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Research Article

Bibliometric Analysis of The Last 40 Years of Chest Journal

 Pınar YILDIZ GÜLHAN^{a,*},  Mehmet Nurullah KURUTKAN^b

^a Department of Chest Diseases, Faculty of Medicine, Düzce University, Düzce, Turkey

^b Department of Health Management, Faculty of Management, Düzce University, Düzce, Turkey

*Corresponding author's e-mail address: pinaryildiz691@hotmail.com

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ABSTRACT

Chest Journal, which began to be scanned in the Web of Science in 1980, is one of the leading journals in the field of Critical Care Medicine and Respiratory System (quartile 1). In this study, the research trends of the publications in the Chest Journal were examined using three different bibliometric analysis programs (Bibliometrix, VOSviewer, and CiteSpace) in the period between 1980-2019. Along with the main statistics, keyword co-occurrence network map, density document co-citation, time map, and burst (references) analysis were performed. According to the results of the analysis, the research trends of Chest Journal were subject to discussion. The countries with the most publications are America, Canada, the United Kingdom, France, and Japan. According to the Co-Occurrence network map analysis, Chest journal's publications consist of clusters of cellular structures, thoracic oncology, chest infection, pulmonary and cardiovascular, sleep and pulmonary function test, and obstructive lung diseases. The studies in the "COPD / Formoterol Metered Dose inhaler" and "Patients / VTE disease chest guideline" clusters were found to be the most recent studies. This article has the potential to provide a valuable reference for scientists to understand Chest Journal's research trends and to grasp current issues in the field.

Keywords: Chest, Bibliometric analysis, Bibliometrix, VOSviewer, CiteSpace

Chest Dergisinin Son 40 Yılıının Bibliyometrik Analizi

Öz

1980 yılında Web of Science'ta taranmaya başlayan Chest Journal, Critical Care Medicine and Respiratory System (quartile 1) alanında önde gelen dergilerden biridir. Bu çalışmada Chest Journal'da yer alan yayınların araştırma trendleri 1980-2019 döneminde üç farklı bibliyometrik analiz programı (Bibliometrix, VOSviewer ve CiteSpace) kullanılarak incelenmiştir. Ana istatistiklerin yanı sıra, anahtar kelime birlikte oluşum ağ haritası, yoğunluk belgesi birlikte atıf, zaman haritası ve patlama (referanslar) analizi gerçekleştirildi. Analiz sonuçlarına göre Chest Journal'ın araştırma trendleri tartışmaya açıldı. Co-Occurrence ağ haritası analizine göre, en çok yayını olan ülkeler Amerika, Kanada, Birleşik Krallık, Fransa ve Japonya'dır. Chest dergisinin yayınları hücresel yapı kümeleri, torasik onkoloji, göğüs enfeksiyonu, pulmoner ve kardiyovasküler, uyku ve pulmoner fonksiyon testi ve obstrüktif akciğer hastalıklarından oluşmaktadır. "COPD / Formoterol Ölçülü Doz inhaleri" ve "Hastalar / VTE hastalığı göğüs kılavuzu" kümelerindeki çalışmalar en son çalışmalar olarak bulundu. Bu makale, bilim adamlarının Chest Journal'ın araştırma eğilimlerini anlamaları ve bu alandaki güncel sorunları kavramaları için değerli bir referans sağlama potansiyeline sahiptir.

Anahtar Kelimeler: Chest, Bibliyometrik analiz, Bibliometrix, VOSviewer, CiteSpace

I. INTRODUCTION

Chest (ISSN: 0012-3692; e-ISSN: 0012-3692) is a monthly international peer-reviewed journal and the official journal of the American College of Chest Physicians. The Chest Journal involves publications on all aspects of subjects such as Asthma, Chest Infections, COPD, Critical Care, Diffuse Lung Disease, Education and Clinical Practice, Pulmonary and Cardiovascular, Sleep and Thoracic Oncology. The editor in chief is Mr. Peter Mazzone (Cleveland Clinic Respiratory Institute). The Chest is listed as one of the most respected journals with high Impact factors among the journals publishing in the field of the respiratory systems [1]. While the 2019 impact value was 8.308, the five-year Impact Factor was realized as 7.772. Chest started to be published in 1935. The journal, which started to be scanned in Web of Science as of 1980, ranks 4th among 36 journals in the field of Critical Care Medicine and is Quartile 1. In the field of Respiratory System, ranking 6th among 64 journals.

