vestbo J	532
4	Donaldson GC	521
5	Wedzicha JA	496
6	Seemungal TAR	465
7	Miravittles M	442
8	Rabe KF	436
9	Sethi S	407
10	Anthonisen NR	377

many articles, they have relatively few collaborations with other authors and have not entered the top 10 with high centrality scores. The top 5 authors by citations are: Celli BR, Hurst JR, Vestbo J, Donaldson GC, and Wedzicha JA (*Table 9*). The top 5 authors by co-citation centrality score are: Hurst JR, Seemungal TAR, Miravittles M, Bhatt SP, and Ram FSF (*Table 10, Figure 6*). The results of the citation analysis also show that related studies in European and American countries are cited more frequently than other countries, and the number of citations and the centrality of co-citation of studies in China and South Korea are not among the top 10.

Journals

The 3,785 documents on AECOPD come from 738 journals; 29 journals published more than 20 documents

Table 10 Top 10 authors of centrality in co-citation

Rank	Authors	Centrality
1	Hurst JR	0.14
2	Seemungal TAR	0.08
3	Miravittles M	0.08
4	Bhatt SP	0.08
5	Ram FSF	0.08
6	Celli BR	0.07
7	Vestbo J	0.07
8	Donaldson GC	0.07
9	Jones PW	0.07
10	Tashkin DP	0.07

on AECOPD in the last ten years (*Table 11*), accounting for 1,983 (52.39%) documents. The top 5 journals that publish papers in this field are: *Am J Resp Crit Care*, *Chest*, *Eur Respir J*, *Thorax*, and *New Engl J Med* (*Table 12*). Only *Circulation* and *Am J Manag Care* are cited with a centrality score of more than 0.05. *Circulation* is a professional journal for cardiovascular diseases, and *Am J Manag Care* is a professional journal for disease management (*Table 13*).

Keyword analysis

The keyword analysis results show that the top 5 most used keywords are: chronic obstructive pulmonary disease, acute exacerbation, mortality, management, and risk (*Table 14*).

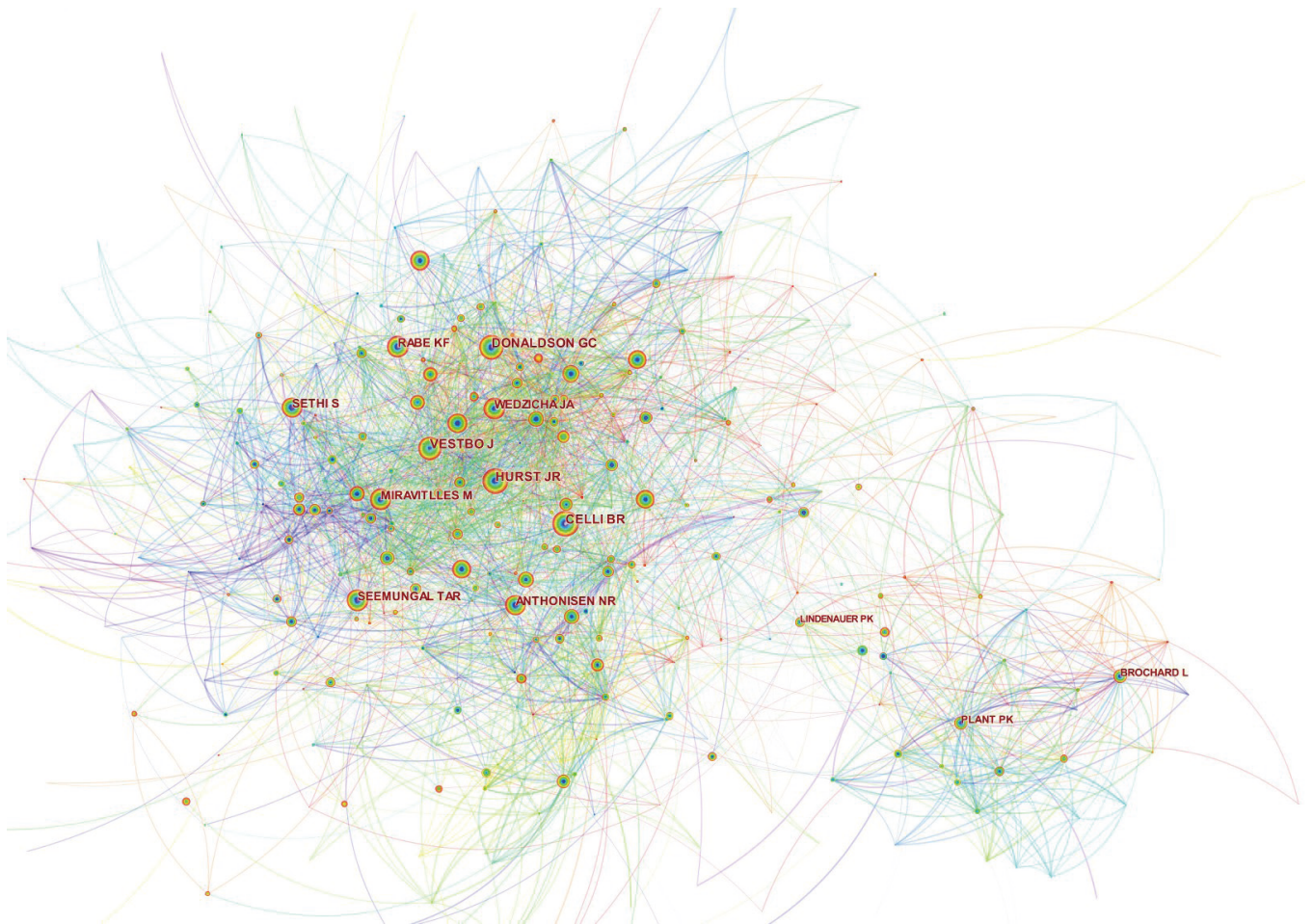
**Figure 6** The author's co-cited visualization map.

