



Research Trends on Acupuncture for Shoulder Pain Treatment Over the Past 15 Years: A Bibliometric Analysis

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Objective: Currently, acupuncture for shoulder pain has been widely used in clinical and scientific research worldwide, but the bibliometric literature on acupuncture for shoulder pain is still scarce. This study reviews the application of acupuncture in the treatment of shoulder pain over the past 15 years, to analyze the current state of research, research hotspots, and trends. The article can also provide a reference for future research.

Methods: This paper searches the core collection of the Web of Science database for publications related to acupuncture therapy for shoulder pain between 2008 and 2022. And the data were visualized and analyzed using VOSviewer and CiteSpace for annual publications, countries, institutions, journals and co-cited journals, authors and co-cited authors, keywords, and emergent keywords.

Results: A total of 135 papers were included, with an overall increasing trend in the number of annual publications. The country with the highest centrality in publishing articles is the United States (0.28). In terms of research institutions, Kyung Hee University has the highest number of publications (18). In terms of authors, Lewith George, Lind Klaus, MacPherson Hugh, Sherman Karen J, and Vickers Andrew J are the five most published authors. Vickers, Andrew J. is the most co-cited author (50 times). In terms of journals, PAIN has the highest number of publications (82) and co-cited frequency (232), while the highest impact factor was BMJ-BRIT MED J (96.216). "Acupuncture" was the most frequently mentioned keyword (65 times), with the keyword "protocol" appearing the most recently. Emerging keywords that are still in vogue are "stroke", "systematic review" and "stimulation".

Conclusion: This study provides statistics on current research on the treatment of shoulder pain with acupuncture, which may be able to inform future research directions for all researchers and physicians, as well as facilitate closer communication and collaboration.

Keywords: shoulder pain, acupuncture, bibliometric analysis, VOSviewer, CiteSpace

Introduction

Shoulder pain is pain and impaired movement in the shoulder area, often due to muscle strain, external impingement and wear and tear of the joint capsule.¹ The prevalence of shoulder pain in the general population increases with age, ranging from 7% to 30% and the prevalence is higher in women than in men.² A literature investigating the severity and impact on quality of life of various types of pain indicated that shoulder pain has a prevalence of 42% and is the third most common musculoskeletal disorder. Shoulder pain is a condition that causes a lot of physical and mental damage to the patient and has seriously affected people's quality of life.^{3,4}

Commonly used treatments for shoulder pain include oral anti-inflammatory drugs, physiotherapy, exercise therapy, drug injections and surgical treatment. However, a growing body of literature indicates that surgical interventions do not yield better results than exercise therapy or physiotherapy.⁵ Similarly, long-term use of hormonal drugs can cause side

effects for patients.⁶ Modern research has shown that acupuncture has significant advantages for pain relief. Acupuncture not only provides an analgesic effect in the short term, but also addresses some of the causes of pain in the long term.^{7,8} It relieves pain, regulates blood circulation, boosts immunity and improves joint range of motion.^{9,10} Acupuncture also has the advantages of low risk, few side effects, ease of handling, and low cost, making the use of acupuncture as a complementary and alternative therapy for shoulder pain widely used in clinical practice.¹¹⁻¹⁴ However, despite the popularity of acupuncture in the clinical and research fields, no articles have yet analyzed this content using a bibliometric approach.

Bibliometrics is the cross-cutting science of quantitative analysis of a large body of literature in a specific field through mathematical and statistical methods. It is a statistical analysis and quantitative tool for research publications. By counting the co-occurrence of authors, organizations, countries, keywords, and citations in the literature, we can understand the various network relationships.¹⁵ Bibliometrics provides a visual representation of the current state of research, allowing us to understand the most influential authors, institutions, countries, and journals in the field, so that we can guide the direction of our research and facilitate the formation of efficient collaborations.¹⁶ In recent years, scholars have made extensive use of bibliometrics in their research in the field of medicine. For example, researchers have used bibliometrics to analyze publications on COVID-19,¹⁷ trends in osteoporosis in rheumatoid arthritis,¹⁸ and nonspecific lower back pain.¹⁹ Therefore, the bibliometric analysis allows us to understand the current state of research on acupuncture for shoulder pain and then analyze it further.

In this study, we aim to use bibliometric methods to analyze a large number of studies on acupuncture for shoulder pain from a macroscopic perspective, as well as to discuss research trends and future research directions in acupuncture for shoulder pain.

Materials and Methods

Data Sources, Search Strategies

A systematic literature search was conducted on the Core Collection of Web of Science database to identify relevant papers for this bibliometric study. Generate initial search results using the following search string: “(acupuncture OR electroacupuncture) AND (shoulder pain)”. This produced 285 papers, which further analyzed using the following inclusion criteria: (a) published between 1 January 2008 and 31 December 2022, and (b) categorized as ‘papers’ or ‘reviews’. The papers were selected manually based on title and abstract. The final result was 135 articles.

Data Analysis

The paper analyses the number of annual publications, countries, institutions, authors and co-cited authors, journals and co-cited journals, impact factor (IFs) of the journals, keywords, and emergent keywords. To note, IFs of the distributing journals were based on the 2021 version of Journal Citation Reports (JCR), which is the current latest version. VOSviewer (version 1.6.18) and CiteSpace (version 6.1. R6) are the two main software programs used in the analysis.

