

Current Perspectives and Trend of Acupuncture in Breast Cancer-Related Symptoms: A Bibliometric Study

Hanzhi Wang^{1,2,*}, Siying Qu^{2,*}, Tianshu Zhou^{3,*}, Qunqi Hu², Xiaoxuan Zhao¹, Qujia Yang^{1,2}, Hengyu Chi², Shiling Luo¹, Xinyue Li⁴, Huanxiao Ke^{1,2}, Xiaofen He⁵, Hongli Zhao¹

¹Department of Traditional Chinese Medicine (TCM) Gynecology, Hangzhou Hospital of Traditional Chinese Medicine Affiliated to Zhejiang Chinese Medical University, Hangzhou City, Zhejiang Province, People's Republic of China; ²Zhejiang Chinese Medical University, Hangzhou City, Zhejiang Province, People's Republic of China; ³Wenzhou Medical University, Wenzhou City, Zhejiang Province, People's Republic of China; ⁴Women's Hospital, School of Medicine, Zhejiang University, Hangzhou City, Zhejiang Province, People's Republic of China; ⁵Department of Neurobiology and Acupuncture Research, The Third Clinical Medical College, Zhejiang Chinese Medical University, Key Laboratory of Acupuncture and Neurology of Zhejiang Province, Hangzhou City, Zhejiang Province, People's Republic of China

*These authors contributed equally to this work

Correspondence: Xiaofen He, Department of Neurobiology and Acupuncture Research, The Third Clinical Medical College, Zhejiang Chinese Medical University, Key Laboratory of Acupuncture and Neurology of Zhejiang Province, Zhejiang Chinese Medical University, 548 Binwen Road, Binjiang District, Hangzhou City, Zhejiang Province, People's Republic of China, Email zjhxfl986@163.com; Hongli Zhao, Department of Traditional Chinese Medicine (TCM) Gynecology, Hangzhou Hospital of Traditional Chinese Medicine Affiliated to Zhejiang Chinese Medical University, 453 Tiyuchang Road, Xihu District, Hangzhou City, Zhejiang Province, People's Republic of China, Email z6hl@163.com

Purpose: This bibliometric research aims to delineate global publication trends and emerging research interests in the use of acupuncture for breast cancer (BC)-related symptoms treatment over the past three decades. Furthermore, it identifies influential institutions, potential collaborative partners, and future research trends, thereby providing guidance for relevant, novel research directions.

Methods: Scientific publications related to acupuncture for BC-related symptoms were gathered from the Web of Science Core Collection (WoSCC) from 1993 to 2023. Four software applications were principally used to analyze the resulting data: the “bibliometrix” package in the R environment (version 4.2.3), VOSviewer, CiteSpace6.1.R6, and the bibliometrics website. These applications were employed to evaluate different parameters.

Results: A total of 621 papers on acupuncture in BC-related symptoms treatment were analyzed. The United States, China, and South Korea contributed the most, with Memorial Sloan Kettering Cancer Center, and Columbia University leading institutions. It is interesting to mention that Mao, Jun J. and Molassiotis, A. feature among the top 10 authors and co-cited authors. JAMA is the leading journal, with an ongoing focus on acupuncture's effectiveness. Keywords show that the initial research focus was mainly on “vasomotor symptoms”, but in recent years there has been a gradual shift towards “pain”, “chemotherapy-induced peripheral neuropathy (CIPN)”, “electroacupuncture”, and “non-specific effects”.

Conclusion: Acupuncture has demonstrated a unique value in the process of adjuvant treatment of BC-related symptoms, and has been shown to be effective in reducing pain, eliminating fatigue, and improving quality of life. The study of the mechanisms of acupuncture and the application of electroacupuncture are possible future research priorities in this field. This study offers a deep perspective on acupuncture for BC research, highlighting key points and future trends.

Keywords: breast cancer-related symptoms, acupuncture, bibliometric study, cancer pain, CiteSpace, VOSviewer

Introduction

Breast cancer (BC) is the most common female malignancy, accounting for 30% of all female malignancies.¹ Globally, BC affects about 2.1 million people a year.² Due to early diagnosis and better treatments, the mortality rates in BC have steadily fallen in recent years.³ The most commonly used treatment approaches for BC include surgery, endocrine therapy, and chemotherapy.⁴ However, these treatments are accompanied by significant adverse effects.⁵ BC

survivors not only experience physical problems including pain and gastrointestinal reactions, but also mental problems such as insomnia and post-traumatic stress disorder.⁶ Multiple studies reported that 60% to 100% of BC patients experience at least one menopausal symptom,⁷ 36.2% of survivors suffered from post-mastectomy pain syndrome,⁸ and 2% to 77% suffered from lymphedema. Meanwhile, up to 32.2% of BC survivors were estimated to have negative emotions.⁹ As the long-term survival rate has gradually improved, more emphasis has been placed on assisting survivors in managing the side effects of BC therapy that may impact function and quality of life (QOL).

Finding a safe and effective strategy to enhance the QOL of BC survivors is critical. Based on suggestions from international clinical practice guideline development groups, acupuncture is a safe and ancient medical therapy for a number of cancer-related symptoms.¹⁰ Numerous clinical studies on the efficacy and safety of acupuncture for treating BC-related symptoms have been published over the past 30 years.¹¹ For example, acupuncture not only could significantly relieve joint pain associated with aromatase inhibitors among BC survivors,¹² but it could also minimize the opioid dose and treat opioid-related adverse effects.¹³ Meanwhile, Chien reported that acupuncture dramatically attenuated BC-related menopausal symptoms, and treatment gains were maintained up to 3 months after the completion of treatment.¹⁴ Therefore, analyzing the application trends, research status, and hotspots of acupuncture for BC-related symptoms is critical for use with acupuncture in clinical practice and deeper fundamental research.

Bibliometrics has been extensively used in diverse clinical fields as an emerging method in recent years.¹⁵ It is the application of statistical and mathematical techniques to scholarly publications, revealing multiple facets and study trends in that area.¹⁶ In addition, the quantity of bibliometrics literature has exponentially increased over the past few years. Citespace is the most commonly used information visualization software based on citation analysis theory.¹⁷ VOSviewer visualizes literature data in a multivariate, time-phased, and dynamic citation analysis language.^{16,18} Using the Bibliometric software to examine articles in the R language environment is simple and quick.¹⁹ In recent years, acupuncture-related bibliometrics have grown exponentially, including acupuncture for pain,²⁰ depression,²¹ and inflammation.¹⁷ To the best of our knowledge, acupuncture therapy's effects on BC-related symptoms have not yet been the subject of a thorough bibliometric analysis.

In this study, we use the bibliometric approach and scientific knowledge map to graphically analyze the research progress, current status, and hotspots of acupuncture for BC-related symptoms throughout the previous 30 years from multiple perspectives. We also predict future research trends in this area.

Material and Methods

Source of Data and Search Strategy

The data was gathered from the Web of Science Core Collection (WoSCC) database. The WoSCC was selected because it is the most extensive and frequently utilized database, embodying the most significant and appropriate journals.²² The search method included the topics “breast neoplasm” and “acupuncture therapy”, with the limited time set from 1993 to 2023. Literature that was an article or review was included, and the language was set to English. [Table 1](#) displays the precise search techniques and outcomes.

