



Bibliometric and Visual Analysis of the Literature on Electroconvulsive Therapy in Psychiatry between 2000-2023

2000-2023 Yılları Arasında Psikiyatride Elektrokonvülsif Tedavi ile İlgili Literatürün Bibliyometrik ve Görsel Analizi

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Abstract

Aim: This study aims to give a bibliometric overview of the electroconvulsive therapy (ECT) literature in the psychiatry research area, published between 2000 and 2023.

Material and Method: The data was retrieved on June 1, 2023, in accordance with the set search strategy, from the Web of Science Core Collection, which served as the data source. For the analysis of published literature, the bibliometrics tool VOS Viewer was employed.

Results: According to the search strategy, this study included 1909 articles regarding ECT. With 567 publications and 12632 citations, the United States was determined to be the country with the greatest importance in this study. Additionally, more than 100 publications on ECT were published in Germany (n=171), Australia (n=148), China (n=127), the Netherlands (n=124), and Japan (n=110). Based on the volume of published records, the Mayo Clinic in the United States was the most significant institution in ECT research. The bulk of publications (39.9%) were published in the Journal of ECT.

Conclusions: The bibliometric analysis in this study provided information on recent developments in publications on ECT from 2000 to 2023. The results can act as the basis for further field research.

Keywords: Bibliometric analysis, electroconvulsive therapy, electroshock therapy

Öz

Amaç: Bu çalışma, psikiyatri araştırma alanında 2000-2023 yılları arasında yayınlanan elektrokonvülsif tedavi (EKT) literatürüne bibliyometrik bir bakış sunmayı amaçlamaktadır.

Gereç ve Yöntem: Veriler, belirlenen arama stratejisine uygun olarak 1 Haziran 2023 tarihinde veri kaynağı olarak kullanılan Web of Science Core Collection'dan alınmıştır. Yayınlanan literatürün analizi için bibliyometri aracı VOS Viewer kullanılmıştır.

Bulgular: Arama stratejisine göre, bu çalışma EKT ile ilgili 1909 makaleyi içermektedir. Amerika Birleşik Devletleri 567 yayın ve 12632 atıf ile bu çalışmada en büyük öneme sahip ülke olarak belirlenmiştir. Ayrıca, Almanya (n=171), Avustralya (n=148), Çin (n=127), Hollanda (n=124) ve Japonya'da (n=110) EKT ile ilgili 100'den fazla yayın yayımlanmıştır. Yayınlanan kayıtların hacmine göre, Amerika Birleşik Devletleri'ndeki Mayo Kliniği EKT araştırmalarında en önemli kurumdu. Yayınların büyük kısmı (%39,9) Journal of ECT'de yayımlanmıştır.

Sonuç: Bu çalışmadaki bibliyometrik analiz, 2000'den 2023'e kadar EKT ile ilgili yayınlardaki son gelişmeler hakkında bilgi sağlamıştır. Sonuçlar, daha ileri saha araştırmaları için temel oluşturabilir.

Anahtar Kelimeler: Bibliyometrik analiz, elektrokonvülsif tedavi, elektroşok tedavisi



INTRODUCTION

Electroconvulsive therapy (ECT) or electroshock therapy is a psychiatric treatment for mental illnesses, which is based on inducing artificial epileptic seizures by passing an electric current through the brain.^[1] ECT can be used to treat major psychiatric diseases like mood disorders and schizophrenia. It can benefit greatly from this safe, well-tolerated, and very successful therapy, especially when catatonic symptoms or an abrupt aggravation of psychotic symptoms are prevalent.^[2] Also, Parkinson's disease, mania, catatonia, delirium, neuroleptic malignant syndrome, autism, agitation, and depression in demented individuals are among those successfully treated by ECT.^[3,4] This method has long been used to treat psychiatric disorders when pharmacological treatments are inoperative.^[4] But this method was first introduced in the year 1938, by Cerletti.^[5] Patients with schizophrenia were the first patients to receive ECT.^[6] ECT therapy was the most popular one for treating acute psychosis up until 1952 when pharmaceutical treatment completely replaced it.^[7] Nevertheless, as to its effectiveness in treating resistant schizophrenia, its use has recently attracted a lot of interest from specialists.^[8] The decrease in adverse effects has been facilitated by technical developments that have improved this process. Therefore, modified ECT is currently regarded as an efficient and secure kind of therapy, especially in populations that are more susceptible, including geriatric patients, youths, and pregnant women.^[2] In addition, catatonia and patients with serious suicidal ideation or intent benefit greatly from ECT treatment. ECT is particularly essential in the treatment of acute illnesses that require quick recovery. Elderly patients benefit from ECT even more than adult populations of mixed ages. Medically speaking, there aren't many reasons not to use ECT as a treatment.^[9] The only early biological treatment still in use today among those first offered in psychiatry is ECT.^[2] In order to identify when this technique should be utilized, the Spanish Society of Psychiatry created a consensus in 2018.^[10]

Today, bibliometric analyses have been conducted in many fields, including psychiatry.^[11-14] However, there is no bibliometric study aiming to analyze the literature on general use practices as a whole system of ECT in psychiatry. This research aimed to point out ECT usage in psychiatry over the previous 23 years using bibliometrics. This article attempts to give psychiatrists a thorough and impartial summary of current research on ECT procedures and supporting data. Additionally, it seeks to offer a thorough analysis of a variety of factors, including target publications for academics to publish their articles in and connections between institutions and nations.