VOSviewer can construct co-authorship, co-occurrence, citation, bibliographic coupling, or co-citation networks of scientific publications.²⁰ In this paper, the software was mainly used to analysis countries, institutions, authors and co-cited authors, journals and co-cited journals, and keywords. This resulted in a map of distribution by cluster as well as a map by average publication time. In maps distributed by clusters, linked terms are automatically grouped and clustered using different colors. The different nodes represent different items, and the size of the circles represents the number of items, reflecting the weight of the item. The higher the similarity of two nodes, the more likely they are to appear in the same article. The thickness of the connecting lines between the items represents the size of their relevance. The strength of the link between two nodes indicates the frequency of co-occurrence. It can be used as a quantitative indicator to describe the relationship of nodes.¹⁶ In the case of the map by time, the colors are different, mainly according to the time of year, with yellow representing the most recent publication and purple indicating a longer period of time since publication. In order to visualize the presentation of the network, we put a limit on the number of items.²¹

CiteSpace is another computational tool, developed by Professor Chaomei Chen, for visual exploration and knowledge discovery in bibliographic databases.²² Centrality analysis and burst detection functions have received much

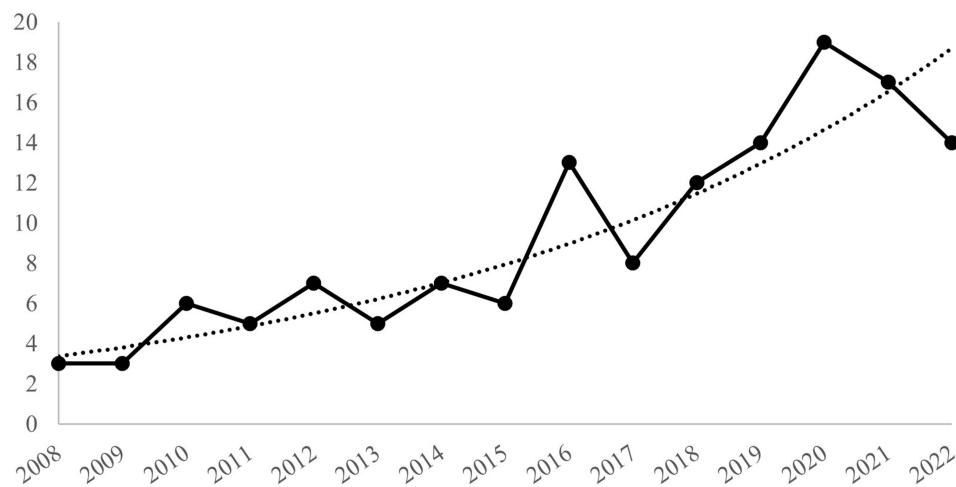


Figure 1 Distribution of publications by year.

attention from scholars in recent years.²¹ High centrality represents the high impact and relevance of the project in question, while the burst detection function yields research hotspots and trends in the field. Therefore, this paper is mainly used to analyze the number of annual publications, the centrality of countries and keywords, and burst keywords.

Results

Distribution by Year

Through culling, we ended up with 135 articles for analysis and discussion. [Figure 1](#) indicates the specific number of publications per year. We found that the number of publications on acupuncture for shoulder pain has fluctuated over the past 15 years, but still shows an overall upward trend. Starting in 2008 and remaining relatively stable overall until 2015, publications increased in 2016. The period from 2017 to 2020 is a period of sustained growth in this type of article, with a further decrease after 2020.

Distribution by Country

To better present the visualization, 11 countries or regions were selected for this study using VOSviewer. The five countries with the most published literature are China, USA, South Korea, England, and Germany ([Table 1](#)). The yellow in [Figure 2](#) indicates that the organizations had published papers in recent years, and the blue indicates otherwise. Among them USA has a higher centrality (0.28).

Distribution by Organization

Analysis of the research institutions for these articles using Vos yielded 14 clusters ([Figure 3](#)), with the clusters being mainly by region, with little linkage between clusters. The main regions are universities in Korea and Japan, centered on

Table 1 Distribution of the Publications by Country

Ranking	Country/Region	Counts	% of 135	Centrality
1	USA	28	20.74	0.28
2	England	16	11.85	0.19
3	Peoples R China	45	33.33	0.15
4	Germany	13	9.63	0.01
5	Australia	7	5.19	0.01

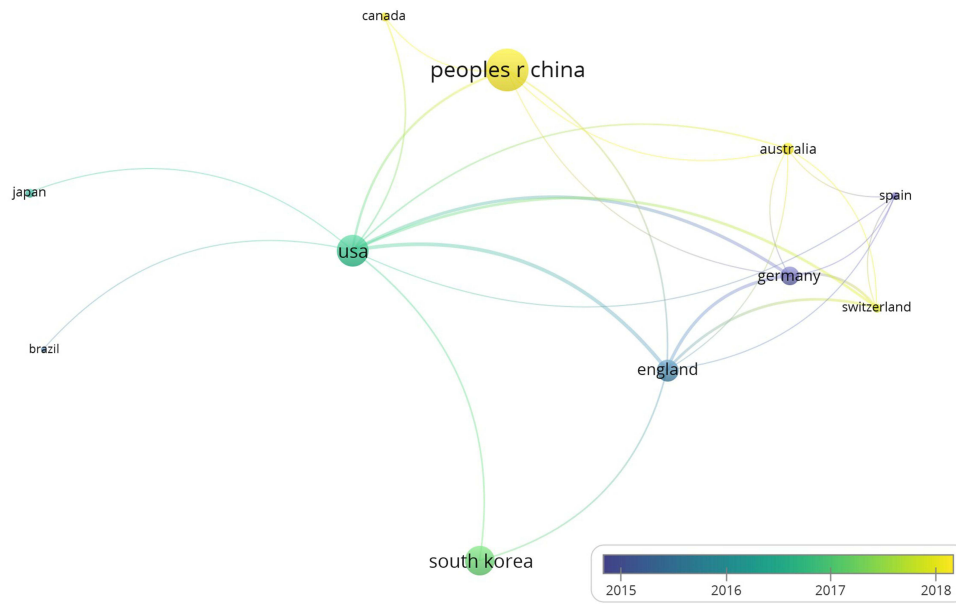


Figure 2 Network map of the country according to the average publication year.