Table 11 Top 29 journals in terms of number of articles published

Journals	Papers	Percentage
<i>International Journal of Chronic Obstructive Pulmonary Disease</i>	320	8.45
<i>European Respiratory Journal</i>	197	5.20
<i>American Journal of Respiratory and Critical Care Medicine</i>	194	5.13
<i>Respirology</i>	141	3.73
<i>Journal of Chronic Obstructive Pulmonary Disease</i>	102	2.69
<i>PLoS One</i>	91	2.40
<i>Respiratory Medicine</i>	71	1.88
<i>Respiratory Research</i>	71	1.88
<i>Clinical Respiratory Journal</i>	61	1.61
<i>Chest</i>	58	1.53
<i>Journal of Thoracic Disease</i>	58	1.53
<i>Thorax</i>	58	1.53
<i>BMC Pulmonary Medicine</i>	56	1.48
<i>Medicine</i>	47	1.24
<i>Chronic Respiratory Disease</i>	40	1.06
<i>Internal Medicine Journal</i>	38	1.00
<i>Cochrane Database of Systematic Reviews</i>	37	0.98
<i>Respiration</i>	37	0.98
<i>Expert Review of Respiratory Medicine</i>	36	0.95
<i>Annals of the American Thoracic Society</i>	35	0.92
<i>BMJ Open</i>	34	0.90
<i>Lung</i>	30	0.79
<i>Current Opinion in Pulmonary Medicine</i>	29	0.77
<i>Pulmonary Pharmacology Therapeutics</i>	28	0.74
<i>International Journal of Clinical and Experimental Medicine</i>	24	0.63
<i>Respiratory Care</i>	24	0.63
<i>Trials</i>	24	0.63
<i>Critical Care Medicine</i>	21	0.55
<i>Revue Des Maladies Respiratoires</i>	21	0.55

Table 12 Top 10 journals cited

Rank	Journals	Citations
1	<i>Am J Resp Crit Care</i>	2,650
2	<i>Chest</i>	2,579
3	<i>Eur Respir J</i>	2,526
4	<i>Thorax</i>	2,354
5	<i>New Engl J Med</i>	1,829
6	<i>Resp Med</i>	1,705
7	<i>Lancet</i>	1,660
8	<i>Int J Chronic Obstr</i>	1,238
9	<i>PLoS One</i>	1,043
10	<i>JAMA-J Am Med Assoc</i>	1,011

