

Earthquake-Related Lung Diseases; A Bibliometric Analysis of Publications

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ABSTRACT

Aim: Earthquake-related lung diseases (ERLD) can be seen as direct and indirect disaster results. ERLD such as inhalation of dust and particulates from collapsed buildings in earthquakes, aspiration of water and pathogens due to tsunami after earthquakes, pulmonary thromboembolism, infectious respiratory diseases, and chest traumas can develop after earthquakes. The aim of this bibliometric review is to explore the intellectual structure of ERLD publications.

Material and Methods: A search strategy for databases related to the ERLD area was developed. 334 articles were accessed in the Web of Science database. As a result of the full-text readings, 152 articles remained, and 152 articles were subjected to citation and co-citation analysis with bibliometric software. In addition to this research, methodologies based on cluster analysis were used to examine the intellectual structure of the field.

Results: When the time period of the publications is examined, it is seen that the first publication was published in 1996. When the top three authors are examined, Yanai shares the ranking with 6 publications, Ueda 6 publications, and Kobayashi 5 publications. Japan, also an earthquake country, is in first place with 50 publications. Three main clusters were identified. These clusters are "chest traumas: types, frequency, and medical intervention strategies," "earthquake preparedness and earthquake response capacity," and "respiratory tract infections and an earthquake."

Conclusion: In addition to identifying the most influential journals, authors, and countries on earthquakes in the area of ERLD, this research identified the dominant research themes in this field. Our research outlines the area of ERLD, provides an agenda for future research, and contributes to the fact that the relationship between earthquakes and pulmonary diseases is studied more deeply.

Keywords: Earthquake; lung; bibliometric analysis.

Deprem İlişkili Akciğer Hastalıkları; Yayınların Bibliyometrik Analizi

ÖZ

Amaç: Depreme bağlı akciğer hastalıkları (DİAH), afetin hem doğrudan hem de dolaylı sonucu olarak görülebilmektedir. Depremlerde yıkılan binalardan çıkan toz ve partiküllerin solunması, deprem sonrası oluşabilecek tsunami nedeniyle su ve patojenlerin aspirasyonu, pulmoner tromboembolizm, bulaşıcı solunum yolu hastalıkları ve göğüs travmaları gibi birçok DİAH gelişebilir. Bu bibliyometrik incelemenin amacı, DİAH yayınlarının entelektüel yapısını keşfetmektir.

Gereç ve Yöntemler: DİAH alanıyla ilgili veri tabanları için bir arama stratejisi geliştirilmiştir. Web of Science veri tabanında 334 makaleye ulaşılmıştır. Tam metin okumaları sonucunda kalan 152 makale bibliyometrik yazılım ile atıf ve ortak atıf analizine tabi tutulmuştur. Bu araştırmaya ek olarak, alanın entelektüel yapısını incelemek için küme analizine dayalı metodolojiler kullanılmıştır.

Bulgular: Yayınların yapıldığı zaman dilimine bakıldığında ilk yayının 1996 yılında yayımlandığı görülmektedir. İlk üç yazar incelendiğinde Yanai 6 yayın, Ueda 6 yayın ve Kobayashi 5 yayın ile sıralamayı paylaşıyor. Aynı zamanda bir deprem ülkesi olan Japonya 50 yayınlı ilk sırada yer alıyor. Üç ana küme belirlenmiş olup, bu kümeler, "göğüs travmaları: tipleri, sıklıkları ve tıbbi müdahale stratejileri", "depreme hazırlıklı olma ve depreme müdahale kapasitesi" ve "solunum yolu enfeksiyonları ve depremdir".

Sonuç: Bu araştırma, DİAH alanındaki depremler konusunda en etkili dergileri, yazarları ve ülkeleri belirlemenin yanı sıra, bu alandaki baskın araştırma temalarını da belirlemiştir. Araştırmamız DİAH alanını özetlemekte, gelecekteki araştırmalar için bir gündem sağlamakta ve deprem ile akciğer hastalıkları arasındaki ilişkinin daha derinlemesine çalışılmasına katkıda bulunmaktadır.

Anahtar Kelimeler: Deprem; akciğer; bibliyometrik analiz.