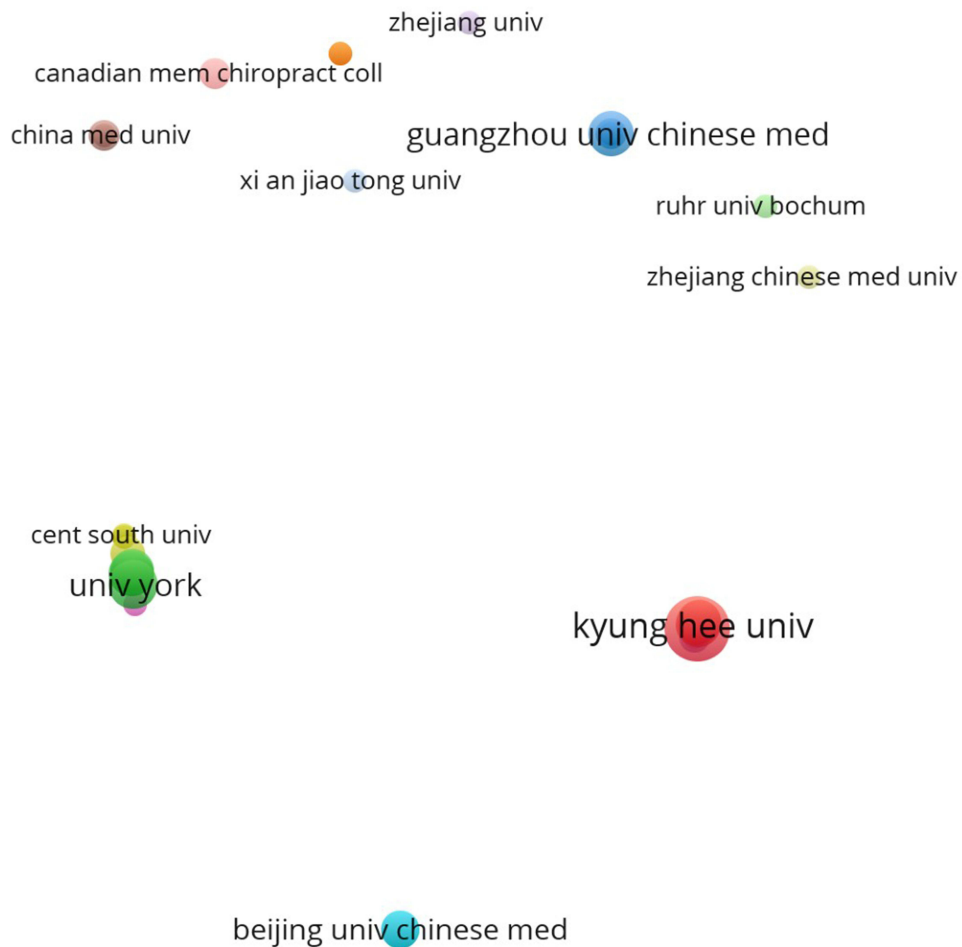


Figure 3 Network map of the 14 clusters of organizations.

Table 2 Distribution by Organization

Ranking	Organization	Records (n)	% (of 135)
1	Kyung Hee university	18	13.33
2	University of York	8	5.93
3	Wonkwang University	7	5.19
	Technische Universität München	7	5.19
	Guangzhou University of Chinese Medicine	7	5.19
6	Korea Institute of Oriental Medicine	6	4.44
	Pusan National University	6	4.44
	Keele University	6	4.44
	Memorial Sloan-Kettering Cancer Center	6	4.44
10	University of Southampton	5	3.70
	Beijing University of Chinese Medicine	5	3.70
	Capital Medical University	5	3.70

Kyung Hee University, university institutions in Europe and North America and various medical schools in China. The largest number of publications was at Kyung Hee University in Korea with 18 papers (13.33%). The University of York was next with 8 publications (5.93%). Next in line were Wonkwang University, which both published 7 (5.19%) articles, Technische Universität München, and Guangzhou University of Chinese Medicine (Table 2). The data were analyzed according to the average year of publication, with yellow in Figure 4 indicating recent publications and purple indicating

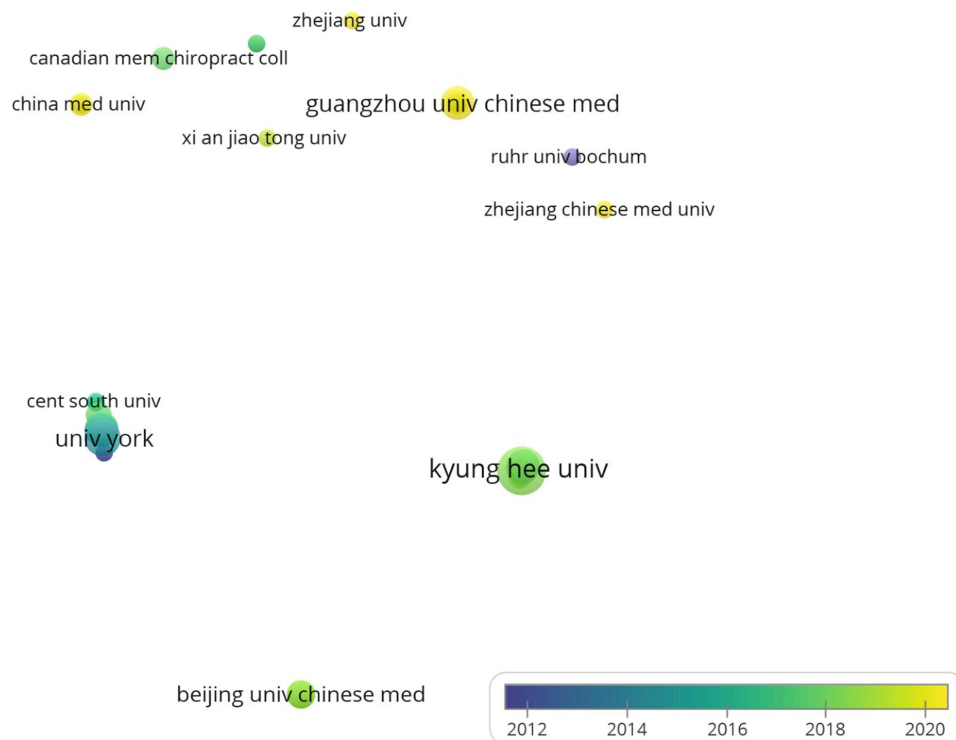


Figure 4 Network map of the organizations according to the average publication year.

