A Bibliometric Analysis of WOS-based Studies on Hemiparesis Caused by Cerebral Apoplexy

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Abstract

The leading cause of cerebrovascular disease, cerebral apoplexy, is by far one of the three conditions that pose the greatest risk to human health. With the trend toward an elderly society, cerebral apoplexy research has advanced incredibly quickly in recent years. Bibliometric analysis is used in the current investigation to assess trends in this sector. Articles were searched for in the Web of Science (subsequently referred to as WOS) database up until January 20, 2023. Bibliographic details, including country, institution, journal, author, citation, and keywords, of the chosen publications were automatically converted and analyzed using the Bibliometric software program. For this analysis, 3 617 articles were chosen from 1971 to 2023 in total. Thirteen articles received more than 100 citations overall, according to the citation analysis. Based on a Bibliometric examination of the literature used in this study, it could be seen that China (256 articles), Japan (366 articles), and the United States (1127 articles) provided the most publications. The most publications came from Northern University (164 records, 4.53% of articles). Levin, MF was the most productive author, with 40 papers (1.11% of the articles). These articles were published in 667 journals, most of which (145, or 4.01% of the articles) were published in the Archives of Physical Medicine and Rehabilitation. The curve is particularly prominent for the keywords "hemiparesis," "rehabilitation," and "stroke." The effects of cerebral apoplexy-causing hemiparesis and the efficiency of interventions, particularly restorative therapies, are anticipated to be the main topics of future research.

1.Introduction

Hemiparesis is a term that refers to a specific form of neurological disease, primarily caused by cerebrovascular disease and its primary diseases, manifesting itself as a movement disorder of one of the upper or lower extremities together with paralysis of the tongue muscles and muscles below the eye fissure. Most cerebrovascular diseases are caused by cerebral apoplexy. After cardiovascular disease, cerebral apoplexy has overtaken tumors as the second most prevalent disease in China, still increasing at a rate of nearly 15% annually. The current incidence of cerebrovascular disease in China is 120 to 180 per 100,000, second in the world, with a mortality rate of 60 to 120 per 100,000. With such a high prevalence and despite the ongoing updating of modern medicine, the mortality rate has decreased significantly, but 50% to 80% of survivors have been reported to have motor dysfunction, such as hemiplegia, aphasia, dysphagia, thermoregulatory abnormalities, endocrine abnormalities, etc., with paralysis of one limb being a common post-stroke consequence [1]. Loss of limb function results in various degrees of disability, including the ability to care for yourself, which is painful for patients and their families, places a tremendous load on society, and has a significant financial and social impact on the nation.

Bibliometric analysis of scientific literature is a quantitative method of representing scientific literature visually using quantitative methods [2]. In recent years, it has been extensively used in analyzing published literature in different fields, such as studies of cerebral apoplexy resulting in hemiparesis. This study describes and summarizes the development of research in the literature connected to the WOS database using a

quantitative approach, which can be used as a reference and to help China improve the level of literature search and scientific research capacity. This bibliometric analysis reviewed trends in all research related to cerebral apoplexy-related hemiparesis over the last 50 years and specifically highlighted the value of rehabilitation therapy after stroke hemiplegia in its conclusions. However, this is not sufficient to fully reflect the research trends in the content related to cerebral apoplexy leading to hemiparesis, as the clinical application of related directions has been of great concern. Therefore, in this study, we focused primarily on using the " bibliometrix" (https://bibliometric.com/app) to analyze the current state of research in post-stroke hemiparesis, and the results of this study will guide future research in this area.

2.Materials and Methods

2.1. Data Sources and Search Strategies

Data were obtained from the WOS. Based on previous study protocols, keywords used for participant conditions were 'Hemiparesis (Abstract) OR Motor disorder (Abstract) OR Dyspraxia (Abstract) OR Dyskinesia (Abstract) OR Movement disorders (Abstract) OR dyskinesis (Abstract) OR motor disturbance (Abstract) OR movement disorder (Abstract) OR dyskinesia (Abstract) OR paralysis (Abstract) OR TD (Abstract) '. Keywords used for interventions were 'cerebral apoplexy'. By 2 February 2023, all queries had been completed for several types of article that contained search terms in their abstracts.