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INTRODUCTION

Earthquakes are some of the most catastrophic natural disasters to affect mankind. More than a million earthquakes occur worldwide yearly, roughly two per minute (1,2). Earthquake-related lung diseases (ERLD) can be seen as both direct and indirect results of the disaster. ERLD such as inhalation of dust and particulates from collapsed buildings in earthquakes, aspiration of water and pathogens due to tsunami after earthquakes, pulmonary thromboembolism, infectious respiratory diseases, and chest traumas such as pneumothorax, rib fracture, hemothorax, hemopneumothorax, a diaphragmatic tear can develop after earthquakes (3-5).

The aim of this bibliometric review is to explore the intellectual structure of ERLD publications. In this study, the classic publications on the subject will be subjected to a general evaluation.

The research questions of this bibliometric analysis (BA) are the following;

- RQ1. What is the publication trend of earthquake-related studies in publications on lung diseases?
- RQ2. What are the most prolific authors, countries and regions, and institutions working on earthquakes in the field of lung diseases?
- RQ3. In which journals have the most effective publications on ERLD found their place?
- RQ4. What research topics do earthquake-related publications mainly focus on in the field of lung diseases? How many clusters did the leading authors contribute to the intellectual structure of this field and the subjects they covered to find a place for themselves?

We used bibliometric techniques such as performance analysis, co-citation, and document analysis to review ERLD publications and to answer our research questions. BA uses quantitative and statistical analysis to evaluate a topic, field, or theory (6). BA offers specific results about the importance of top authors, institutions, publications, and countries (7). BA is also widely used to illustrate previous and current research in the relevant field, to identify and describe the most popular areas of study, and to suggest new research directions for academics (8-9).

MATERIAL AND METHODS

Search Methods

We preferred the bibliometric methodology in our research. With the performance analysis, we first determined the number of publications and citations of the studies dealing with ERLD publications, the most important journals, authors, and countries. Based on studies by Small (10), White, and McCain (11), we conducted a co-citation analysis of 152 articles on ERLD publications. In addition to this research, we used cluster analysis-based methodologies to examine the intellectual structure of the field.

Bibliometrix and VOSviewer programs were used in the performance analysis of the research. We also used the Bibexcel application for scientific mapping. Although the K means algorithm was performed in SPSS 23 and Jamovi 1.6.23 programs using the correlation matrix created from the Bibexcel application, we applied the document analysis technique because all the articles were gathered under a single dimension. The technique is summarized in Figure 1 regarding all analysis steps and the software used in each step.

RESULTS

In this section, we conducted a performance analysis on the number of publications and citations of earthquake-related studies, the most prestigious journals, authors, and countries in publications on lung diseases over 152 articles. We created a common citation network of 152 articles in the second stage. We then selected 71 articles meeting at least 10 citation sub-requirements using Bibexcel software and transformed them into a correlation matrix for further research. Following this procedure, we ran the k means algorithm on the dataset containing 71 articles. In the third stage, all of the articles in the three clusters created as a result of these analyzes were read and analyzed. However, it should be kept in mind that the frequency of updating the database and its ability to be up-to-date is a focus on previous research rather than existing literature when revealing a field's historical, intellectual structure (12). Despite this disadvantage, the k-means algorithm and document analysis are sufficient to examine the intellectual framework of earthquake-related publications and produce comparative results in publications on lung diseases.

Performance Analysis

Prepared summary information about the performance of the broadcasts is given in Figure 2. The annual growth rate of publications is 10.37%. While a total of 907 authors prepare their publications, the rate of authors for international cooperation is 18.42%. Each of the 152 studies with 3683 references received an average of 13.68 citations.

What is the publication trend of earthquake-related studies in publications on lung diseases (RQ1)?

When the time period of the publications is examined, it is seen that the first publication was published in 1996 and showed an unstable trend until 2005. After 2010, the number of publications increased, albeit at a low speed. A total of 20 studies were published in 2012, the year in which the most publications were published. Based on an analysis of the citation data, it can be observed that there was a steady increase in citations starting from 2005, followed by the establishment of a stable pattern after 2011 (see Figure 3). Regarding publication types, the number of articles is 143, and the number of review articles is 9.