Data Collection and Analysis

The data were retrieved by two independent reviewers from the WoSCC database. Any differences were settled by the decision of a third senior reviewer. With the help of the intrinsic function of WoSCC, the publication features were analyzed to provide a number of bibliometric parameters, primarily the Hirsch index, yearly publications, the output of countries, journals and citations. Furthermore, the impact factor of every journal was calculated using the Journal Citation Reports 2022 edition.

Data were transformed to “txt” format, designated “download_*.txt”, and then loaded into the “bibliometrix” package in the R environment (version 4.2.3), VOSviewer, bibliometrics (<http://bibliometric.com/>), and CiteSpace V6.1.6 for analysis ([Figure 1](#)). The “bibliometrix” package in the R environment (version 4.2.3) function was used to automatically transform and analyze the bibliographic data of the selected articles. We analyzed information related to countries, the author's countries and keywords. The collaborative networks between institutions and authors were examined using

Table 1 The Topic Search Query

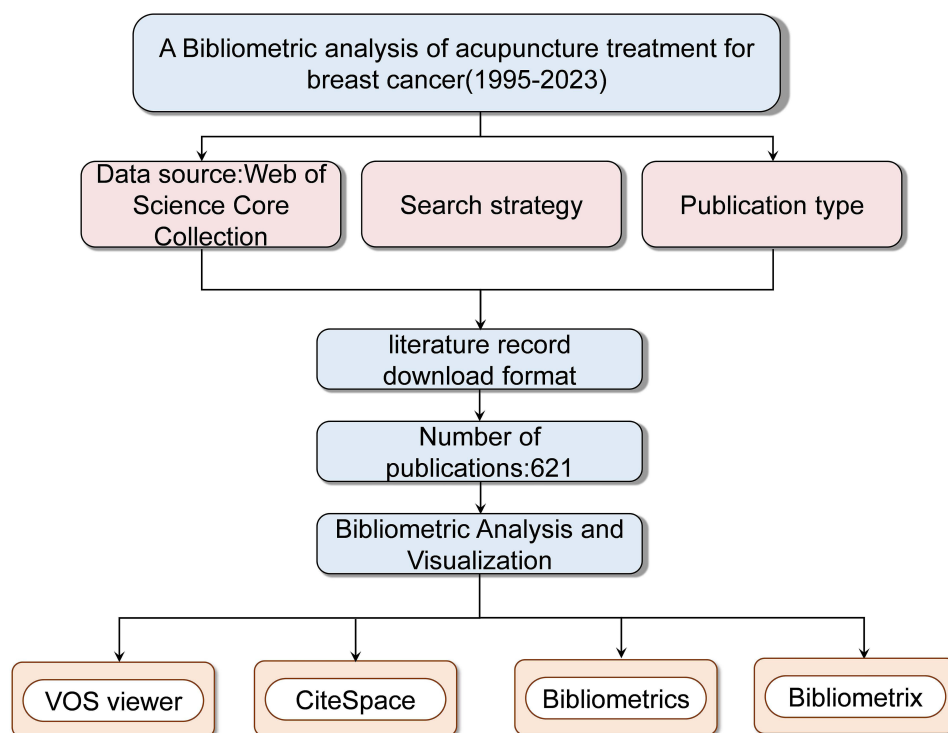
Set	Results	Search Query
#1	439,175	((TS=("breast neoplasm*" OR "breast neoplas*" OR "breast cancer*" OR "breast carcinoma*" OR "breast carcin*" OR "breast tumor*" OR "breast tumour*" OR "breast oncolog*" OR "mammary carcinoma*" OR "mammary cancer*" OR "mammary neoplasm*" OR "mammary tumor*" OR "mammary tumour*" OR "malignant neoplasm of breast" OR "malignant tumor of breast" OR "breast malignant tumor*" OR "cancer mammary" OR "carcinoma mammae" OR "cancer of breast")) AND DT=(Article OR Review)) AND LA=(English) Indexes=WoSCC, Timespan=1993-01-01 to 2023-03-21
#2	28,988	((TS=(acupunct* OR eletro-acupunct* OR electroacupunct* OR "acupuncture therapy" OR "acupuncture treatment*" OR "body acupuncture" OR "needle acupuncture" OR "manual acupuncture" OR "acupuncture points" OR electroacupuncture OR "warm acupuncture" OR moxibust* OR "acupuncture point*" OR "Auricular acupuncture" OR acupress* OR acupoint* OR auriculotherap* OR auriculoacupunct* OR meridian*)) AND DT=(Article OR Review)) AND LA=(English) Indexes=WoSCC, Timespan=1993-01-01 to 2023-03-21
#3	621	#1 AND #2

VOSviewer. The collaborative analysis of countries was specifically plotted using the bibliometrics website. CiteSpace's parameters were set as follows: (1) time slice: 1993–2023, 1 year per slice; (2) node type was chosen at a time; (3) 50 best items were used as selection criteria; (4) pruning: pathfinder. In addition, the timeline view of co-cited references and all items' keywords were captured, along with powerful citation burst maps.

Results

Analysis of Annual Publications

The volume of literature in a field and its changing trend can reflect the development stage. A total of 621 documents about acupuncture in BC research were included, including 442 "Articles" and 179 "Review Articles". Although the time frame of our search was nearly 30 years, [Figure 2](#) demonstrates that the first study in this field was published in 1995.

**Figure 1** Flow-chart of the study.

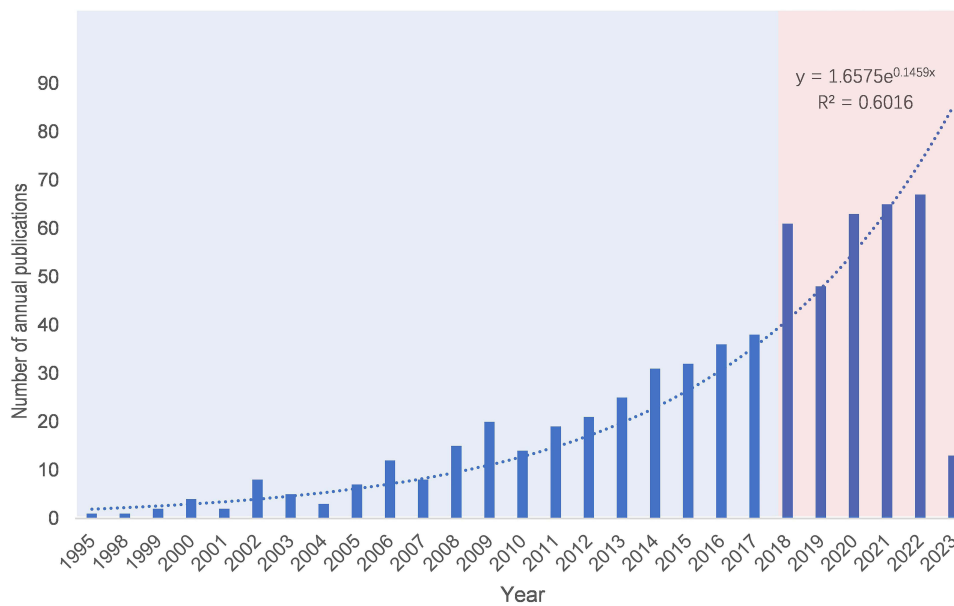


Figure 2 Annual trends of global scientific publications from 1995 to 2023.

