

Bibliometric Analysis of Multiple Sclerosis Studies in Pharmacology Journals

Mazhar ÖZKAN¹, Tuğba Nurcan YÜKSEL^{2*}, Fatih TOZOĞLU³

Highlights:

- On the highest number of documents was observed by the United States
- The most cited document is Therapeutic Advances in Neurological Disorders
- The most cited study is conducted by Ferreria-Vieira et al. (2016) and published in the 'Current Neuropharmacology' journal

ABSTRACT:

Multiple sclerosis (MS) is a prevalent neurological disease with a global impact on patients' lives. Our study aimed to conduct a bibliometric analysis of research published in the field of pharmacology over the past decade. We retrieved original articles on MS from pharmacology journals in the last ten years through the Scopus database. The collected data underwent analysis using VOSViewer software, examining relationships between studies based on parameters such as citation, authorship, and organizations. In our country-based analysis, the United States emerged with the highest document count, totaling 350, followed by Germany with 210 documents. Claudio Viegas holds the top position with four publications in the last decade. The most prolific organization identified was associated with the Biogen-Cambridge-MA-United States group. However, Chulalongkorn University in Bangkok, Thailand, specifically the Department of Psychiatry, received the most citations. The most cited document was "Therapeutic Advances in Neurological Disorders," while the study with the highest citations was Ferreria-Vieira et al.'s (2016) work published in *Current Neuropharmacology*. Research efforts on MS treatment are evidently growing, with diverse research groups contributing worldwide. We anticipate that our study will provide valuable guidance to researchers in the field by shedding light on significant research and their interconnections in recent years.

Keywords:

- Bibliometric analysis
- Multiple sclerosis
- Pharmacology
- VOSViewer

¹Mazhar ÖZKAN ([Orcid ID: 0000-0002-8745-2493](https://orcid.org/0000-0002-8745-2493)), Tekirdağ Namık Kemal University, Faculty of Medicine, Department of Anatomy, Tekirdağ, Türkiye

^{2*}Tuğba Nurcan YÜKSEL ([Orcid ID: 0000-0001-5092-1674](https://orcid.org/0000-0001-5092-1674)), Tekirdağ Namık Kemal University, Faculty of Medicine, Department of Pharmacology, Tekirdağ, Türkiye

³Fatih TOZOĞLU ([Orcid ID: 0000-0002-8882-9264](https://orcid.org/0000-0002-8882-9264)), Bilecik Şeyh Edebali University, Vocational School, Department of Food Technology, Bilecik, Türkiye

*Corresponding Author: Tuğba Nurcan YUKSEL, e-mail: tnyuksel@nku.edu.tr

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INTRODUCTION

The clinical and phenotypic range of immune-mediated central nervous system (CNS) demyelinating disorders is extensive (Thompson et al., 2018). While specific clinical features are indicative of MS, its phenotypic expressions exhibit significant variability (Gelfand 2014). Multiple sclerosis (MS) stands as an immune-mediated disorder affecting the central nervous system. The heritability of MS risk accounts for around 25%, while the remaining susceptibility is associated with environmental, epigenetic, and gene–gene or gene–environment interactions (Olsson, Barcellos, & Alfredsson, 2017). MS is classified clinically into four types; and the studies are quite extensive (Gholamzad et al., 2019). MS incidence and prevalence are increasing globally. About 85 percent of patients experience MS starting with recurring episodes caused by inflammation, known as relapsing–remitting MS, followed by increasing impairment caused by neurodegeneration, known as secondary progressive MS (Dobson & Giovannoni, 2019). However, a small percentage of people (10-15%) endure continuous, non-relapsing advancement from illness start, which is referred to as primary progressive MS (Lin, Zhou, & Xu, 2023). Despite the rapid evolution of the therapeutic landscape, treatment options for the progressive disease are currently limited.

Treatments for MS primarily revolve around prescribed immunosuppressive and immunomodulating agents. Furthermore, researchers have developed a range of disease-modifying treatments to diminish attack frequency and regulate inflammation in affected individuals (Gholamzad et al., 2019). Treatments for multiple sclerosis have been effective in reducing disability and increasing survival rates, but no cure has been found, and the causes of the illness are still not fully understood. (Walton et al., 2020). The present state of MS therapy focuses on the following goals: reduction of biological activity, improvement of symptoms, prevention of recurrence and disability progression, and mitigation of biological activity during acute episodes (Hauser & Cree, 2020). Notably, there are a number of dangers associated with these treatments, including an increased incidence of common and opportunistic infections, even if they are quite effective.

