

Acupuncture for in Low Back Pain: A Bibliometric Analysis Based on Web of Science Core Collection Database from 2003 to 2023

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ABSTRACT

Background: Low back pain is an orthopedic disease that is a very common and often recurrent disease. LBP has a high prevalence in both populations and individuals throughout their lifetime, affecting the quality of life of most people. In recent years, there has been a trend towards younger age, not only middle-aged and elderly diseases. In recent years, acupuncture has been widely used worldwide to treat low back pain. Therefore, this study aims to conduct a bibliometric analysis of acupuncture in the treatment of low back pain since 2003, and to explore the current status and future development.

Methods: Search the Web of Science Core Collection Database for the treatment of low back pain from 2003 to 2023. Use CiteSpace (6.1R6) to analyze countries, institutions, authors/cited authors, cited journals, reference, and keywords.

Results: From 2003 to 2022, a total of 277 articles on acupuncture treatment of low back pain have been included. The number of published articles keeps growing. The most active countries, institutions, authors and journals in the field of acupuncture in the treatment of low back pain were analyzed by Citespace visualization. There are 35 countries, among which the United States and China produce the most documents. 517 authors from 386 institutions participated in the research in this field, with Lee Jun-Hwan of Kyung Hee University being the most published institution and author. Cherkin DC is the most frequently cited author. Among 506 journals, IF the highest is ANN INTERN MED. EVID-BASED COMPL ALT published the most articles, and SPINE was the most frequently cited journal. Manheimer E is the most frequently cited reference, Lee JH cited references ranked first in terms of centrality, the keyword " Low back pain " ranked first in terms of frequency in the study, and the most centrality was "Acupuncture".

Conclusion: This study provides the trend of acupuncture treatment for lumbago over the past 20 years, which helps researchers to find the hot spots in this field and explore new directions for future research.

Keywords: Acupuncture; Low Back Pain; Bibliometric Analysis; Citespace

Abbreviations: LBP: Low Back Pain; NSAIDs: Non-Steroidal Anti-Inflammatory Drugs; NIH: National Institutes of Health; GERAC: German Acupuncture Trials; IF: Low Impact Factor

Background

Low back pain (LBP) is an orthopedic disease that is common and prone to recurrence [1], which refers to spinal and paraspinal symptoms in the lumbosacral region and categorized as acute, subacute, or chronic [2]. According to the condition can be divided into acute less than 4-6 weeks, subacute 4-12 weeks, chronic more than 12 weeks. It is often accompanied by impaired mobility in the thoracic, lumbar, or sacroiliac regions, pain, and radiating pain into the lower extremities [3,4]. It is experienced by 70% to 80% of adults at some time in their lives [5]. globally life expectancy from disability due to low back pain increased by 54% between 1990 and 2015, largely due to population growth and ageing. Low back pain is now the leading cause of disability worldwide [6]. The WHO Global Older Persons and Adult Health Study results indicate that older people in low- and middle-income countries are at risk and a leading cause of disability in low back pain [7]. LBP is highly prevalent in the United States. The annual prevalence of low back pain in the United States is estimated at 15% to 20%, and the lifetime prevalence is over 60% [8]. Approximately 80% of Americans experience at least one episode of back pain during their lifetime [9].

However, its pathogenesis has not been completely clear. According to epidemiological surveys, the global point prevalence of LBP is estimated to be 12% [10]. Data from seven countries in Latin America show that the prevalence of LBP is estimated between 4.2 and 10.1% of the population [5]. LBP can induce an absence of enthusiasm, mental unrest, and physical discomfort or burden on its bearer [11]. At present, the treatment of LBP with western medicine is mainly symptomatic. The commonly used drugs included non-steroidal anti-inflammatory drugs (NSAIDs), Serotonin-norepinephrine reuptake inhibitor, skeletal muscle relaxants. NSAIDs, the first-line treatment for low back pain, have serious gastrointestinal and neurological side effects. Acupuncture, originated in China, is an important part of traditional Chinese medicine, with thousands of years of history, and has become one of the most widely accepted alternative medicine methods worldwide. In 1997, the National Institutes of Health (NIH) documented the efficacy and safety of acupuncture [12,13]. Acupuncture is used in a variety of health care settings. The therapy is covered by some insurance policies when it is determined to be medically necessary.

In the UK, approximately 4 million acupuncture sessions were offered to patients in 2009, with about two-third provided beyond the National Health Service [14]. In America, 3.1 million adults and 150,000 children used acupuncture in 2007, which increased approximately by 1 million since 2002 [15]. Anatomically, the mechanism of effectiveness of acupuncture in LBP is that the outer part of the waist is muscular musculoskeleton and the inner part is the kidney [16].

The "Yellow Emperor's Internal Classic" records that "the main tendons of the liver, the main bones of the kidneys, and the main muscles of the spleen", so the occurrence of low back pain is closely related to the three organs of the liver, spleen and kidney. A growing body of research has revealed the therapeutic effects of acupuncture in clinical. CiteSpace is an extremely useful visualization tool to understand past and present developments in related fields by analyzing literature and to demonstrate the new trends and driving forces of scientific development [17,18]. Professor Chen Chaomei invented CiteSpace, which intuitively represents the co-cited information such as countries, institutions, authors, keywords, cited journals, cited authors, and cited references in the form of maps [19]. Through the scientific mapping program, it helps to visually analyze and study the structure, dynamic mode and trend of the field, so that researchers can intuitively identify the evolution path of the discipline, the classic basic literature, and hot spots of the discipline, so as to provide reference for subsequent research [20].

Bibliometrics is a discipline that applies mathematical and statistical methods to the study of literature and other communication media, which can give researchers a comprehensive understanding of the research progress and trends in a scientific field [21,22]. At present, CiteSpace is the most commonly used bibliometric tool, which can carry out various kinds of effective analysis. Therefore, this study conducted a visual analysis of publications on acupuncture for LBP in the Web of Science Core Collection Database through CiteSpace, the purpose of this study is to explore the trend and knowledge map of acupuncture treatment of LBP which facilitate future research and clinical applications.