From 1995 to the present, the number of publications shows a gradual upward trend over time. It is important to mention that there has been a substantial increase in 2018. Based on the time of publication and quantitative characteristics of the literature, research on acupuncture BC may be separated into two phases, namely the basic phase (1995–2017) and the significant growth phase (2018–2022). 272 documents were published, accounting for 51.04% of the total in Period 2. We anticipated that 85 papers would be written on acupuncture for BC in 2023 based on the fitting curve.

Analysis of Countries

Forty-nine countries published more than one paper on acupuncture for the BC study between 1995 and 2023. Table 2 depicts the ten most productive nations and regions. The USA published the most papers ($n = 226$, 36.39%), followed by China ($n = 159$, 25.60%) and South Korea ($n = 51$, 8.21%). USA had the most citations (8936 times), the highest H-index (49) and centrality (0.33). The map of cross-country collaborations shows the density of collaboration between countries

Table 2 Top 10 Productive Countries Related to Acupuncture for BC

Rank	Countries	Count	Centrality	H-Index	Citations
1	USA	226	0.33	49	8936
2	China	159	0.21	24	2014
3	The United Kingdom	51	0.19	24	2060
4	South Korea	51	0.16	16	883
5	Australia	41	0.04	14	907
6	Canada	34	0.03	14	1628
7	Germany	25	0.05	13	468
8	Israel	20	0	9	259
9	Italy	17	0.07	7	437
10	Sweden	14	0	9	433

(Figure 3A). The USA has research collaborations with many countries, with China Canada, and UK collaborating most closely. However, the level of collaboration between other countries is lower. In Figure 3B, we find that the USA has long been in first place in terms of annual postings until 2015. China’s annual publication volume jumped in 2015 and was roughly equal to the USA in the following years, surpassing it in 2019. As shown in Figure 3C and D, papers in acupuncture for BC were mostly published in North America, Asia, and European nations.

Analysis of Institutions

These papers were contributed by 1011 institutions, with a total of 161 papers being provided by the top 10 institutions, accounting for 25.93% of all the publications (Table 3). Memorial Sloan Kettering Cancer Center ranked first (n = 37, 5.96%), followed by Columbia University (n =17, 2.74%). Memorial Sloan Kettering Cancer Center is ranked first in terms of intermediary centrality, indicating that it is very influential in the field of acupuncture for BC. Meanwhile, we noticed that although Harvard University is only 7th in relation to the number of articles published, it is second in terms of intermediary centrality at 0.13, indicating that this institution is also making an important contribution to the field.

Authors and Co-Cited Authors

Over 3212 authors and 14,391 co-cited authors are included in this area of study. Among these authors, the top three were Mao, Jun J. (n = 27, 4.35%), Ben-arye, Eran (n = 15, 2.41%), and Bao, Ting (n = 12, 1.93%). The term “co-cited authors” refers to authors who have two (or more) writings referencing them at the same time. Among the leading 5 co-citation authors, Molassiotis, A. (n = 167, 26.89%) ranked first, followed by Mao, Jun J. (n = 144, 23.19%), and Deng G. (n = 110, 17.71%). Author/co-cited author collaboration network visualization is depicted in Figures 4A and B. There is close cooperation between authors, and the centrality of each author is much less than 0.1.

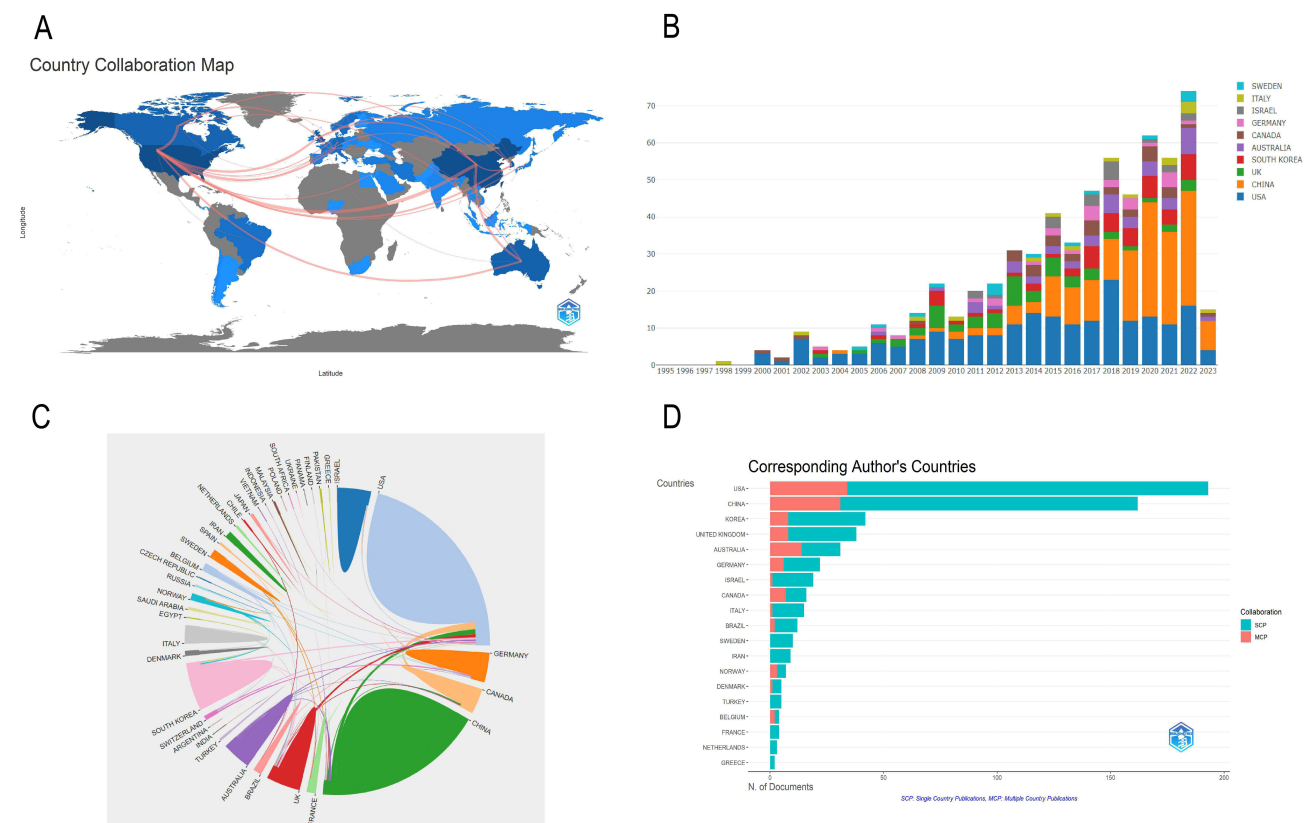


Figure 3 (A) Country Collaboration Map. (B) The changing trend of the annual publication quantity in the top ten countries from 1995 to 2023. (C) The international collaborations' visualization map of countries/regions. (D) Corresponding Author's Countries.

Table 3 The Top 10 Productive Institutions Ranked by the Numbers of Publications

Rank	Institutions	Count	Centrality	H-Index	Citations
1	Mem Sloan Kettering Canc Ctr	37	0.15	18	1404
2	Columbia Univ	17	0.13	12	1731
3	Beijing Univ Chinese Med	16	0.02	8	127
4	Shanghai Univ Tradit Chinese Med	15	0.03	5	149
5	Clalit Hlth Serv	14	0.04	8	119
6	China Acad Chinese Med Sci	13	0.05	8	202
7	Harvard Univ	13	0.13	17	1406
8	Univ Michigan	12	0.03	9	575
9	Korea Inst Oriental Med	12	0.08	8	209
10	Technion Israel Inst Technol	12	0.02	8	139

Analysis of Journals and Cited Journals

The 621 articles collected were allocated to 217 publications. The top 10 journals published roughly 32.37% of all publications (Table 4). Among them, Integrative Cancer Therapies ranked first (47 articles, 7.57%), followed by Supportive Care in Cancer (36 articles, 5.79%) and Journal of Alternative and Complementary Medicine (19 articles, 3.06%).