Bibliometrics is an important branch of information science. Bibliometric methods are effective tools, which are developed to evaluate a particular aspect of a study or the values of a particular journal [2],[3]. With the scientific and visual mapping tools, bibliometrics has been implemented in various fields of research such as engineering [4], road safety [5], evaluation of social life cycle [4], financial performance [6] and rescheduling higher education [7]. Bibliometrics enables the illustration of the development process of a journal. For instance, the development process of a journal could be evaluated based on productivity, impact, the total number of publications (TP), the total number of citations (TC) and an average number of citations per publication (AC), as well as certain generally accepted bibliometric indicators such as H-index, g-index and m index [8],[9]. Accordingly, one of the fields of study where bibliometric analyses can be performed is the bibliometric analyses of a journal or a set of journals representing a discipline. Bibliometric analyses have been performed on journals such as the Journal of Network and Computer Applications [10], Omega [9], Journal of Endodontics [11], Journal of Hand Surgery [12], Journal of King Saud University [13], Journal of Business Research [4] and ten major journals on Dermatology [15].

II. MATERIAL VE METHOD

Web of Science (WoS) is preferred due to being one of the most common databases among academicians and providing current and detailed information on many leading journals including worldwide publications [16]. On November 11th, 2020, the name of the journal ("Chest" as the keyword) was determined as a search strategy from the WoS Core Collection database. The findings were filtered at the data article level, and the raw data were downloaded as "plain.txt". As a result, a total of 18,450 articles since the first publication in 1980 were downloaded from the database. In this study, a bibliometric analysis was performed on the raw data including the articles published in Chest between 1980 and 2019. The analyses performed within the scope of the study are presented in Table 1:

Table 1. Software and analyses

Software	Analysis
Bibliometrix	Main Statistics
	Total number of publications and average number of citations
Biblioshiny	Productivity and Collaboration Networks of Countries and Institutions
	Highly Contribute Authors Papers, Citations
VOSviewer	Keyword co-occurrence network map
	Density visualization
CiteSpace	Document co-citation analysis
	Time map of clusters
	Burst (References)

The remainder of this article is structured as follows: Part 2 focuses on the main findings. Part 3 examines the organizations such as Productivity and Collaboration Networks of Countries and Institutions. In Part 4, major sets, time maps, and citation bursts are examined. Part 5 performs a word analysis in terms of data mining. The remaining parts include discussion, limitations and conclusion.

III. RESULTS

In this part, general information is provided about the type and annual trend of the publications, and the most cited publications in the CHEST between 1980 and 2019.

A.1. Chest and Types of Publications

There are 17 types of publications in Chest. In this study, analysis was performed on articles using the bibliometric software.

A.2. Main Statistics

A total of 18,450 articles were written over a period of 39 years. The number of authors is 51,040, and the number of studies with a single author is 1,391. The number of citations per article is 54.73, and there are 272,202 references in total. The average number of authors per publication is 5.04. The h-index of Chest was calculated as 316, the g-index was 489, and the m-index was 7.70. The cooperation index rate in the publications was 2.93. All the other data are presented in Table 2 below:

Table 2. Main statistics (1980-2019)

MAIN INFORMATION ABOUT	Results	AUTHORS	Results
Timespan	1980:2019	Authors	51040
Sources (Journals, Books, etc)	1	Author Appearances	93046
Documents	18450	Authors of single-authored documents	1032
Average years from publication	21,1	Authors of multi-authored documents	50008
Average citations per documents	54,73	AUTHORS COLLABORATION	
Average citations per year per doc	3,264	Single-authored documents	1391
References	272202	Documents per Author	0,361
		Authors per Document	2,77
		Co-Authors per Documents	5,04
		Collaboration Index	2,93