Table 3 Distribution by Journal

Ranking	Journal	IF	Counts
1	Pain	7.926	82
2	Cochrane database of systematic reviews	11.874	63
3	Journal of alternative and complementary medicine	2.381	61
4	Acupuncture in medicine	1.976	51
	BMJ-British medical journal	96.216	51
6	Annals of internal medicine	51.598	47
7	Archives of physical medicine and rehabilitation	4.06	46
8	Rheumatology	7.046	44
9	Evidence-based complementary and alternative medicine	2.65	43
	Complementary therapies in medicine	3.335	43

earlier publications. The average year of publication is the most recent for Zhejiang University and Zhejiang University of Chinese Medicine, and the earliest for Ruhr University Bochum.

Distribution by Journal and Co-Cited Journal

In terms of journals, *PAIN* (82) is the journal with the highest number of publications, followed by *COCHRANE DB SYST REV* (63), *J ALTERN COMPLEM MED* (61) (Table 3). The highest impact factor was recorded in *BMJ-BRIT MED J* (96.216).

Figure 5 shows the 114 journals that have been co-cited at least 10 times. In this figure, the distance between two journals in the visualization gives a general indication of the relevance of the journals in terms of co-citation links. In general, the closer two journals are located, the more relevant they are. The most co-cited is *PAIN* (232 times), followed by *Cochrane db syst rev* (156 times), *J shoulder elb surg* (131 times), etc.

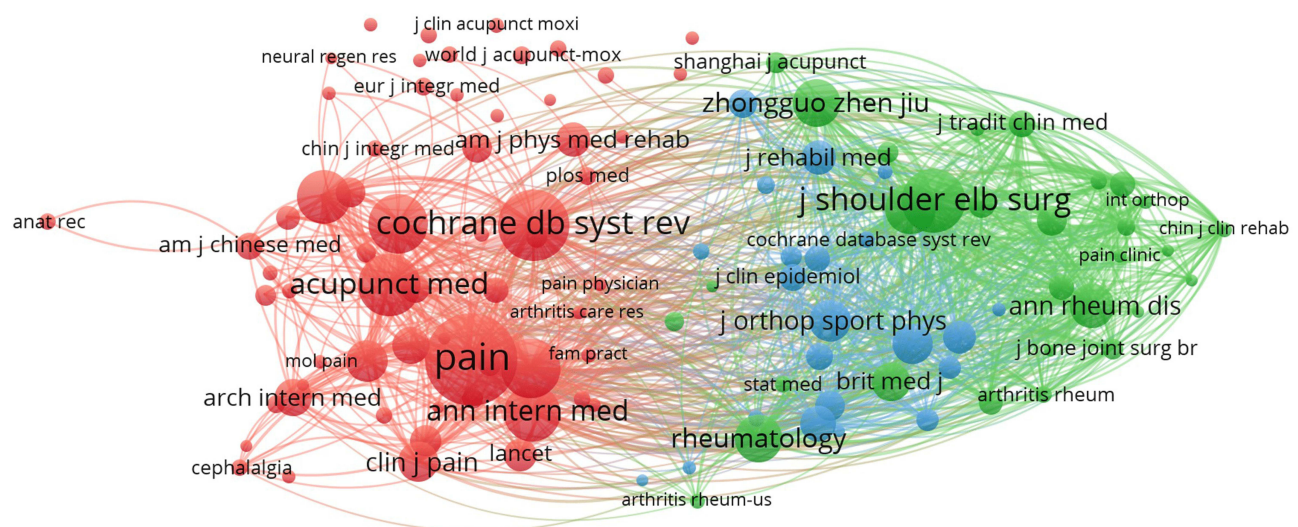


Figure 5 Network map of the co-cited journal.