2.2. Data Collection and Bibliometric Analysis

As of February 2, 2023, 3639 records were recorded. Scientific literature can be found in the WOS Core Collection database, one of the most important databases. The quantitative analysis included 3 617 records after filtering for duplicates. Figure 1 illustrates the flow diagram of preferred reporting items for systematic reviews and meta-analysis (PRISMA) to select studies.

Figure 1. Flow diagram of the study selection procedure.

A "bibliometrix" function was applied to the bibliographic information of the selected publications to automatically convert and analyze it[3,4]. All information related to the country, institution, author, journal, citation, and keywords was analyzed.

3.Results

3.1. Data Descriptive Analysis

In short, 3617 documents were found to have 2.27 average citations. Ten different types of documents were included, such as books, book chapters, articles, editorials, conference papers, notes, reviews, letters, errata, and short surveys. In this search, 21,551 authors related to the topic were found, indicating that most publications are co-authored. There were an average of 5.958 coauthors per publication.

3.2. Global Trends in Publications

A total of 3617 articles related to hemiparesis caused by cerebral apoplexy were retrieved from WOS for the period 1971-2023. The global trend has increased steadily since 1991 from 3 articles (0.08%) in 1971 to 169 articles (4.67%) in 2022. The annual growth rate is 30.12%. (Figure 2).

Figure 2 Number of studies on hemiparesis caused by cerebral apoplexy

3.3. Analysis of Citations

This study analyzed the number of citations to articles published as the first and corresponding authors separately. Citation analysis revealed twelve first authors and nine corresponding authors with more than 100 citations. Figure 3a shows the top ten authors with the most citations. Figure 3b illustrates the top ten corresponding authors with the most citations.

Figure 3a Histogram of the top 10 articles cited.

Figure 3b Histogram of the top 10 articles cited.

3.4. Analysis of Countries

The top five countries with the most published articles, according to the country of the authors, are the United States, Japan, China, Canada and Germany. The United States contributed the most articles (1127,31.16%), followed by Japan (366,10.12%), China (268,7.08%), Canada (239,6.61%), and Germany(233,6.44%) (Figure 4). Additionally, the collaboration map in this field was analyzed for each country or region. China and the United States had the most collaborations.

Figure 4 The most productive countries and regions in the field of hemiparesis research caused by cerebral apoplexy.

3.5. An Analysis of Institutions

A total of 3787 institutions participated in the research, as shown in Figure 5. 164 publications were contributed by Northwestern University (4.53%), followed by the University of Florida (119,3.29%), University of Maryland (110,3.04%), University of Calgary (90,2.49%), and Washington University (86,2.38%).

Figure 5 Top ten institutions performing research on hemiparesis caused by cerebral apoplexy-causing hemiparesis.

3.6. An Analysis of the Authors

Figure 6 summarizes the top ten most productive authors. Levin, MF produced the most publications, with forty articles (1.11%), followed by Abo, M with thirty-eight articles (1.05%), Kirton, A (31,0.86%) Page, SJ (20.77%) and Michaelsen, SM (20.75%)

Figure 6 The top ten authors produced research work on cerebral apoplexy.

3.7. Analysis of Journals

Figure 7 shows the 10 most popular journals of the 361 articles analyzed. There were the most publications on Neurorehabilitation and Neural repair (149,4.12%), followed by the Archives of Physical Medicine and Rehabilitation(145, 4.01%), Stroke(131,3.62%), Journal of Stroke & Cerebrovascular Diseases (120,3.32%) and Topics in Stroke Rehabilitation (97,2.68%).

Figure 7 Top ten publications.

