ORIGINAL RESEARCH

Bibliometric Analysis of Research Trends on Manual Therapy for Low Back Pain Over Past 2 Decades

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Purpose: Low back pain (LBP) is a prevalent musculoskeletal disorder, and manual therapy (MT) is frequently employed as a non-pharmacological treatment for LBP. This study aims to explore the research hotspots and trends in MT for LBP. MT has gained widespread acceptance in clinical practice due to its proven safety and effectiveness. The study aims to analyze the developments in the field of MT for LBP over the past 23 years, including leading countries, institutions, authoritative authors, journals, keywords, and references. It endeavors to provide a comprehensive summary of the existing research foundation and to analyze the current cutting-edge research trends.

Methods: Relevant articles between 2000 and 2023 were retrieved from the Web of Science Core Collection (WOSCC) database. We used the software VOSviewer and CiteSpace to perform the analysis and summarize current research hotspots and emerging trends.

Results: Through screening, we included 1643 papers from 2000 to 2023. In general, the number of articles published each year showed an upward trend. The United States had the highest number of publications and citations. Canadian Memorial Chiropractic College was the most published research institution. The University of Pittsburgh in the United States had the most collaboration with other research institutions. Long, Cynthia R. was the active author. Journal of Manipulative and Physiological Therapeutics was the most prolific journal with 234 publications.

Conclusion: This study provides an overview of the current status and trends of clinical studies on MT for LBP in the past 23 years using the visualization software, which may help researchers identify potential collaborators and collaborating institutions, hot topics, and new perspectives in research frontiers, while providing new clinical practice ideas for the treatment of LBP.

Keywords: CiteSpace, VOSviewer, bibliometric analysis, back pain, manual therapy

Introduction

LBP is a common symptom[1] that encompasses various types of pain, such as nociceptive, neuropathic, or nociplastic pain. It can affect individuals of all ages, from children to the elderly.[2] The highest rates of LBP occur among manual workers, people with physical and mental disabilities, smokers, and obese individuals.[1] The pathoanatomical etiology of LBP remains unclear, and it is estimated that most people will experience at least one episode of LBP during their lifetime. Although acute LBP is usually self-limiting, studies indicate that over 60% of individuals with LBP experience recurrent episodes one year after onset, leading to chronic and persistent pain.[3] Between 1990 and 2015, the number of people with disabilities caused by LBP increased by 54% worldwide,[1] with the fastest growth observed in low-income and middle-income countries.[4] The dysfunction and emotional problems caused by chronic pain seriously affect patients' quality of life. As a consequence, LBP has become a global public health problem that necessitates enhanced research and exploration to reduce the associated economic and medical burden.[5,6]

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Management guidelines advocate a multimodal approach to improve symptoms of LBP, incorporating educational reassurance, analgesics, and non-pharmacologic treatments.[7] However, the prevalent issue of overusing opioids and opting for surgery persists, warranting attention.[8] The treatment of LBP focuses on relieving pain and preventing its progression. The primary goal of LBP treatment is to alleviate pain and prevent its progression. Complementary and alternative therapies, such as acupuncture, physical factor therapy, and exercise therapy, are commonly employed to address LBP. Despite their recognized safety and efficacy, long-term adherence to these treatments can be challenging for patients, and noticeable effects may require time to manifest.

As a non-invasive non-pharmacological therapy, MT is widely used in the treatment of LBP due to its recognized safety and effectiveness.[9] MT encompasses massage, bone setting, chiropractic manipulation, joint mobilization, among others. Many clinical guidelines recommend MT for managing acute LBP.[10] Clinical trials have shown that MT can not only alleviate pain but also foster enhanced connectivity between brain regions responsible for pain perception and motor processing.[11–15] This phenomenon may be attributed to the manipulation's ability to realign dislocated vertebrae, increase joint space, optimize biomechanical structures, and alleviate nerve root compression and irritation. Additionally, MT has been shown to reduce fear avoidance behaviors by modulating blood oxygen level-dependent signals in the brain circuits of LBP patients.[16] Few bibliometric studies have been performed on research relating to MT of LBP, though many clinical trials were conducted in this field. The purpose of this study was to demonstrate the new trends and frontiers of MT for LBP by using bibliometric software.

Methods
Search Strategy
All relevant articles from 2000-01-01 to 2023-01-01 were obtained from WOSCC, which includes Social Science Citation (SCI)-EXPANDED, Social Science Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), Conference Proceedings Citation Index – Science (CPCI-S), and Conference Proceedings Citation Index -Social Science and Humanities (CPCI-SSH). WOSCC is the world's largest and most influential citation-based database, encompassing comprehensive literature data. It is the preferred choice for bibliometric analysis due to its extensive coverage of scholarly publications.[17,18] To avoid bias due to the daily update of the database, we completed the retrieval process on 24 February 2023.

Searching keywords was established about Medical Subject Heading (MeSH) terms from PubMed. The retrieval strategy was as follows: TS= (low back pain) And (manual therapy). Document types were articles and reviews. The language was restricted to English. A total of 1643 publications met the inclusion criteria. The flow chart is shown in Figure 1.

Data Extraction
By the following exclusion criteria, records were excluded: (1) A record was extracted if "low back pain" and "manual therapy" was not found in its title, abstract, or keywords; (2) Publication time out 2000–2023; (3) Other document types: conference abstracts, letters, news, editorial materials, proceeding papers, book chapters, short reports, case studies; (4) Not in the English language.

The data that came from WOSCC were inputted into Microsoft Excel 2016 (Redmond, Washington, USA), CiteSpace (Drexel University, Philadelphia, USA), and VOSviewer (Leiden University, Leiden, the Netherlands).