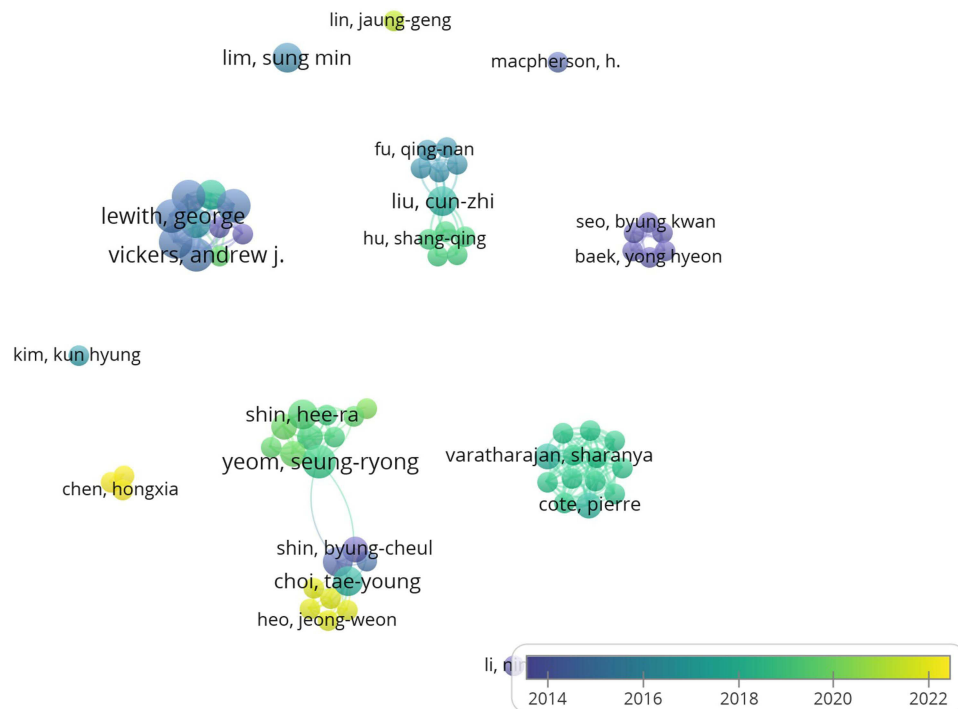
Table 4 Distribution by Author

Ranking	Author	Records (n)	% (of 135)
1	Vickers Andrew J (Memorial Sloan-Kettering Cancer Center)	5	3.70
	Lewith George (University of Southampton)	5	3.70
	Linde Klaus (Technische Universität München)	5	3.70
	MacPherson Hugh (University of York)	5	3.70
	Sherman Karen J (University of Washington)	5	3.70
2	Shin Hee-Ra (Wonkwang University)	4	2.96
	Choi Tae –Young (Chosun University)	4	2.96
	Foster Nadine E (The University of Queensland)	4	2.96
	Lee Myeong Soo (Korea Inst Oriental Med)	4	2.96
	Lim Sung Min (Yonsei University)	4	2.96
	Liu, Cun-Zhi (Beijing University of Chinese Medicine)	4	2.96
	Witt Claudia M (Universität Zürich)	4	2.96

Distribution by Author and Co-Cited Author

In terms of authors, Lewith George from the University of Southampton, Lindé Klaus from Technische Universität München, MacPherson Hugh from the University of York, Sherman Karen J from the University of Washington and Vickers Andrew J from the Memorial Sloan-Kettering Cancer Center. They were the five most published authors, together accounting for 18.5% of the total (Table 4).

In total, there are 755 authors for the 135 articles, of which 67 were selected for analysis using Vos in order to present a better visualization. This resulted in 13 clusters. In Figure 6, the yellow color indicates that the average year of

**Figure 6** Network map of the author according to the average publication year.

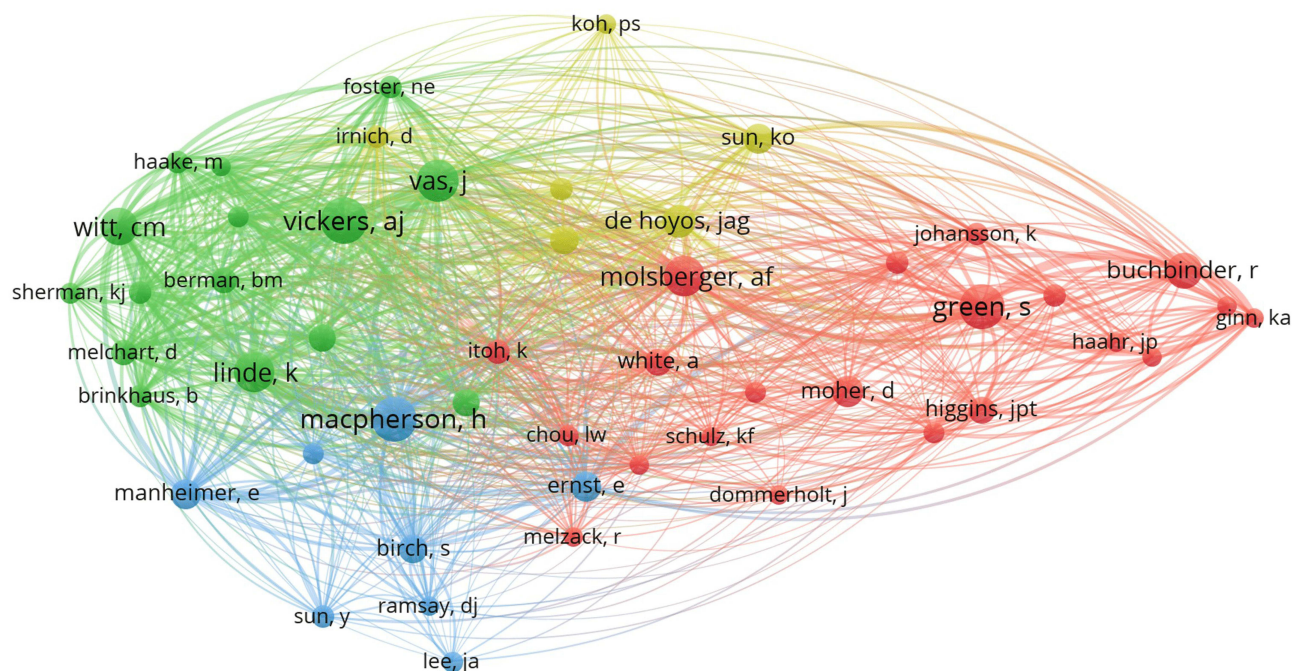


Figure 7 Network map of the co-cited author.

publication of the authors is closer to the present, while the purple color indicates the opposite. Three scholars from China, Lu Liming, Zhan Jie and Chen Hongxia, published their literature in the most recent average year.

Co-citation is a phenomenon where two or more authors or their articles are simultaneously cited in other literature. In this paper, we included 50 authors who were cited at least 10 times. As shown in [Figure 7](#), Vickers Andrew J has the highest number of co-citations (50), and Green MacPherson, and Vas are also cited more frequently (>40).

Distribution by Keywords and Burst Keywords

The keywords used in the 135 papers were analyzed using VOSviewer. Of the 579 keywords extracted from the titles and abstracts of the articles, 53 were mentioned more than five times ([Figure 8](#)). Of these, “acupuncture” was mentioned most often (65 times), followed by “pain” (34), “shoulder pain” (33). The highest centrality was for “pain” (0.31) ([Table 5](#)).

Next the keyword results were classified according to the average year of publication ([Figure 9](#)). Yellow indicates the keywords used in the most recent publications; blue indicates the opposite. The keyword “protocol” is the most recent and the terms “mechanisms”, “meta-analysis” and “reliability” are also more recent.