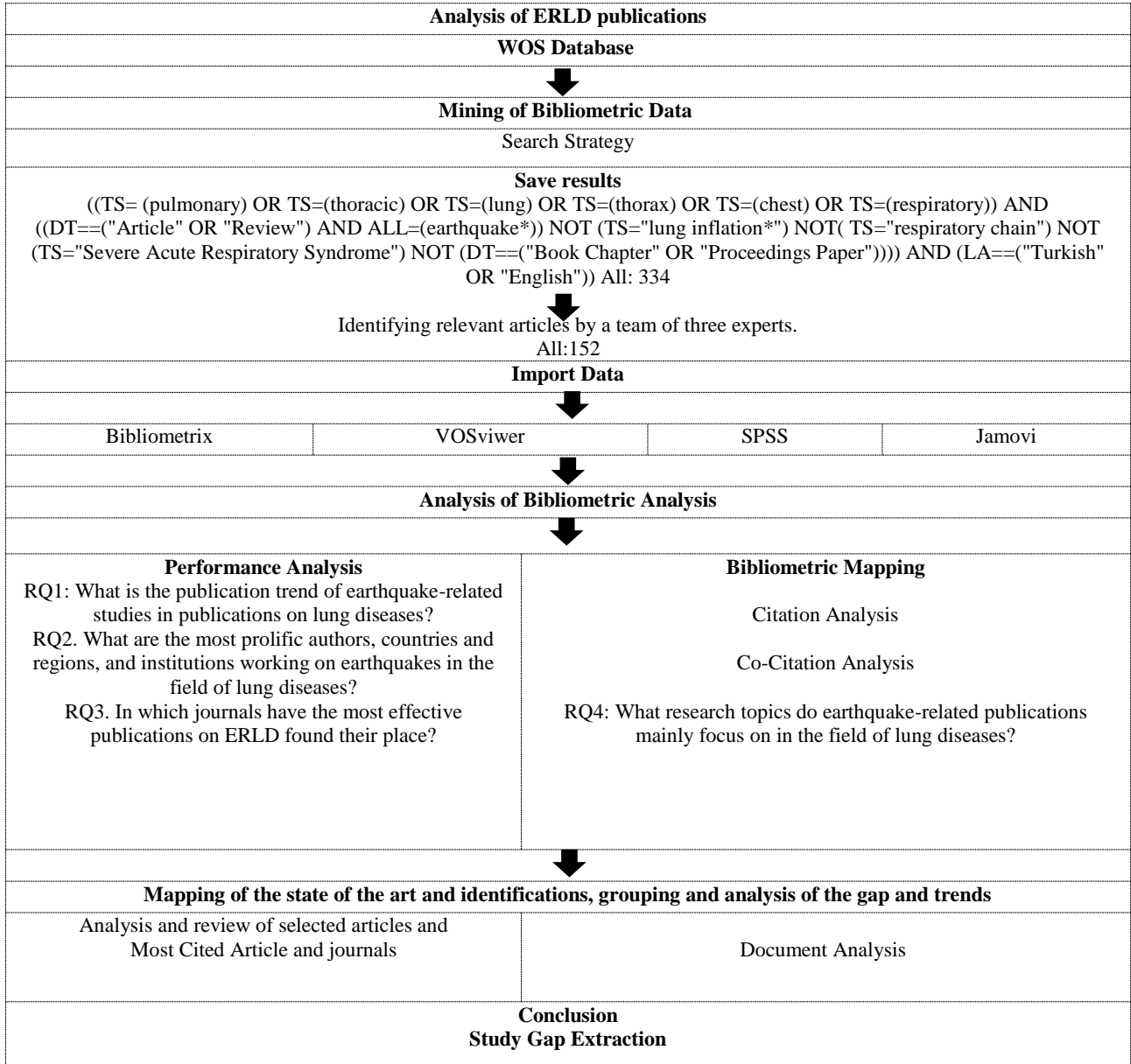


Figure 1. Methodological approach (Author’s Presentation)

