

Research trends on Legionellosis

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Received: 2021-12-23.

Accepted: 2022-02-24



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J Clin Med Kaz 2022; 19(2):29-32

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Abstract

Aim: The aim of the study is to analyze the scientific studies about Legionellosis which published in all around the world.

Material and methods: The Elsevier's Scopus database (<https://www.scopus.com/>) was searched with the for bibliometric analysis method. Articles were selected only according to their valid scientific properties which accepted by scientific community with their methodologic design. The publications were analyzed according to publication years, countries, authors, institutions, funding institutions, publishing languages, themes, citations, keywords, methods, and samples. The Scopus database was filtered for document type which only the articles. The data containing the keywords "legionellosis" or "Legionella pneumophila" or "Legionella" or "Pontiac fever" in their title were retrieved till December 13, 2021.

Results: In total, 8778 documents relating to Legionellosis were identified in the Scopus database till December 13, 2021. 7073 of the documents were articles. The articles were published in mainly in the discipline of medicine (n=4766, 67.38%). The first articles were published in the year 1977 and was from United States of America (USA). There were two surges in the number of publications in the years 1983 and 2013. After 1980, the annual number of articles never dropped below 100 articles per year. The USA dominated the scientific production on Legionella with the number of 2214 (31.30%) publications. The top 5 leading scientifically productive countries on Legionella literature after USA were Germany (n=8.41%), United Kingdom (7.64%), France (7.36%) and Japan (n=512, 7.23%). The publications on Legionellosis were from more than 100 countries globally. The maximum number of the citation was in the year of 1978. 1126 (15.9%) of the articles were not cited yet.

Conclusion: The number of publications was high since the first reports were published, but the number of cites decreased since 2020.

Key words: bibliometric analysis, Legionnaires' disease, Legionellosis

Introduction

Legionnaires' disease or Legionellosis is a serious lung infection caused by *Legionella* species. The *Legionella* family currently consists of more than 60 species comprising 70 distinct serogroups [1,2]. Only a few of these are associated with disease in humans. The most common type of disease is *Legionella pneumophila* and *L. pneumophila* serogroup 1, with different invasion and virulence abilities than others, are responsible for 75-80% of cases. However, it can cause nosocomial pneumonia. The disease was first described in 1976 at a congress of American Legionnaires at a Philadelphia hotel

(Bellevue Stratford Hotel), with an outbreak of pneumonia among attendees. Of the participants attending the congress, 221 were affected by *L. pneumophila* and 34 died. Since the infection first appeared in the meeting with the legionnaires and the causative microorganism was isolated from lung tissue samples, the disease was called "Legionnaires' disease" and the bacterium causing the infection was named *L. pneumophila*. Legionnaires' disease was first identified with a hotel-acquired epidemic, and it was soon realized that it could occur with hospital-acquired outbreaks or sporadic cases [2,3].

The term of Legionellosis is used to describe bacterial infections that can range from mild febrile

resolving illness (Pontiac fever) to pneumonia, which can be rapid and fatal (Legionnaires' disease) [1]. Legionnaires' disease is a systemic infection that can occur in a wide clinical spectrum, from mild lower respiratory tract involvement to forms which can progress to severe coma and death that affecting all organs [4]. The main pathological events occur in the lungs and the state of the defense mechanisms determines the course of the disease. Since it cannot be distinguished from other types of pneumonia clinically and radiologically, its definitive diagnosis is made by microbiological examination. Legionnaires' disease will not develop if there is no contaminated water source. It is considered that there are two ways for the bacterium to reach the lungs. The widely accepted route is the inhalation of water aerosols containing *Legionella*, which are emitted into the respiratory air from environmental sources (fans of cooling towers, whirlpools and showerheads, spray humidifiers, decorative fountains...). Another important transmission route is the passage of bacteria settled in the oropharynx into the respiratory tract as a result of aspiration of water containing *Legionella*. There is no human-to-human transmission [2,4]. This disease is seen globally and as it is known to be a nosocomial pathogen for hospital plumbing, and its importance is increasing [5,6].

In this study, we aimed to analyze the publications on Legionellosis and to guide researchers about Legionella.

Material and methods

The aim of the study was to analyze the articles on Legionellosis. The Elsevier's Scopus bibliometric database (<https://www.scopus.com/>) was searched for bibliometric analysis method. Articles were selected only according to their valid scientific properties which accepted by scientific community with their methodologic design. Congress book abstracts, reviews, letters, etc. were not included.

The articles on Legionellosis were analyzed according to publication years, countries, authors, institutions, funding institutions, publishing languages, themes, citations, keywords, methods, and samples. The Scopus database was searched for article document type. The data were retrieved until the date of December 13, 2021 which containing the keywords "legionellosis" or "Legionella pneumophila" or "Legionella" or "Pontiac fever" in their title.