Methods

Data Acquisition

To prevent omissions in literature searches, we acquired the synonyms for "acupuncture" and "low back pain" through the MeSH Database in PubMed. We extracted literature from the WOS Core Collection through the website of Jiangxi University of Traditional Chinese Medicine Library. The search strategy (Table 1) (Figure 1) covers the topics of "Acupuncture" and "low back pain" from January 1, 2003 to February 2, 2023. There are no language restrictions and a total of 1359 literatures were searched and imported into the Endnoteexpress Manager. In addition, we screened titles and abstracts according to inclusion and exclusion criteria.

The inclusion criteria were as follows:

1. Published between 2003 and February 2023,
2. Only articles and reviews,
3. Articles focused primarily on acupuncture for LBP.

Studies that met the following criteria were excluded:

1. Duplicate publications,
2. Non-article-type literature (e.g., book reviews, notices, editorial materials, conference abstracts, proceedings papers,

letters, news entries, and corrections,

3. Articles not related to the search topic. Finally, 277 literatures were included and save it as a text document and import it to Citespace for visual analysis.

Table 1: Search Queries.

Set	Result	Search Query
#1	48157	TS="Back Pains, Low" OR "Back Pain, Low" OR "Low Back Pain" OR "Low Back Pains" OR "Pain, Low Back" OR "Pains, Low Back" OR "Lumbago" OR "Lower Back Pain" OR " Back Pain, Lower" OR "Back Pains, Lower" OR "Lower Back Pains" OR "Pain, Lower Back" OR "Pains, Lower Back" OR "Low Back Ache" OR "Ache, Low Back" OR "Aches, Low Back" OR "Back Ache, Low" OR "Back Aches, Low" OR "Low Back Aches" OR "Low Backache" OR "Backache, Low" OR "Backaches, Low" OR "Low Backaches" OR "Low Back Pain, Postural" OR "Postural Low Back Pain" OR "Low Back Pain, Posterior Compartment" OR "Low Back Pain, Recurrent" OR "Recurrent Low Back Pain" OR "Low Back Pain, Mechanical" OR "Mechanical Low Back Pain"
#2	19730	TS= "Acupuncture" OR "Acupuncture Therapy" OR "Ear Acupuncture" OR "Acupuncture Points" OR "Manual Acupuncture" OR "Auricular" OR "Acupuncture Treatment" OR "Acupuncture Analgesia" OR "Scalp Acupuncture" OR "Electroacupuncture" OR "Electro-acupuncture" OR "Needle Acupuncture" OR "fire needle" OR "moxibustion" OR "Acupuncture and moxibustion"
#3	1359	#1 AND #2

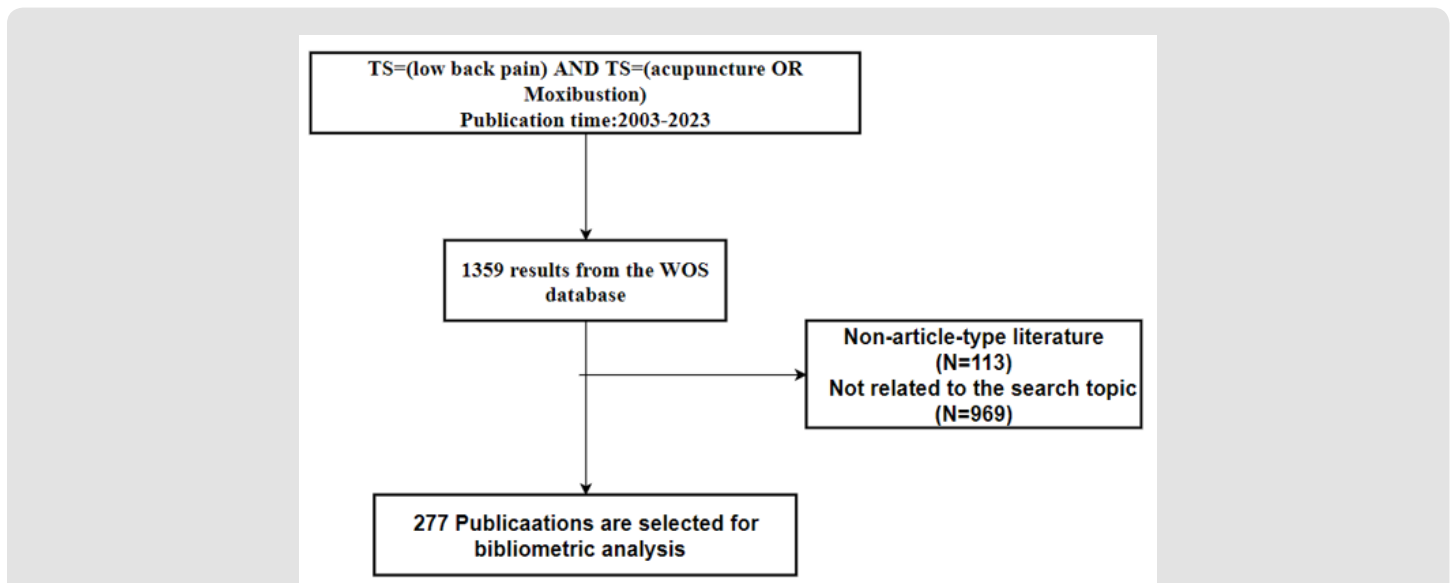


Figure 1: Flowchart of the selection process for the eligible literature.

Analysis Tool

The visualization software version is CiteSpace 6.1R6(64-bit) [23] base version, invented by Professor Chen Chaomei, Department of Computer and Information Science, Drexel University, USA, which can be used to analyze regularity and distribution among research institutions and researchers. Parameters include :2003-2022 time slice; 1 year/tablet; Node selection type, one at a time; Generate node and link diagrams. Each node represents an element, such as author, organization, country, and so on. The different colored nodes inside and outside represent the years 2003-2022. The lines between nodes represent the co-occurrence of co-citation. For all calculations, the threshold for "Top N% per slice" is 50.