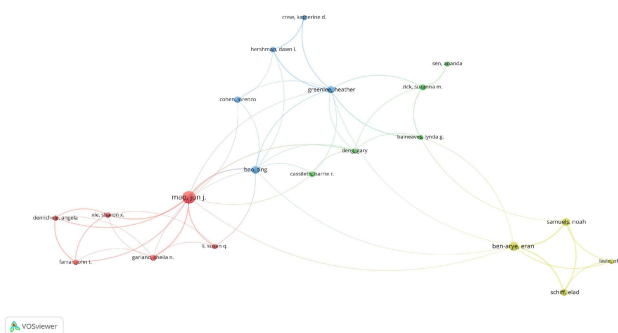
The top three co-cited journals were the Journal of Clinical Oncology, Support Care Cancer, and Breast Cancer Research and Treatment (Table 5). This suggests that these journals hold significance in acupuncture research for the treatment of BC. The Jama-Journal of the American Medical Association, with the highest impact factor (IF) of 157.335, was also quite active.

Figure 5 demonstrates that the majority of the articles were published in the field of “Medicine, Medical, and Clinical” on the left, with three important outward citation paths visualized as green curves, and they were significantly influenced by the fields of “Molecular, Biology, Genetics”, “Health, Nursing, Medicine”, and “Psychology Education Social”.

Analysis of References

Table 6 presents the top ten papers ranked by co-citation frequency in descending order. The ten most co-cited references include one clinical practice guideline, two systematic reviews, and seven clinical studies. Excitingly, one clinical study

A



B

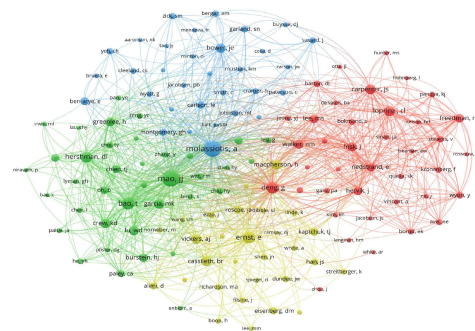
**Figure 4** A network map showing authors (A) or co-cited authors (B) involved in acupuncture in research in relation to BC.

Table 4 The Top 10 Journals Involved in Research on Acupuncture in Relation to BC

Rank	Journal	Count	Citations	IF	JCR
1	Integrative Cancer Therapies	47	719	3.077	Q2
2	Supportive Care in Cancer	36	687	3.359	Q1
3	Journal of Alternative and Complementary Medicine	19	492	2.381	Q3
4	Medicine	18	50	1.817	Q3
5	Breast Cancer Research and Treatment	17	773	4.624	Q2
6	Acupuncture in Medicine	16	277	1.976	Q3
7	Journal of Clinical Oncology	15	2181	50.717	Q1
8	Cancer	12	466	6.921	Q1
9	BMC Complementary and Alternative Medicine	11	170	4.782	Q1
10	Complementary Therapies in Clinical Practice	10	71	3.577	Q2

Table 5 The Top 10 Co-Cited Journals Involved in Research on Acupuncture in Relation to BC

Rank	Co-Cited Journals	Count	Centrality	IF	JCR
1	Journal of Clinical Oncology	478	0.01	50.717	Q1
2	Support Care Cancer	323	0.01	3.359	Q2
3	Cancer	308	0.01	6.921	Q1
4	Breast Cancer Research and Treatment	284	0.05	4.624	Q2
5	Journal of Alternative and Complementary Medicine	276	0.01	2.381	Q3
6	Integrative Cancer Therapies	261	0.02	3.077	Q2
7	Jama-Journal of the American Medical Association	246	0.02	157.335	Q1
8	Journal of Pain and Symptom Management	240	0.01	5.576	Q1
9	Acupuncture in Medicine	234	0.03	1.976	Q3
10	Complementary Therapies in Medicine	224	0.01	3.335	Q2

was the most cited paper in the area from 1993 to 2023. These references were published in important and renowned journals. The review that had the greatest centrality of co-cited sources was in the journal of BREAST.

According to the dynamics of the research area, [Figure 6](#) displays the top 25 references in the citation boom that occurred throughout the growth of acupuncture for BC research from 1993 to 2023. References with high strength levels are usually significant turning moments in the scientific mapping area. The milestone paper is a clinical trial of acupuncture on aromatase inhibitor-related joint pain.¹² This literature can be broadly categorized into two phases: the first phase of research focuses on clinical studies related to acupuncture for the treatment of vasodilatory symptoms of BC, especially hot flashes; the outbreak of literature in the last decade can be categorized as the second phase, where research is being transformed into clinical studies related to acupuncture for the treatment of pain and peripheral neuropathies of BC and related guidelines.

The cluster analysis of reference allowed us to observe those 10 clusters. Four of these clusters correlated with disease names, including #3 menopausal problem, #4 inhibitor-induced arthralgia, #6 reducing hot flash, and #7 night sweat. Another quartet focused on treatment techniques such as #0 cancer care, #1 acupuncture therapy, #2 alternative

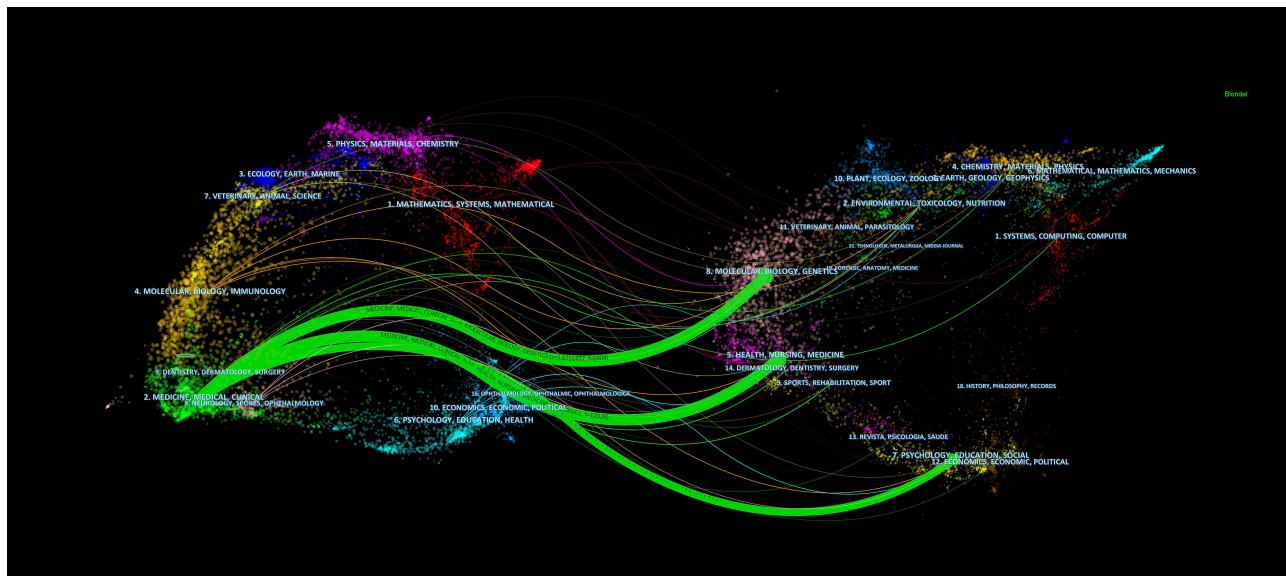


Figure 5 A network map showing Journals and Co-cited Journals involved in acupuncture in research in relation to BC.

therapeutic approaches, and #9 Chinese medicine. The top ten clusters that were most recently active included #1 acupuncture therapy, #4 inhibitor-induced arthralgia, and #5 nonspecific effects (Figure 7).