3.8. Analysis of Keywords

This study analyzed the trends in keywords and extended keywords from 1971 to 2023. The most keywords were stroke, rehabilitation, and hemiparesis. For extended keywords, rehabilitation, recovery, and hemiparesis dominated the trend. Figure 8a shows how keywords have changed from year to year. Figure 8b illustrates the changes in the extended keywords over time.

Figure 8a Trend of keywords.

Figure 8b Trend of extended keywords.

4.Discussion

Globally, population aging has emerged as a significant social issue [5]. The number of people over 70 has increased globally between 1990 and 2019. In particular, there has been a growth of 115.4% in the population between the ages of 70 and 79, a 164.7% between the ages of 80 and 94, and a 363.7% between the ages of 95 and above. In 2019, there were 168.3 million more people aged 70 to 79 yearsyears old were present than there were in 1990. In addition, the number of people over 95 increased by 3.7 million, and those between 80 and 94 increased by 90.1 million [6]. In 2050, 1 in 6 people worldwide is predicted to be over 65 (16%), up from 1 in 11 (9%), according to the World Population Prospects 2019. Within the next 50 years, the proportion of seniors in Northern Africa, Western Asia, Central Asia, Southern Asia, Eastern and Southeast Asia, Latin America and the Caribbean is expected to triple. However, by 2050, one in four people in Europe and North America may be over 65. For the first time in 2018, adults over 65 outnumbered young people

under five on a global scale. By 2050, there will be 426 million older people, up from 143 million in 2019. The growing geriatric populations contribute to cerebral apoplexy-induced hemiparesis. Hemiparesis is a serious neurological condition that can lead to a degree of loss of motor, sensory and speech abilities and can even affect the patient's intelligence. And it is one of the most common symptoms caused by cerebral apoplexy. The graph also shows that since 2007, the literature on this disease has increased.

This study evaluated trends in publication related to cerebral apoplexy in hemiparesis research and examined countries, journals, and authors contributing to the field. The summit in 2020 was 211 articles, up from one in 1971 and 169 in 2022. The global trend has steadily increased since 1991 and has grown by leaps and bounds since 2007. The five countries with the most publications, according to the country of the authors, are the United States, Japan, China, Canada, and Germany. Except for China, all of the main participants in this study were developed nations with aging populations, particularly Japan. Government estimates for 2015 show that 14% and 26.7%, respectively, of the populations of Japan and the United States were over 65 [7]. The World Population Prospects 2019 estimates that by 2035, there will be 410 million people in China over the age of 60 or 28.4% of the country's total population. The World Population Prospects 2019 estimates that by 2035, there will be 410 million people in China over the age of 60 or 28.4% of the country's total population. This statistic shows that China is on the verge of becoming a serious aging society, and in response, the government has implemented some initiatives to support the elderly and pensioners [8]. The results of this study also showed that a large number of publications came from Neurorehabilitation and Neural Repair. A variety of studies and reports indicate potential directions for collaborative research and publication in the future.

Hemiparesis is the main sensory-motor impairment after cerebral apoplexy [9]. Hemiparesis can cause a person to be unable to move one limb, or even any limb at all, affecting the person's ability to act autonomously and even care for themselves. This syndrome creates suffering and a great burden for the patient and his family, as well as considerable economic and social problems for the country. Therefore, an essential component of the treatments of cerebral apoplexy recovery is the rehabilitation of hemiplegic limb function in stroke patients. Ramesh, V et al. use Microsoft Kinect to capture joint position data for calculations to accurately identify hemiparesis, gaining valuable time from the onset of stroke to the diagnostic portion [10]. Bindawas, SM, found that recovery from hemiplegia after cerebral apoplexy is related to damaged functional areas of the brain [11]. Motiei-Langroudi, R et al. applied unilateral-multilateral analysis and found that the volume and age of chronic subdural hematomas were significantly associated with hemiparesis [12]. The study by Wang, YF et al. aimed to investigate the core Scalp acupuncture combinations for the treatment of hemiparesis after cerebral apoplexy using a systematic review and Apriori algorithm-based association rule analysis [13]. The systematic review by Pathak, A et al. found the effectiveness of neurodevelopmental treatment based on randomized controlled trials in the rehabilitation of stroke patients with motor disabilities [14]. Retrospective chart analysis by Kim, CH et al. found a difference in recovery rates between the left and right hemiplegic groups. Based on this conclusion, it is recommended that different gait rehabilitation strategies can be used depending on the side of the paralysis [15].