Analysis Tools
VOSviewer is a bibliometric analysis software for drawing knowledge maps, which can be used for co-occurrence analysis, co-citation analysis, and literature coupling analysis.[19] It can visually display research results and has unique advantages in clustering technology and map display.[20,21] CiteSpace is a literature visualization software developed in Java language.[22] Through the processing of the literature in the existing database, the software can objectively analyze the research process of a subject field accurately and conveniently, predict the future research trend of the field, and provide new ideas for the following research direction.[23,24] Therefore, the application of this software has attracted the attention of many scholars and researchers.[25]
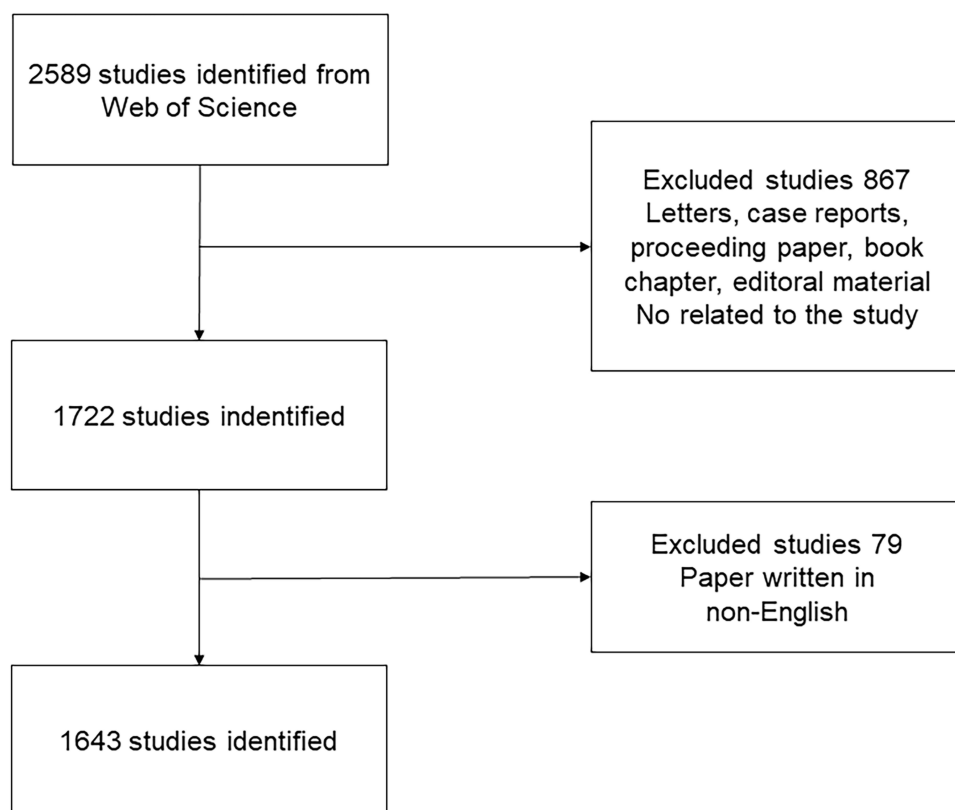
Figure 1 Flow chart of this study.

In this study, VOSviewer (version 1.6.19) and CiteSpace (version 6.1.R6) software were used to visually analyze the literature related to the MT of LBP in the WOSCC database and draw the knowledge map, aiming to gain the research status, research hotspots, and development trends in this field and provide a reference for future research.
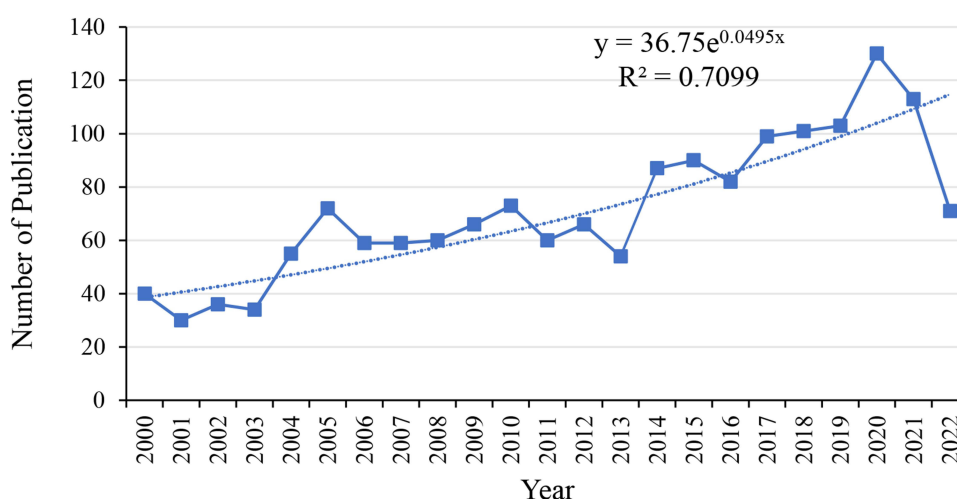
Parameter Settings

We used VOSviewer to perform citation analysis for authors, bibliographic coupling analysis for journals, co-occurrence analysis for countries and keywords, and co-citation for cited references.[18,20,26,27] Different types of analysis and units of analysis were selected according to the needs of the analysis content. The parameters were set as follows: Counting method selected "Full counting", Minimum number of occurrences of a keyword selected "5".

CiteSpace was used to carry out visual analysis from the aspects of countries, authors, keywords, and references. The period is set to 2000–2023. Years Slicing is set to 1. The threshold is set to "TOP N", which is N = 50. For network clipping connection, select "Pathfinder" and "Pruning the sliced networks". We chose institutions, keywords and references as nodes to conduct co-occurrence analysis and generate visual maps.

Results

Analysis of Publications

A total of 1643 publications were included in the analysis. As shown in Figure 2, the number of publications showed an overall rising trend from 2000 to 2022. It reached a peak in 2020, with 130 publications. From 2012 to 2022, the number of publications accounted for 60% of the total number of publications. The number of articles published in this research field increased approximately exponentially, and the prediction model formula was $y = 36.75e^{0.0495x}$. In this formula, Y represented the number of publications and X represented the year. R^2 is 0.7099, showing that the curve was well fitted. This indicates that the field has a particular research foundation and continues to receive attention from researchers.

The chart shows an equation:
$$y = 36.75e^{0.0495x}$$
$$R^2 = 0.7099$$

with y-axis labeled "Number of Publication" and x-axis labeled "Year" (2000 to 2022).

Figure 2 Annual publication outputs and growth prediction from 2000 to 2022. The number of published documents increases exponentially, and conforms to the formula: $y = 36.75e^{0.0495x}$, R^2 is 0.7099, showing that the curve was well fitted.