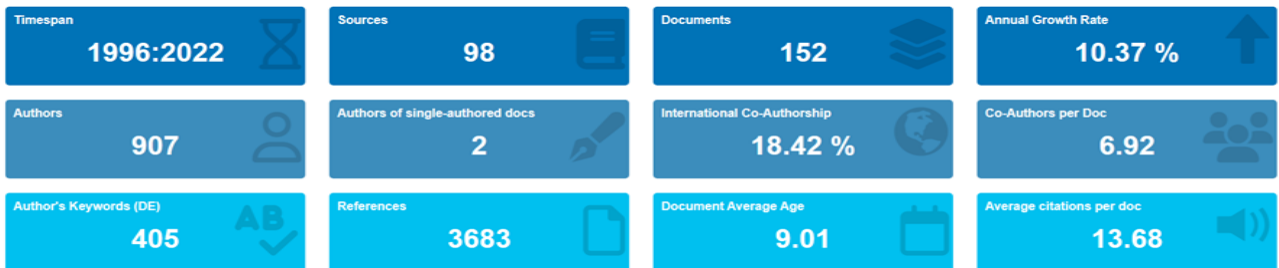


Figure 2. Main information for publications

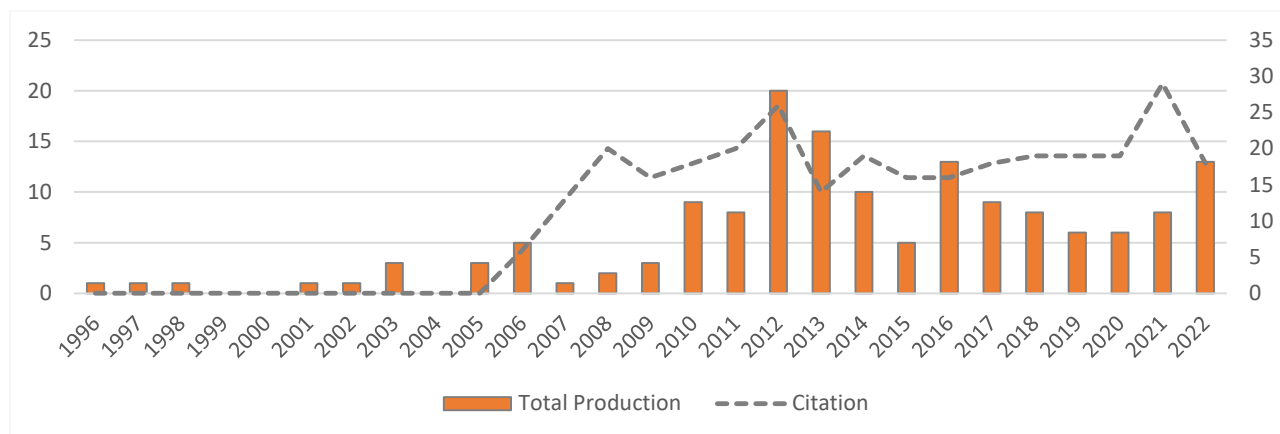


Figure 3. Number of publications and citations by year

Most prolific authors, countries and regions, and institutions (RQ2)

The purpose of RQ2 is to identify the most prolific authors, countries and regions, and institutions working on earthquakes in the field of lung diseases. This type of analysis is a critical part of any bibliometric review because it helps readers find authors who have made significant contributions to building the intellectual capital of a particular field of research and countries or regions and institutions that contribute to the research agenda.

Almost all bibliometric reviews perform this analysis as a "standard" procedure (13).

Most prolific writers (RQ2)

There are a total of 908 authors working on ERLD. The number of authors who published an article with a single name is 3, and Multi-authorship in this field is like a basic pattern. The average number of authors per publication is 6.88 (Figure 2). When the top three authors are examined, Yanai shares the ranking with 6 publications, Ueda 6 publications, and Kobayashi 5 publications (Table 1).

Table 1. Authors with the most publications and the number of citations

#	Authors	University	Country	TP	C	C/P
1	Yanai M	Japanese Red Cross Ishinomaki Hosp	Japan	6	124	11.27
2	Ueda S	Osaka Saiseikai Nakatsu Hosp	Japan	6	99	9
3	Kobayashi S	Japanese Red Cross Ishinomaki Hosp	Japan	5	97	8.82
4	Suzuki S	Japanese Red Cross Ishinomaki Hosp	Japan	4	70	6.36
5	Chu Z	Chongqing Medical University	China	4	23	1.64
6	Yamamura O	University of Fukui	Japan	4	41	4.56
7	Chen T	North Sichuan Medical University	China	4	23	1.64
8	Dong Z	Fudan University	China	4	23	1.64
9	Nukiwa T	Tohoku University	Japan	3	38	3.45
10	Kanamori H	Tohoku University	Japan	3	29	2.64

TP, total production; C, citation; P, production; C/P: citation /production

Most influential publications (RQ3)

When the most cited studies are examined, Kouadio et al. (227 citations), Peek-Asa et al. (143 citations), Maegele et al. (79 citations), Cook et al. (79 citations) and Phalkey et al. (50 citations) (14-18). The focus of RQ3 is to analyze the performance of academic publications dealing with ERLD, using the most influential publications as indicators. In the table prepared based on the total number of citations taken from the Web of Science database, the ten most influential publications on earthquakes in lung diseases are presented in Table 2.