Table 13 Top 10 journals of centrality in citation

Rank	Journals	Centrality
1	<i>Circulation</i>	0.07
2	<i>Am J Manag Care</i>	0.06
3	<i>Am J Resp Crit Care</i>	0.05
4	<i>Chest</i>	0.05
5	<i>PLoS One</i>	0.05
6	<i>J Immunol</i>	0.05
7	<i>J Appl Physiol</i>	0.05
8	<i>Eur Respir J</i>	0.04
9	<i>Intens Care Med</i>	0.04
10	<i>J Allergy Clin Immun</i>	0.04

Table 14 Top 10 keywords by frequency

Rank	Keywords	Frequency
1	Chronic obstructive pulmonary disease	2,582
2	Acute exacerbation	1,876
3	Mortality	625
4	Management	317
5	Risk	302
6	Inflammation	293
7	Asthma	269
8	Noninvasive ventilation	267
9	Outcome	232
10	Quality of life	230

The keywords with the highest centrality score are: chronic obstructive pulmonary disease and acute exacerbation (Table 15). We use CiteSpace V software to generate a keyword co-occurrence map (Figure 7: N=332, E=2,138). For high-frequency keywords, CiteSpace is used to perform burst detection, and the results are shown in Figure 8.

Table 15 Top 10 keywords by centrality

Rank	Keywords	Centrality
1	Chronic obstructive pulmonary disease	0.27
2	Acute exacerbation	0.22
3	Infection	0.08
4	Mortality	0.07
5	Asthma	0.07
6	Quality of life	0.07
7	Lung function	0.06
8	Therapy	0.05
9	Care	0.05
10	Double blind	0.05

There is a time change in the utility of keywords, indicating the shift of research focus.

Discussion

The results of this study show that AECOPD research has continued to grow in the past decade. Important research comes mainly from several developed countries in Europe and North America. The cooperation between the institutions and authors in these countries is relatively close. Asian countries, including China and South Korea, have published many papers, while the collaboration is relatively small and the number of citations is few. The journals in this field are mainly respiratory professional journals and top comprehensive journals. Keyword analysis suggests that the research hotspots in the past ten years are gradually changing.

Research on AECOPD contains many aspects, mainly including risk factors for AECOPD (16,17), biomarkers (13,18), and management (19-21). In terms of risk factors, current research still believes that respiratory tract infection is the most common cause of AECOPD. Therefore, patients with COPD should actively prevent infection during the