Analysis of Keywords

Publications yielded a total of 2171 keywords related to acupuncture for BC. Since 1993, a total of 25 keywords have experienced significant bursts. Figure 8 shows that keywords such as inhibitor-induced validation (2018–2023), inhibitor induced arthralgia (2019–2023), cancer pain (2019–2023), fatigue (2019–2023), therapy (2020–2023), induced peripheral neuropathy (2020–2023), safety (2020–2023), electroacupuncture (2021–2023), pain (2021–2023), and risk factor (2021–2023) have gained prominence in recent years. This indicates that research concerning these topics is currently garnering attention and signifies potential developmental trends in the field.

A cluster analysis of the keywords revealed 10 clusters. These clusters pertained mostly to disease name (#1, #3, #4), treatment (#0, #2, #5, #6, #8), and mechanism (#7). For a deeper exploration of characteristics of the temporal evolution

Table 6 Top 10 Co-Cited References with the Highest Frequency

Rank	Co-Cited Reference	Count	Centrality	IF
1	Hershman DL, 2018, J AM MED ASSOC, V320, P167	53	0.02	157.335
2	Greenlee H, 2017, CANCER J CLIN, V67, P195	45	0.03	286.13
3	Molassiotis A, 2012, J CLIN ONCOL, V30, P4470	34	0.01	50.717
4	Lesi G, 2016, J CLIN ONCOL, V34, P1795	31	0.08	50.717
5	Walker EM, 2010, J CLIN ONCOL, V28, P634	29	0.07	50.717
6	Mao JJ, 2014, EUR J CANCER, V50, P267	28	0.1	10.002
7	He YH, 2020, JAMA ONCOL, V6, P271	27	0.02	33.006
8	Hervik J, 2009, BREAST CANCER RES TR, V116, P311	26	0.07	4.624
9	Garcia MK, 2013, J CLIN ONCOL, V31, P952	26	0.05	50.717
10	Bokmand S, 2013, BREAST, V22, P320	25	0.15	4.254

Top 25 References with the Strongest Citation Bursts

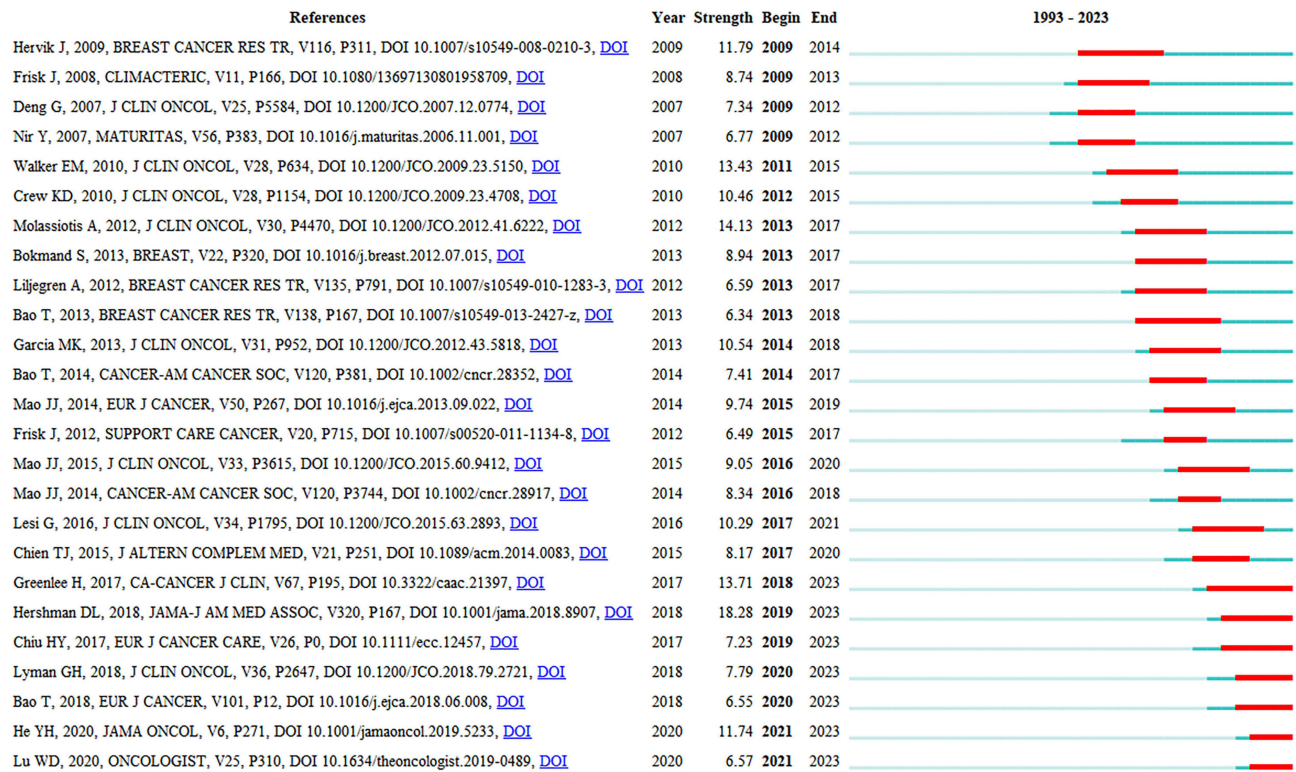


Figure 6 Top 25 references with the strongest citation bursts from 1995 to 2023.