The ten most cited ERLD articles are shown in Table 2. With 227 citations, the review entitled "Infectious diseases following natural disasters: prevention and control measures" by Kouadio et al., published in Expert Review of Anti-infective Therapy (impact factor (IF): 18.92) ranked first (14).

Table 2. Top publications

#	Title	Authors	Y	TC	C/Y
1	Infectious diseases following natural disasters: prevention and control measures	Kouadio et al. (26)	2012	227	18.92
2	Fatal and hospitalized injuries resulting from the 1994 Northridge earthquake	Peek-Asa et al. (27)	1998	143	5.5
3	The long-distance tertiary air transfer and care of tsunami victims: Injury pattern and microbiological and psychological aspects	Maegele et al (28)	2005	79	4.16
4	Health effects of natural dust - Role of trace elements and compounds	Cook et al. (29)	2005	76	4
5	Injury epidemiology after the 2001 Gujarat earthquake in India: a retrospective analysis of injuries treated at a rural hospital in the Kutch district immediately after the disaster	Phalkey et al. (30)	2011	50	3.85
6	The impact of the 2011 Great East Japan Earthquake on hospitalization for respiratory disease in a rapidly aging society: a retrospective descriptive and cross-sectional study at the disaster base hospital in Ishinomaki	Yamanda et al. (31)	2013	44	4
7	Follow-up after the Hanshin-Awaji earthquake: Diverse influences on pneumonia, bronchial asthma, peptic ulcer, and diabetes mellitus	Takakura et al (32)	1997	40	1.48
8	Crush Syndrome and Acute Kidney Injury in the Wenchuan Earthquake	He et al. (33)	2011	39	3
9	The epidemiological analyses of trauma patients in Chongqing teaching hospitals following the Wenchuan earthquake	Yang et al. (34)	2009	39	2.6
10	Intensive care in a field hospital in an urban disaster area: Lessons from the August 1999 earthquake in Turkey	Halpern et al. (35)	2003	37	1.76

Y, year; TC, total citation; C/Y, citations per year

Countries and regions with the most publications

The 20 most productive countries that have published research on ERLD are shown in Table 3 and Figure 4. Japan, also an earthquake country, is in first place with 50 publications. China shares the first five places with 35 publications, the USA with 14, Turkey with nine, and Iran with eight. The fact that many articles about Japan, earthquake, and diseases were published in the article's title in a simple Google Scholar search strategy indicates that this ranking is not accidental (19-21).

The table also shows that in ERLD publications, authors are mostly from Asia, America, Asia, and Europe. Among the top 10 most productive countries, five publications came from Asia, two from North America, and three from Europe.

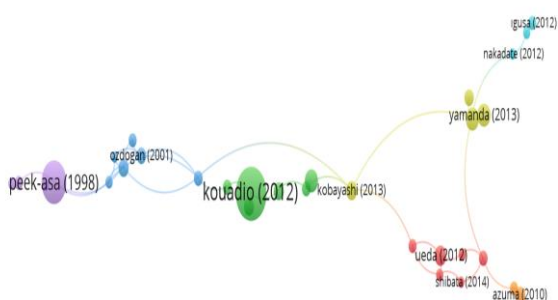


Figure 4. Citation network visualization (n= 334)

Table 3. Top countries and territories for earthquake publications in ERLD

#	Region	Country	TP	SCP	MCP	Freq	MCP Ratio
1	Asia	Japan	50	44	6	0.33	0.12
2	Asia	China	35	32	3	0.23	0.09
3	North America	USA	14	9	5	0.09	0.36
4	Europe	Turkey	9	9	0	0.06	0
5	Asia	Iran	8	7	1	0.05	0.13
6	Europe	Italy	5	5	0	0.03	0
7	North America	Canada	4	1	3	0.03	0.75
8	Europe	Germany	3	1	2	0.02	0.67
9	Asia	India	3	2	1	0.02	0.33
10	Asia	Pakistan	3	2	1	0.02	0.33
11	Oceania	Australia	2	0	2	0.01	1
12	Asia	Indonesia	2	2	0	0.01	0
13	Asia	Israel	2	2	0	0.01	0
14	Asia	Nepal	2	1	1	0.01	0.5
15	Europe	Belgium	1	0	1	0.01	1
16	Europe	Greece	1	1	0	0.01	0
17	North America	Haiti	1	1	0	0.01	0
18	Europe	Iceland	1	0	1	0.01	1
19	Asia	Korea	1	1	0	0.01	0
20	Asia	Malasia	1	0	1	0.01	1