Analysis of Countries/Regions

A total of 1643 articles from 61 countries or regions were published, as shown in Table 1. The United States had the largest number of papers in this field (714 publications, 43.45%), followed by Canada (212 publications, 12.90%), Australia (198 publications, 12.05%), the United Kingdom (167 publications, 10.16%), and China (97 publications, 5.90%). The size of each circle in the Figure 3A represents the number of papers published by the corresponding country/region. The United States ranked first in terms of publication, citation times and cooperation with other countries. The average publication time in the UK was the earliest, indicating that the UK was the first to carry out relevant research. The most frequently cited article on average was in Italy, suggesting that Italy may be a rising star. The comprehensive analysis of publications, links, citations and Avg.pub. Year indicated that the United States and the United Kingdom held the dominant positions in this field.
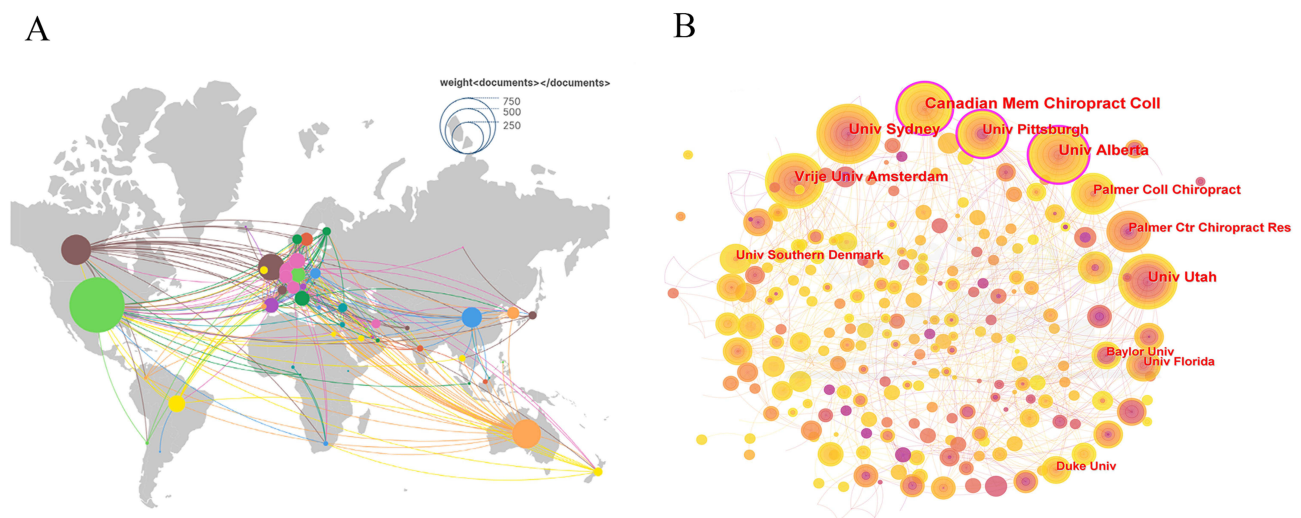
Analysis of Institutions

A total of 603 institutions and 825 connections were generated, and the density of the network was 0.0045 in Figure 3B. The purple outer circle represents the centrality, with wider circle indicating higher centrality.[20] Nodes with high centrality are considered significant points in the field.[28] The lines between nodes represent the cooperation relationships,[29] with more lines indicating more cooperation. University of Pittsburgh, Canadian Memorial Chiropractic College, University of Alberta Centrality bigger than 0.1 indicated that these three institutions have

Table 1 Top 10 Countries That Published Articles on MT for LBP

Country	Publications	Links	Citations	Avg. Pub. Year	Avg. Citations
United States	714	33	26,805	2012.413	37.542
Canada	212	26	7137	2013.829	33.6651
Australia	198	30	10,504	2013.455	53.0505
United Kingdom	167	32	10,920	2011.151	65.3892
China	97	14	1351	2017.206	13.9278
Netherlands	90	23	8446	2012.214	93.8444
Brazil	66	13	2584	2015.076	39.1515
Denmark	58	16	1255	2015.517	21.6379
Italy	53	22	5636	2016.264	106.3396
Spain	52	21	3246	2017.235	62.4231

Abbreviations: Avg. pub. Year, Average publication Year; Avg. citations, Average citations.

Figure 3 The analysis of countries and institutions. (**A**) Cooperation map of countries in MT from 2000–2023. The circle represents the country, the higher the number of articles, the larger the circle; Connections represent cooperation and communication, and the more connections, the closer cooperation and communication. (**B**) Cooperation map of institutions from 2000–2023. The circle represents the research institution, and the higher the number of publications, the larger the circle. The connection represents the number of cooperation and exchanges between research units, and the more connections, the closer the cooperation and exchanges. The outermost purple circle represents centrality, and the higher the centrality, the more important the node.

a place in the field. In order of the number of articles published, the top five institutions were: Canadian Memorial Chiropractic College, the University of Sydney, the University of Alberta, Vrije University Amsterdam, and the University of Utah. The top three were all from Canada. The biological basis and MT of musculoskeletal system injuries was one of the five research areas of Canadian Memorial Chiropractic College. The college focused on macro-and micro-level changes in LBP treated by MT.[30,31] From the perspective of node connections, there were close cooperations between institutions. Especially University of Pittsburgh (33 publications) in the United States had the highest centrality, which means it has established good research cooperation with other institutions (Table 2). Analysis of publications and centrality indicated that Canadian Memorial Chiropractic College was the leading research institution.

Analysis of Authors

For better visualization, only 174 authors with at least 5 articles were included in the collaborative author network. Nodes were authors in the knowledge graph, and links were relations. Five different colors appeared in Figure 4, with the same color indicating a close collaboration among the authors.[32] We selected the top 12 authors, most of whom were from the United States in Table 3. The author who collaborated most strongly with the others and published the most articles was Long, Cynthia R. She is from Palmer Center for Chiropractic Research (PCCR), Palmer College of Chiropractic and IA. PCCR is the most funded chiropractic research center in the United States. Her research focused on the efficacy analysis of manipulation therapy with different intensities in the intervention of LBP in veterans.[33,34] The articles of Maher, Christopher G. had the highest citations, but the total link strength was not high, which indicated that his articles were receiving attention and should strengthen collaborative communication with other researchers. He is from the George