In general, hemiparesis has been a major concern among the various symptoms caused by cerebral apoplexy. It affects not only the physical function of the patient, but also their daily life, their financial situation, and their social activities. The incidence and severity of hemiparesis vary, as some patients may experience some mild symptoms, while others may experience more severe symptoms, which may even lead to a vegetative state. As a result, hemiparesis has been the subject of much attention and concern from experts and society in general among the various symptoms caused by stroke.

5.Conclusions

Our analysis reveals a rapid increase in research related to hemiparesis and stroke worldwide, with the United States leading the way. In addition, one of the top researchers in this area is John Levin, MF of McGill University. By becoming knowledgeable about the leading institutions, journals, authors, and citations, researchers can plan their upcoming studies. In light of new trends, they will also be free to decide the course of their research. However, researchers must be aware of the limitations of bibliometric analysis when

using databases. Not all journals in all fields are covered by WOS. Additionally, there is a lack of periodicals published in languages other than English.

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Conflicts of Interest: There is no conflict of interest to declare.

References

[1]Mao-bin Wang. Modern assessment and treatment of hemiplegia. Beijing: Huaxia Publishing House,1990:159p.

[2]Ellegaard, O., Wallin, J.A. The bibliometric analysis of scholarly production: How great is the impact Scientometrics 2015,105,1809–1831.

[3]Guo, J., Gu, D., Zhao, T., Zhao, Z., Xiong, Y., Sun, M., Xin, C., Zhang, Y., Pei, L., Sun, J. Trends in Piezo Channel Research Over the Past Decade: A Bibliometric Analysis. Front. Pharmacol. 2021, 12,668714.

[4]Aria, M., Cuccurullo, C. bibliometrix: An R-tool for comprehensive science mapping analysis. J. Informetr. 2017, 11, 959–975.

[5]Ciocca, M., Zaffina, S., Fernandez Salinas, A., Bocci, C., Palomba, P., Conti, M.G., Terreri, S., Frisullo, G., Giorda, E., Scarsella, M., et al. Evolution of Human Memory B Cells From Childhood to Old Age. Front Immunol. 2021,12, 690534.

[6]GBD 2019 Ageing Collaborators. Global, regional, and national burden of diseases and injuries for adults 70 years and older: Systematic analysis for the Global Burden of Disease 2019 Study. BMJ 2022, 376, e068208.

[7]Tang, J., Liu, W. China's Aging Process and Some Misunderstandings on It. J. Beijing Univ. Technol. (Soc. Sci. Ed.) 2018,18,8-18.

[8]de Azevedo, JA, Barbosa, FDS, Seixas, VM , Scipioni, KRDD, Sampaio, PYS, da Cruz, DMC, Piscitelli, D, Chui, KK, Zanona, AD. Effects of constraint-induced movement therapy on activity and participation after a stroke: Systematic review and meta-analysis. Frontiers in Human Neuroscience.2023,987061.

[9]Ramesh, V, Agrawal, K, Meyer, B, Cauwenberghs, G, Weibel, N.Stroke-Associated Hemiparesis Detection Using Body Joints and Support Vector Machines.International Conference on Pervasive Computing Technologies for Healthcare.2018,55-58.