Whereas qualitative methods are used in systematic literature reviews and are to interpretation biases from academics, bibliometric analysis and meta-analysis employ quantitative methods, mitigating such biases. The primary goal of meta-analysis is to synthesize empirical data by assessing the magnitude of effects and correlations between different variables. Whereas bibliometric analysis examines the social and structural links among various research components, it delineates and visualizes the intellectual and bibliometric structure of a field (e.g., authors, countries, institutions, topics). By providing scientists with a thorough perspective in one place, well-executed bibliometric research may lay strong groundwork for making unique and significant contributions to a subject. (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021; Kaba & Çoşkun, 2022).

In the literature, numerous studies have explored the comparison of various software applications utilized for bibliometric analysis (Aleixandre-Benavent et al., 2015; Yang, Tu, Feng, Lai, & Wang, 2021). An existing study specifically focuses on the bibliometric analysis of MS treatment (Aykaç & Elicaçık, 2022). However, a bibliometric analysis and contemporary data presentation of MS studies in pharmacology journals over the past decade are notably absent. Given this informational gap, the present study set out to fill it by analyzing pharmacological studies published in pharmacology journals over the past decade in an effort to shed light on research networks, current trends, and research on MS. In addition, our study will contribute both medically and academically to future studies on MS disease and its treatment, which affects the society significantly.

MATERIALS AND METHODS

Research Strategy

The Scopus database was queried for the bibliometric information (n=2803). For the purpose of filtering, the term "multiple sclerosis" was input. The study covered English articles published between 2013 and 2023 in the Pharmacology, Toxicology, and Pharmaceutics area.

Statistical analysis

Bibliometric analysis was performed on the data using VOSviewer 1.6.19, developed by Leiden University.

Utilizing VOSViewer software, graphs illustrating the interrelationships of the research were generated. Microsoft Excel was used to generate the tables.

RESULTS AND DISCUSSION

Over the past several years, bibliometric analysis has been increasingly prominent in the field of business research (Donthu et al., 2020b, Donthu, Kumar, Pattnaik, & Lim, 2021, Khan et al., 2021). The development, availability, and accessibility of bibliometric tools like VOSviewer, Gephi, and Leximancer, as well as scientific databases like Scopus and Web of Science, have contributed to this meteoric rise in popularity. In addition, bibliometric methodology's transfer from the field of information science to that of business research has been an important factor. Bibliographic analysis is becoming increasingly popular in business research for good reason: it is effective at handling massive amounts of scientific data and producing significant research impact, thus its tremendous growth is not a novelty (Donthu et al., 2021).

Frequent use of network visualization software in bibliometric analysis is observed. This software might be command-based, like R's Bibliometrix package, or totally graphical, like VOSviewer (van Eck & Waltman, 2010, Aria & Cuccurullo, 2017). Bibliometric analysis stands out as an emerging tool for obtaining more quantitative information on collaboration between diverse organizations, the impact of publications, and emerging trends (Albuquerque et al., 2017; Ellegaard & Wallin, 2015). Bibliometry involves the examination of scientific publications through diverse statistical methodologies (Demir, Akmeşe, Erbay, Taylan-Özkan, & Mumcuoğlu, 2020; Kosovali & Mutlu, 2023). This analytical strategy makes it easier to understand the dynamics of a study topic, identify patterns, and direct future research. It makes it easier to use data to draw conclusions that can shape how knowledge in a particular field develops. Bibliometric analysis, in contrast to meta-analysis, permits the evaluation of present trends (authors, journals, keywords) on a specific subject by processing citations. As a result, it provides a chance to identify areas where research is lacking and investigate potential partnerships or networks (Donthu et al., 2021).