TP: Total Production; SCP: Single Country Production; MCP: Multiple Country Production; Freq: Frequency

The most productive journals

A total of 152 articles were found in 87 journals. The journals with the highest value in terms of the h index are

Chest, Disaster Medicine and Public Health Preparedness, Prehospital and Disaster Medicine, and Respiratory Investigation with the h five indexes (Table 4).

Table 4. The most productive journals

Journal name	h_index	g_index	m_index	TC	NP	PY_start
Chest	5.00	5.00	0.18	104	5	1996
Disaster Medicine and Public Health Preparedness	5.00	10.00	0.31	112	13	2008
Prehospital and Disaster Medicine	5.00	7.00	0.28	97	7	2006
Respiratory Investigation	5.00	9.00	0.42	89	9	2012
Chinese Journal of Traumatology	3.00	3.00	0.20	32	3	2009
Internal Medicine	3.00	5.00	0.11	73	5	1997
International Journal of Environmental Research and Public Health	3.00	4.00	0.50	20	5	2018
American Journal of Tropical Medicine and Hygiene	2.00	2.00	0.17	13	2	2012
BMJ Open	2.00	3.00	0.18	53	3	2013
Critical Care Medicine	2.00	2.00	0.10	116	2	2003
European Journal of Trauma and Emergency Surgery	2.00	2.00	0.15	11	2	2011
Global Health Action	2.00	2.00	0.15	77	2	2011
Indoor and Built Environment	2.00	2.00	0.25	18	2	2016
International Journal of Disaster Risk Reduction	2.00	2.00	0.50	9	2	2020
Plos One	2.00	3.00	0.20	24	3	2014
Surgery Today	2.00	2.00	0.09	17	2	2002
Tohoku Journal of Experimental Medicine	2.00	2.00	0.17	48	2	2012
American Journal of Emergency Medicine	1.00	1.00	0.13	7	1	2016
American Journal of Infection Control	1.00	1.00	0.10	3	1	2014

Note 1: TC: Total Citation; NP: Number of Production, PY: Production Year

Note 2: The h" index measures how many of a researcher's publications are cited at least "h" times. For example, if a researcher's "h" index is 10, this means that at least ten publications are cited at least ten times." The g" index is an index developed based on the fact that the h index is not sensitive to the level of impact created by highly cited publications. The M index, on the other hand, is prepared with the concern that the overwhelming difference between the citation performance of people who have just started publishing life compared to those who have been publishing in the field for years is against equity.

Cluster Analysis

This section will discuss three sub-themes based on citation, co-citation, and the classification of studies with ten or more citations. The number of articles subjected to co-citation analysis is quite insufficient. Each color represents a theme; however, the number of articles within the themes is insufficient. In order to overcome this handicap, every article whose nodes are in the image was examined and evaluated.

Co-citation Analysis

Co-citation analysis shows the citation frequency of two different analysis units (article, author, journal) in the same study (22-23). Using 152 articles, we performed a co-citation network analysis with the VOSviewer program. We show the co-citation network formed from the analysis in Figure 5. The analysis allowed us to visualize common attribution patterns among field studies and identify the intensity and strength of associations between studies. Co-citation analysis showed that the intellectual structure of articles dealing with earthquakes in the field of lung diseases was gathered in three main clusters.