Results and Discussion

Annual Publication Outputs and Time Trend

The number of papers published annually is a measure of basic research and a true reflection of scientific research development, which partly reflects growing knowledge in the field. The final collection of data from the WoSCC database. We enter the annual publication numbers for different years into a Microsoft Excel sheet and use the charting tool to generate a trend line of the annual publication numbers of AR studies on the effects of acupuncture, as shown in the (Figure 2) From 2003 to 2022, the number of articles LBP studies on acupuncture revealed a fluctuating but increasingly upward trend. The period

from 2003 to 2007 was a period of rapid development, with the number of articles increasing from 4 to 16. From 2008 to 2022, there was a fluctuating growth trend, with three distinct growth periods. The first was from 2008 to 2009, when the number of articles increased from 10 to 20. The number of articles declined from 2009 to 2011. The second time, in 2011-12, the number of articles increased from

10 to 19. The third was from 2016 to 2020, when the number of literatures increased from 6 to 22. From 2020 to 2022, the number of articles decreased but still increased. Overall, these results indicate that acupuncture therapy for LBP has received continued support and attention in recent years.

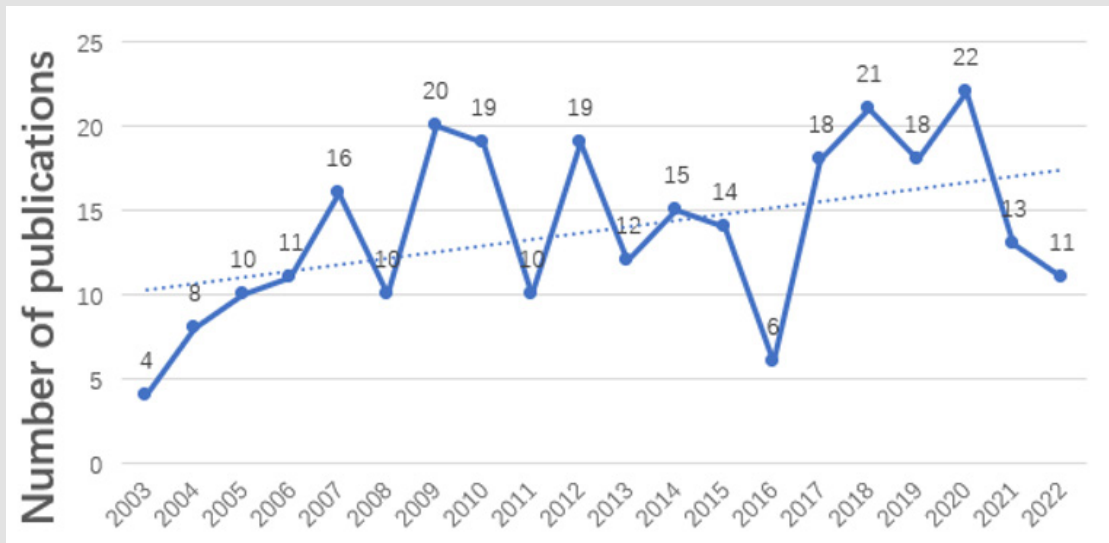


Figure 2: The number of annual publication on acupuncture for LBP by the WoSCC.

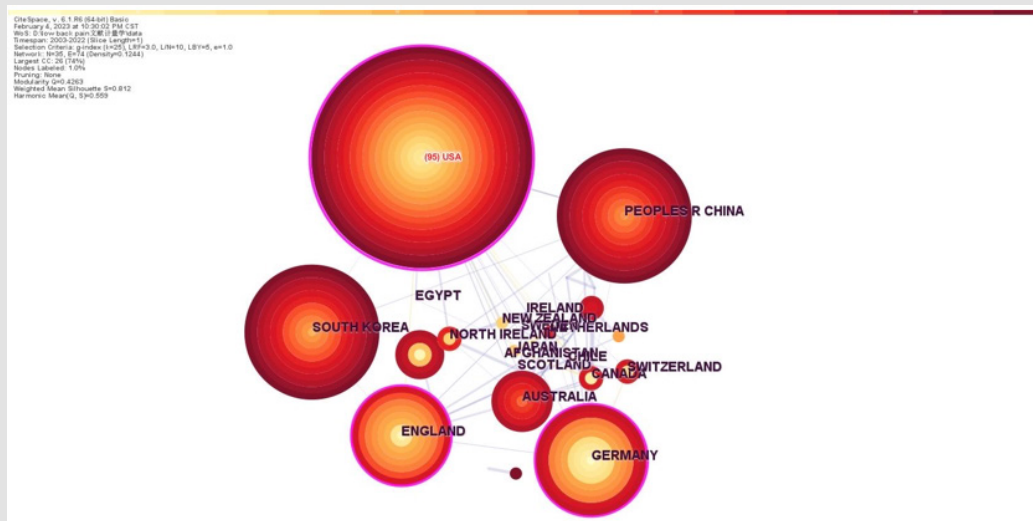


Figure 3: Map of countries researching acupuncture for LBP from 2003 to 2022.

Analysis of Countries

CiteSpace was used to visualize the number of articles published on acupuncture for lower back pain in each country from 2003 to 2022. Visualization analysis showed that 35 countries participated in

the study of acupuncture for low back pain, consisting of 35 nodes and 74 links (Figure 3). The United States ranked first with the largest number of publications (95 articles), followed by China (43 articles), South Korea (35 articles), Germany (28 articles), and England (27 ar-

ticles) (Table 2). The top 3 centrality countries (yellow circle) are the United States (0.43), Germany (0.35), and the United Kingdom (0.22), and other countries were less than 0.10. It can be seen that the United States, Germany and the United Kingdom play a non-negligible role in research in this field and the main force in this field. They have formed their own international cooperation network.

Table 2: Top 5 active countries researching acupuncture for LBP.

Rank	Counts	Country	Rank	Centrality	Country
1	95	USA	1	0.43	USA
2	43	China	2	0.35	Germany
3	35	South korea	3	0.22	England
4	28	Germany	4	0.08	Canada
5	27	England	5	0.06	Australia

Analysis of Institutions

The institutional co-occurrence analysis using CiteSpace obtained 386 nodes and 581 links, which means that 386 institutions participated in the study of acupuncture for low back pain (Figure 4). The top five institutions in terms of publication volume are Kyung Hee Univ (18), Korea Inst Oriental Med (11), Oregon Hlth&Sci Univ (7), China Med Univ (7), Harvard Med Sch (7). The top two centrality institutions are Kyung Hee Univ (0.06), Harvard University (0.06), Massachusetts Gen Hosp (0.05) (Table 3). Besides, their centrality was less than 0.1. From the number of published literature and the centrality of two aspects of analysis shows that institutions in South Korea, China and the United States play a key role in researching this area. In addition, cooperation among international cooperation agencies should be strengthened.