MATERIAL AND METHOD

In this bibliometric study, the data was retrieved on June 1, 2023, using the set search approach from the Web of Science Core Collection.

The search parameters were: (electroconvulsive therapy OR electroshock therapy); time span: 2000-30 May 2023; language

type: all; literature type: Article; index: Sci-Expanded (SCIE), Social Sciences Citation Index (SSCI) and research areas: Psychology OR Psychiatry OR behavioral sciences)

Articles that were not devoted to the study of psychology or psychiatry were excluded. False positives were removed from the initial sample, and it was then enlarged with pertinent missed papers.

Bibliographic data should be standardized before processing due to a researcher may use several different names.^[15] After normalization, descriptive statistics, bibliometric analysis, and co-word analysis were used to examine the bibliographic data. The h-index was used to determine the articles with the greatest impact. According to the definition of the h-index, "a research area has index h when h of its the number articles have at least h citations each, and the remaining number-h articles have less than or equal to h citations each." The classics of the field are those articles that have more citations than or equal to the h-index.^[16] The published literature was analyzed using the bibliometrics program VOSViewer (Leiden University, van Eck NJ)^[17]

The co-word analysis aids in the identification of the most pertinent research topics and their relationships by calculating the co-occurrence frequency of keyword pairs in an article.^[19-20] The most prolific publications' cooperation networks were scrutinized using co-word analysis, and a graph showing the researchers and the number of articles they co-authored as a consequence was produced. The co-word analysis was done with the VOSViewer tool.

For quantitative and qualitative analysis, the TXT format files were imported into Microsoft Excel 2019 (Microsoft Corporation). Journal Citation Reports (JCR) category was utilized for the quality assessment of the data as indications of the impact of the articles. It represents the average number of citations received by each article published in this journal over the previous two years. The JCR assigns each scientific journal to its associated IF and ranks them according to particular fields as a sign of scientific "prestige." JCR data categories from the JCR of 2021 were used in this investigation.^[21]

RESULTS

According to the research methodology, 1909 research articles published in the field of psychiatry/psychology and behavioral sciences published in SCIE and SSSI indexes between 2000 and 2023 were reached. Each publication received an average of 17.97 citations each year and 34,314 citations overall. 11,418 articles in total cited these articles.

When the publication languages of these publications were analyzed, English (n=1840, 96.386%) was the main publication language. German (n=25, 1.310%), French (n=12, 0.629%), Spanish (n=12, 0.629%), Turkish (n=12, 0.629%), Polish (n=7, 0.367%), and Danish (n=1, 0.052%) were other publication languages. 24.777% of them were published as open access. 2020 and 2021 were the years with the highest number of

publications with 138 articles each. Although the number of publications was irregular, it did not fall below 100 articles per year between 2018-2022. In 2023, 43 articles were published, but this number may be misleading as it reflects the first 5 months of this year.

Authors from 66 countries contributed to the literature on ECT. The United States was the leading country with 570 (29.859%) articles on ECT. Germany (n=171), Australia (n=148), China (n=127), Netherlands (n=124), and Japan (n=110) published more than 100 articles on ECT. **Figure 1** shows the global distribution of the ECT publications. **Figure 1** was produced with the Excel program.

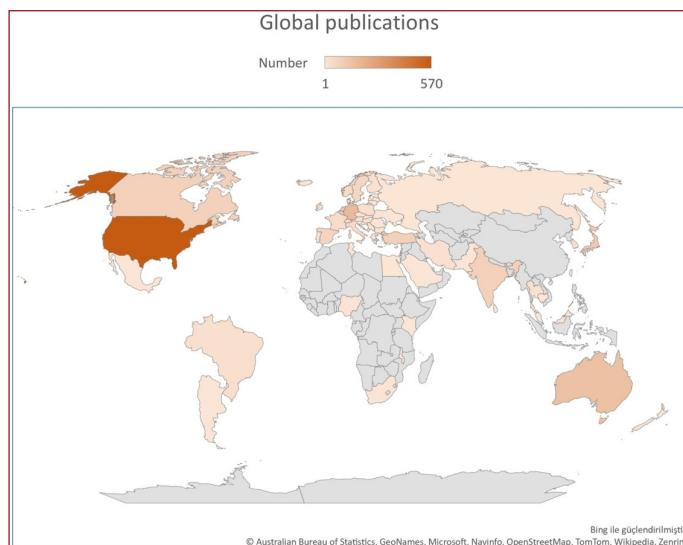


Figure 1. Global number of publications

In total, researchers from 1,918 institutions contributed to the ECT literature. The Mayo Clinic (the United States) (n=78), KU Leuven (Belgium) (n=66), Harvard University (the United States) (n=58), Columbia University (the United States) (n=52), and the National Institute of Mental Health and Neuro-Sciences (India) (n=50) were the leading institutions in the field.