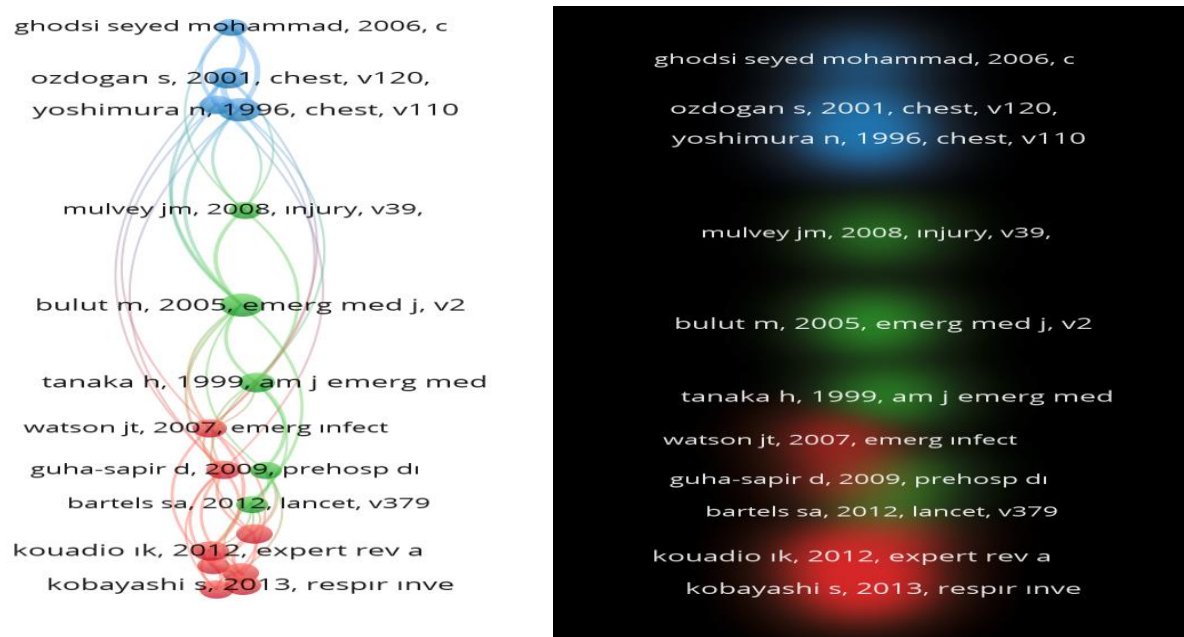


Figure 5. Co-citation network visualization (n=152)

Suggestion for the theme name for the blue cluster: Chest traumas: Types, frequency, and medical intervention strategies. All four articles analyze the type and consequences of chest injuries in major earthquakes. Examining the patterns and frequency of chest injuries to earthquake victims in different regions offers insights into the best medical response strategies. Therefore, a suitable theme for the four articles might be: "Chest traumas: Types, frequency, and medical intervention strategies. This theme covers the commonalities between studies and highlights the importance of understanding the nature of chest trauma in earthquakes and the need for effective medical response plans. Four articles summarize various studies investigating the types, frequency, and consequences of chest trauma caused by earthquakes. Common findings include that chest traumas cause a significant problem in earthquakes, the most common injuries are rib fractures and hemothorax/pneumothorax, and patients with multiple injuries with a high injury severity score are at higher risk of death. It is also emphasized that emergency medical teams should be trained and equipped to accurately diagnose, treat and manage chest traumas during earthquakes (24-27).

Suggestion for the theme name of the green cluster: Earthquake preparedness and earthquake response capacity

These articles address the impact of earthquakes on medical services and patient outcomes. Mulvey et al., Bulut et al., and Tanaka et al. performed retrospective analyses of hospital medical records following earthquakes in Pakistan, Turkey, and Japan, respectively. Studies document the types of injuries, subsequent treatment, infections, and logistical requirements. The authors emphasize that appropriate triage and timely treatment of severely injured earthquake victims are important to reduce morbidity and mortality (28-30). Osaki and Minova conducted a descriptive and case-

control study to identify factors associated with earthquake deaths in Japan. They found that the mortality rate increased in older people, which was much higher, especially among people with physical disabilities living in destroyed shelters (31). Overall, studies point to the need for adequate disaster response and preparedness for institutions and individuals exposing earthquakes and other natural disasters.

Suggestion for the theme name of the red cluster: Respiratory tract infections and earthquake

According to Allworth's study in 2005, it was stated that bacterial infection should be suspected in the case of a cough that does not stop despite treatment in people who were in danger of drowning in the tsunami that occurred after the earthquake (32). Guha Sapir et al. conducted a study in 2009 to explain the importance of communicable diseases and injuries that occur due to natural disasters and to determine the basic recommendations for the control and follow-up of these diseases. According to the study results, some diseases (e.g., cholera, malaria, dengue) may not be a priority immediately after the disaster. Some normally rare conditions, particularly aspiration pneumonia, and tetanus, require special preparation for emergency responders. In addition, resistant and rare pathogens due to natural disasters in the tropics require specialized knowledge to rapidly and successfully treat related infections (33).