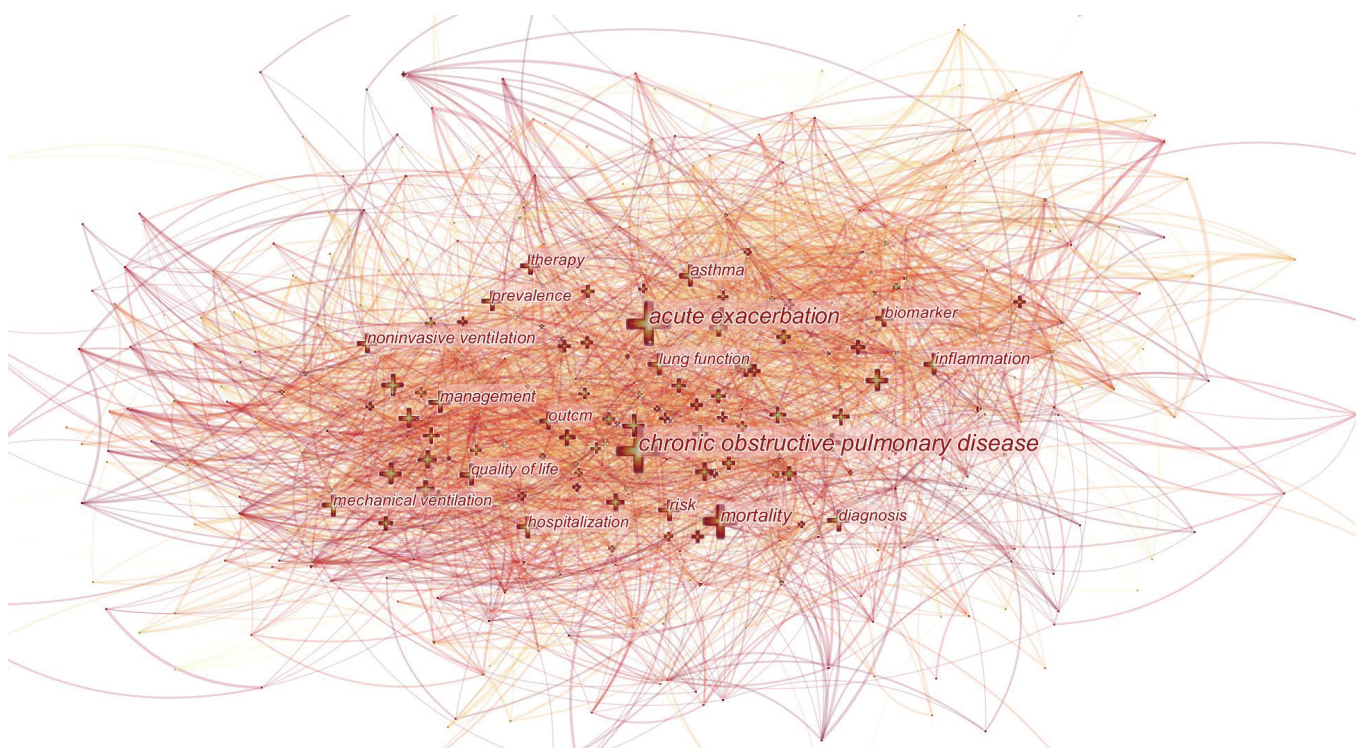


Figure 7 Keyword co-occurrence map. Identified in the figure are keywords that often appear together.



Figure 8 Top 25 keywords with the strongest citation bursts.

stable period (22). The 2020 version of the global initiative for chronic obstructive lung disease (GOLD) pointed out that respiratory virus infection is a risk factor for the deterioration of the condition of AECOPD patients and the prolonged hospital stay (23). In addition, smoking and air pollution are currently also important risk factors for AECOPD (24–26). These studies are also reflected in the keyword analysis of this study (*Figure 8*). Burst analysis shows respiratory virus infections [2010–2014], air pollution [2017–2018], and smoking [2018–2020] are all high-frequency keywords. In the research of AECOPD biomarkers, both procalcitonin and C-reactive protein are related to AECOPD and its prognosis (27,28). Many studies have shown that eosinophils can be used as a monitoring indicator for the hormone treatment of AECOPD (29–31). GOLD also recommends this (23). The keyword analysis of this study also shows that eosinophils are high-frequency keywords in 2018–2020 (*Figure 8*). For the management of AECOPD, there have been many studies in the past 10 years. Mainly in two aspects: drug treatment and non-drug treatment. In terms of drug treatment, the first is the medication strategy in the acute exacerbation period. It is necessary to clarify the treatment goals and rationally use antibacterial drugs, tracheal dilation drugs, and hormones

(23,32,33). In terms of non-drug treatment, attention should be paid to oxygen therapy and non-invasive mechanical ventilation (23,34,35). More importantly, AECOPD should be prevented when COPD is stable. For high-risk patients, GOLD recommends that patients start treatment with a combination treatment plan that includes inhaled hormones (23,36,37). Our research shows that pathogenesis is one of the high-frequency keywords in this field in recent years. As mentioned above, the current trend is to classify AECOPD according to the cause and further adopt targeted treatment, which is also the precise treatment of respiratory diseases (38).