Publications on ECT were published in 141 different journals. The Journal of ECT published the majority of articles (39.9%) on ECT (**Table 1**).

Table 1. Mostly publishing journals on ECT			
Publication Titles	n	%	Journal Impact Factor™ (Five year)
Journal of ECT	760	39.811	3.868
Journal of Affective Disorders	101	5.291	6.569
Journal of Clinical Psychiatry	46	2.410	5.626
Psychiatry Research	39	2.043	6.381
Journal of Psychiatric Research	38	1.991	5.959
Acta Psychiatrica Scandinavica	34	1.781	7.466
Frontiers in Psychiatry	31	1.624	5.556
European Archives of Psychiatry and Clinical Neuroscience	29	1.519	4.871
Neuropsychiatric Disease and Treatment	28	1.467	3.482
Psychiatry and Clinical Neurosciences	27	1.414	7.918

The majority of the ECT studies were funded by the National Institutes of Health, the National Institute of Mental Health, and the United States Department of Health and Human Services (**Table 2**).

Table 2. Top funding agencies on ECT		
Funding Agencies	n	%
United States Department of Health Human Services	150	7.858
National Institutes of Health	142	7.438
National Institute of Mental Health	108	5.657
National Natural Science Foundation of China	55	2.881
German Research Foundation	29	1.519
Eli Lilly	22	1.152
Ministry of Education Culture Sports Science and Technology Japan	22	1.152
Johnson Johnson	21	1.100
Janssen Biotech Inc	20	1.048

In ECT articles, researchers used 2594 keywords. 204 of these keywords were used more than 5 times. A visualization of the keyword co-occurrence analysis with Vosviewer is given in **Figure 2**. Apart from ECT and its equivalent words[(electroconvulsive therapy, electroconvulsive therapy (ECT)], the most frequently used keywords were depression, major depressive disorder, major depression, schizophrenia, bipolar disorder, catatonia, and cognition (**Table 3**).

Table 3. Keyword analysis		
Keyword	Occurrences	Total link strength
Anesthesia	38	69
Attitudes	27	30
Bipolar disorder	59	93
Catatonia	69	96
Cognition	58	118
Depression	334	458
Depressive disorder	33	47
ECT	400	385
Elderly	29	53
Electroconvulsive therapy	1139	977
Electroconvulsive therapy (ECT)	86	66
Ketamine	34	82
Major depression	79	112
Major depressive disorder	122	164
Memory	42	86
Propofol	45	74
Psychosis	27	40
Relapse	30	52
Schizophrenia	111	152
Seizure duration	26	36
Seizure threshold	30	36
Survey	30	41
Treatment-resistant depression	31	47

The United States, Germany, and Netherlands' publications had the highest h indexes 52, 33 and 30 respectively (**Table 4**).