Table 2 Top 5 Institutions That Published Articles on MT for LBP

Institution	Country	Publications	Citations	Institution	Centrality
Canadian Memorial Chiropractic College	Canada	48	1293	University of Pittsburgh	0.12
University of Sydney	Canada	45	4984	Canadian Memorial Chiropractic College	0.1
University of Alberta	Canada	44	1505	University of Alberta	0.1
Vrije Universiteit Amsterdam	Netherland	39	4539	University of Sydney	0.09
The University of Utah	American	34	1905	Duke University	0.09
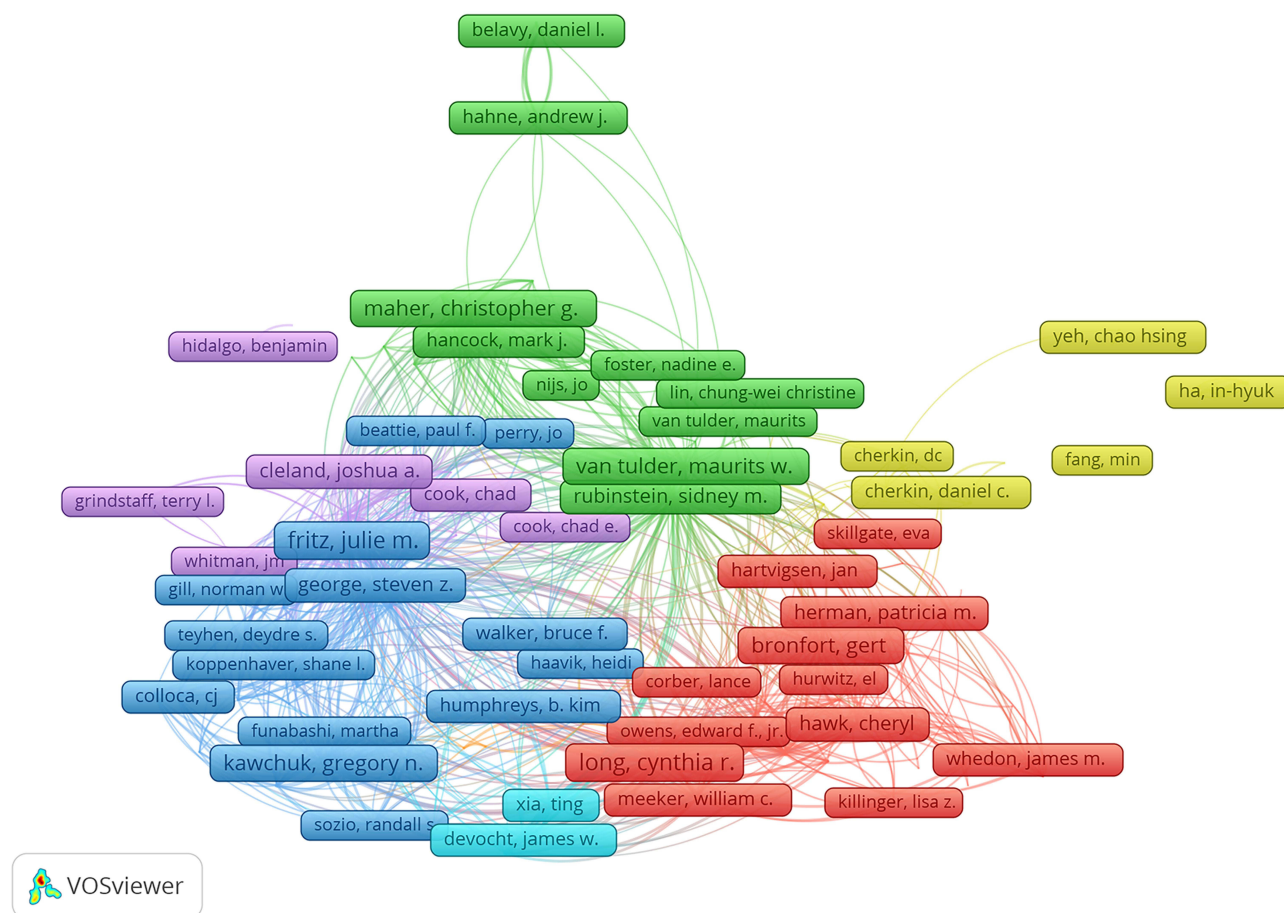
Figure 4 Cooperation map of authors from 2000 to 2023. Nodes represent authors, and the size of nodes is proportional to the number of publications. The connections represent the number of cooperative exchanges between authors, and the more connections, the closer the cooperation and exchanges.

Institute for Global Health, Sydney Medical School, at University of Sydney. Maher, Christopher G. focused on non-drug therapy, MT, and exercise therapy for LBP.[35,36]

Analysis of Journals

Academic journals serve as the medium through which researchers publish their results, and they reflect the quality of research to some extent. A total of 840 journals and 1643 articles were included in the study. As shown in Table 4, the total number of articles published by the top ten cited journals accounted for 36% of all literature. In terms of total citations, Spine had the

Table 3 Top 12 Authors That Published Articles on MT for LBP

Author	Institution	Country	Publications	Citations	Total Link Strength
Long, Cynthia R.	Palmer College of Chiropractic	USA	29	495	1085.00
Fritz, Julie M.	University of Utah	USA	26	1511	840.00
Goertz, Christine M.	Duke University	USA	22	330	761.00
Bronfort, Gert	University of Minnesota	USA	19	742	460.00
Van Tulder, Maurits W.	Vrije Universiteit	Netherland	19	1383	725.00
Kawchuk, Gregory N.	University of Alberta	Canada	18	291	632.00
Maher, Christopher G.	The University of Sydney	Australia	18	2242	581.00
George, Steven Z.	University of Florida	USA	17	1541	805.00
Bishop, Mark D.	University of Florida	USA	16	1416	746.00
Cleland, Joshua A.	Tufts University School of Medicine	USA	16	663	374.00
Hurwitz, Eric L.	Southern California University of Health Sciences	USA	16	226	254.00
Rubinstein, Sidney M.	Vrije Universiteit	Netherland	16	1103	664.00