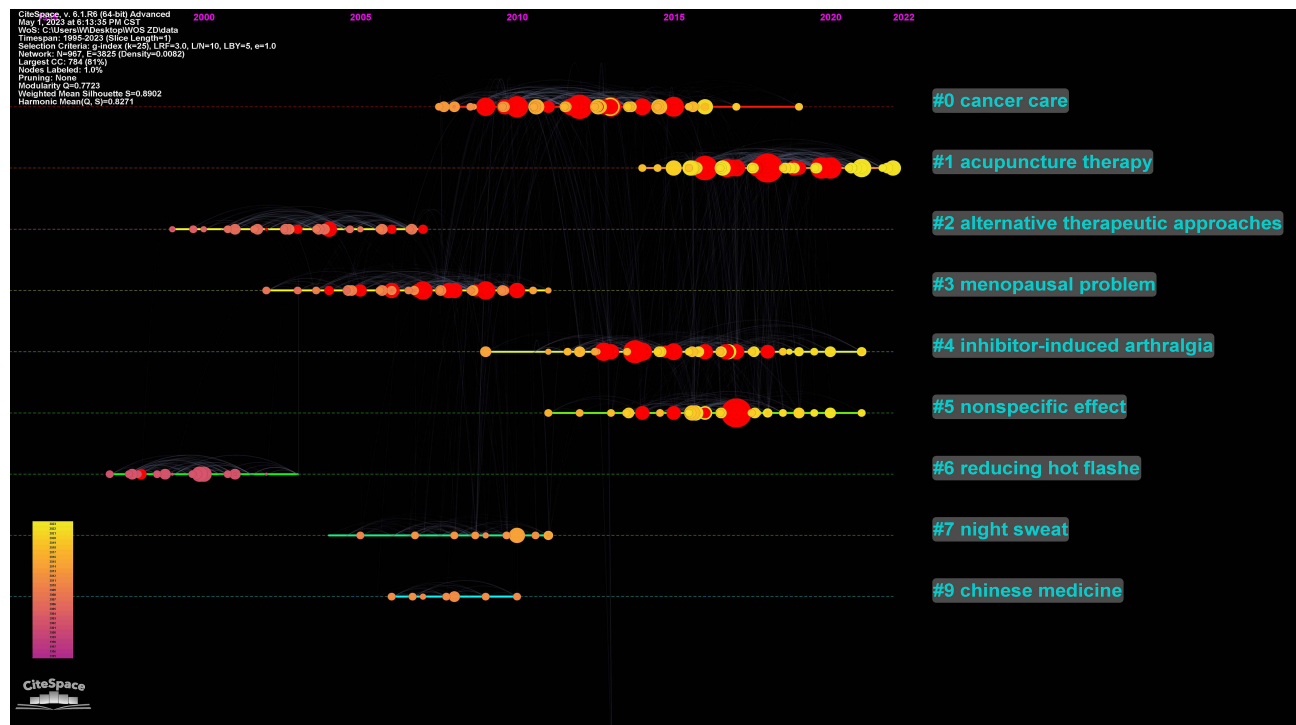


Figure 7 References cluster time-line map related to acupuncture on BC from 1995 to 2023.

Top 25 Keywords with the Strongest Citation Bursts

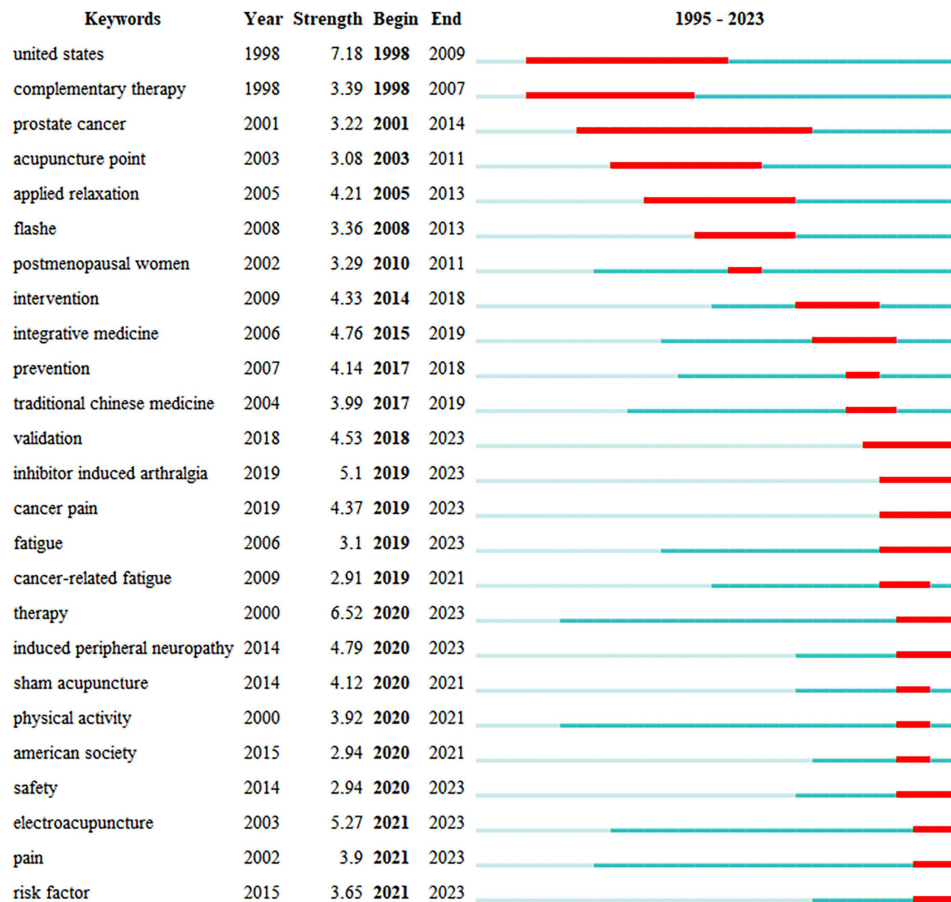


Figure 8 Top 25 keywords with the strongest citation bursts from 1995 to 2023.

of the knowledge base in acupuncture for BC, cluster analysis was performed using the timeline view tool of CiteSpace (Figure 9). The clusters that were most recently active included #0 complementary therapies, #1 hot flashes, #3 symptom cluster, #4 nausea, #5 trial, and #8 traditional Chinese medicine.

Thematic evolution maps offer an alternative perspective on identifying research hotspots and trends. From 1995 to 2012, the primary research focus was on “prevalence”. The mainstream research topic shifted to “Quality of life” during the years 2013–2016, while “fatigue” emerged as a novel keyword from 2017–2019. In particular, the research on acupuncture for BC from 2020 to 2023 showed a notable increase in the appearance of “mechanisms” and “expression” (Figure 10A).

Moreover, we constructed a thematic map of hotspots, as shown in Figure 10B. The upper right quadrant, exemplifying strong centrality and high density, indicates that the research themes symbolized by the keywords in this region are highly popular. Consequently, prevalent themes during the period 1993–2003 include “hypnosis”, “clinical oncology program”, “risk factors”, “validation”, and “functional assessment”.

Discussion

General Information

For this particular investigation, we conducted a thorough exploration of the WoSCC databases to locate articles related to acupuncture for BC that were published between 1995 and 2023. This scientometric study comprised 621 articles published in 217 journals by 1011 institutions in 49 countries.