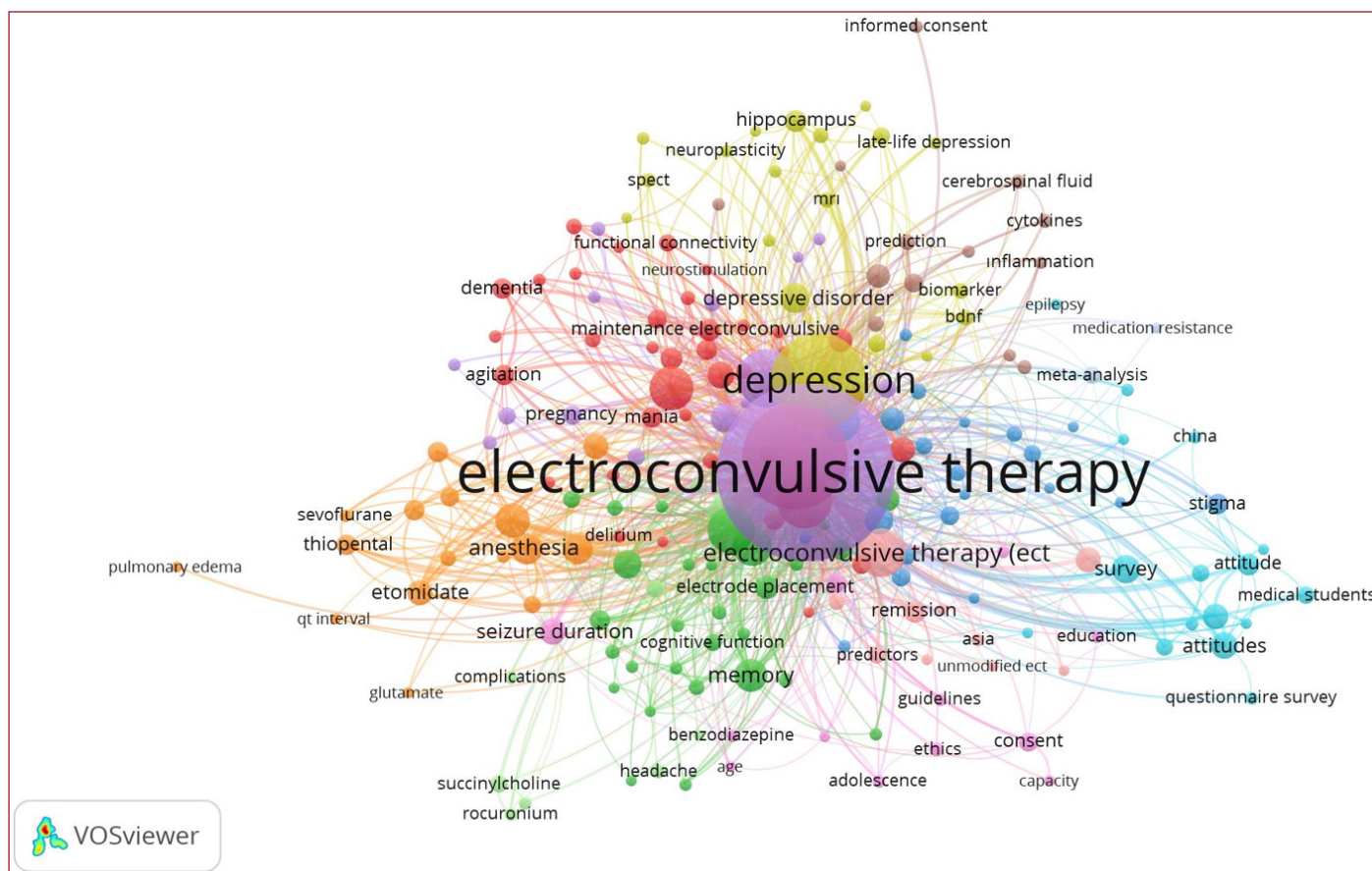


Figure 2. Keyword analysis

Table 4. Top published countries and number of citations

Country	Number of documents	Number of citations	Total link strength	H index
Australia	148	1849	112129	24
Belgium	80	1303	91894	18
Canada	81	1154	53660	18
Denmark	51	1687	51744	18
England	84	1637	58485	21
Germany	170	3729	131526	33
Japan	110	1580	66089	23
Netherlands	124	2681	131304	30
China	127	1525	76673	21
Spain	66	842	58315	16
Sweden	57	1580	54074	17
Turkey	88	771	34928	17
The United States	567	12632	279977	52*
India	83	1202	34182	18

According to the bibliographic coupling between countries analysis, the largest double indicates the country with the highest number of publications, the thickest lines indicate total link strength and the same colors indicate collaborations. This graph was made with the VosViewer tool. The United States (12632 citations), Germany (3729 citations), and the Netherlands (2681 citations) were the most cited countries. Also, Columbia University (2661 citations), Mayo Clinic (1441 citations), and Duke University (785 citations) were the

most cited institutions (Figure 4). Figure 5 shows the co-authorship analysis between organizations that published more than 10 articles.

The study published by Sackeim et al.^[22] in 2000 was the most cited article with 578 citations. The article published by Madsen et al.^[23] in 2000 was the 2nd most frequently cited article with 577 citations. This study was an experimental rat study.^[23]

2021 was the most cited year with 4025 citations. Figure 6 depicts the citation numbers between 2000-2023. This graph was downloaded from the WOS website.

The article 'Increased neurogenesis in a model of electroconvulsive therapy' published by Madsen et al.^[23] in 2000 was the most cited article on ECT with 579 citations.

DISCUSSION

This study aimed to examine the developments of ECT studies in the last 23 years, bibliometric parameters such as the most productive countries, institutions, and target journals for researchers. The findings may offer advice to patients, academics, physicians, funding organizations, and policymakers. The WOS database was used to retrieve the ETC publications, as this database offers top-notch publications on various scientific fields from around the world.^[19,20]