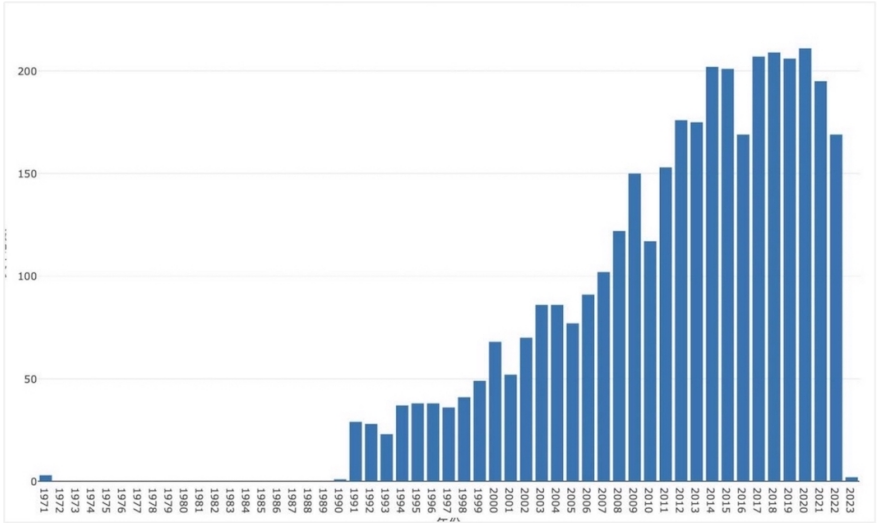
[10]Bindawas, SM, Mawajdeh, HM, Vennu, VS , Alhaidary, HM. Functional recovery differences after stroke rehabilitation in patients with uni- or bilateral hemiparesis.Neurosciences. 2017,22,186-191.

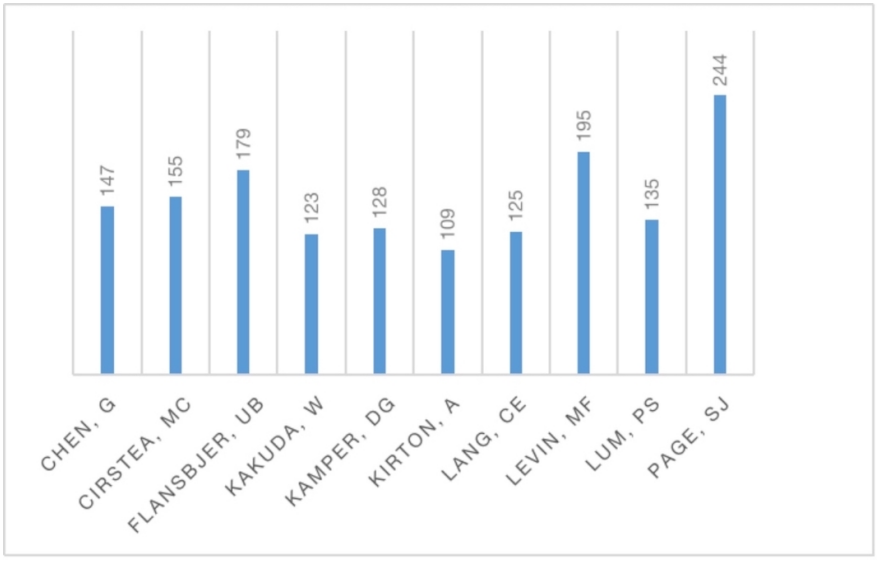
[11]Motiei-Langroudi, R, Alterman, RL, Stippler, M, Phan, K, Alturki, AY, Papavassiliou, E, Kasper, EM, Arle, J, Ogilvy, CS, Thomas, AJ. Factors influencing the presence of hemiparesis in chronic subdural hematoma. Journal of Neurosurgery.2019, 131,1926-1930.