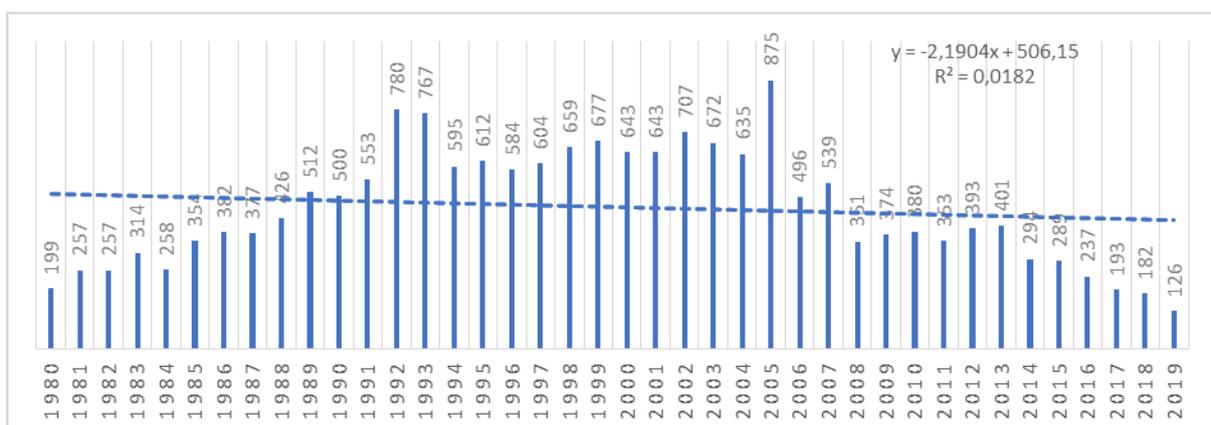


Figure 1. Number of publications

The number of articles published in Chest was observed to have increased steadily between 1980 and 1992. The number of publications, which followed horizontal progress between 1992 and 2004, steadily decreased since 2005. The annual growth rate of publications was calculated as -1.17% (Figure 1). It was observed that the rate of supplementary issues published by the journal was the highest (7 additional issues) in 2005. In recent years, there were between 1 and 3 supplementary issues. The highest number of publications belonged to 2005 when there were 7 supplementary issues published.

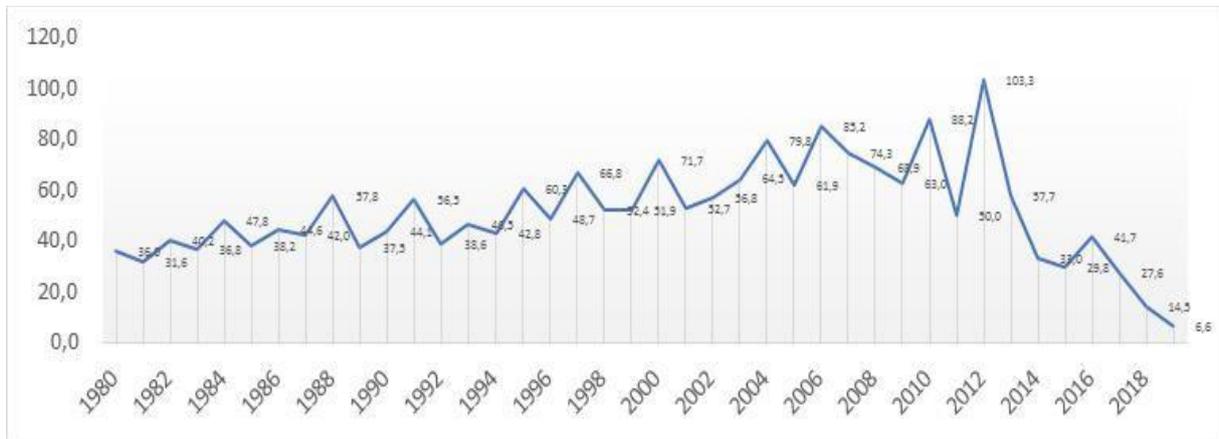


Figure 2. Average article citations per year

Looking at the average number of citations per article per year, it was observed that the citation performance of the articles peaked in 2012, and the performance of the articles published recently was lower compared to the articles belonging to the previous period. When 2019 was excluded, a downward trend was observed since 2012 (Figure 2).