Our research results show that the most frequently cited journals in this field are mainly top-level journals in the field of respiratory sciences and top-level comprehensive journals, but the number one journal of co-cited centrality is *Circulation*-a cardiovascular top journal. COPD is closely related to cardiovascular disease, including common risk factors, pathophysiological mechanisms, and similar clinical manifestations, and simultaneously aggravate each other (39). It is often necessary to distinguish AECOPD from acute heart failure and coronary heart disease in clinical research. At the same time of treatment and management, it is necessary to treat both situations in many

aspects, such as medication and rehabilitation (40-42).

This study also shows that the important research literature on AECOPD comes mainly from developed countries in Europe and North America, and the cooperation between them is also relatively close. However, these countries are significantly different from other countries in terms of tobacco control and air pollution. Especially in China, contrary to the trend of decreasing number of smokers in the United States, the number of smokers in China has increased significantly (43-45). Therefore, in this field, Chinese research should pay full attention to the impact of smoking and other risk factors on COPD patients. According to the main cause of AECOPD, we recommend future study focus on the prevention of respiratory viral infection to decrease the risk of COPD and AECOPD. In general, this study shows an overview and some problems of the research of AECOPD in recent ten years. According to our results, investigators may find some important focus to study.

The limitations of this research: Bibliometrics uses an indirect method to describe the research overview of a certain topic and cannot fully present more than 3,000 search results documents. It can only reflect the general situation of the current research through the primary data. Most of the target documents of this study are clinical studies. Clinical research is closely related to basic research. When there is a breakthrough in basic research, it may impact clinical research or even rewrite the guidelines. Therefore, while understanding the research situation in this field, we should also pay close attention to related basic research.

Acknowledgments

Funding: Medical Science and Technology Project for Social Development in Xuzhou (KC16S126).

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://dx.doi.org/10.21037/apm-21-2756>). All authors reported they received funding support from Medical Science and Technology Project for Social Development in Xuzhou (KC16S126).

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related

to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Open Access Statement: This is an Open Access article distributed in accordance with the Creative Commons Attribution-NonCommercial-NoDerivs 4.0 International License (CC BY-NC-ND 4.0), which permits the non-commercial replication and distribution of the article with the strict proviso that no changes or edits are made and the original work is properly cited (including links to both the formal publication through the relevant DOI and the license). See: <https://creativecommons.org/licenses/by-nc-nd/4.0/>.

References

1. López-Campos JL, Tan W, Soriano JB. Global burden of COPD. *Respirology* 2016;21:14-23.
2. Houghton AM. Mechanistic links between COPD and lung cancer. *Nat Rev Cancer* 2013;13:233-45.
3. Criner RN, Han MK. COPD Care in the 21st Century: A Public Health Priority. *Respir Care* 2018;63:591-600.
4. Zhu B, Wang Y, Ming J, et al. Disease burden of COPD in China: a systematic review. *Int J Chron Obstruct Pulmon Dis* 2018;13:1353-64.
5. Wang C, Xu J, Yang L, et al. Prevalence and risk factors of chronic obstructive pulmonary disease in China (the China Pulmonary Health CPH study): a national cross-sectional study. *Lancet* 2018;391:1706-17.
6. Zhang J, Yao W, You X, et al. Comparative analysis of medical expenditure with nebulized budesonide versus systemic corticosteroids in hospitalized patients with acute exacerbations of chronic obstructive pulmonary disease in China. *Int J Chron Obstruct Pulmon Dis* 2019;14:1195-207.
7. Li F, Sun Z, Li H, et al. Factors associated with hospitalisation costs in patients with chronic obstructive pulmonary disease. *Int J Tuberc Lung Dis* 2018;22:458-63.
8. Han MK, Quibrera PM, Carretta EE, et al. Frequency of exacerbations in patients with chronic obstructive pulmonary disease: an analysis of the SPIROMICS cohort. *Lancet Respir Med* 2017;5:619-26.
9. Liang L, Cai Y, Barratt B, et al. Associations between daily air quality and hospitalisations for acute exacerbation of chronic obstructive pulmonary disease in Beijing, 2013-17: an ecological analysis. *Lancet Planet Health* 2019;3:e270-9.
10. Leuppi JD, Schuetz P, Bingisser R, et al. Short-term vs conventional glucocorticoid therapy in acute exacerbations