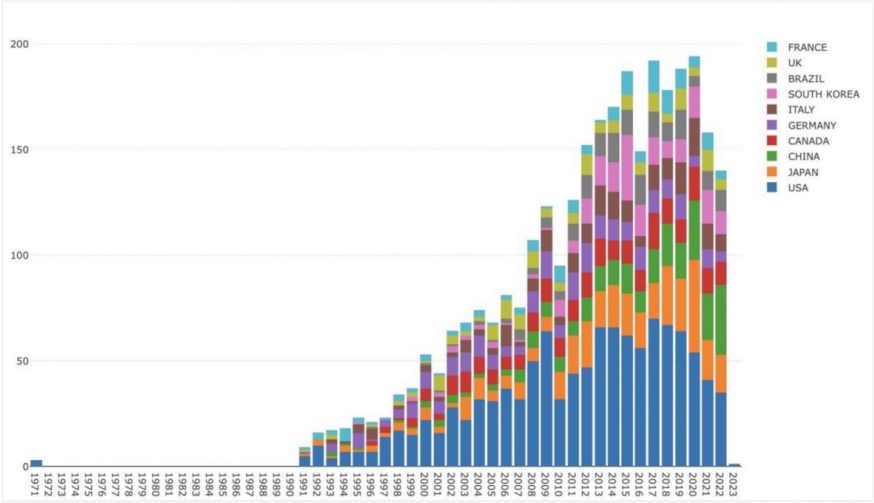
[12]Wang, YF, Chen, WY, Lee, CT, Shen, YY, Lan, CC, Liu, GT, Kuo, CY, Chen, ML, Hsieh, PC.Combinations of scalp acupuncture location for the treatment of post-stroke hemiparesis: A systematic review and Apriori algorithm-based association rule analysis. Frontiers in Neuroscience.2022,956854.

[13]Pathak, A, Gyanpuri, V, Dev, P, Dhiman, NR.The Bobath Concept (NDT) as rehabilitation in stroke patients: A systematic review.Journal of Family Medicine and Primary Care.2022, 10,3983-3990.

[14]Kim, CH, Chu, H, Kang, GH, Sung, KK, Kang, DG, Lee, HS, Lee, S.Difference in gait recovery rate of hemiparetic stroke patients according to paralyzed side A cross-sectional study based on a retrospective chart review.Medicine.2019, e18023.