“Burst keywords” are keywords that have been frequently cited over a period of time, thus indicating cutting-edge areas. [Figure 10](#) shows the 17 burst keywords in order of start year. As shown in the figure, the survey started with the keyword “electrical nerve stimulation” in 2008 and continued until 2012. “Systematic review” became popular among researchers in 2020 and continues to be so today, with the highest intensity (3.5) of the 17 outbreak keywords. Burst keywords that are currently in prevalence are “stroke”, “systematic review” and “stimulation”.

Discussion

In a visual analysis of 135 selected articles, we found an overall upward trend in the literature on acupuncture for shoulder pain. This demonstrates the growing interest and acceptance of acupuncture by various researchers, clinicians and patients. Based on current trends, it can be predicted that the research literature on acupuncture for shoulder pain will continue to grow in the coming years.

In terms of countries of publication, the top ranked countries are spread across continents and seems to be positively correlated with the economic power of the country. Acupuncture originated in China and became popular earlier in Asia, so if the literature included were not restricted to languages, more Asian countries would be included. The average year

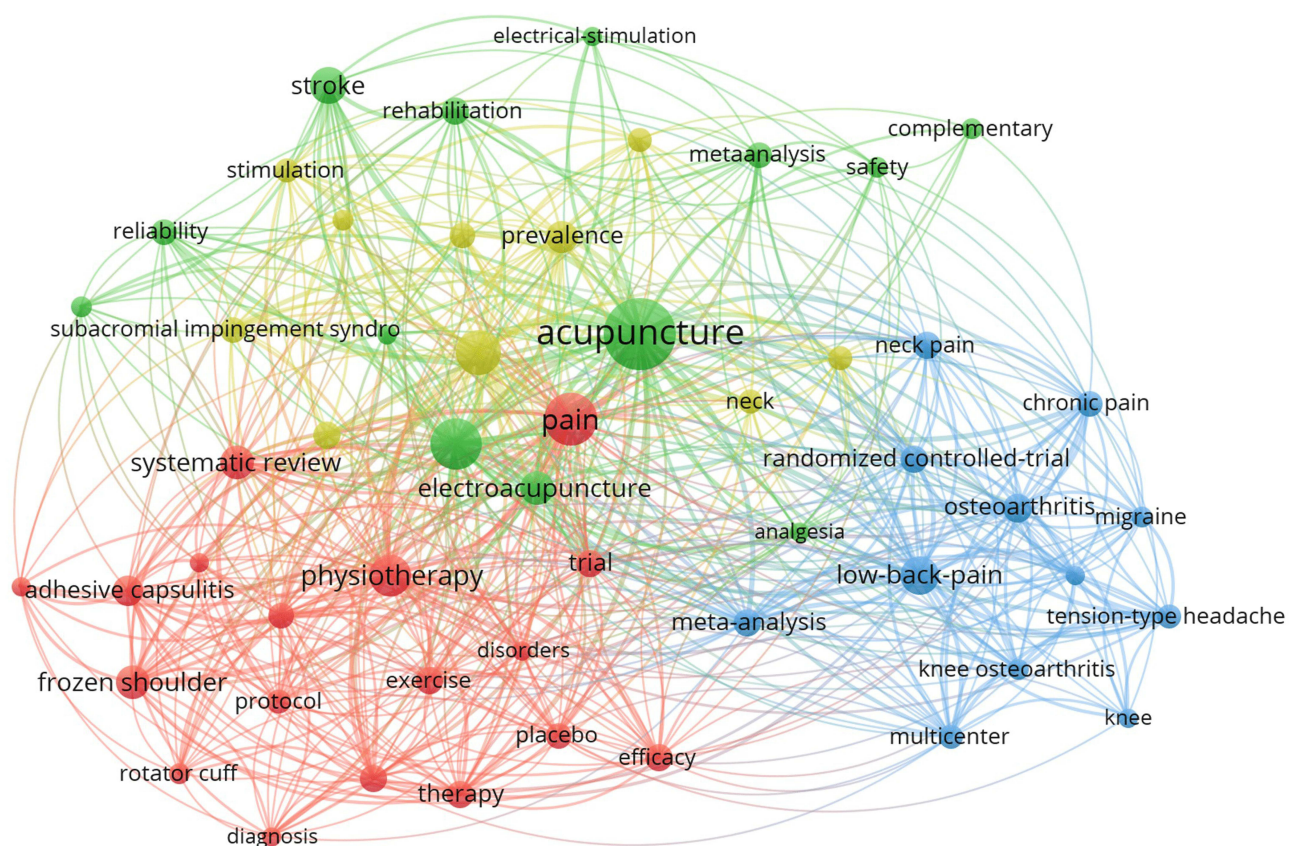


Figure 8 Network map of the keywords.

of publication for China is relatively recent, suggesting that acupuncture for shoulder pain has attracted the attention of scholars in China in recent years, and that the trend is for the number of studies to increase in subsequent years. However, despite the large number of publications in China, the centrality of the literature is only third, which indicates that the influence of the literature published by domestic scholars is not yet sufficient. Therefore, we need to improve the quality of research and strengthen international cooperation in the future. The links between countries are mostly regional, but

Table 5 Distribution by Keywords

Ranking	Keyword	Frequency	Centrality
1	Acupuncture	65	0.20
2	Pain	34	0.31
3	Shoulder pain	33	0.25
4	Management	26	0.06
5	Physiotherapy	21	0.12
6	Low-back-pain	18	0.27
7	Electroacupuncture	15	0.07
	Frozen shoulder	15	0.09
	Systematic review	15	0.09
10	Prevalence	12	0.07