Kuado et al. when the part of their 2012 study on chest diseases is summarized, the following issues come to the fore: Post-earthquake epidemics may also result from the destruction of water/plumbing systems and deterioration of health conditions directly caused by the earthquake (14). A study conducted after the 2001 El Salvador earthquake showed that 30% of the 594 people affected had an upper respiratory tract infection (34). Respiratory tract infections were also found in 14% of Iran's 75,586 population displaced by the 2003 Bam earthquake. It has been

associated with inadequate protection during freezing winter nights (35). Increases in the incidence of acute respiratory infections were also documented after the 2005 Pakistan earthquake (36). In Aceh (Indonesia) province, ARIs-related morbidity and mortality rates were highest among tsunami victims in 2004 (37).

Kobayashi et al. Their 2013 study focused on the impact of the Great East Japan Earthquake on COPD patients. In this study, it was determined that the earthquake, in particular, had a serious adverse effect on the clinical outcomes of COPD patients. Sudden massive displacements and problems of being unable to reach healthy conditions increase the disease's negative effect (38).

According to the study conducted by Watson et al. in 2017, it is emphasized that the relationship between natural disasters and infectious diseases is frequently misunderstood. The risk of epidemics is assumed to be very high following natural disasters, but this fear is often due to a perceived association between dead bodies and epidemics. Epidemic risk factors after disasters are associated with population displacement. The availability of safe water and sanitation facilities, the degree of overcrowding, the basic health status of the population, and the availability of health services interact in the context of local disease ecology, affecting the risk of communicable diseases and deaths in the affected population (39).

Analysis of the most cited articles with document review technique

When the studies written in ERLD were examined in general, it was seen that the subjects of respiratory diseases, infections, and trauma were covered. In this section, the relevant issues are briefly and intricately discussed.

Most cited reviews include topics on the types of infections seen after earthquakes (40, 14). All infectious diseases, including lung diseases, occur after disasters. This is due to population displacement, unsafe water and sanitation facilities, overcrowded and dysfunctional healthcare in affected areas, and low vaccination status (41). Living in an overcrowded environment after an earthquake is a common problem and may facilitate the transmission of infectious respiratory diseases (42, 43).

The most cited studies in the area of ERLD are studies investigating traumas caused by earthquakes. The most cited trauma study investigated injuries caused by the 1994 Northridge earthquake in Los Angeles. In this study, it was shown that injury rates did not differ according to gender and increased significantly with increasing age. Most deaths were reported from building collapses, and most hospital-accepted injuries were caused by falling or being struck by objects. While extremity injuries were the most common among hospital admissions, head, and chest injuries were the most common injuries leading to death (15). Their study of Phalkey et al., which investigated the epidemiology of injury after the 2001 Gujarat earthquake in India, found that younger men were more prone to injury, unlike the study of Peek-Asa et al. (18).

Limitations and Future Research

As in all studies, this study also has some limitations. First, a few terms and words were used to find and describe articles dealing with ERLD. New conceptualizations and

denominations emerge, and accepting and using these words often takes time. For example, given the nature of the research, different key terms may reveal different articles that may impact the research results. Future studies may explore the earthquake issue in lung diseases using different bibliometric analyses. Other methods, such as co-word analysis, may reveal different clusters and results (44). Finally, BA tends to focus more on retrospectives, heavily emphasizing the most cited articles. Therefore, future research can examine the subject with bibliographic coupling analysis.

CONCLUSION

In addition to identifying the most influential journals, authors, and countries on earthquakes in the field of lung diseases, this research identified the dominant research themes in this field and set an agenda for future research. Our research revealed the existence of three clusters on the subject of earthquakes in the field of lung diseases. In the first cluster, the dominant themes were Chest traumas: Types, frequency, and medical intervention strategies. In the second cluster, the issues of being prepared for earthquakes and the capacity to respond to earthquakes came to the fore. Finally, respiratory tract infections and earthquake issues came to the fore in the third cluster. Our research outlines the area of ERLD, provides an agenda for future research, and contributes to the fact that the relationship between earthquakes and pulmonary diseases is studied more deeply.

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