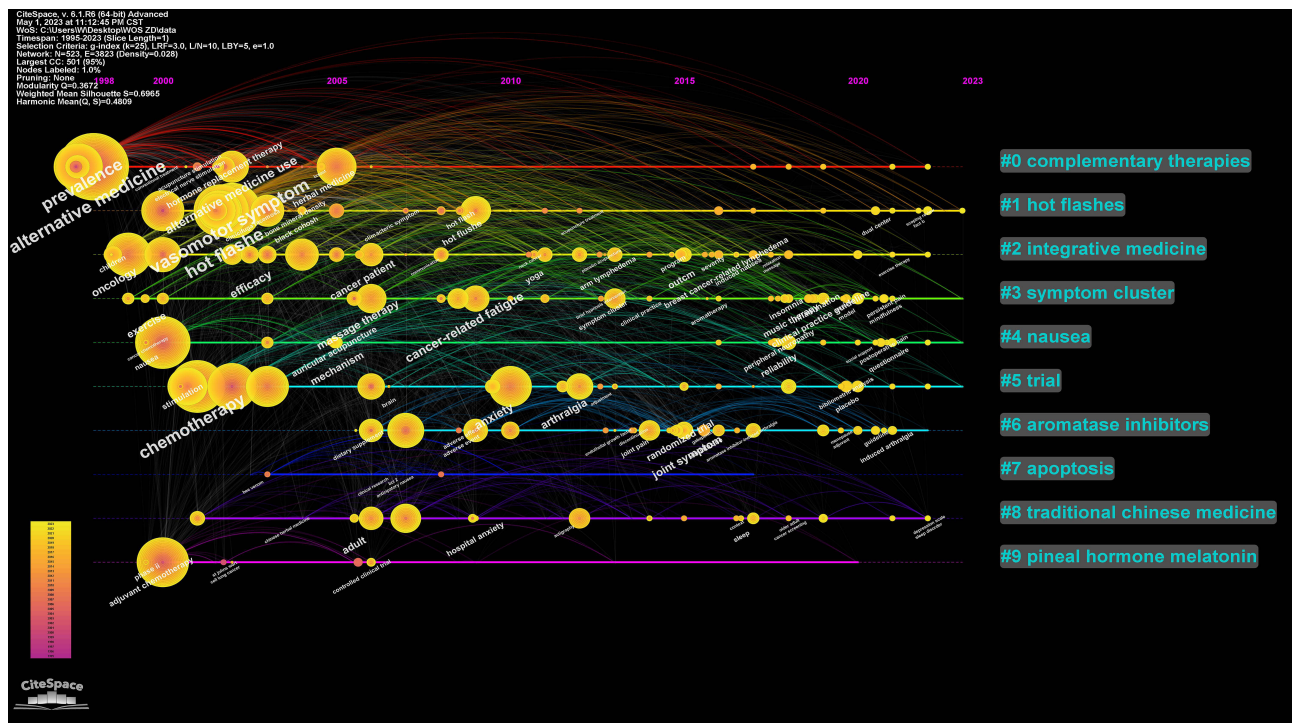


Figure 9 Keyword cluster time-line map related to acupuncture on BC from 1995 to 2023.

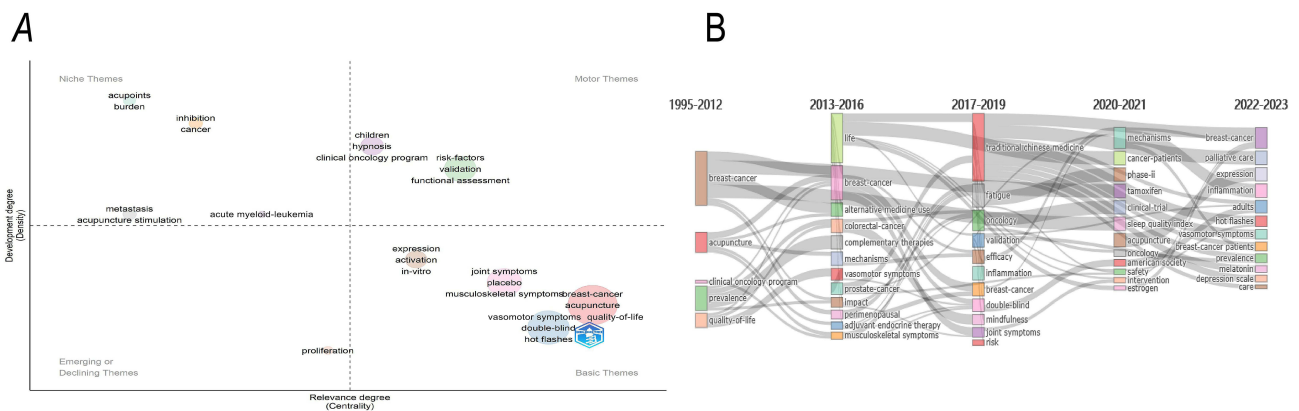


Figure 10 (A) Thematic map of keywords. (B) Keyword evolution analysis.

We can classify three-decades of development into two periods as the basic phase (1995–2017) and the significant growth phase (2018–2022). There was an increased number of patients developing complications such as pain, acupuncture has been widely used with its unique advantages in analgesia.²³ Aromatase inhibitors (AIs) have been included in the 2018 treatment guidelines for BC. About half of women who take AIs develop arthritis-like joint stiffness and pain, some clinical evidence suggests that acupuncture can successfully manage joint stiffness and pain.²⁴ Consequently, research on BC acupuncture therapy-related research has developed to a new level.

The number of articles published in the USA was far in advance and had taken the lead. One in eight women is likely to have BC, indicating that the USA is a country with a high rate of BC.²⁵ That could be hundreds of millions of dollars a year in research funding in the United States.²⁶ China was the only developing nation among these ten most published countries, which is closely linked with the increased provision in the medical field.²⁷ Memorial Sloan Kettering Cancer

Center, established in 1884, is consistently ranked in the top two of the best hospitals in the United States for cancer specialties. Mao Jun J., Bao Ting and Deng Gary are leading members of the institution researching the field.

The top four active authors were from the United States. This finding may mean that US researchers have made a significant contribution to this study. In terms of co-cited authors, the top ranking was Molassiotis Alex, followed by Mao Jun J. and Deng Gary. Molassiotis Alex (The Hong Kong Polytechnic University) is widely recognized for his substantial contributions to the development of clinical practice guidelines for evidence-based combination therapy for BC.²⁸ Mao Jun J.'s research is important for reducing peripheral neuropathy induced by neoadjuvant paclitaxel in BC patients.²⁹ Deng Gary focused on the study of acupuncture for dyspnea in BC patients and chronic fatigue after chemotherapy.³⁰

Knowledge Base

The top 10 co-cited journals are mostly top-tier publications and consist of seven clinical trials, two reviews, and one clinical practice recommendation. Seven clinical studies outline the process of discovery and development of acupuncture for BC-related symptoms. The seven clinical studies included acupuncture for vasodilatory symptoms in women with BC-related symptoms,^{31–34} aromatase inhibitor-related joint pain,^{12,35} and cancer-caused fatigue.³⁶ Research shows acupuncture's increasing popularity as an alternative medicine worldwide due to its effectiveness. A high-IF study by Hershman included 226 early-stage BC patients who were taking AIs through a multicenter collaboration. They concluded that the true acupuncture group significantly reduced joint pain at 6 weeks.¹² However, accuracy issues were found in their test results.

Three articles, consisting of one clinical practice guideline and two systematic reviews, were examined. Meta-analyses and systematic reviews of *RCT* showed that acupuncture is effective in reducing cancer pain, nausea and can reduce the use of painkillers.^{37,38} Additionally, in 2017, the Society for Integrative Oncology issued a clinical practice guideline that highlighted the role of acupuncture in symptom relief and acupuncture for the treatment of chemotherapy-induced nausea and vomiting (CINV) with a "B" grade of recommendation.²⁸

Research Hotspots

The research hotspots, in addition to the symptoms such as pain and vasodilatory symptoms, which are also focused on QOL and electroacupuncture, are major highlights of the treatment.