MS is a debilitating disease that manifests in young adults, leading to progressive physical disability and cognitive impairment (McGinley, Goldschmidt & Rae-Grant AD, 2021). While the etiology of MS remains unknown, its pathophysiology has been linked to the development of autoreactive lymphocytes and antigen-presenting cells in the body (Simkins, Duncan & Bourdette, 2021). MS has undergone a therapeutic revolution in the past 30 years, witnessing the approval of over 20 subsequent therapies for relapsing-remitting MS. Notably, several therapies have expanded their indications to include progressive disease (Amin & Hersh, 2023). This transformative period has shifted the landscape from injectable therapies being the sole option to an environment that offers injectable, infusible, and oral therapies to patients. Moreover, there has been an improvement in the treatments' relative effectiveness over time. These advancements have resulted in less impairment due

to relapses and a marked decrease in their frequency (Peterson, Jalil, Beard, Kakara, & Sriwastava, 2022). Despite substantial progress in understanding the pathophysiology of MS and the proliferation of treatments aimed at preventing relapses, there remain unmet needs in halting and reversing disease progression, as evidenced by various references. At the same time, research groups worldwide actively explore new therapeutic agents and regularly publish their findings, especially in pharmacological journals. From 2013 to 2023, pharmacology journals published a total of 158 MS papers, which were analyzed, using bibliometric methods.

The utilization of diverse bibliometric tools, each reliant on distinct databases, may lead to variations in analysis outcomes, introducing challenges and limitations to researchers during literature review processes (AIRyalat, Malkawi, & Momani, 2019). In our study, we employed the Scopus database to identify the most influential articles, journals, researchers, and organizations associated with MS over the past decade. Additionally, we conducted keyword mapping to trace recurring keywords linked to idebenone in these studies, categorized by their respective years of occurrence

Looking at the breakdown of publications published on treatments for multiple sclerosis from 2013 to 2023, the most cited publication, with 1381 citations, was the study by Craik D.J. and colleagues, while other highly cited studies are detailed in Table 1.

Table 1. The Ten Most Cited Papers

Documents	Citations
Craik et al. (2013)	1381
Luczynski et al. (2016)	355
Moghe et al. (2015)	318
Harbo et al. (2013)	306
Spagnuolo et al. (2018)	267
Noorafshan and Ashkani-esfahani (2013)	256
Achiron et al. (2021)	237
Watad et al. (2021)	232
Pruenster et al. (2016)	226
Witalison et al. (2015)	197

Between 2013 and 2023, when investigating journals that published the most articles on MS, we found that Therapeutic Advances in Neurological Disorders was the most prolific with 130 documents and 2265 citations (Figure 1).

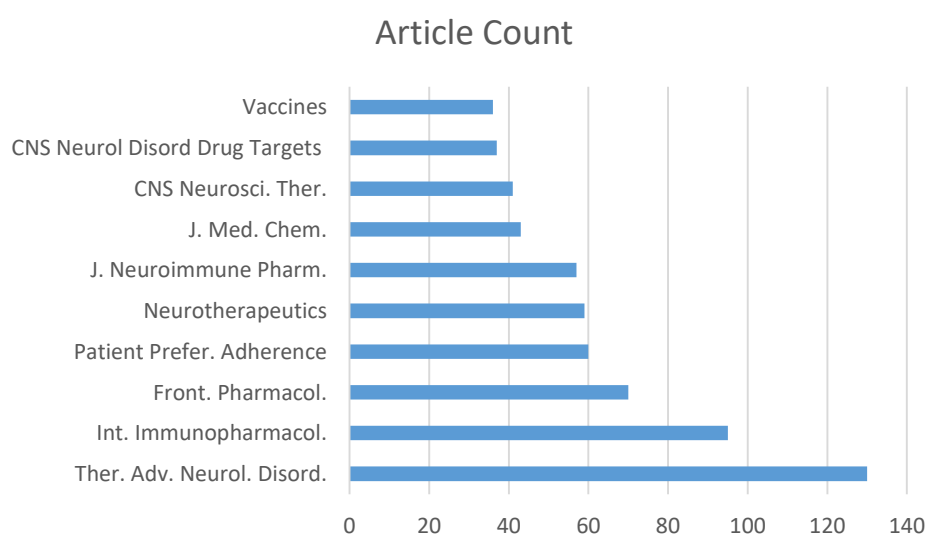


Figure 1. Ten Journals with the Highest Number of Published Articles

In the analysis conducted with VOSViewer, articles on MS published in the study area journals were distributed into four groups (Figure 2).