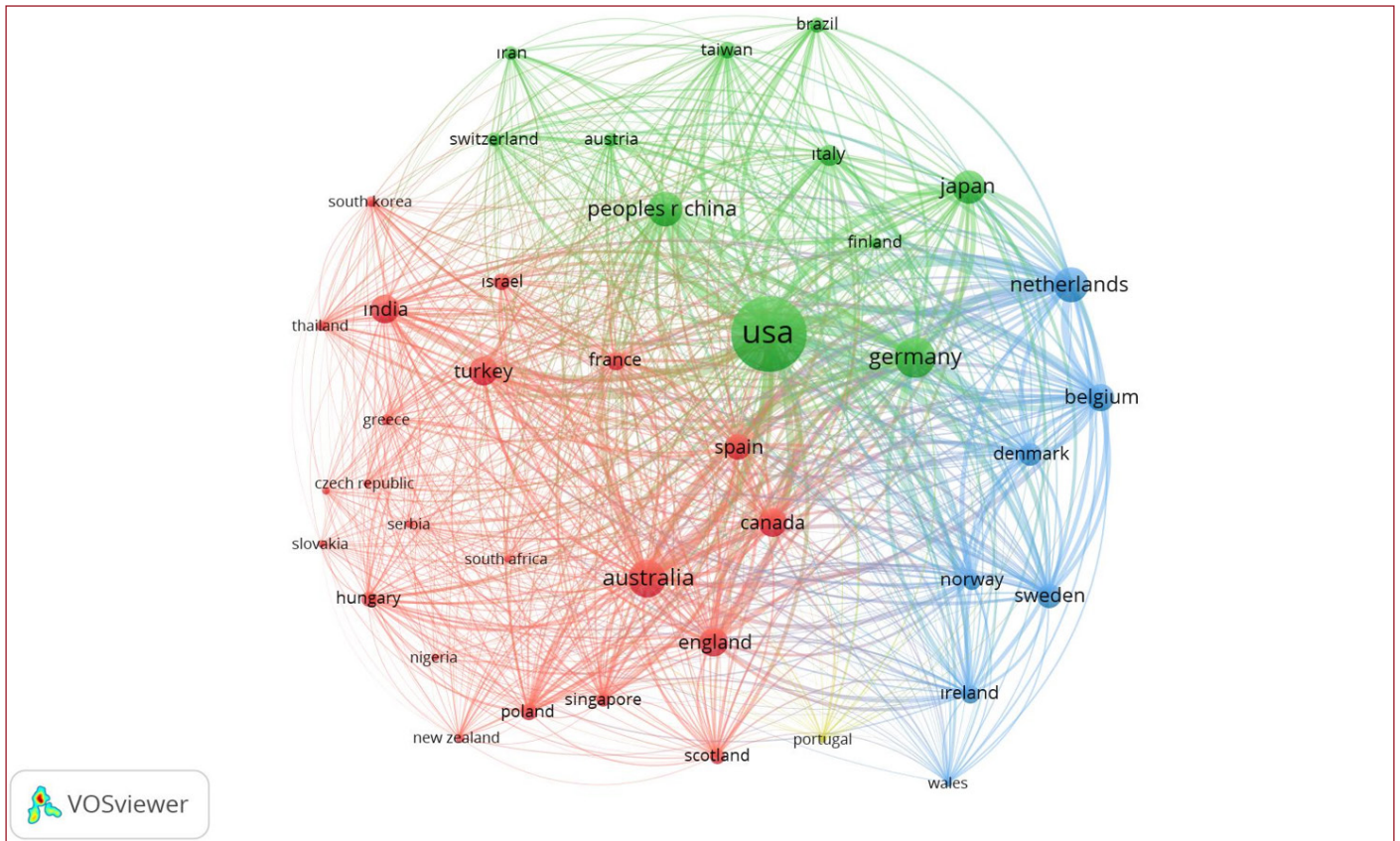


Figure 3. The bibliographic coupling between countries

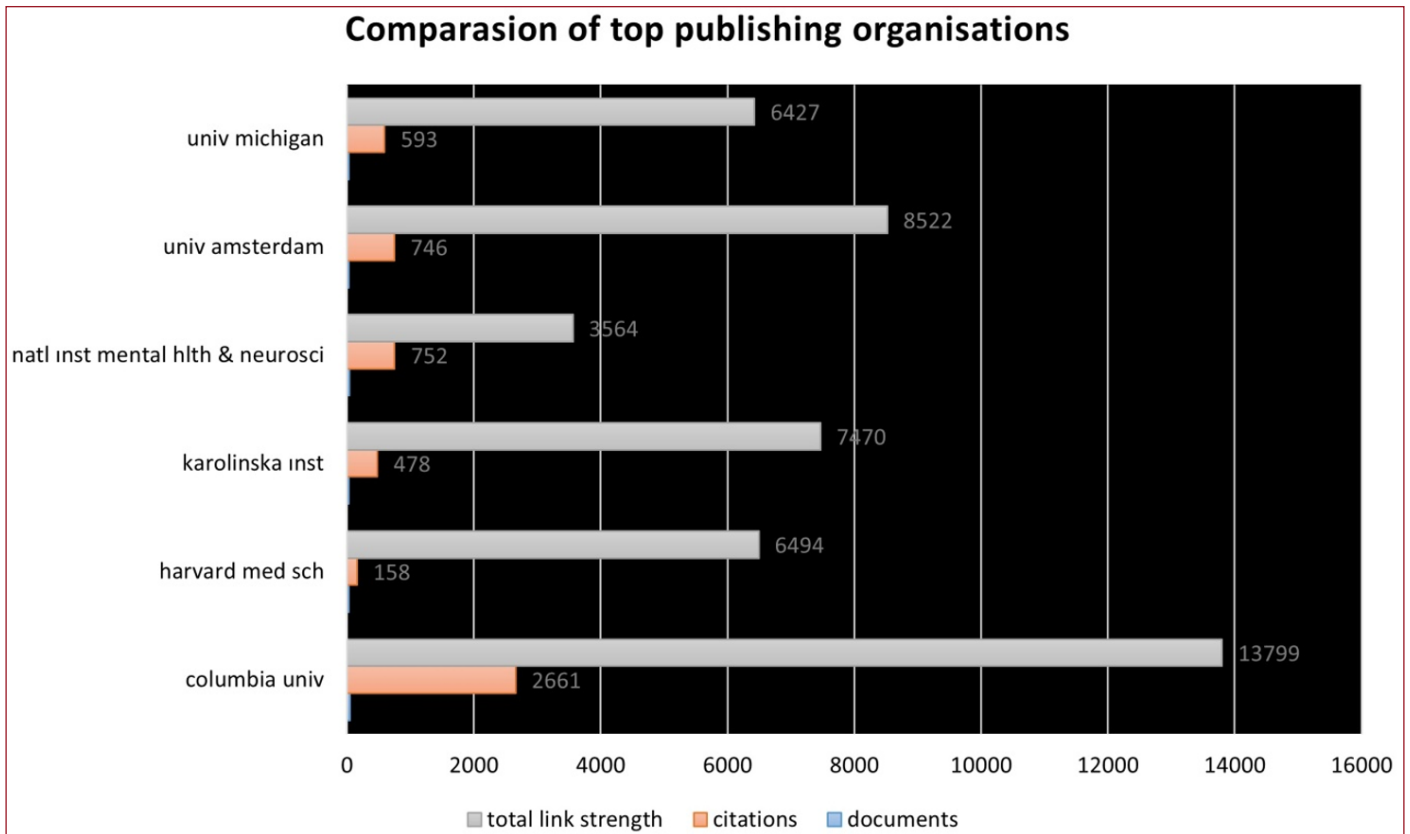


Figure 4. Comparasion of most publishing organisations

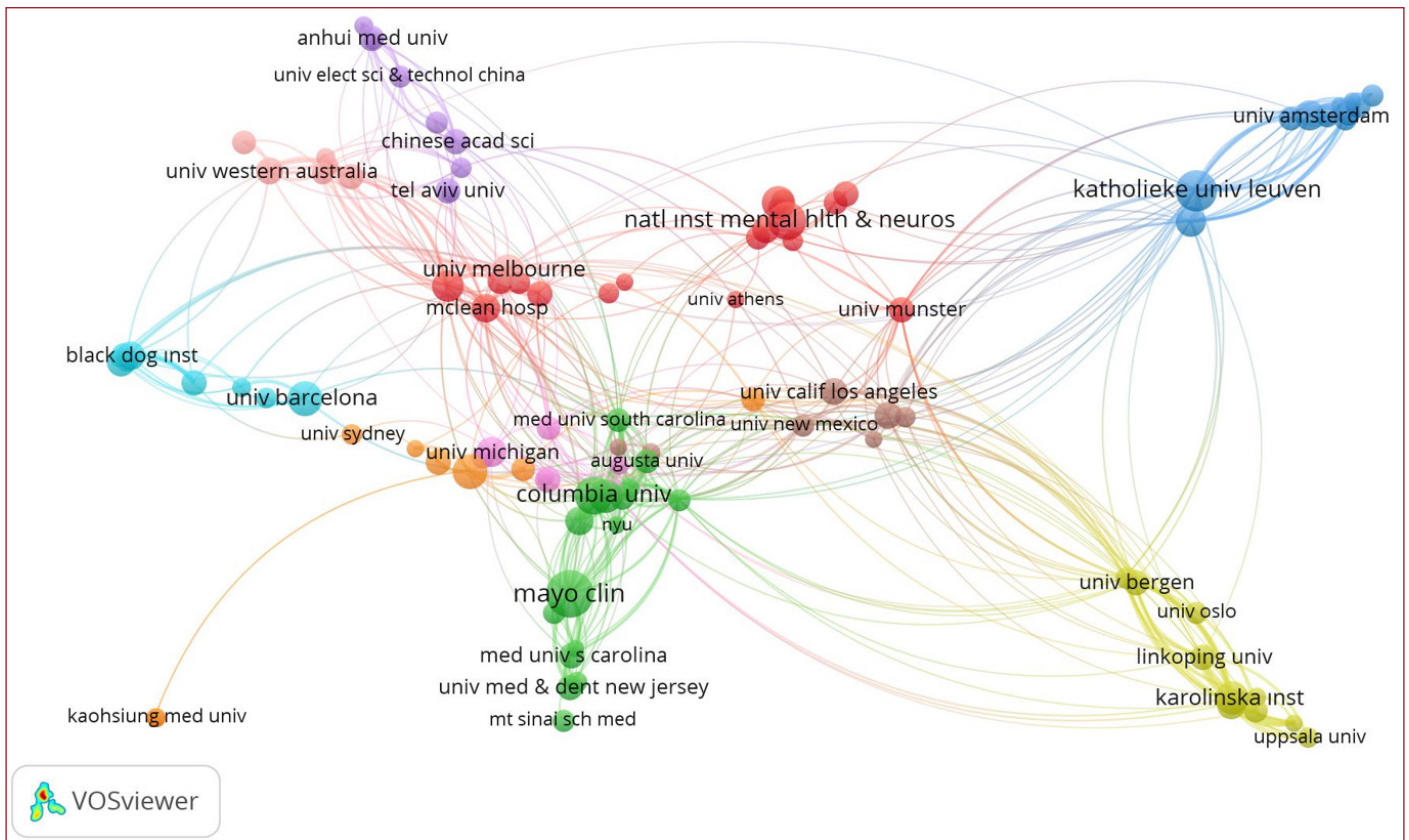


Figure 5. Co-authorship analysis between organisations

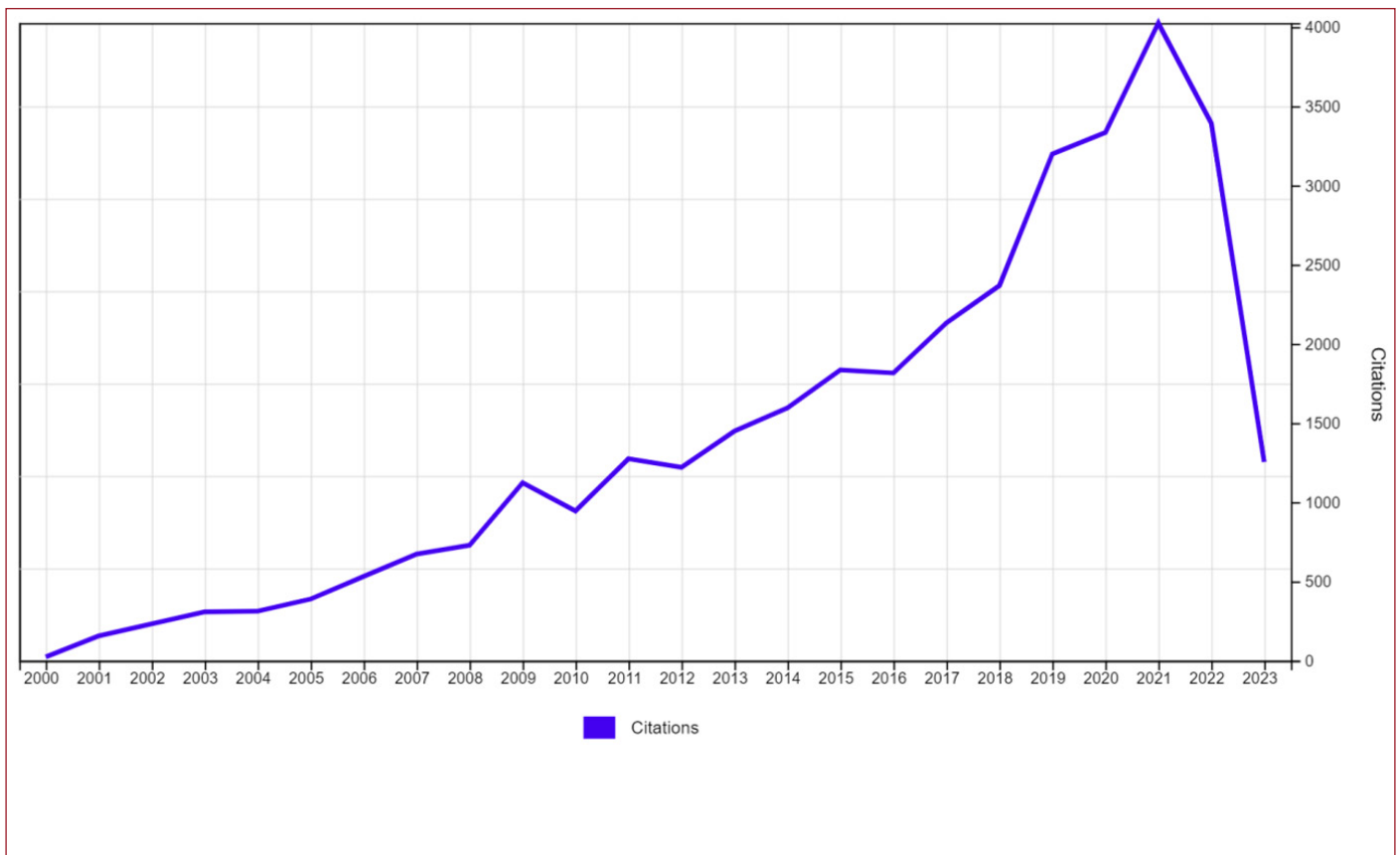


Figure 6. Citation numbers between 2000-2023

Several freeware visualization tools have also been created to assist researchers in creating knowledge network maps, tracing scientific advances, and identifying developing hotspots in a research field. These tools include VOSViewer, CiteSpace, Pajek, and BibExcel. Co-authorship, co-citation, and co-occurrence analysis are the three approaches that are most frequently utilized.^[24-30] Scientific mapping offers a dataset visualization to show the connections between various countries and documents.^[28] In this study, the VosViewer tool was used for creating network maps and identifying developing keywords.

By utilizing bibliometrics, this study aims to highlight the 23-year history of ECT use in psychiatry. According to this research, 1909 articles on ECT were written by 6528 researchers. The objective of this article is to provide psychiatrists with a complete and unbiased summary of the most recent research on ECT techniques and supporting evidence. Thus, it seems reasonable to assume that this field experienced its peak between 2018 and 2022. However, 43 articles were published in 2023, albeit the count may be confusing given it only includes the first five months of the year.