- of chronic obstructive pulmonary disease: the REDUCE randomized clinical trial. *JAMA* 2013;309:2223-31.
11. Butler CC, Gillespie D, White P, et al. C-Reactive Protein Testing to Guide Antibiotic Prescribing for COPD Exacerbations. *N Engl J Med* 2019;381:111-20.
 12. Polverino F, Kheradmand F. COVID-19, COPD, and AECOPD: Immunological, Epidemiological, and Clinical Aspects. *Front Med (Lausanne)* 2021;7:627278.
 13. Mathioudakis AG, Janssens W, Sivapalan P, et al. Acute exacerbations of chronic obstructive pulmonary disease: in search of diagnostic biomarkers and treatable traits. *Thorax* 2020;75:520-7.
 14. Cooper ID. Bibliometrics basics. *J Med Libr Assoc* 2015;103:217-8.
 15. Roldan-Valadez E, Salazar-Ruiz SY, Ibarra-Contreras R, et al. Current concepts on bibliometrics: a brief review about impact factor, Eigenfactor score, CiteScore, SCImago Journal Rank, Source-Normalised Impact per Paper, H-index, and alternative metrics. *Ir J Med Sci* 2019;188:939-51.
 16. Hogeia SP, Tudorache E, Fildan AP, et al. Risk factors of chronic obstructive pulmonary disease exacerbations. *Clin Respir J* 2020;14:183-97.
 17. Hartley BF, Barnes NC, Lettis S, et al. Risk factors for exacerbations and pneumonia in patients with chronic obstructive pulmonary disease: a pooled analysis. *Respir Res* 2020;21:5.
 18. Stockley RA, Halpin DMG, Celli BR, et al. Chronic Obstructive Pulmonary Disease Biomarkers and Their Interpretation. *Am J Respir Crit Care Med* 2019;199:1195-204.
 19. Riley CM, Sciruba FC. Diagnosis and Outpatient Management of Chronic Obstructive Pulmonary Disease: A Review. *JAMA* 2019;321:786-97.
 20. Whittaker Brown SA, Braman S. Recent Advances in the Management of Acute Exacerbations of Chronic Obstructive Pulmonary Disease. *Med Clin North Am* 2020;104:615-30.
 21. Reis AJ, Alves C, Furtado S, et al. COPD exacerbations: management and hospital discharge. *Pulmonology* 2018;24:345-50.
 22. Eklöf J, Sørensen R, Ingebrigtsen TS, et al. *Pseudomonas aeruginosa* and risk of death and exacerbations in patients with chronic obstructive pulmonary disease: an observational cohort study of 22 053 patients. *Clin Microbiol Infect* 2020;26:227-34.
 23. Singh D, Agusti A, Anzueto A, et al. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Lung Disease: the GOLD science committee report 2019. *Eur Respir J* 2019;53:1900164.
 24. Cho J, Lee CH, Hwang SS, et al. Risk of acute exacerbations in chronic obstructive pulmonary disease associated with biomass smoke compared with tobacco smoke. *BMC Pulm Med* 2019;19:68.
 25. Annesi-Maesano I. Air Pollution and Chronic Obstructive Pulmonary Disease Exacerbations: When Prevention Becomes Feasible. *Am J Respir Crit Care Med* 2019;199:547-8.
 26. Pfeffer PE, Donaldson GC, Mackay AJ, et al. Increased Chronic Obstructive Pulmonary Disease Exacerbations of Likely Viral Etiology Follow Elevated Ambient Nitrogen Oxides. *Am J Respir Crit Care Med* 2019;199:581-91.
 27. Ni W, Bao J, Yang D, et al. Potential of serum procalcitonin in predicting bacterial exacerbation and guiding antibiotic administration in severe COPD exacerbations: a systematic review and meta-analysis. *Infect Dis (Lond)* 2019;51:639-50.
 28. Francis NA, Gillespie D, White P, et al. C-reactive protein point-of-care testing for safely reducing antibiotics for acute exacerbations of chronic obstructive pulmonary disease: the PACE RCT. *Health Technol Assess* 2020;24:1-108.
 29. Watz H, Tetzlaff K, Wouters EF, et al. Blood eosinophil count and exacerbations in severe chronic obstructive pulmonary disease after withdrawal of inhaled corticosteroids: a post-hoc analysis of the WISDOM trial. *Lancet Respir Med* 2016;4:390-8.
 30. Yun JH, Lamb A, Chase R, et al. Blood eosinophil count thresholds and exacerbations in patients with chronic obstructive pulmonary disease. *J Allergy Clin Immunol* 2018;141:2037-2047.e10.
 31. Pascoe S, Barnes N, Brusselle G, et al. Blood eosinophils and treatment response with triple and dual combination therapy in chronic obstructive pulmonary disease: analysis of the IMPACT trial. *Lancet Respir Med* 2019;7:745-56.
 32. Ding Z, Li X, Lu Y, et al. A randomized, controlled multicentric study of inhaled budesonide and intravenous methylprednisolone in the treatment on acute exacerbation of chronic obstructive pulmonary disease. *Respir Med* 2016;121:39-47.
 33. Stolz D, Hirsch HH, Schilter D, et al. Intensified Therapy with Inhaled Corticosteroids and Long-Acting β_2 -Agonists at the Onset of Upper Respiratory Tract Infection to Prevent Chronic Obstructive Pulmonary Disease Exacerbations. A Multicenter, Randomized, Double-Blind, Placebo-controlled Trial. *Am J Respir Crit Care Med*