The searches were performed only at the day of December 13, 2021, to avoid bias as the database is daily updating. Duplications were included in the review only once. The obtained data were analyzed in the Excel forms created by the researchers. The data was analyzed with both quantitative and qualitative methods and the top-rated publications were analyzed comprehensively.

Çanakkale On Sekiz March University's online library and digital resources were used to accessing information.

Ethical Approval

The study complied with the Helsinki Declaration, which was revised in 2013. Ethics committee approval is not required as there is no human or animal research.

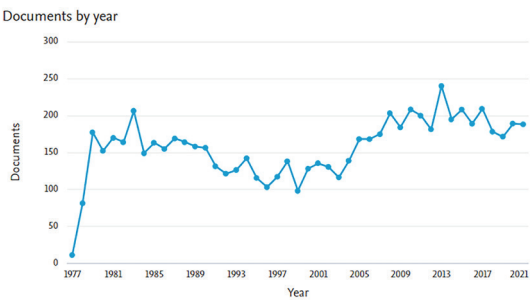
Statistical methods

The data in the tables were given as absolute values (frequency and percentage) by using Microsoft Excel 2010. No advanced statistical analyses tests were used. The visualization of the citing analyses was done with the Dimension program (Free Version) and WOS viewer (<https://app.dimensions.ai/discover/publication>)

Results

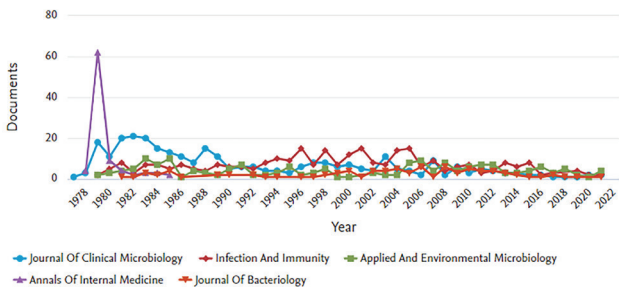
In total, 8778 documents relating to Legionellosis were identified in the Scopus database till December 13, 2021. 7073 of the documents were articles, and we only analyzed the articles which has a trustworthy scientific impact. 2859 (40.42%) of the articles were published as open access (OA). Articles were published in mainly in the categories of medicine (n=4766, 67.38%), Immunology and Microbiology (n=2067, 29.22%), Biochemistry, Genetics and Molecular Biology (n=1286, 18.18%) and Environmental Science (n=667, 9.43%). The first articles were published in the year 1977 and from United States of America (USA). There were two surges in the number of publications in the years 1983 and 2013. After 1980, the annual number of articles never dropped below 100 articles per year (Figure 1). The USA dominated scientific production on Legionella with the number of 2214 (31.30%) publications. The top 10 leading scientifically productive countries on Legionella literature were after than USA were Germany (n=595, 8.41%), United Kingdom (n=541, 7.64%), France (n=521, 7.36%), Japan (n=512, 7.23%), Italy (n=301, 4.23%), Canada (n=265, 3.74%), Spain (n=258, 3.64%), China (n=214, 3.02%) and Netherlands (n=193, 2.72%). Turkey was in the 22nd place. The publications on Legionellosis were from more than 100 countries globally.

Figure 1 - Number of publications by the years



The majority of the articles (n=5960, 84.26%) were written in English language. French (n=189, 2.67%) and German (n=187, 2.64%) languages were the other most preferred languages. The highest number of articles on Legionellosis were published in the journals; Journal Of Clinical Microbiology (n=307, 4.34%), Infection and Immunity (n=292, 4.12%), Applied and Environmental Microbiology (n=179, 2.53%), Annals of Internal Medicine (n=89, 1.25%) and Journal of Bacteriology (n=89, 1.25%). The published numbers of top 5 journals by years were given in Figure 2.

Figure 2 - Published numbers of top 5 journals by years



Most funding sponsors were National Institute of Allergy and Infectious Diseases (n=595, 8.41%), National Institutes of Health (n=290, 4.10%), U.S. Department of Health and Human Services (n=178, 2.51%) National Institute of General Medical Sciences (n=91, 1.28%), Deutsche Forschungsgemeinschaft (n=75, 1.06%) Japan Society for the Promotion of Science

(n=62, 0.87%) and National Natural Science Foundation of China (n=57, 0.8%). The most of the funding sponsors were from USA. 5559 (78.59%) of the articles were not funded.

Nicholas P. Cianciotto (Northwestern University Feinberg School of Medicine, USA) and Sophie Jarraud (Claude Bernard University, France) were the most productive authors on legionellosis literature with 91 articles. The Centers for Disease Control and Prevention was the leading affiliation on this topic with 302 articles (Table 1).