A.3. Productivity and Collaboration Networks of Countries and Institutions

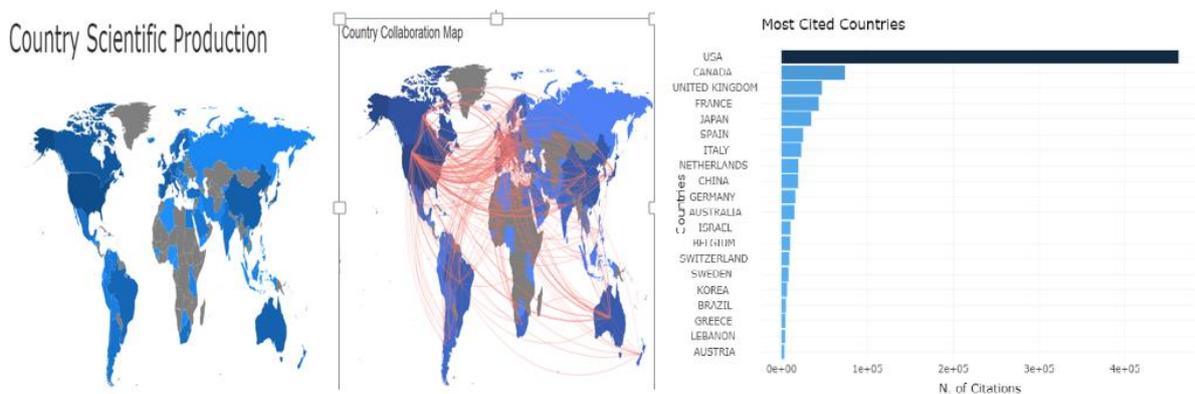


Figure 3. Productive countries, cooperation between countries and the top cited countries

In Figure 3, the countries marked as dark blue in the figures were the countries that produced more articles, had more collaboration, and cited the most. When the geographical maps were examined, the USA, Canada, England, France, and Japan were observed to be the leading countries.

Looking at the table presenting the number of publications by the universities, it was observed that the universities in the top five were the universities of the USA. The top three universities with the highest contribution were the University Of California System, US Department of Veterans Affairs, and Veterans Health Administration VHA (Table 3).

Table 3. Total number of publications by Universities

NO	UNIVERSITY	Number
1	UNIVERSITY OF CALIFORNIA SYSTEM	1.011
2	US DEPARTMENT OF VETERANS AFFAIRS	966
3	VETERANS HEALTH ADMINISTRATION VHA	963
4	HARVARD UNIVERSITY	813
5	MAYO CLINIC	475
6	UNIVERSITY OF TORONTO	431
7	UNIVERSITY OF COLORADO SYSTEM	430
8	ASSISTANCE PUBLIQUE HOPITAUX PARIS APHP	407
9	UNIVERSITY OF COLORADO ANSCHUTZ MEDICAL CAMPUS	387
10	JOHNS HOPKINS UNIVERSITY	377

According to the total number of publications, the most collaborative countries were Sweden, Canada, and Belgium. Countries with high MCP rates were more cooperative. It was calculated as follows: MCP rate= number of MCPs/Total number of publications. Countries with an MCP rate above 20% were the countries with high international cooperation in terms of Chest (Figure 4).