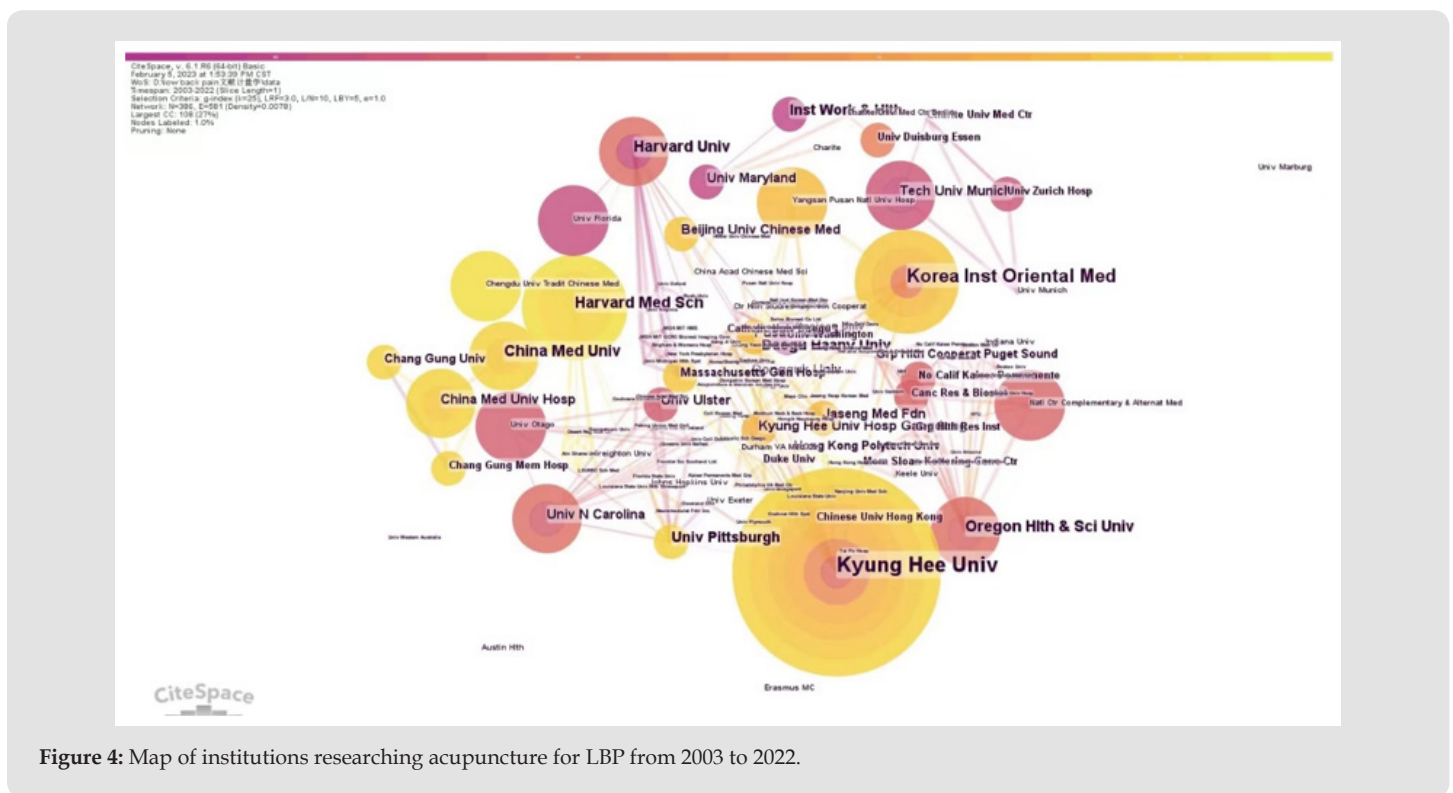


Figure 4: Map of institutions researching acupuncture for LBP from 2003 to 2022.

Table 3: Top 5 active institutions researching acupuncture for LBP.

Rank	Counts	Institution	Rank	Centrality	Institution
1	18	Kyung Hee Univ	1	0.06	Kyung Hee Univ
2	11	Korea Inst Oriental Med	2	0.06	Harvard University
3	7	Oregon Hlth&Sci Univ	3	0.05	Massachusetts Gen Hosp
4	7	China Med Univ	4	0.04	Univ Pittsburgh
5	7	Harvard Med Sch	5	0.03	Univ Ulster

Analysis of Author and Co-Cited Author

Author visualization analysis using CiteSpace obtained 517 nodes and 958 links, indicating that 517 authors participated in the study of acupuncture treatment of low back pain (Figure 5). The top five authors are Lee, Jun-Hwan (6), Cherkin, Daniel C (5), Brinkhaus, Benno (5), Ha, In-Hyuk (5), Avins, Andrew L (4) (Table 4). However, in the author's visualization analysis, the centrality is 0. From The number and centrality of publications from authors indicate that researchers mainly focus on the United States, South Korea and Germany, and do not have close communication with researchers from other coun-

tries. Therefore, researchers from different countries need to further communicate and strengthen cooperation. The co-cited author with CiteSpace for visualization analysis obtained 648 nodes and 3444 links. There were 648 co-authors involved in this study (Figure 6). the top five co-cited authors are Cherkin DC (90), Furlan AD (74), Ernst E (60), Deyo RA (56), Brinkhaus B (50). Number one in centrality is Cherkin DC with 0.12, and other co-cited author were less than 0.10 (Table 5). Among the top five co-cited authors, which are all from developed countries. This shows that developed countries play a major advantage in the study of acupuncture treatment of low back pain.