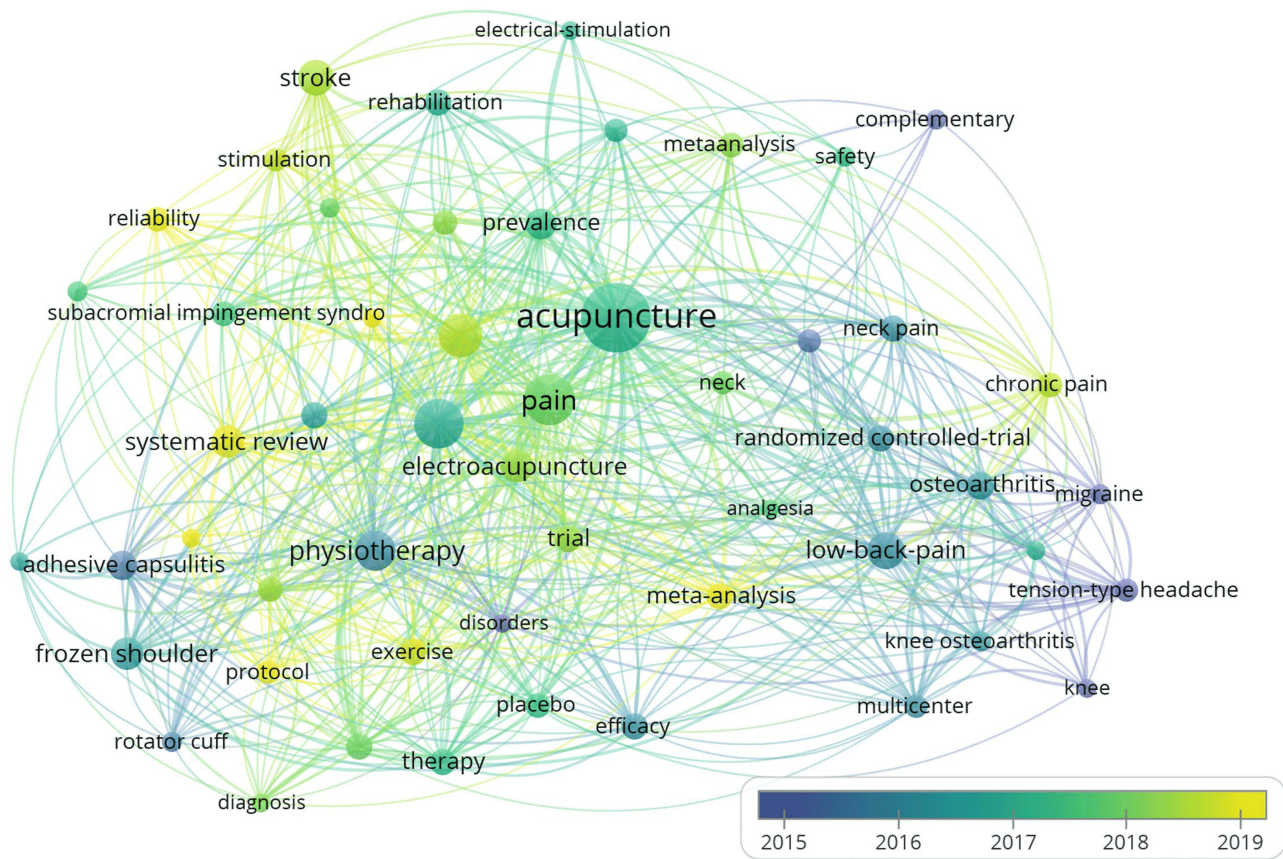


Figure 9 Network map of the keywords according to the average publication year.

Top 17 Authors with the Strongest Citation Bursts

Authors	Year	Strength	Begin	End	2008-2022
electrical nerve stimulation	2008	1.9	2008	2012	
randomized trial	2008	1.87	2008	2009	
knee	2009	2.06	2009	2012	
complementary	2010	1.42	2010	2014	
multicenter	2010	1.4	2010	2014	
neck pain	2012	2.1	2012	2016	
trigger point	2015	2.72	2015	2018	
double blind	2011	1.67	2015	2016	
physiotherapy	2011	2.38	2016	2017	
therapy	2008	1.61	2016	2017	
chronic pain	2017	2.31	2017	2018	
reliability	2017	1.56	2017	2019	
Prevalence	2015	2.46	2018	2020	
diagnosis	2019	1.91	2019	2020	
stroke	2019	1.57	2019	2022	
systematic review	2009	3.5	2020	2022	
stimulation	2020	2	2020	2022	

Figure 10 Top 17 keywords with the strongest citation bursts.

the future should promote greater cooperation. There are various schools of acupuncture in different regions, influenced by culture, geography and various factors, and greater cooperation and exchange would facilitate better development of acupuncture.²³

In terms of research institutions, the clusters are mainly divided by region, with not much cooperation between regions. According to the analysis of publication time, the research center gradually shifted from the West to the East. However, there is a lack of collaboration and linkages between Chinese institutions and institutions compared to other regions. Scholars in China should collaborate more with other universities to increase the credibility and impact of their research.²⁴

In terms of authors, the top authors in terms of number of publications were from European and USA research institutions. Of these, Lewith George, an academic conducting primary care research, received 693 and 576 citations respectively for his 2 articles on chronic pain.^{11,25} In general, the authors in Asia have published on average a little more recently than in both Europe and North America. This suggests that a great deal of research on acupuncture for shoulder pain has begun in Asia in recent years, and the focus of researchers has gradually shifted towards Asia. However, at present, the number of publications and citations by Chinese authors is still not as high as those by European and American scholars. This suggests that domestic authors still need to continue to strengthen their research and improve the quality and depth of their studies. The author with the highest number of co-cited times is Vickers Andrew J. It shows that this author has a high core influence in the field of acupuncture for the treatment of shoulder pain. Vickers Andrew J specializes in prostate cancer, randomized controlled research, and acupuncture. He collaborated with Lewith George, Sherman Karen J and others on a meta-analysis of data on acupuncture for individual patients with chronic pain. The paper suggests that acupuncture is effective in treating chronic pain, not just a placebo effect.¹¹ Acupuncture is a reasonable referral option for chronic shoulder pain. Also, the co-cited authors hinted at the intersection of related authors in their research areas, which provides some reference for collaboration between authors. The development of medicine is rapid, and only through diverse cooperation, accelerating the transfer and exchange of information, can we promote faster and better development of medicine.²⁶