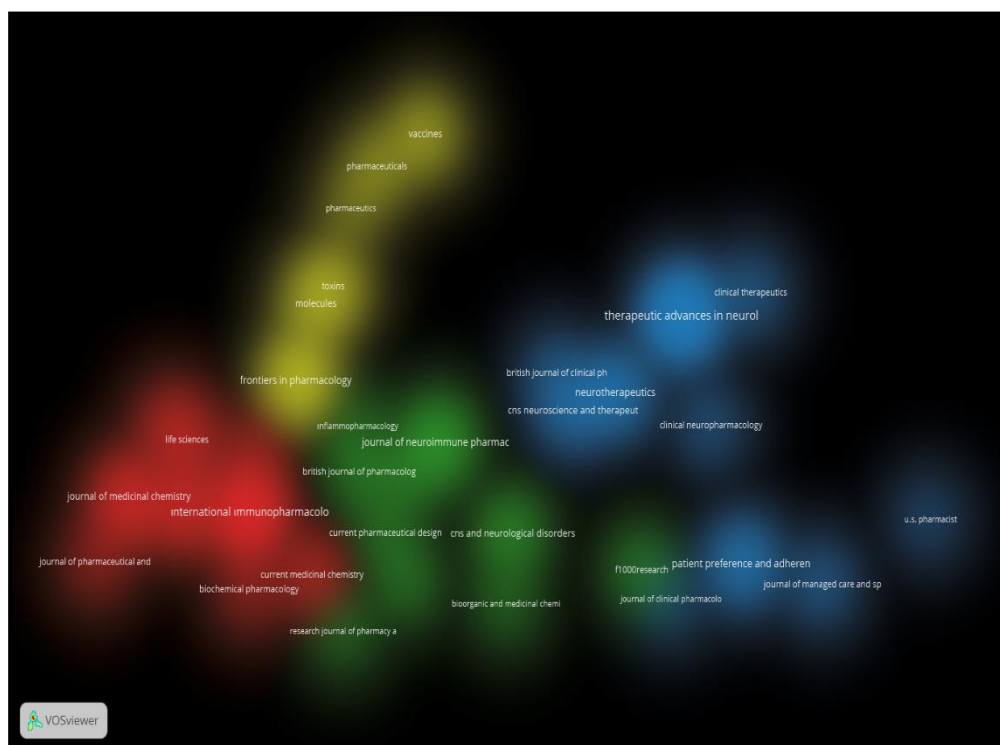


Figure 2. The Journal Clusters About MS Papers Published

The group linked with Biogen in Cambridge, Massachusetts, USA, produced the most documents (13 in total), as seen in Table 2. On the other hand, the Department of Psychiatry at Chulalongkorn University in Bangkok, Thailand, has the most citations with 212 over three articles.

Table 2. Top Ten Organizations By Documents

Organizations	Documents	Total link strength
Biogen, Cambridge, MA, United States	26	12
Tehran University of Medical Sciences Immunology Department	11	9
Novartis Pharmaceuticals Corporation, United States	11	7
Novartis Pharma, Switzerland	10	7
Medical University of Vienna Department of Neurology	8	3
Mashhad University of Medical Sciences Pharmacological Research Center of Medicinal Plants	7	11
Centre For Human Drug Research, Netherlands	6	1
Cairo University Faculty of Pharmacy Department of Pharmacology and Toxicology	6	0
Tarbiat Modares University Faculty of Medical Sciences Physiology Department	6	0
Tabriz University of Medical Sciences Drug Applied Research Center	6	4

Figure 3 illustrates the network structures of the countries with the highest number of MS-papers in the last decade and the organizational distribution over the years. The United States stands out prominently in the analysis. We observed that other countries follow a similar arrangement as shown in Figure 3.

in MS research. The research does have a few caveats, though. One possibility is that there is incorrect or missing information in the database that we have not been able to find or fix. The second limitation is that we limited our evaluation to articles written in English. Nevertheless, as the first study to investigate pharmacological journal publications on MS disease from 2013 to 2023 and provide bibliometric analysis data, this research will contribute significantly to the literature. Moreover, it will guide future research on MS and its treatment by providing valuable insights.

CONCLUSION

The results of this study provide helpful information for writers looking for publications to publish their MS research in. We hope that by shedding light on research gaps and associated processes, our findings will provide researchers working with idebenone with a firm grounding..

Conflict of Interest

The article authors declare that there is no conflict of interest between them.

Author's Contributions

The authors declare that they have contributed equally to the article.

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