Table 4 Top 10 Journals According to Citation

Journal	Publications	Count (%)	Citations	Country	Impact Factor (2022)	JCR
Spine	86	5.23	6807	USA	3.241	Q2
Annals of Internal Medicine	11	0.67	5132	USA	51.598	Q1
European Spine Journal	24	1.46	4774	USA	2.721	Q2
Journal of Manipulative and Physiological Therapeutics	234	14.24	4506	USA	1.300	Q4
European Journal of Pain	12	0.73	3967	UK	3.651	Q2
Manual Therapy	69	4.20	3239	USA	NA	Q2
Physical Therapy	41	2.50	2719	USA	NA	Q1
Journal of Orthopaedic and Sports Physical Therapy	58	3.53	1892	USA	6.276	Q1
BMC Musculoskeletal Disorders	43	2.62	1655	UK	2.562	Q3
Cochrane Database of Systematic Reviews	15	0.91	1511	UK	12.008	Q1

highest one (6807), followed by Annals of Internal Medicine (5132) and European Spine Journal (4774). The Journal of Manipulative and Physiological Therapeutics (234) had the highest number of publications, accounting for 14.53% of the total number of publications. Most of the journals in the field of MT of LBP were published in the United States. The journal with the highest impact factor was Annals of Internal Medicine in Q1. Figure 5 showed three clusters of journals in this field. The
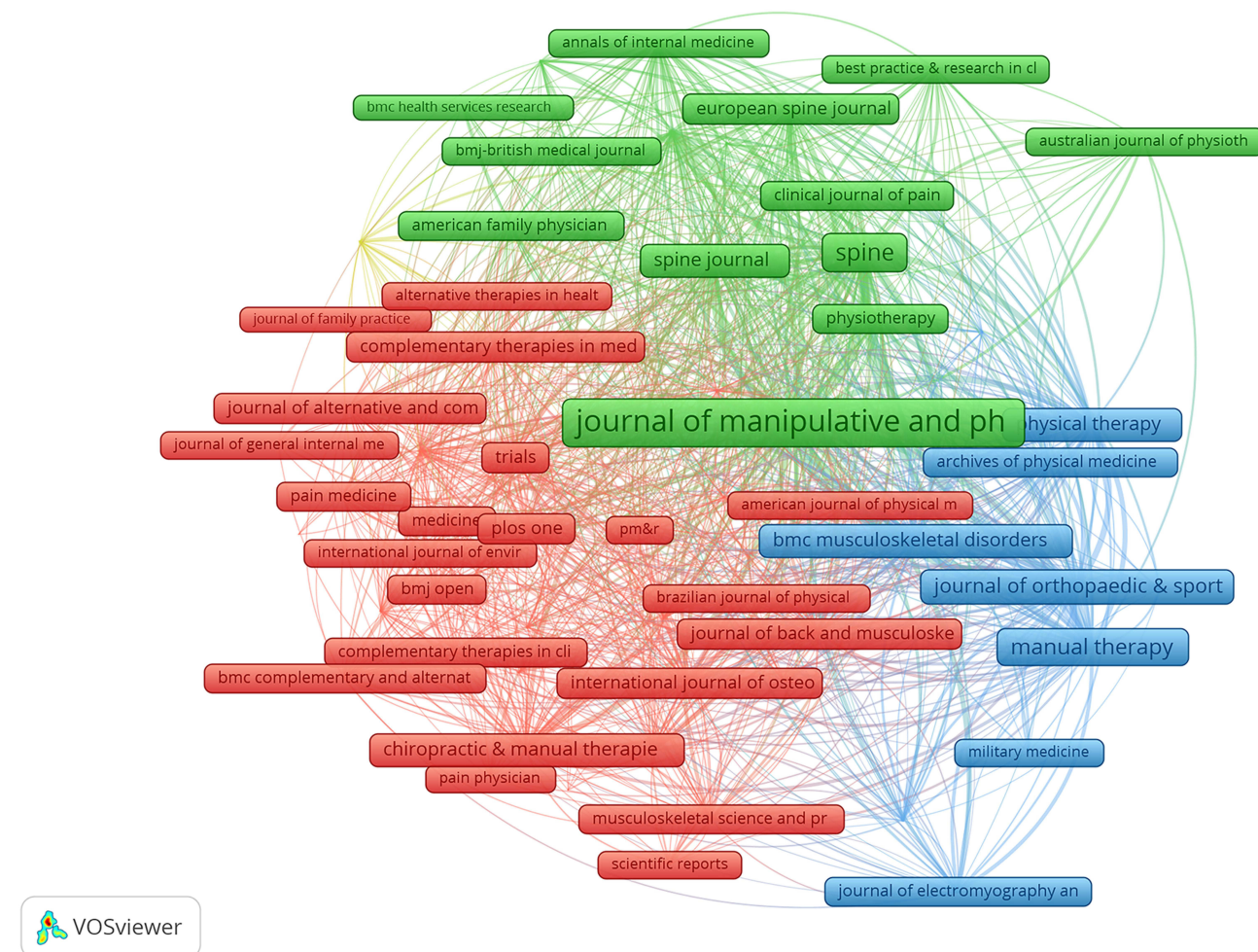
Figure 5 Bibliographic coupling analysis highly cited journals, weighted by citations, visualized map. Nodes represent journals, and the larger the node, the greater the number of citations.

green cluster mainly published on spine-related diseases, the blue cluster published MT and other complementary therapies, while the red cluster published pain-related content.

Analysis of Keywords and Strongest Burst Keywords

The 614 keywords were divided into 7 clusters by VOSviewer. Red labels represented the locations, characters, and types of LBP. In Figure 6A, green, blue, yellow, and purple represented the current treatments, epidemiology, risk factors, and research methods. Figure 6B showed the keywords cluster map, offering insights into the development trends and new directions of this discipline. CiteSpace was utilized to cluster keywords, employing the classical log-likelihood ratio (LLR) algorithm, which yielded a total of 12 clusters. In this figure, Q=0.3579, S=0.6777. The Q value > 0.3 and S value > 0.5, demonstrating that the network clustering was significant and the literature within each cluster topic was consistent.[37] The biggest cluster was the #0 systematic review, followed by auricular point acupuncture, laser therapy, and physical therapy. Figure 7 showed the top 25 keywords with the strongest citation bursts. The left endpoint of the red line represented the emergence time, and the right represented the end time. Recent emerging keywords highlighted current research hotspots, focusing on validity, chronic LBP, clinical treatment guidelines, depression, and musculoskeletal manipulation. The current field of MT of LBP attention is directed towards its effectiveness, as well as the psychological state of patients, such as depression and anxiety.[38]

Analysis of References

Reference co-citation map can explore research topics closely related to the academic field.[39,40] A total of 44,897 cited literature were included, and 348 literature met the criteria when the minimum number of citations of a cited reference was set to be at least 20. In Figure 8, the red cluster mainly focused on epidemiology, diagnosis, and evaluation. The blue cluster focused on non-drug therapy, spinal manipulation, and so on. Green clustering mainly focused on the advantages of MT compared with other therapies. The yellow cluster was concentrated in randomized controlled trials and systematic reviews.