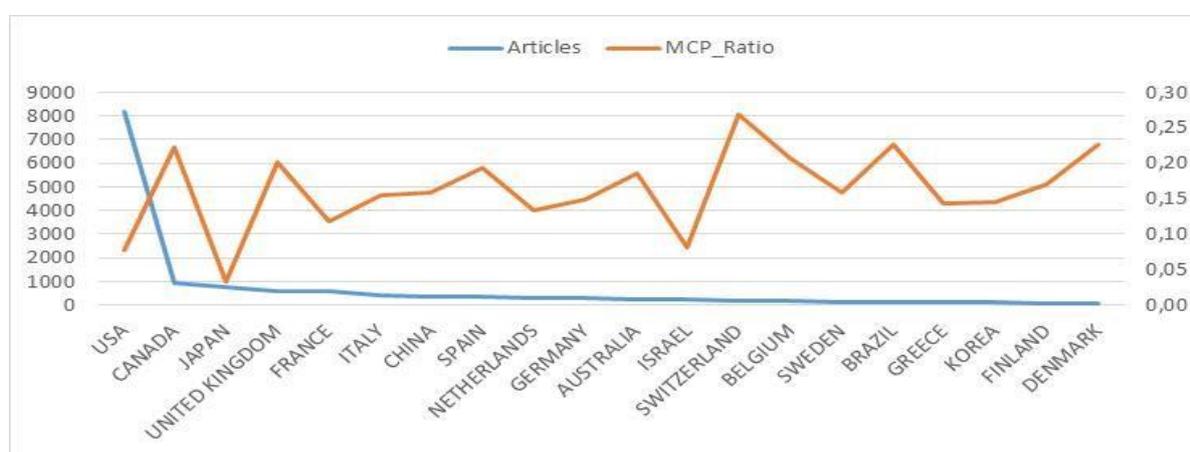


Figure 4. MCP Ratio

A.4. Highly Contributive Authors, Papers and Citations

The "H-index" is a unique and simple performance index, which includes both the quantity and visibility of publications. It is an author-level metric that tries to measure the productivity and citation impact of publications made by the scientists [17]. The g-index is an alternative to the h-index, which does not consider an average number of citations for measuring the global citation performance of a series of articles. The index is calculated based on the distribution of citations received by the publications of a particular researcher. While the g-index gives more weight to articles with high citations, the h-index is insensitive towards the articles with high citations [18]. One way to facilitate the comparison between academicians with different durations of academic careers is to divide the h-index by the number of years the academy has been active (measured as the number of years since the first published article). This index, which was created by Hirsch, was defined as the m-index [19] When the scores of the authors were evaluated in terms of the h, g, and m indices, Kollef MH had the highest score in only h and g indices, while ERNST A had the highest value in the m-index (Table 4).

Table 4. Highly Contributive Authors

Author	h_index	g_index	m_index	TC	NP	PY_start
LIGHT RW	39	58	0.975	3881	102	1981
KOLLEF MH	53	82	1.606	17540	82	1988
BARNES PJ	40	66	1.143	5552	66	1986
HIRSH J	48	64	1.333	11899	64	1985
SAHN SA	37	64	0.902	4643	64	1980

IRWIN RS	30	55	0.75	3132	62	1981
RYU JH	34	62	1.214	3977	62	1993
ERNST A	39	60	1.857	4811	60	2000
LIP GYH	31	58	1.824	15675	58	2004
STEIN PD	33	54	0.805	4779	54	1980
TASHKIN DP	30	51	0.732	3216	51	1980
MEHTA AC	22	46	0.629	2381	46	1986
RUBIN BK	23	40	0.742	1637	46	1990
HUMBERT M	24	44	0.857	2386	44	1993
WISE RA	24	38	0.615	1483	44	1982

The horizontal line shows the time frame between the first and last publications of the author in the relevant period. The size of the small bubbles indicates the abundance of the number of springs. The darkness of the colors in the bubbles gets darker in proportion to the number of citations received. For many years, the authors who published in Chest were Taskhin, Irwin, Light, Shan. Recently, the most published and the cited author was Lip (Figure 5). When the studies of the authors mentioned in the Web of Science (WoS) database were examined, it was observed that Tashkin DP mostly published in the field of obstructive pulmonary diseases, Irwin RS mostly published in the field of clinical symptoms (cough), and infection, Light RW mostly published in the field of pleural diseases. The studies by Lip2 were mostly about anticoagulant therapy.