In terms of published journals, there was a significant difference in impact factor between the journals, with the highest being *BMJ-BRIT MED J* (IF 96.216) and the lowest being *ACUPUNCT MED* (IF 1.976). This difference also reflects a potential gap in the quality of literature in the field of acupuncture research for shoulder pain. In terms of co-cited journals, *PAIN* (IF 7.926) remains the core journal in this area, with a randomized controlled study on acupuncture for chronic shoulder pain being cited the most frequently, with a total of 97.27 co-citations.²⁷ And the most cited piece of literature came from *ARCHIVES OF INTERNAL MEDICINE* (IF 4.06), a meta analysis of acupuncture for chronic pain, which was cited a total of 693 times.¹¹

In terms of keywords, 579 keywords were extracted from 135 articles. The analysis of keyword usage over time reveals the emergence of the term “protocol”, indicating increased attention to the soundness and validity of medical research protocols. High-quality protocols contribute to the efficient conduct of experiments.²⁸ However, reasonable randomized controlled trials (RCT) studies of acupuncture still face many problems, such as the selection of different needle sizes for different populations,²⁹ and randomized controlled studies of acupuncture often face the problem of too few experiments,³⁰ as well as the need to exclude the effect of placebo effects that acupuncture may have.^{31,32}

And more and more scholars are not stopping at clinical efficacy studies, but are beginning to conduct extensive research on the mechanisms underlying the efficacy of acupuncture for shoulder pain.⁹ Modern medical research has shown that neurotransmitters are the material basis for the effects of acupuncture, and that the effects of acupuncture analgesia are related to changes in neurotransmitters. But the exact mechanism has not been elucidated.⁹ Researchers have also studied the brain mechanisms of acupuncture for pain from magnetic resonance imaging and other aspects.^{33,34} Meta-analysis is a statistical method used to combine the results of different studies on the same topic. The significance of the conclusions depends on the quality of the included studies, and a meta-analysis provides a more accurate assessment of research findings in this area of study than individual studies and facilitates the exploration of consistency of evidence across studies and variability between studies. This will also help healthcare professionals to make better clinical choices.³⁵ “Reliability” may represent more than just the reliability of research protocols; as acupuncture techniques become more widespread, there is also a greater demand for the safety of acupuncture in clinical practice.³⁶ However, by reading some prospective studies on the safety of acupuncture treatments, it is easy to see that acupuncture has a low probability of serious adverse events compared to general medical treatments, and the adverse reactions that do occur are very mild.³⁷

Burst keywords that are currently in the epidemic stage are “stroke”, “systematic review” and “stimulation”. Shoulder pain is a common disability in stroke patients in the subacute recovery period and can affect recovery of arm function, routine rehabilitation and independence in activities of daily living.³⁸ This not only limits the patient’s mobility, but also causes significant damage to their life and mental well-being. The prevalence of post-stroke shoulder pain is approximately 22–23% in the general stroke survivor population and 54–55% in stroke patients in the rehabilitation setting.³⁹ To a certain extent, acupuncture can effectively reduce shoulder pain after stroke.⁴⁰ The acupuncture treatments available are also flexible and varied. Acupuncture coupled with moxibustion can promote the absorption of oedema, and techniques such as bee venom and floating acupuncture also have significant effects.^{41,42}

While systematic reviews have been the preferred type of literature by scholars in recent years, there are still many problems with the publication of this type of literature,^{43,44} such as the lack of depth in many current systematic reviews, as well as the difficulty of reaching double-blindness and other problems due to the lack of strict inclusion criteria for acupuncture studies, which can affect the validity of systematic reviews.⁴⁵ Problems such as unclear definitions and incorrect methodology are also common. Rather than blindly following the trend of completing a systematic review, scholars need to improve the quality of the acupuncture research literature with strict inclusion criteria, accurate definitions, and proper methods of analysis.^{46–48} An article on the role of acupuncture in pain management mentions that acupuncture stimulates meridians or energy channels in the body, thereby correcting imbalances in the organism and achieving organismal recovery.⁴⁹ Some studies suggest that in this process, the mechanical movement of acupuncture stimulates calcium ion movement, and this mechanical wave further promotes the secretion of endogenous opioids in the body, thus providing an analgesic effect.⁵⁰

Limitations

Some limitations should be addressed in our study. First, our literature search was conducted only in the Core Collection of Web of Science database. Second, this study only analyzed the English literature, but acupuncture is more popular in Asian regions, such as China. This can lead to a less comprehensive literature collection. However, in general, this study continues to provide a summary of the current status and research trend on acupuncture for shoulder pain.

Conclusion

This bibliometric study examines the landscape of scientific research and clinical practice in acupuncture treatment for shoulder pain. The findings reveal an increasing trend in literature on acupuncture for shoulder pain, indicating active research in this area. While China has the highest number of published articles, it lacks centrality, suggesting a shift in research focus to Asia, but emphasizing the need for research quality. Kyung Hee University in Korea emerges as the leading research institution, but collaboration between institutions needs improvement. Authors from European and US research institutions contribute significantly to the field, and their impact is analyzed. The study highlights a gap in the impact factor of published journals, indicating a potential disparity in research quality. Analysis of keywords identifies current research hotspots and trends.

Overall, the study provides valuable insights into research hotspots and potential collaborators, while emphasizing the importance of international exchanges, collaborations, and robust research designs for future advancements in acupuncture for shoulder pain.

Data Sharing Statement

The raw data can be directly obtained from the Web of Science Core Collection (WoSCC).

Ethics Approval

This article does not contain any studies with human or animal subjects performed by any of the authors.

Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no conflicts of interest in this work.

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