The citation frequency of a single article reflects its academic level and influence.[41] The higher the citation frequency, the greater the attention received. Table 5 showed the top ten with the number of citation articles. Among them, the article[42] titled "Survey of chronic pain in Europe: Prevalence, impact on daily life, and treatment" by Breivik, H. had the
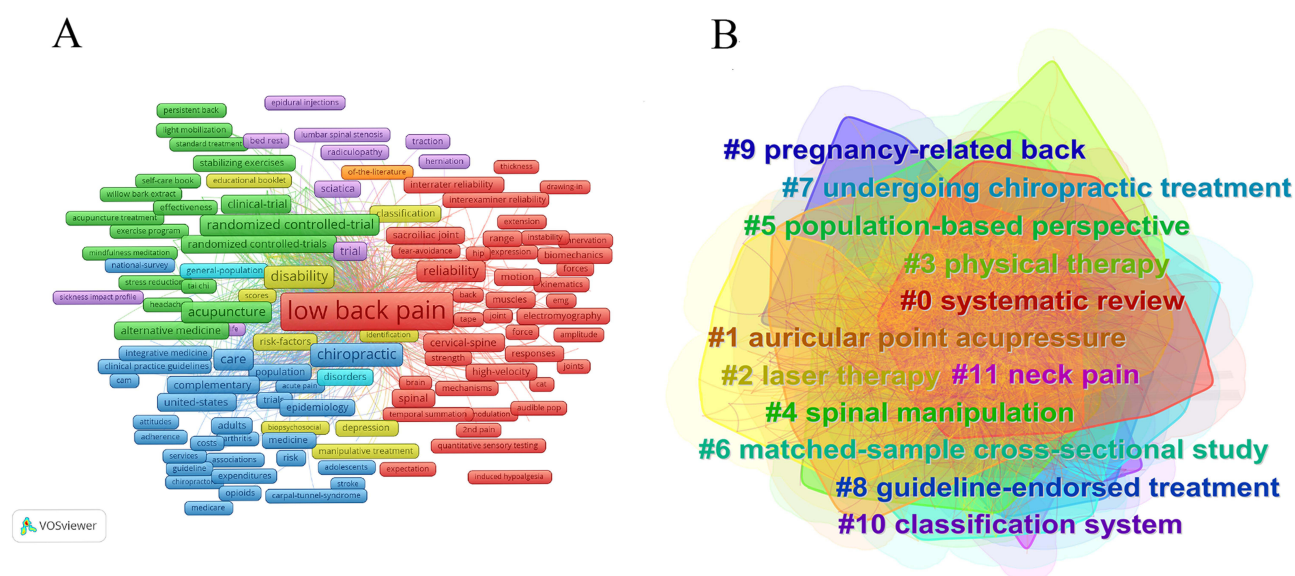
Figure 6 The analysis of keywords. (**A**) Co-occurrence analysis of keywords by overlay visualization. Nodes represent keywords, and the larger the node, the more times it appears. (**B**) Cluster analysis of keywords. The # in the figure represents clustering, and the keyword clustering map is generated according to LLR method. There are 12 clusters in total.

Keywords	Year	Strength	Begin	End	2000 – 2023
chiropractic manipulation	2000	13.77	**2000**	2004	
follow up	2000	10.35	**2000**	2005	
randomized clinical trial	2000	8.81	**2000**	2010	
physiotherapy	2000	6.69	**2000**	2007	
bed rest	2000	6.1	**2000**	2007	
cervical spine	2000	5.12	**2000**	2006	
pain	2001	4.93	**2001**	2008	
conservative treatment	2002	10.49	**2002**	2005	
centralization phenomenon	2000	7.48	**2003**	2009	
interrater reliability	2003	5.47	**2003**	2007	
sacroiliac joint	2000	5.13	**2004**	2006	
manipulation - spinal	2008	5.53	**2008**	2012	
clinical prediction rule	2005	10.11	**2009**	2013	
evidence informed management	2009	5.02	**2009**	2017	
osteopathic manipulative treatment	2014	4.98	**2014**	2020	
complementary and alternative medicine	2016	5.95	**2016**	2020	
chronic pain	2004	5.17	**2016**	2020	
clinical practice guideline	2001	5.49	**2017**	2021	
global burden	2017	4.96	**2017**	2021	
association	2010	8.6	**2018**	2023	
validity	2000	7.81	**2018**	2021	
chronic low back pain	2001	7.62	**2019**	2021	
musculoskeletal pain	2004	5.7	**2019**	2020	
depression	2004	5.28	**2019**	2020	
musculoskeletal manipulation	2007	5.51	**2021**	2023	

Figure 7 Top 25 Keywords with the Strongest Citation Bursts. The left end of the red line represents the time when the keyword appears, and the right end represents the time when it ends.

most citations (3157). The survey showed that the majority of patients with chronic pain received non-drug treatment, with one-third of them choosing massage therapy. Among these ten references, four were published in Annals of Internal Medicine,[43–46] one was published in Lancet,[8] one was published in Manual therapy[47] and three in European Spine

Figure 8 A network diagram of co-cited references. Nodes in the figure represent references, and the larger the number of citations, the higher. Wired representatives are cited in the same literature.

Journal.[48–50] Combined with Table 4, this indicated that these two journals were the core journals for the manipulation of LBP.

Top 25 References with the Strongest Citation Bursts in Figure 9, references with suddenly increasing citation bursts at different times represented current research hotspots.[51] By analyzing these references, we can predict the future

Table 5 Top 10 Cited References Related to MT for LBP

Title	First Author	Citations	Journal	Impact Factor (2022)	Publication Year	DOI
Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment[42]	Breivik, H.	3157	Eur J Pain	3.651	2006	10.1016/j.ejpain.2005.06.009
Diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of Physicians and the American Pain Society[43]	Chou, Roger	1945	Ann Intern Med	51.598	2007	10.7326/0003-4819-147-7-200710020-00006
Chapter 4. European guidelines for the management of chronic nonspecific low back pain[48]	Airaksinen, O.	1546	Eur Spine J	2.721	2006	10.1007/s00586-006-1072-1
Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: a Clinical Practice Guideline From the American College of Physicians[44]	Qaseem, A.	965	Ann Intern Med	51.598	2017	10.7326/M16-2367
Non-specific low back pain[8]	Maher, C.	917	Lancet	202.731	2017	10.1016/S0140-6736(16)30970–9

(*Continued*)

Table 5 (Continued).