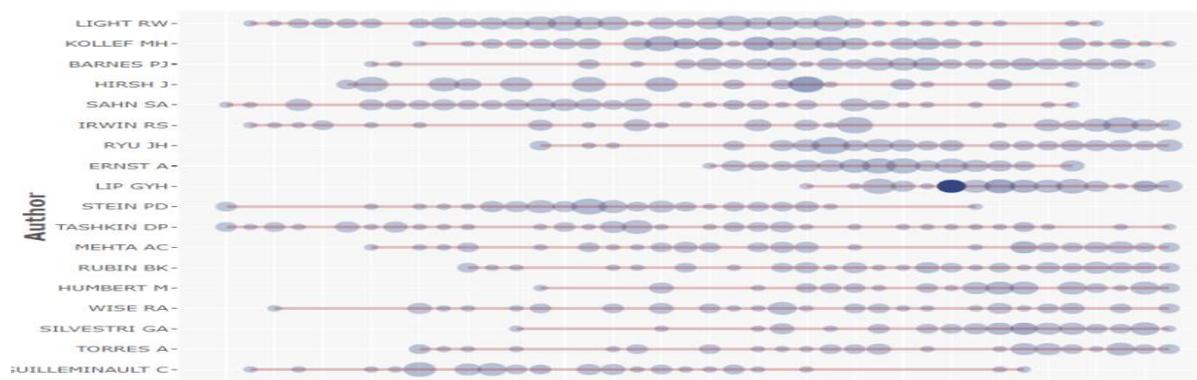


Figure 5. Top-authors' production over time

Table 5. Top 10 cited authors

Paper	Total Citations	TC per Year
MOUNTAIN CF, 1997,	3707	154.5
LIP GYH, 2010,	3255	295.9
KNAUS WA, 1991,	2577	85.9
PISTERS R, 2010,	2245	204.1
GEERTS WH, 2004,	2063	121.4
KEARON C, 2012,	1880	208.9
KEARON C, 2016,	1829	365.8
MOUNTAIN CF, 1986,	1657	47.3
KOLLEF MH, 1999,	1228	55.8
IBRAHIM EH, 2000,	1223	58.2

When the studies of the most cited authors in the Gene Web of Science (WoS) database were examined (Table 5), it was observed that MOUNTAIN CF conducted studies on the staging of lung cancer, LIP GYH conducted studies on cardiovascular disease, and KNAUS WA conducted studies on Intensive care. Considering the content of the studies, it was observed that the authors conducted studies on the accepted criteria regarding the patients and diseases in their fields. It was understood that the author distribution of the articles on Chest did not comply with Lotka's law.

A.5. Word Analysis

Word analysis was performed using both bibliometrics and the VOSviewer software. Bibliometrics software analyzes the words by using the title of the article, keywords, abstract, and bibliography of the article. The analysis obtained by using the bibliography of the article is called keyword plus (a feature not found in the other software).