Based on how often two items are cited together, co-citation analysis shows the relationship between them. An article's citations might offer important information about what is currently known about a particular study area. Researchers can determine the intellectual foundation and research horizons within the area, significant authors, and other bibliometric data by looking at the co-citation relationship's strength.^[16]

The relationships between the cited items are captured by citation analysis. The quantity of items that they cited one another determines how closely related the two items are. It was frequently done to determine the significant countries or institutions.^[16]

Also, each node in the VOSViewer maps stands for a particular parameter, such as nations/regions, organizations, or keywords. The weight of the characteristic, such as the number of publications, number of citations, or frequency of occurrence, determines the size of the nodes. The size of the nodes increases with weight. The cluster to which the nodes and lines belong determines their color. Links are depicted by the line connecting the nodes. The indicator of TLS, which may be scaled up to reflect the total co-authorship and co-citation link strength across nations, institutions, or authors, was used to evaluate the strength of the relationships.^[16]

The quantity and similarity of the authors' citations of the same research papers in the analysis of the bibliographic coupling reveal the relationship between the two pieces of work. The degree of relatedness between unrelated authors is influenced by how often they cite a particular article; the more citations, the more related the authors are.^[31]

In a similar study, Cai et al.^[11] examined the relationship between ECT and depressive disorder from 2012 to 2021 with the bibliometric method. 2,184 publications were included

in Cai et al.^[11] study. According to this study, there have been more publications on ECT and depressive disorder since 2012. The United States has made a sizable contribution to the field, and the majority of the top 10 institutions in terms of publications were also American institutions. The United States, Germany, China, Australia, and Canada were the top five nations or regions in terms of publications. The University of Toronto, Duke University, and the University of California are the three institutions with the most publications in the field over the past ten years, each with 104. The current study's findings were similar to Cai et al.^[11] study according to most productive institutions, but the Mayo Clinic (the United States) (n=78), KU Leuven (Belgium) (n=66), Harvard University (the United States) (n=58) were the three institutions with the most publications in the field of ECT. This difference may be due to the fact that the study of Cai et al.^[11] was on ECT and depression.

In this study also the h indexes of the top publishing countries were analyzed. The United States, Germany, and Netherlands' publications had the highest h indexes 52, 33, and 30 respectively. The number of works where they appear together, weighted by frequency of occurrence, is referred to as a keyword co-occurrence analysis. Researchers may be able to find research hotspots and trends in a field and even get ideas for new research projects if they can identify two terms that commonly appear together in a publication.^[16] 'Electroconvulsive therapy, treatment-resistant depression, bipolar disorder, the hippocampus, efficacy, and electrode placement' were all identified as current research hotspots by co-occurrence analysis in Cai et al.^[11] study. Although the current study's topic is similar to Cai et al.^[11] study, the current study is related to the general use of ECT in psychiatry. In the current study, the most frequently used keywords were depression, major depressive disorder, major depression, schizophrenia, bipolar disorder, catatonia, and cognition. This difference highlights the different uses of ECT in psychiatry.

In terms of publications, the Journal of ECT is both the most widely read and cited journal in the area in both Cai et al.^[11] study and the current study. In this study, the number of articles and the JCR of 2021 levels were used to rank the journals. This is a finding that shows the importance of ECT in the field of psychiatry. In addition, when the two most cited articles were reviewed, it was found that the first one was a double-blind clinical study and the second one was an experimental study. Both of these most cited articles were published in 2000. The high number of citations may be related to the fact that the year of publication was 23 years, or it is also possible that these were articles that made a splash at the time of publication.

The Journal of ECT covers all facets of modern ECT and reports on significant clinical and scientific advancements around the globe. It publishes on the effects of induced seizures on behavior and organ systems, review significant research findings on the mode of induction, occurrence, and propagation of seizures, and examine the challenging

sociological, ethical, and legal issues surrounding the use of ECT. Since the subject of the present study was ECT, it was considered an expected result that the highest number of publications were published in this specific journal.

The article 'Increased neurogenesis in a model of electroconvulsive therapy' published by Madsen.^[32] in 2000 was the most cited article on ECT with 579 citations. This article published in Biological Psychiatry journal. This journal is Q1 category quartile.

The article 'A prospective, randomized, double-blind comparison of bilateral and right unilateral electroconvulsive therapy at different stimulus intensities' published by Sackeim et al.^[33] in 2000 was the second most cited article on ECT with 578 citations. This article was published in Archives of General Psychiatry journal. This journal is Q1 category quartile, too. But in this study the content analysis and most cited articles analyses were not performed.

Limitations

This study used a single database and a single bibliometric tool. Content analysis was not performed. The time span was the last 23 years. In addition, only the literature related to the field of psychiatry searched in SSSI and SCIE indexes was analyzed. For all these reasons, it does not reflect the entire literature on ECT. For this reason, further studies can be planned in which content analyses will also be conducted using different bibliometric methods and different data sets.

CONCLUSION

The bibliometric analysis in this study gave information on new patterns in publications on ECT from 2000 to 2023. The findings might serve as a useful starting point for additional field studies. The United States has been the largest contributor to ECT research. Germany, Australia, China, China, the Netherlands, and Japan have also contributed to ECT research. However, the number of publications on ECT from developing countries was very limited.

ETHICAL DECLARATIONS

Ethics Committee Approval: No subjects, either human or animal, were used in the present study. Since this study was a primarily bibliometric study, ethical approval was not required.

Informed Consent: Informed consent was not required.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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