Table 1 Top 10 affiliations on Legionellosis literature (n=7073).	
Affiliation, Country	Number of publications (%)
The Centers for Disease Control and Prevention, USA	302(4.26)
VA Medical Center, USA	142(2.00)
CNRS Centre National de la Recherche Scientifique, France	121(1.71)
National Center for Infectious Diseases, USA	111(1.56)
Université Claude Bernard Lyon 1, France	108(1.52)
Inserm, France	93(1.31)
Public Health Laboratory Service, United Kingdom	86(1.21)
Julius-Maximilians-Universität Würzburg, Germany	80(1.13)
Howard Hughes Medical Institute, USA	77(1.08)
University of Pittsburgh, USA	74(1.04)

Citing analysis

The maximum number of the citation was in the year 1978. 1126 (15.9%) of the articles were not cited yet. The top cited article was published by Fraser et al. (Figure 3) [7].

Citing analyses of the most productive authors on Legionella research was given in Figure 4.

Figure 3 - Publication citation number is the number of times that publications have been cited by other publications in the database.

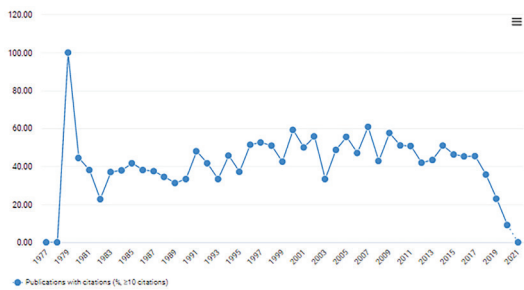
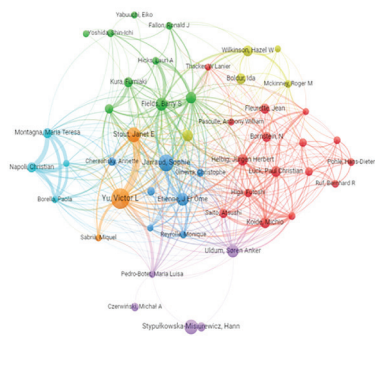


Figure 4 - Citing analyses of the most productive authors on Legionella research



Discussion

Many different bibliometric analysis methods have started to enter the medical literature in recent years, and analysis studies on this subject can be enriched by methods such as mapping and graphing. These studies can be done by using many methods such as content analysis, comparison of scientific productivity by years, countries, and citation numbers. Databases that are frequently used for bibliometric analysis are databases that provide easy and comprehensive data analysis such as Pubmed, EBSCO, Scopus, Pro-Quest, Web of Science. However, other sources such as any database, theses, journals, congresses, etc. can be analyzed with this method [8-13]. The Scopus database is a comprehensive, well-compiled database of abstracts and citations which combining academic literature. This subscription database provides access to metrics and analytical tools [10-12]. With the comprehensive analysis feature Scopus provides, this database also enables publication analysis, which is a different research method [10-14]. There are limited bibliometric studies on infectious diseases [8,15-19]. The bibliometric method refers us quantification about overall trends and highlighting connections or correlations hidden within large amounts of data.

We think that the scientific efficiency of infectious diseases as well as many other disciplines in health, should be evaluated with this method and a roadmap should be created for further studies. In this study, the Scopus database was used for the research. Before conducting this current study, we conducted a literature review on Legionellosis, and we could not reach any similar study. This disease is important as many countries have surveillance tracking systems available on Legionellosis [20]. But the publications were not analyzed yet in bibliometric vision. We aimed to add vision to Legionellosis researchers.

According to the findings of our study, the annual number of articles on the topic Legionellosis never dropped below 100 articles per year after the year 1980. But the number of citations decreased over the years. The majority of articles were published in the year 2013. The USA, Germany, United Kingdom, France, Japan, Italy, Canada, Spain, China and Netherlands produced most of the articles (nearly 75%) on Legionellosis. Although this disease is seen worldwide, the distribution of scientific productivity by country did not reflect disease prevalence. Although there were publications from more than a hundred countries globally, there were very limited publications from developing countries.

The most productive affiliations were also from the USA and France. The first articles were also from the USA. The highest number of USA publications may be due to the fact that the funder affiliations are often from the USA. Additionally, the Centers for Disease Control and Prevention was the leading affiliation on this topic is from the USA, too.

The examining the writing languages of the publications showed that more than 95% of the publications were written in English. This may be due to the predominant language of literature being English. Because greater visibility and a higher number of citations are expected for articles in English, most researchers tend to publish their work in English, even if their native language is not. In addition, English is accepted as the common language of the scientific world. However, non-native English speakers still publish studies in their native language, which explains the lower citation rates, perhaps due to local or regional interest and accessibility.

As a result of the study, the number of publications was high since the first reports were published, but the number of cites decreased since 2020. This situation may be attributed to the global pandemic.

Limitation

The current study has several limitations. Studies in other than Scopus database were not analyzed. Also keywords only in English, so publications written in other languages may be omitted. Content analysis was not performed in our study.

Disclosures: There is no conflict of interest for all authors.

Acknowledgements: None.

Funding: None.

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