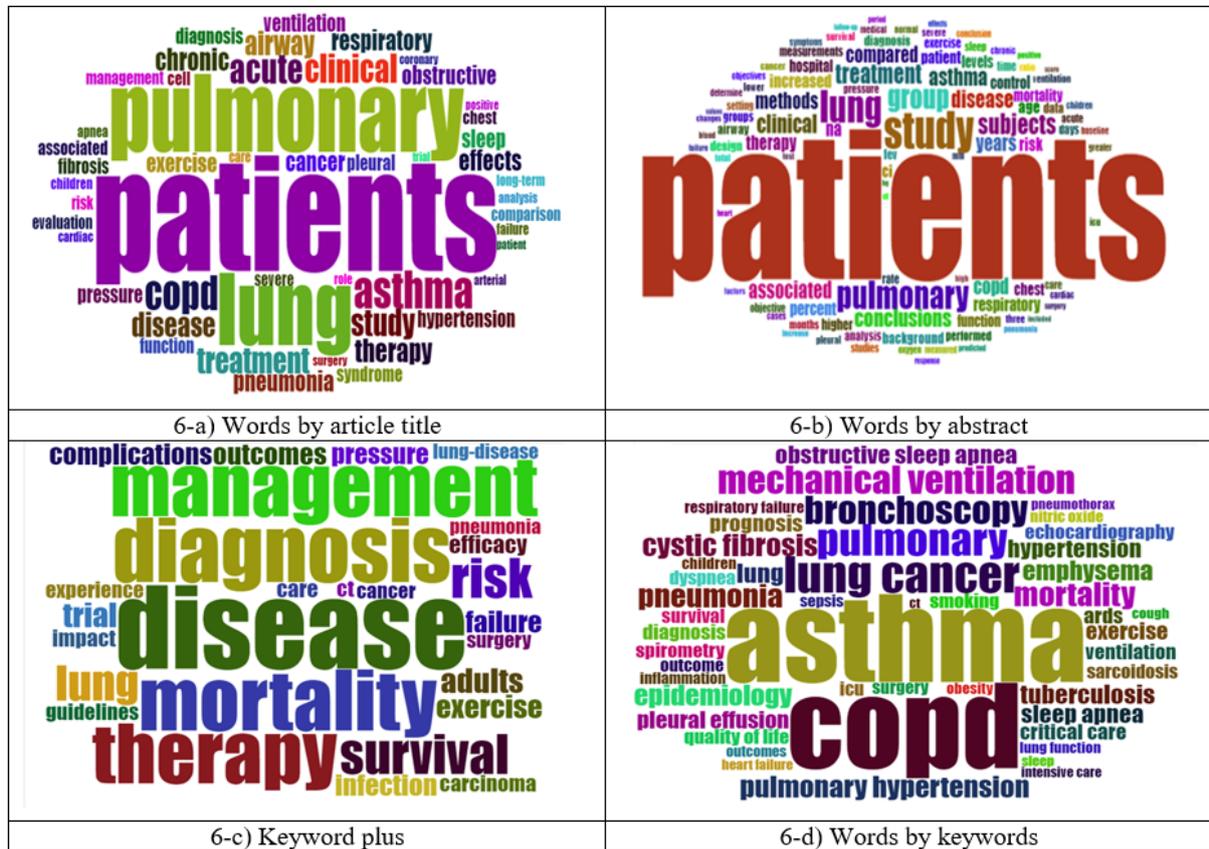


Figure 6. Title of the Article, Keywords, Abstract, and Keyword Plus Word Trees

Under the heading of Keyword plus, words such as disease, management, diagnosis, mortality, and therapy were used more frequently. These were the most commonly used words in references that authors found worthy of citation. Looking at the keywords, words such as asthma, COPD, lung cancer, pulmonary mechanical ventilation, and bronchoscopy were used more frequently (Figure 6).

A Landscape View of the Citation Network the scientific view on the subject above was produced based on the publications between 1980 and 2019. The network consisted of 18,450 articles, and 272,202 references were analyzed. The network had modularity of 0.9151, which was considered high, and a high Mean Silhouette (0.9605) value. This indicated that the specializations in the science map were clearly defined in terms of common resource clusters. The modularity value was expected to be equal to or greater than 0.6. The mean silhouette value was desired to be 0.7 and higher [20]. The youngest cluster and the cluster with the highest number of publications was the "chronic cough" cluster. Therefore, the landscape view was analyzed using the relevant software after removing the clusters that were very small. The fields in different colors indicated the time when the common reference links in these fields appeared for the first time. The software also included the coloring feature of clusters. Each cluster could be tagged with title terms, keywords, and terms derived from the abstract. The largest cluster was # 0 chronic cough. It consisted of 171 articles (Figure 8).