- 2018;197:1136-46.
34. Murphy PB, Rehal S, Arbane G, et al. Effect of Home Noninvasive Ventilation With Oxygen Therapy vs Oxygen Therapy Alone on Hospital Readmission or Death After an Acute COPD Exacerbation: A Randomized Clinical Trial. *JAMA* 2017;317:2177-86.
 35. Sculley JA, Corbridge SJ, Prieto-Centurion V, et al. Home Oxygen Therapy for Patients With COPD: Time for a Reboot. *Respir Care* 2019;64:1574-85.
 36. Lipson DA, Barnhart F, Brealey N, et al. Once-Daily Single-Inhaler Triple versus Dual Therapy in Patients with COPD. *N Engl J Med* 2018;378:1671-80.
 37. Rabe KF, Martinez FJ, Ferguson GT, et al. Triple Inhaled Therapy at Two Glucocorticoid Doses in Moderate-to-Very-Severe COPD. *N Engl J Med* 2020;383:35-48.
 38. Vogelmeier CF, Román-Rodríguez M, Singh D, et al. Goals of COPD treatment: Focus on symptoms and exacerbations. *Respir Med* 2020;166:105938.
 39. André S, Conde B, Fragoso E, et al. COPD and Cardiovascular Disease. *Pulmonology* 2019;25:168-76.
 40. Güder G, Störk S. COPD and heart failure: differential diagnosis and comorbidity. *Herz* 2019;44:502-8.
 41. Vitacca M, Paneroni M. Rehabilitation of Patients with Coexisting COPD and Heart Failure. *COPD* 2018;15:231-7.
 42. Biscaglia S, Ruggiero R, Di Cesare A, et al. Angina and chronic obstructive pulmonary disease: facing the perfect storm. *Eur Heart J Suppl* 2019;21:C17-20.
 43. Cokkinides V, Bandi P, McMahon C, et al. Tobacco control in the United States--recent progress and opportunities. *CA Cancer J Clin* 2009;59:352-65.
 44. Guo H, Quan G. Tobacco control in China and the road to Healthy China 2030. *Int J Tuberc Lung Dis* 2020;24:271-7.
 45. Yang G, Wang Y, Wu Y, et al. The road to effective tobacco control in China. *Lancet* 2015;385:1019-28.

(English Language Editor: J. Chapnick)

Cite this article as: Xu J, Wang X, Li Z, Shi Y, Shi W, Liu Y, Zhao Y, Zhao Y. AECOPD research in the past ten years: a bibliographic analysis based on Web of Science. *Ann Palliat Med* 2021;10(10):10401-10413. doi: 10.21037/apm-21-2756