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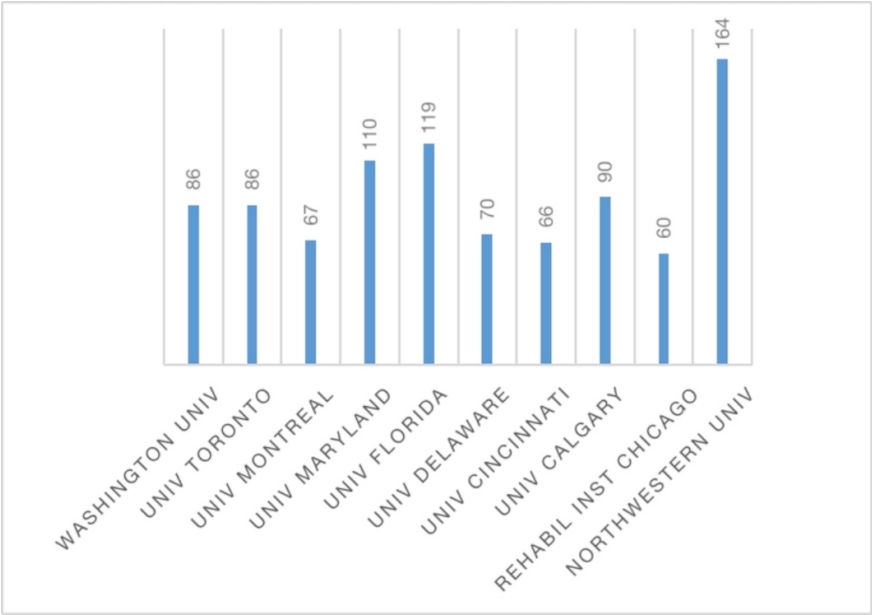
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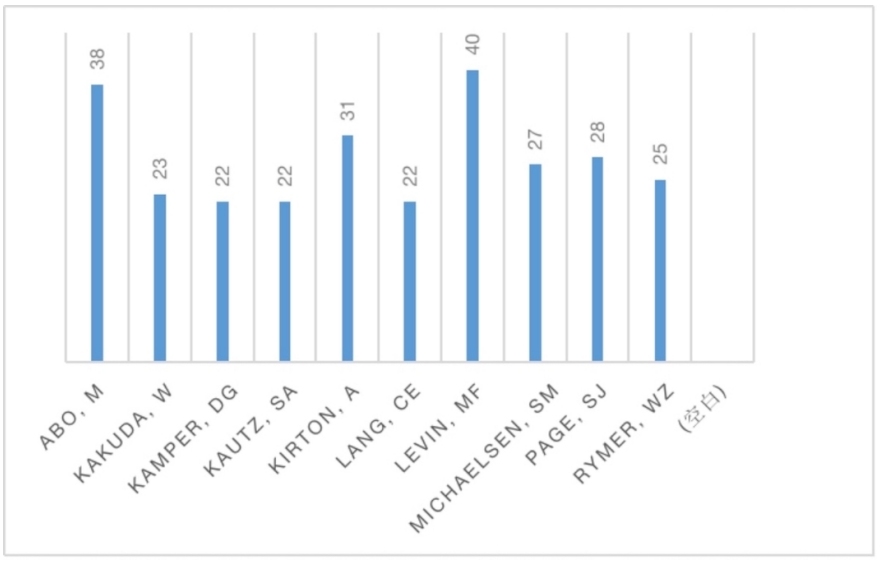
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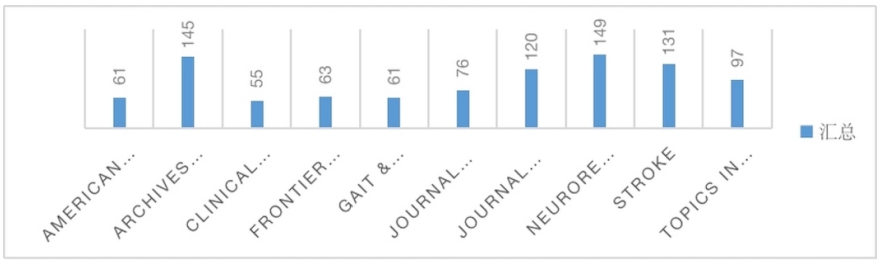