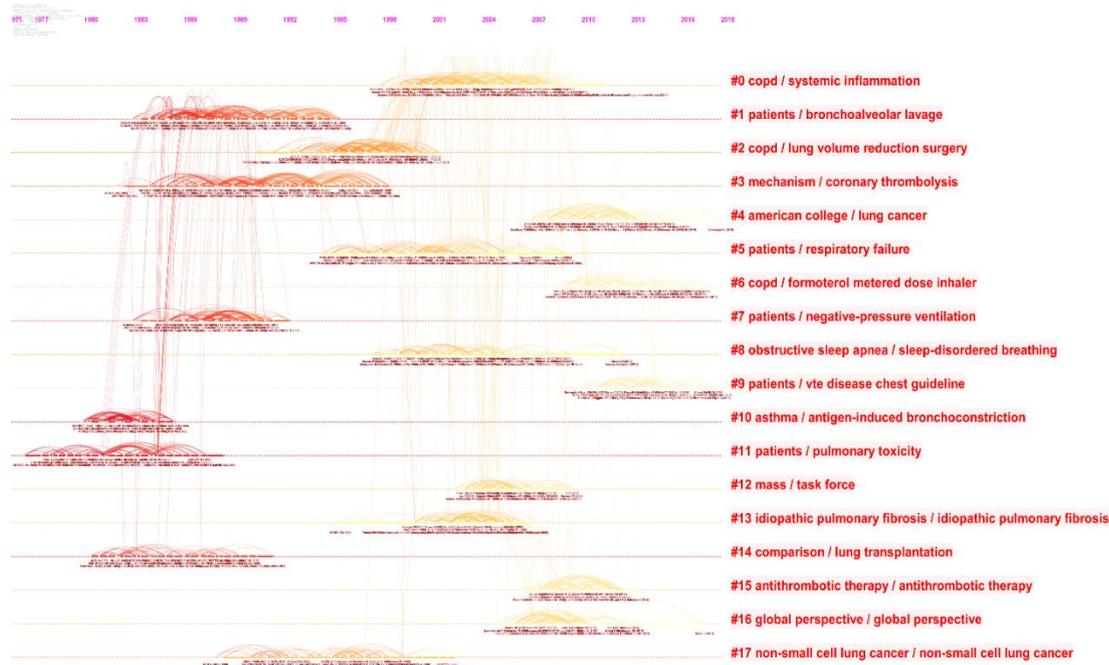


Figure 9. Time map (1984-2019)

Looking at the time map, it was concluded that particularly the two clusters were very active and current. Studies on the "COPD/formoterol metered Dose inhaler" and "Patients/VTE disease chest guideline" clusters were the most recent studies. On the other hand, "Pulmonary toxicity" and "asthma/antigen-induced bronchoconstriction" clusters had lost their activeness in Chest, and the authors had written extensively before 1989 (Figure 9).

IV. DISCUSSION

The annual growth rate of the publications published in Chest is -1.17%. This result is quite interesting, as there is an average of 3% growth per year in all disciplines, and there are some indications that this growth has accelerated in recent years [21]. One of the reasons why the annual growth rate of publications is lower than the determined average is that the number of articles published in the journal has gradually decreased in recent years. Besides, it is observed that the numerical increases in other types of publications are higher compared to the number of articles.

There is an average of 54.73 citations per article. Compared to other disciplines, it is observed that the average number of citations per article is quite high in the field of medical sciences. While there are 260 citations in oncology, 170 in immunology, and 105 in pharmacology [22]. The average number of citations in Chest is approximately 55. It will be interesting to perform an analysis to understand the different factors that can predict the number of citations a publication will receive. The total number of authors per document, the gender of the authors, their affiliations and countries, funding opportunities, fields of research, and/or the journal of publication can be used as the predictions. It is stated that the number of citations is positively correlated with the number of agencies that fund the research, and that more citations are made to the journals representing the discipline with more articles and more resources [22]. Other factors associated with citations include the age of references, journal impact factor, and the funding agencies.

The magnitude of the increase in publications for multi-author publications is greater, and the collaboration index (CI) for multi-author articles has increased significantly over time. This increase in the total number of authors and collaboration is not unique to one field of science. Multi-author articles provide more publications per author per year, helping to reduce the workload. Future research could investigate the cause of this increase more systematically, and try to understand how this might affect the impact or rigidity of the published scientific research [23]. All of the top 10 most cited studies in this journal were written by multiple authors.

In bibliometric analyses, the most cited countries are the most research-intensive countries of the world such as the UK, the USA, China, Japan, Germany, Italy, Canada, and France [24]. However, the eight most productive countries in our study are the USA, Canada, the UK, France, Japan, Spain, Italy, and the Netherlands. The six countries, which are the USA, Canada, the UK, Japan, France, and Italy are the countries that comply with the above list. The productivity of these countries may be related to specific funding opportunities, the number of laboratories, and the number of teaching programs in these countries.

V. CONCLUSION

Results obtained from science mapping, data visualization, and bibliometric software can also be one of the most rational inputs for policymaking. An important restriction is the indexing of raw data for Chest in the Web of Science (WOS) database as of 1980. However, Chest Journal has been published since 1935. Due to coding errors related to the type of articles in Chest that are indexed in the Scopus database as of 1943, the raw data were not taken from the Scopus database.

In future studies, more specific results can be achieved with a larger data set and a special search strategy by including the publications of other journals that contribute the most to the field of Critical Care Medicine and Respiratory System. Besides, bibliometric analysis can be performed on the first 100 articles with the most citations. The contribution of continental Europe and other countries except for the United States to the Critical Care Medicine and Respiratory System field is also worth researching in another type of classification.

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