Title	First Author	Citations	Journal	Impact Factor (2022)	Publication Year	DOI
An updated overview of clinical guidelines for the management of non-specific low back pain in primary care[49]	Koes, B. W.	794	Eur Spine J	2.721	2010	10.1007/s00586-010-1502-y
Chapter 3. European guidelines for the management of acute nonspecific low back pain in primary care[50]	van Tulder, M.	739	Eur Spine J	2.721	2006	10.1007/s00586-006-1071-2
A clinical prediction rule to identify patients with low back pain most likely to benefit from spinal manipulation: a validation study[45]	Childs, John D.	579	Ann Intern Med	51.598	2004	10.7326/0003-4819-141-12-200412210-00008
The mechanisms of manual therapy in the treatment of musculoskeletal pain: a comprehensive model[47]	Bialosky, J. E.	564	Man Ther	2.491	2009	10.1016/j.math.2008.09.001
Systematic review: strategies for using exercise therapy to improve outcomes in chronic low back pain[46]	Hayden, Jill A.	524	Ann Intern Med	51.598	2005	10.7326/0003-4819-142-9-200505030-00014

development trend of research. Among recent publications, the article with the strongest citation bursts was published in Annals of Internal Medicine, titled "Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians".[44] This article suggested that non-pharmacological treatment should be the first choice for both acute and chronic LBP, including exercise, acupuncture, MT, motor control training, progressive relaxation, and behavioral cognitive therapy. Moderate-quality evidence suggested that MT, compared with other therapies, can relieve pain and improve functional status in the short term.[52]
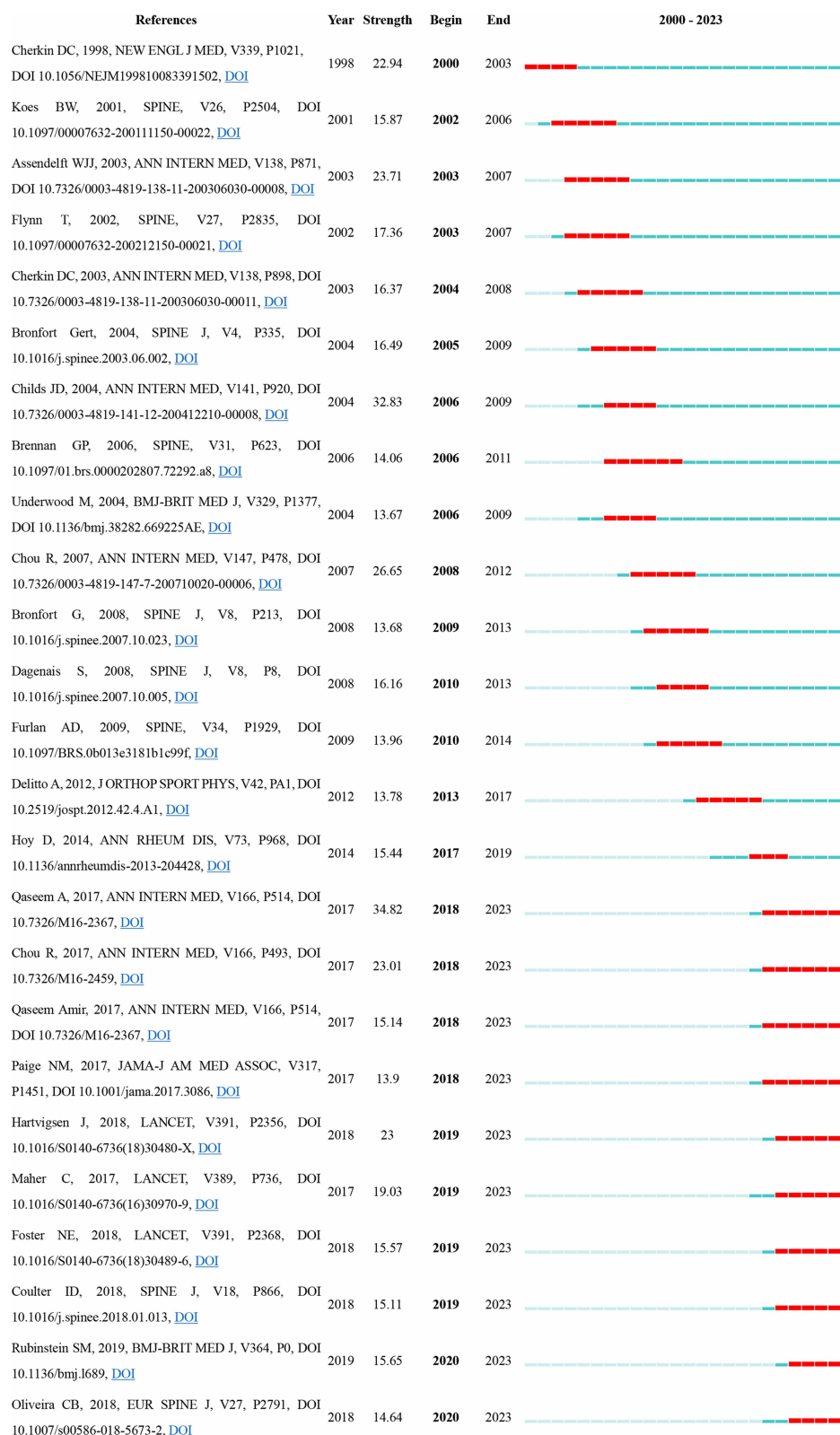
Discussion

The first study on MT for LBP was published in 1985.[53] The study divided 109 patients into three groups and treated them with short-wave diathermy, spinal manipulation, and placebo. The results showed that more than half of the three treatment groups had relief of LBP. Since then, the number of researchers involved in this field has increased steadily. However, there have been no global study to summarize and analyze the current research status.

Bibliometrics enables us to systematically explore academic literature and research findings in relevant fields. Recently, there has been an abundance of bibliometric analyses on LBP, including bibliometric analyses of non-specific LBP,[37] exercise intervention for LBP,[54] and acupuncture treatment for LBP.[55] However, there have been few bibliometric studies conducted on research related to MT of LBP, despite the numerous clinical trials conducted in this field. Through bibliometric analysis, we can assess the quality of existing research from the available literature, understand the current research activity, and explore the evidence level of the effects and potential influencing factors.