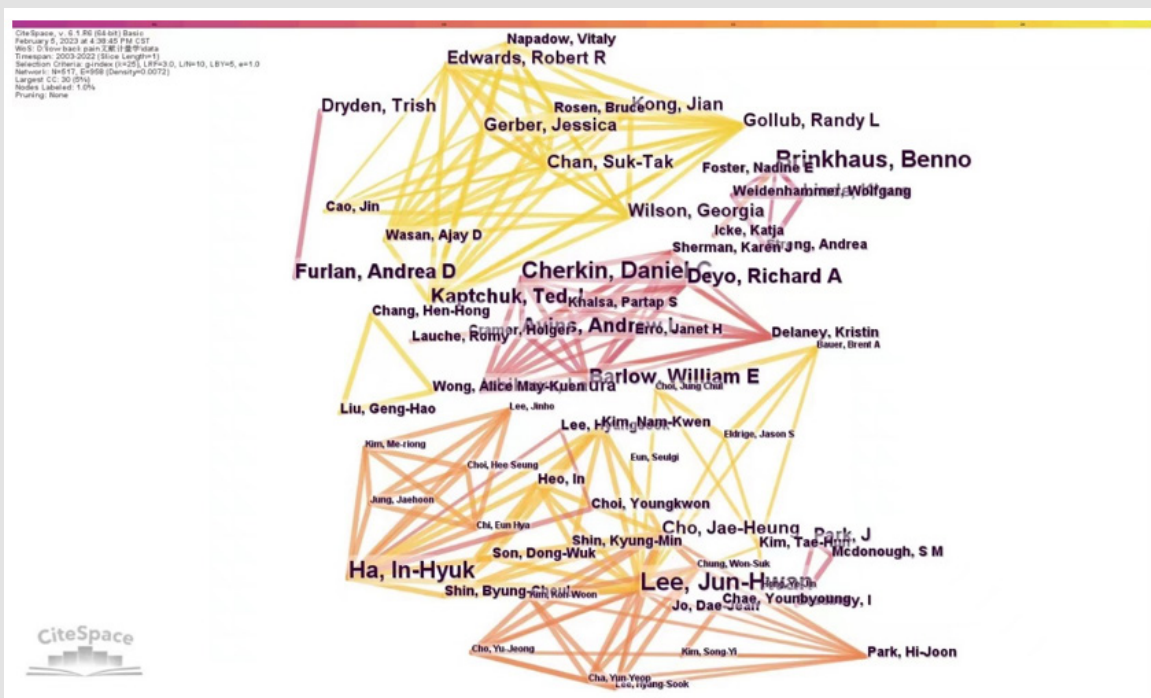


Figure 5: Map of authors researching acupuncture for LBP from 2003 to 2022.

Table 4: Top 5 active author researching acupuncture for LBP.

Rank	Author	Institution	Country	Count	Centrality
1	Lee, Jun-Hwan	College of Oriental Medicine, Kyung Hee University	South Korea	6	0.00
2	Cherkin, Daniel C	Center for Health Studies, Group Health C-operative	USA	5	0.00
3	Brinkhaus, Benno	Social Medicine, Epidemiology, and Health Economics Institute	Germany	5	0.00
4	Ha, In-Hyuk	Health and Environment Institute of	South Korea	5	0.00
5	Avins, Andrew L	Division of Research, Kaiser Permanente Northern California	USA	4	0.00

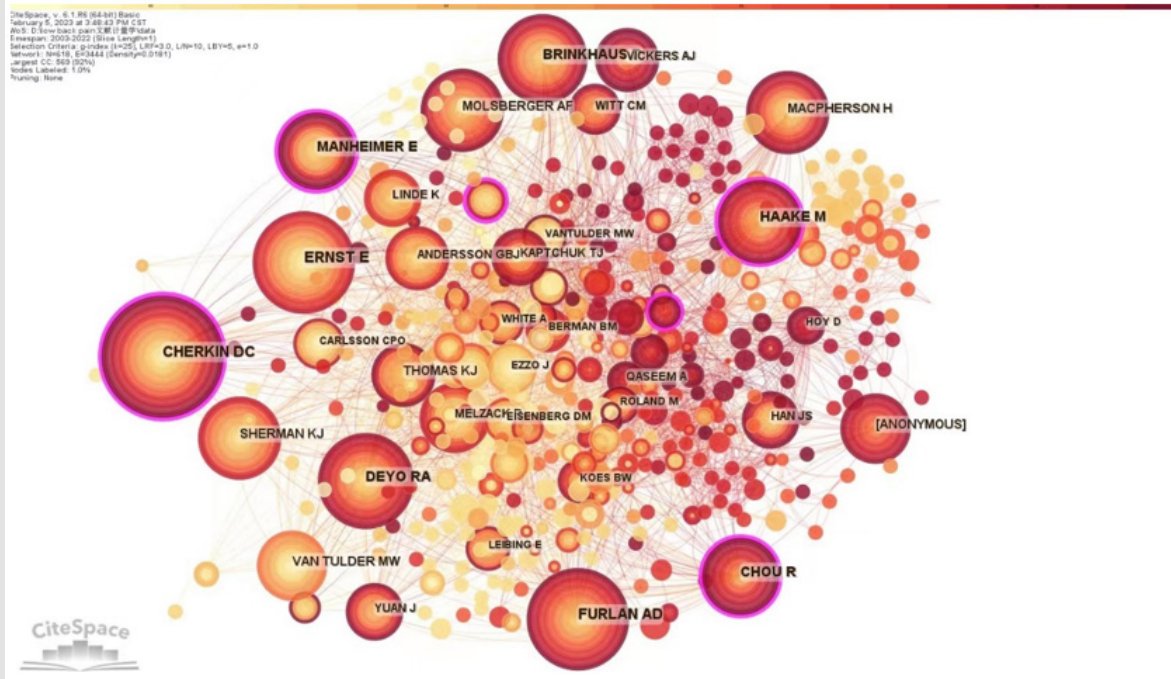


Figure 6: Map of Co-cited authors researching acupuncture for LBP from 2003 to 2022.

Table 5: Top 5 active Co-cited authors researching acupuncture for LBP.

Rank	Co-cited author	Institution	Country	Count	Centrality
1	Cherkin DC	Group Health Research Institute	USA	90	0.12
2	Furlan AD	Work & Health Institute	Canada	74	0.09
3	Ernst E	Exeter and Plymouth Universities	England	66	0.07
4	Deyo RA	the Department of Orthopaedic Surgery and the Dartmouth Institute	USA	56	0.07
5	Brinkhaus B	Social Medicine, Epidemiology, and Health Economics Institute	Germany	50	0.09

Analysis of Journals and Co-Cited Journals

CiteSpace was used for journal co-citation visualization analysis, and 506 nodes and 3848 links were obtained, indicating that 506 journal studies on acupuncture treatment of LBP had been published (Figure 7). Evidence-based Complementary and Alternative Medicine (EVID-BASED COMPL ALT) was the most prolific journal, publishing

16 articles. The five most popular journals are shown in (Table 6), all of which have an IF score of no more than 3 points, among which the highest score is Clinical Journal of Pain, with an IF score of 3.442 points. The top 5 co-cited journals are shown in (Table 6). Spine is the most actively cited magazine with 213, followed by Pain (188), ANN INTERN MED (156), BMJ-BRIT MED J (131) and ARCH INTERN MED (130).