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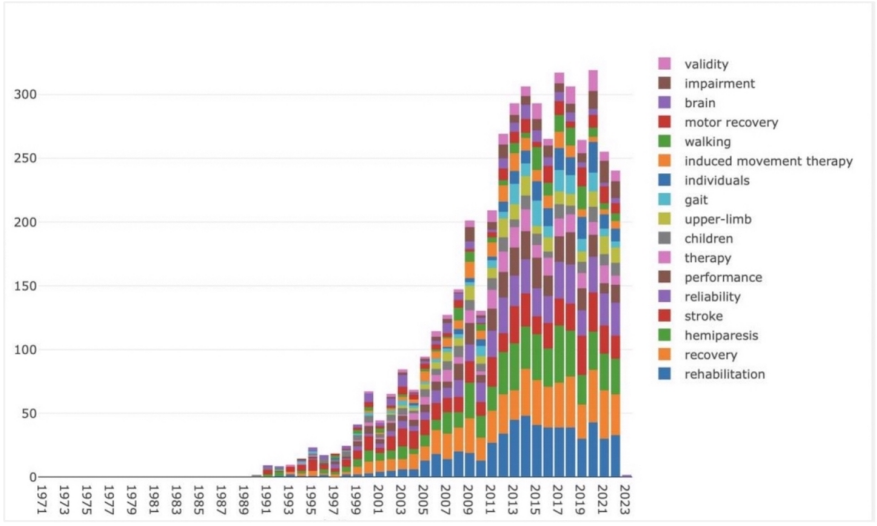
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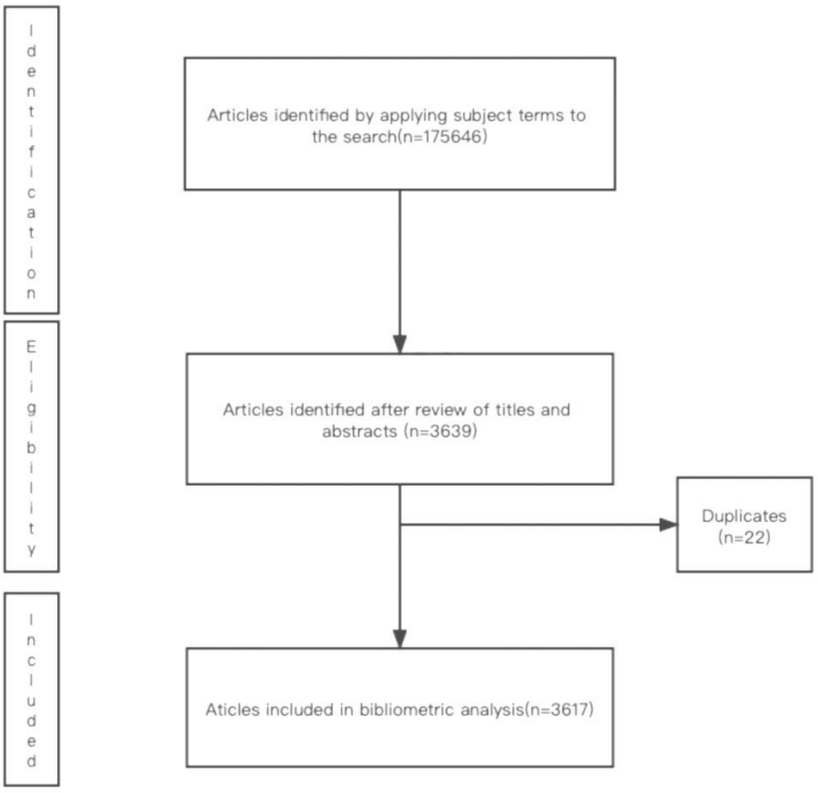
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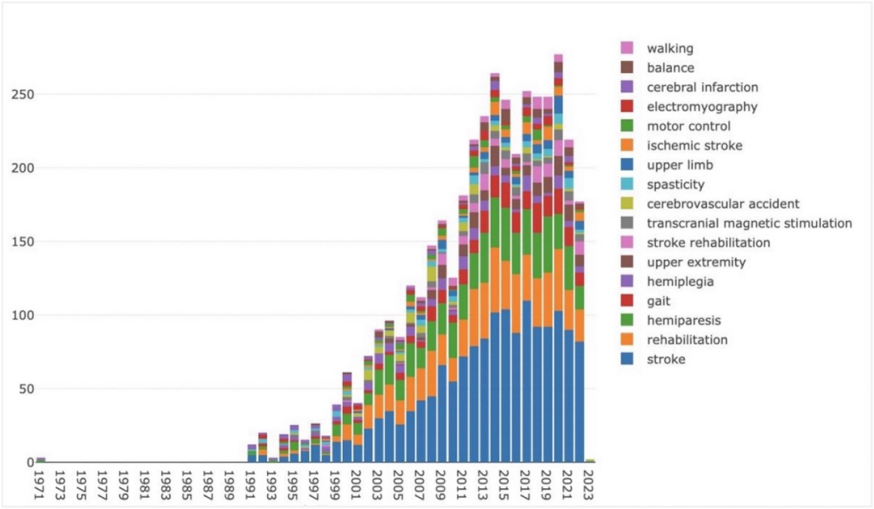
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