This study represents the first global bibliometric analysis of MT for LBP. We used VOSviewer and CiteSpace to analyze 1643 articles included in the WOSCC database and studied the research hotspots and future trends over the past 23 years. Since 2000, the number of publications has shown a steady upward trend, reaching a peak in 2020. Based on the current publishing trend, we predict that the number of publications will continue to grow steadily in the future.

In the field of MT of LBP, the United States is the most productive country, and the Canadian Memorial Chiropractic College is the most published research unit, Long, Cynthia R, who has the highest number of publications and the close collaborations with other authors. From the current thematic classification of MT for LBP, the main research content includes rehabilitation,[56] orthopedics, complementary medicine,[57] health care science,[34] neurology,[58,59] sports science, and other disciplines. Only 10% of LBP has a clear cause, while the majority is categorized as non-specific pain with an unknown cause. Non-specific LBP encompasses both acute and chronic cases, with acute pain lasting less than six weeks and chronic pain lasting more than three months.[60] Non-steroidal anti-inflammatory drugs and muscle relaxants have been found effective in treating acute LBP, whereas strong evidence supports the efficacy of manual and exercise therapy

References	Year	Strength	Begin	End	2000 - 2023
Cherkin DC, 1998, NEW ENGL J MED, V339, P1021, DOI 10.1056/NEJM199810083391502, DOI	1998	22.94	**2000**	2003	
Koes BW, 2001, SPINE, V26, P2504, DOI 10.1097/00007632-200111150-00022, DOI	2001	15.87	**2002**	2006	
Assendelft WJJ, 2003, ANN INTERN MED, V138, P871, DOI 10.7326/0003-4819-138-11-200306030-00008, DOI	2003	23.71	**2003**	2007	
Flynn T, 2002, SPINE, V27, P2835, DOI 10.1097/00007632-200212150-00021, DOI	2002	17.36	**2003**	2007	
Cherkin DC, 2003, ANN INTERN MED, V138, P898, DOI 10.7326/0003-4819-138-11-200306030-00011, DOI	2003	16.37	**2004**	2008	
Bronfort Gert, 2004, SPINE J, V4, P335, DOI 10.1016/j.spinee.2003.06.002, DOI	2004	16.49	**2005**	2009	
Childs JD, 2004, ANN INTERN MED, V141, P920, DOI 10.7326/0003-4819-141-12-200412210-00008, DOI	2004	32.83	**2006**	2009	
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Maher C, 2017, LANCET, V389, P736, DOI 10.1016/S0140-6736(16)30970-9, DOI	2017	19.03	**2019**	2023	
Foster NE, 2018, LANCET, V391, P2368, DOI 10.1016/S0140-6736(18)30489-6, DOI	2018	15.57	**2019**	2023	
Coulter ID, 2018, SPINE J, V18, P866, DOI 10.1016/j.spinee.2018.01.013, DOI	2018	15.11	**2019**	2023	
Rubinstein SM, 2019, BMJ-BRIT MED J, V364, P0, DOI 10.1136/bmj.l689, DOI	2019	15.65	**2020**	2023	
Oliveira CB, 2018, EUR SPINE J, V27, P2791, DOI 10.1007/s00586-018-5673-2, DOI	2018	14.64	**2020**	2023	

Figure 9 Top 25 References with the Strongest Citation Bursts. The left end of the red line represents the time when the reference appears, and the right end represents the time when it ends.

in treating chronic LBP.[61] Guidelines (supported by low to moderate strength evidence) recommend patient education, different types of exercise, and MT to reduce LBP within 20 weeks.[62] The mechanical force applied during MT initiates a series of neurophysiological responses from the peripheral and central nervous systems.[47] However, the deeper mechanisms require further investigation.

By the visual analysis of keywords and highly cited literature, the hotspots in this field focused on evidence-based medicine-related research such as manual strength and safety research,[10,63,64] Moreover, there is a growing emphasis on investigating the psychological state and quality of life of patients with LBP.[65] Yao et al[66] demonstrated that MT could potentially delay intervertebral disc aging by reducing oxidative stress through the Silent mating type information regulation two homolog-1/forkhead box O1 pathway. This finding holds great significance in improving the physical function of elderly individuals through non-drug and non-invasive MT. It is important to pay attention to LBP in special populations. A retrospective study revealed that pregnant women experiencing LBP are more likely to develop postpartum depression compared to those without such symptoms.[67] Pregnant women often seek MT to alleviate pregnancy-related back pain, which have shown significant benefits in reducing pain, improving mobility, and sleep quality.[68] However, more high-quality evidence is still required to confirm the reliability of these findings.

Due to varying research quality, there are certain differences in the classification of guidelines for the treatment of LBP.[69] There remains a shortage of high-quality randomized controlled trials concerning MT for LBP,[70–72] prompting researchers to prioritize exploring high-quality evidence, such as randomized controlled studies, matched sample cross sectional studies and meta analysis. Future focus areas will further delve into the normalization of MT, the efficacy of different intensity techniques, and the neurophysiological mechanisms of MT for LBP.

Limitation

Several limitations need to be noted regarding this study. First, only the data in WOS was selected, and the literature in other databases was not included. Second, due to language and time constraints, non-English papers and literature that were not within the set period were lost. In addition, due to the limitations of the software, the format of the case and abbreviation cannot be modified, and the setting of the threshold and clipping method may cause some data to be cropped.

Conclusion

MT of LBP has garnered increasing attention from scholars. This study systematically summarized the literature in this field through bibliometrics. Current research primarily focuses on the effectiveness and safety of MT, the neurophysiological mechanism involved, and the impact of pain on psychological states. Although there exists a certain research foundation in this area, high-quality evidence-based medicine evidence is still lacking. In the future, significant efforts will be dedicated to enhancing the quality of research in the field of MT for LBP. This will involve conducting rigorous and methodologically sound studies, including randomized controlled trials, matched sample cross-sectional studies, and meta-analyses, all supported by evidence-based medicine principles. Through these endeavors, the aim is to delve deeper into the intensity and standardization of MT techniques and ultimately establish its effectiveness in treating LBP. By emphasizing evidence-based approaches, this research will contribute valuable insights to the field and pave the way for further advancements in the understanding and practice of MT for LBP.

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Disclosure

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