Table 6: Top 5 active Journal and co-cited Journal researching acupuncture for LBP.

Rank	Count	Journal	IF (2023)	Co-cited Journal	Count	IF (2023)
1	16	EVID-BASED COMPL ALT	2.650	Spine	213	3.468
2	14	TRIALS	2.049	Pain	188	6.961
3	10	ACUPUNCT MED	2.267	Ann Intern Med	156	51.598
4	8	Complement Ther Med	3.335	BMJ-BRIT MED J	131	39.89
5	7	Clin J of Pain	3.423	ARCH INTERN MED	130	13.246

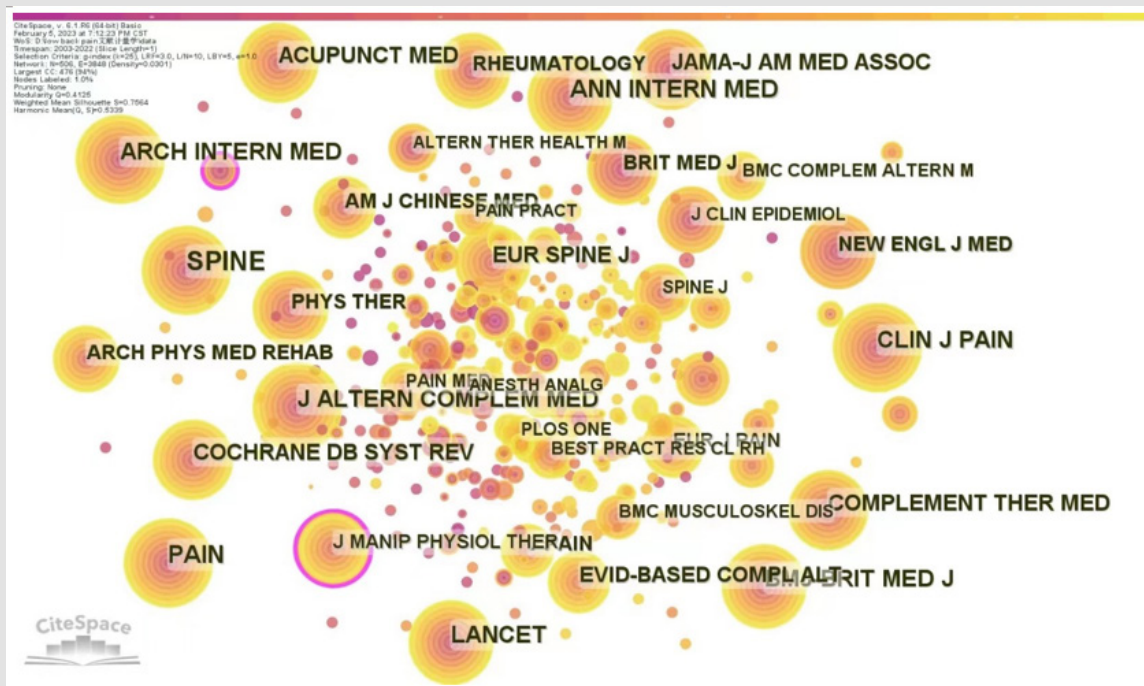


Figure 7: Map of co-cited journals researching acupuncture for LBP from 2003 to 2022.

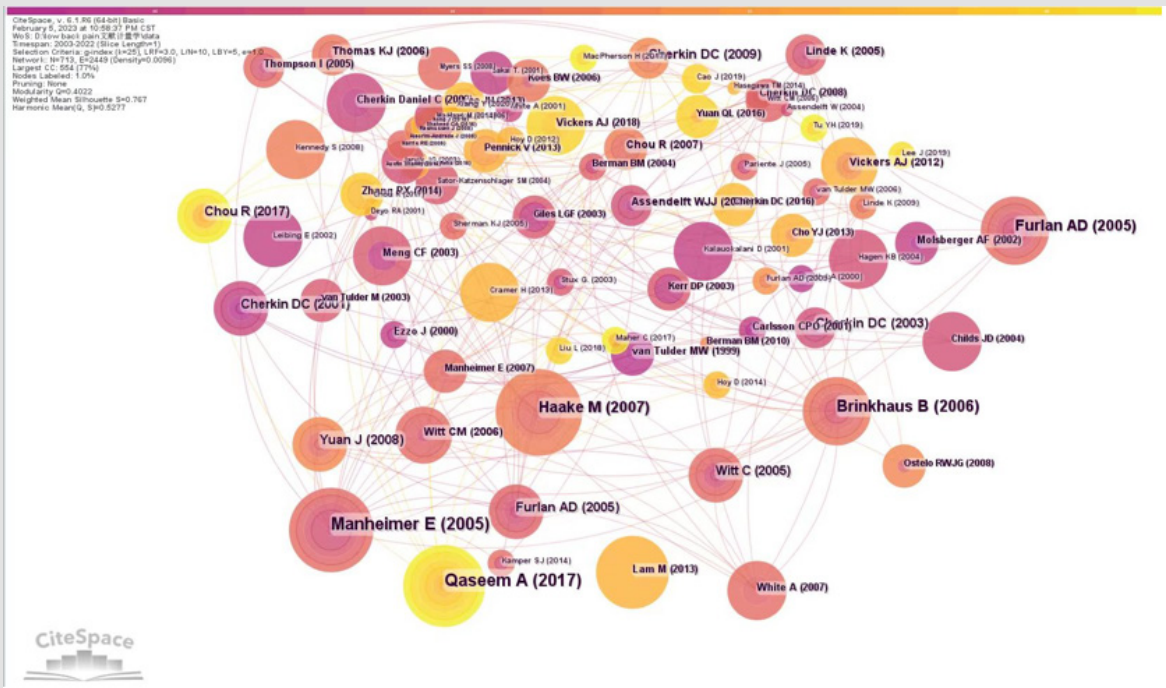


Figure 8: Map of references researching acupuncture for LBP from 2003 to 2022.

Analysis of References

Visual analysis of references using CiteSpace yielded 713 nodes and 2449 links (Figure 8). The top 5 count cited and centrality are shown in (Tables 7 & 8). Four of the top five most-cited articles were about randomized controlled trials, which are “Meta-Analysis: Acupuncture for Low Back Pain” [24] published in ANNALS OF INTERNAL MEDICINE, “Acupuncture in patients with chronic low back pain - A randomized controlled trial” [25] published in ARCHIVES OF INTERNAL MEDICINE, “German Acupuncture Trials (GERAC) for chronic low back pain: randomized, multiter, blinded, parallel-group trial with 3 groups” [26] published in ARCHIVES OF INTERNAL MEDICINE, “Acu-

puncture and Dry-Needling for Low Back Pain: An Updated Systematic Review Within the Framework of the Cochrane Collaboration” [27] published in PAIN MEDICINE. It shows that these articles play a major role in this field. In addition, Meta-Analysis of acupuncture treatment of LBP suggests that acupuncture can effectively relieve LBP. The first ranking for the centrality of citations is Lee JH [28] and Cho YJ [29]. Lee JH found that for acute lower back pain, acupuncture may be more effective than medication or provide more pain relief than sham acupuncture. Cho YJ found that this randomized sham a controlled trial showed that acupuncture treatment was more effective than sham controls in reducing distress and pain intensity in patients with cLBP.

Table 7: Top 5 count of active references researching acupuncture for LBP.

Rank	Count	References	Author and Publication Year
1	28	ANN INTERN MED, V142, P651, DOI 10.7326/0003-4819-142-8-200504190-00014	Manheimer E, 2005 [25]
2	28	ANN INTERN MED, V166, P514, DOI 10.7326/M16-2367	Qaseem A, 2017 [26]
3	22	ARCH INTERN MED, V166, P450, DOI 10.1001/archinte.166.4.450	Brinkhaus B, 2006 [27]
4	20	ARCH INTERN MED, V167, P1892, DOI 10.1001/archinte.167.17.1892	Haake M, 2007 [29]
5	18	SPINE, V30, P944, DOI 10.1097/01.brs.0000158941.21571.01	Furlan AD, 2005 [29]

Table 8: Top 5 Centrality of active references researching acupuncture for LBP.

Rank	Centrality	References	Author and Publication Year
1	0.37	CLIN J PAIN, V29, P172, DOI 10.1097/AJP.0b013e31824909f9	Lee JH, 2013 [30]
2	0.37	SPINE, V38, P549, DOI10.1097/BRS.0b013e318275e601	Cho YJ, 2013 [31]
3	0.32	SPINE, V34, P1669, DOI 10.1097/BRS.0b013e3181ad7bd6	Furlan AD, 2009[32]
4	0.23	ARCH INTERN MED, V172, P1444, DOI 10.1001/archinternmed.2012.3654	Vickers AJ,2012 [33]
5	0.21	ANN INTERN MED, V166, P493, DOI 10.7326/M16-2459	Chou R, 2017 [34]

Analysis of Keywords

The results of keyword analysis over time help to identify research hotspots and predict the development and evolutionary dynamics of the field. Visualization analysis of keywords using CiteSpace yielded 369 nodes and 2300 links (Figure 9). From the perspective of keyword quantity and centrality (Table 9), it’s found that the most

active keywords are “Low back pain”, “Acupuncture”, “Management”, “Randomized controlled trial”, “Meta-analysis”, “Electroacupuncture”, “Chronic low back pain”, “Clinical trial”. “Burst words” refers to the rise of a research frontier, and keywords explode in a short period of time. From 2003 to 2022 the top 20 strongest keywords in the field (Figure 10), “primary care”, “massage”, “reliability”, “trial”, “management” are the rank five “Burst words”.

Table 9: Top 5 active keywords researching acupuncture for LBP.

Rank	Count	Keyword	Rank	Centrality	Keyword
1	147	Low back pain	1	0.31	Acupuncture
2	74	Acupuncture	2	0.29	Randomized controlled trial
3	57	Management	3	0.13	Meta-analysis
4	48	Randomized controlled trial	4	0.12	Management
5	34	Meta-analysis	5	0.12	Electroacupuncture
6	27	Electroacupuncture	6	0.11	Clinical trial
7	27	Therapy	7	0.10	Low back pain
8	26	Care	8	0.10	Chronic low back pain
9	26	Chronic low back pain	9	0.10	Electrical nerve stimulation
10	22	Clinical trial	10	0.09	efficacy

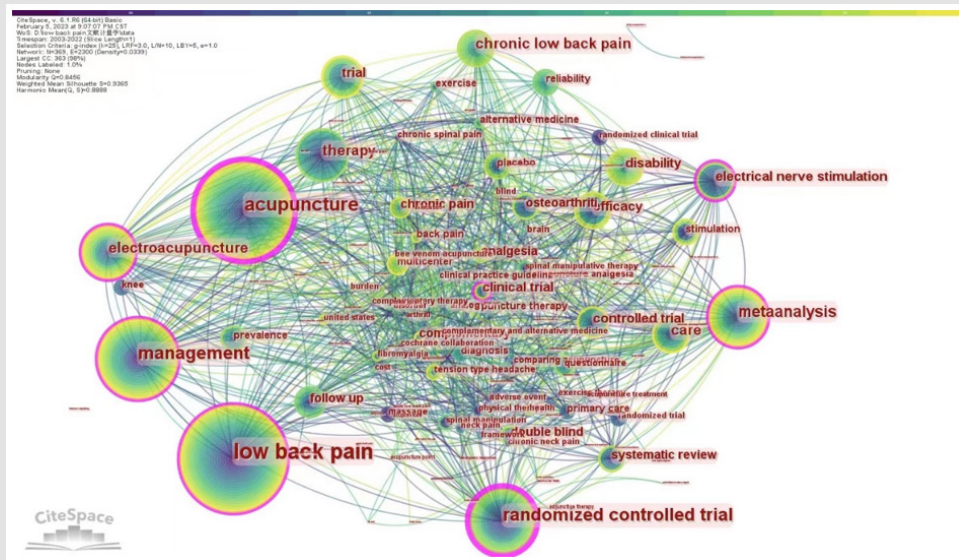


Figure 9: Map of Keywords researching acupuncture for LBP from 2003 to 2022.

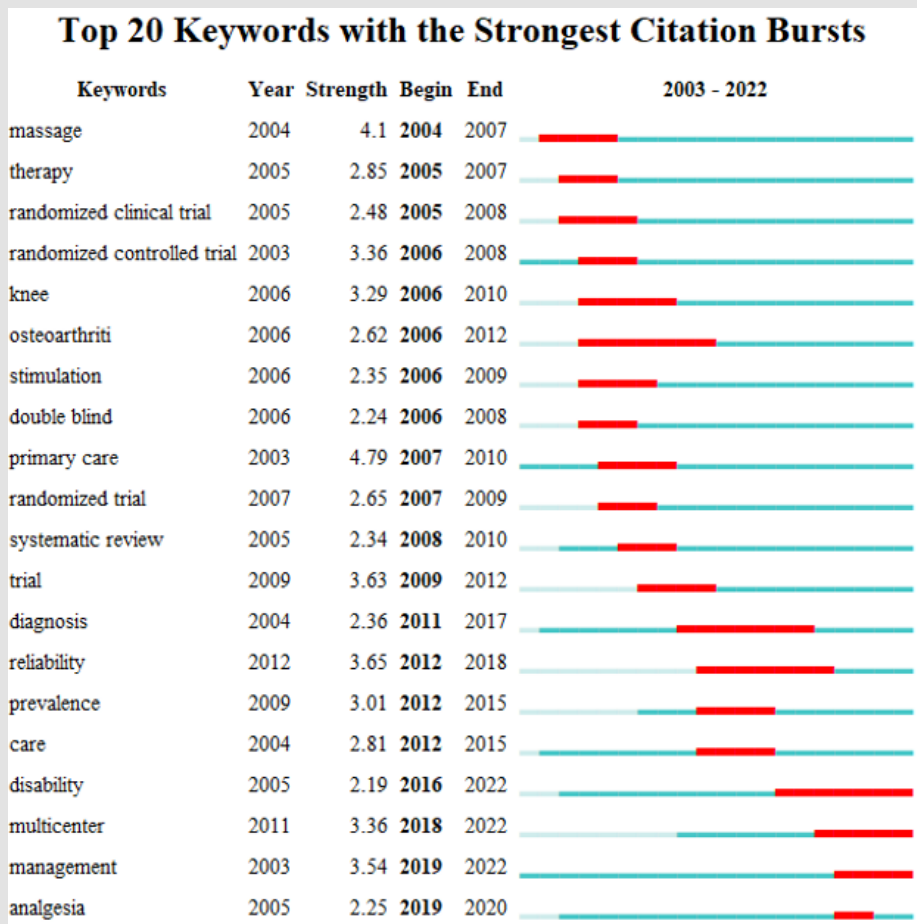


Figure 10: Top 20 keywords with the strongest citation bursts.

Discussion

General Information on Publication

277 articles were included from January 2003 to December 2022. From the perspective of the number of published literatures each year, the number of literatures on acupuncture treatment of LBP has an increasing trend but the development is not stable. This indicates that this field is in a period of rapid development and has great exploration space and research value. Acupuncture has a wide range of treatments, which has been used to treat gynecological diseases such as irregular menstruation, dysmenorrhea, lack of milk, dermatological diseases such as addiction rash, eczema, neurodermatitis, and ENT diseases such as eye swelling and pain, tinnitus, deafness, toothache. From a national point of view, the number of publications published in the United States and China is the main force in this research field, and the centrality is mainly concentrated in developed countries. From the analysis of the institutional map, the degree of cooperation between countries is not high. This means that to a certain extent, international cooperation in acupuncture for the treatment of low back pain needs to be strengthened, and developed countries such as the United States, Germany, and the United Kingdom have advantages.

From the author's point of view, Lee, Jun-Hwan published the most articles. The top five authors are from South Korea, the United States and Germany. The author with the highest number of co-cited papers and centrality is Cherkin DC [30]. The most cited paper was a randomized controlled trial published in ARCHIVES OF INTERNAL MEDICINE in 2009 that showed whether low back pain symptoms improved through multiple controlled trials such as individualized acupuncture, standardized acupuncture, and simulated acupuncture. It mainly questions the efficacy and mechanism of acupuncture and provides reference for clinical application. From the perspective of journals, the top 5 journals with the most publications have a low impact factor (IF). This shows that the international application of acupuncture in the treatment of low back pain is still relatively weak, but there is still a lot of room for improvement [31]. The impact factor of the co-cited journals is high, and most of them are comprehensive medical journals.

Research Hotspots and Frontiers

Keywords reflect the content of the study, the topic of the research, etc. Observed in the spatial dimension, their frequency levels, centrality, and burst intensity can suggest research hotspots [32]. The temporal dimension and its dynamic changes can reflect research trends and help identify research frontiers.

Conclusion

Through this study, from the perspective of annual publications, the field of acupuncture treatment of low back pain is developing rapidly. There are 69 randomized controlled trials in 277 articles, which

show that acupuncture has an immediate and sustained effect in the treatment of low back pain, and that the treatment of low back pain is effective. The difference in effect may be attributed to differences in pain suppression mechanisms [33]. The United States, Germany and the United Kingdom, with their high publication rate and centrality, are considered the most active countries in this field and are the main forces. Acupuncture is increasingly accepted by researchers as a complementary and alternative medicine. Research institutions in this field are scattered, mainly concentrated in some developed countries. International exchanges and cooperation should be strengthened to promote the development of LBP research [34]. In conclusion, this study provides an insight into the trend of acupuncture on LBP and provides insights for researchers [35]. This could help researchers explore new directions for future research in the field.

Author Contributions

JX and YPK design research; YPK, ZZ and KL search and formulate strategies; YPK and XHZ data collection for research; JX and JL assist; LLX and HPZ recalibrate data; YPK makes the charts and writes the first draft; JX revised manuscript; All authors read and approve the final manuscript.

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Disclosure

The authors declare that there are no potential conflicts of interest in this study.

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Data Sharing Statement

The raw data can be supported directly from the Web of Science Core Collection.

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