Over 70% of advanced cancer patients experience moderate to severe pain,³⁹ adding to the current opioid crisis and highlighting the need for nonpharmacological treatments.⁴⁰ An evidence-based guideline strongly recommends acupuncture for arthralgia-induced pain,¹³ especially in patients receiving aromatase inhibitors. A network meta-analysis of 17 RCTs involving 1516 participants ranked acupuncture as the top intervention for improving pain intensity,⁴¹ showing acupuncture plays a great role in pain management. Apart from this, multiple RCTs suggested acupuncture can reduce CINV,⁴² despite its limited role in prevention.⁴³ Importantly, acupuncture can also alleviate vasomotor symptoms like hot flashes and night sweats, which are prevalent in 65% of postmenopausal BC patients.⁴⁴ As the number of survivors increases, addressing these symptoms becomes crucial.⁴⁵ Hormone replacement therapy (HRT), often used for hot flashes, is controversial in BC patients.⁴⁶ Clinical studies have shown that acupuncture is effective in relieving hot flashes without elevating estradiol levels or inducing cancer recurrence.³³ The underlying mechanism of acupuncture, possibly by increasing in endorphin levels and reducing the level of the potent vasodilator calcitonin gene-related peptide continues to be a focus.⁴⁷ Moreover, acupuncture seems to significantly improve night sweats in BC survivors.⁴⁸ Measuring treatment effects on QOL is crucial, particularly for BC patients undergoing therapies such as anthracyclines (ANT), which often have significant side effects.^{49,50} Acupuncture is effective in the secondary prevention of myelosuppression during chemotherapy, and QOL improves in women during treatment.⁵¹

Electroacupuncture, which combines electrostimulation and traditional acupuncture needling, cannot only improve treatment efficiency but also be a targeted route of drug delivery. Preliminary findings suggest electroacupuncture can promote paclitaxel accumulation by altering the microvasculature and microenvironment of mouse BC tumors.⁵² In addition, electroacupuncture significantly induced apoptosis in the tumors.⁵³ Mechanistic analyses have shown that electroacupuncture has been shown to directly decrease triple-negative breast cancer (TNBC) tumor growth by inhibiting

proteins involved in tumor angiogenesis and extracellular matrix, suppressing triple-negative BC-induced inflammation, and upregulating nerve growth factor receptors.⁵⁴ Therefore, future studies should focus on how acupuncture plays various roles in a more targeted way during each stage of BC.

Research Frontiers

Pain is not only a current research hotspot; we predict that it is also a future research trend. In order to better investigate and characterize the cutting-edge field, we conducted a keyword and co-citation analysis of the keywords and co-cited literature for emergence and clustering. Current studies focused on “chemotherapy-induced peripheral neuropathy (CIPN)”, “cancer-related fatigue (CRF)” and “nonspecific effect”.

CIPN poses a significant clinical issue for BC patients,⁵⁵ with a prevalence rate ranging between 30% and 97%.⁵⁶ Mostly, it results in paresthesia and pain, which, according to the current interventions, are not sufficiently addressed.⁵⁵ However, promising evidence from acupuncture studies suggests pain reduction and enhanced nerve conduction in CIPN patients.⁵⁷ While findings from a phase IIA trial indicate acupuncture’s potential in reducing CIPN’s severity among BC patients undergoing neoadjuvant therapy,²⁹ it is essential to note the necessity for larger-scale studies to solidify these conclusions.

CRF has received inadequate attention, diagnosis, and care. A Study tracking fatigue trajectories in BC patients found that high fatigue is often accompanied by depressive tendencies and higher rates of sleep disorders.⁵⁸ A randomized controlled study found that acupuncture relieved physical and psychological fatigue and reduced the incidence of anxiety and depression.³⁶ Acupuncture should be advocated as an effective alternative therapy for CRF patients, particularly those with BC.⁵⁹ According to research, acupuncture works to reduce fatigue by influencing the variety and amount of intestinal bacteria, enhancing intestinal barrier performance, and modifying brain gut peptides.⁶⁰ With the advancement of genome and transcriptome sequencing, they showed that acupuncture can improve CRF in BC by blocking the Leptin/AMPK signaling pathway and thereby minimizing mitochondrial functional impairment.⁶¹ While acupuncture presents several potential benefits in BC treatment, particularly in managing CIPN and CRF, future studies need to provide larger samples and maintain stringent controls to ensure the results’ validity and reliability.

Increasing evidence shows that acupuncture therapy has nonspecific effects in addition to specific therapeutic effects.⁶² Meta-analysis has shown that the clinical efficacy of “comfort needling” is also influenced by nonspecific effects and that comfort needling has some specific potency due to the contact of the treatment modality with the skin, resulting in the projection of somatosensory fibers to various brainstem nuclear area and hypothalamus.⁶³ Acupuncture does not only provide analgesia by suppressing the sensation of pain, but it can also provide analgesia by intervening on emotions and cognitions (expectations) to relieve the sensation of pain.⁶⁴ To further measure the specificity impact of acupuncture and to encourage the growth of acupuncture on a global scale, sham acupuncture control should be implemented in a way that minimizes the influence of factors such as patient-doctor communication, patients’ expectations, and the attitude of the practitioner.

Strengths and Limitations

Our study provides a systematic analysis of acupuncture treatment for BC-related symptoms, which can provide some guidance. We also used multiple bibliometric programs to analyze the research hotspots and trends in multiple dimensions. However, this study has several drawbacks. First, we just included articles from WoSCC. Again, the retrieved articles were limited to those published in English. Finally, complete annual data for 2023 is not yet available, new hotspot areas may have been missed, and further updates are needed for future studies.

Conclusion

In summary, acupuncture treatment for BC-related symptoms is a challenging subject in clinical and basic research. Acupuncture treatment for BC-related symptoms is a relatively new field, receiving increased attention since 2018. The use of acupuncture in symptom management of BC has been broadening and the scope of research has gradually overstepped from single symptom management to an integrated oncology treatment model. A number of clinical trials have been conducted to validate the efficacy and safety of acupuncture therapy for the treatment of BC-related symptoms, with studies focusing on acupuncture’s improvement of BC-related

symptoms and adverse effects after BC treatment. There are increasing studies on acupuncture in the treatment of pain, vasodilatory symptoms, CIPN, and CRF. These are important for promoting the use of acupuncture therapy and improving the quality of life of BC patients. Improving these symptoms and studying their mechanisms will be the focus of future research. In the future, basic and translational research should be carried out to reveal the mechanism of the effect of acupuncture and moxibustion, and at the same time, multi-center and large sample RCTs should be conducted to provide more credible data, and multi-methods combination therapy research should be carried out to enrich and standardize the treatment of breast cancer, so as to bring about a new development and change in the field.

Data Sharing Statement

The data can be acquired directly from the WoSCC.

Ethics Approval

This article does not contain any studies involving either human or animal subjects, thus, institutional review board ethical approval was not required.

Acknowledgments

We thank all of the publications and writers who contributed to this study.

Author Contributions

All authors agreed to submit the work to the current journal, gave final approval of the version to be published, and agreed to be responsible for all aspects of the work. They also all actively participated in the conception and design, acquisition, analysis, and interpretation of the data, contributed significantly to the article's writing, or critically revised it for important intellectual content.

Funding

This research was supported by the National Natural Science Foundation of China (No. 81804181) and the Hangzhou Science and Technology Development Plan Project (No. 202004A13).

Disclosure

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

References

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. *CA Cancer J Clin.* 2020;70(1):7–30. doi:10.3322/caac.21590
2. Malla R, Marni R, Chakraborty A, et al. Diallyl disulfide and diallyl trisulfide in garlic as novel therapeutic agents to overcome drug resistance in breast cancer. *J Pharm Anal.* 2022;12(2):221–231. doi:10.1016/j.jpha.2021.11.004
3. Ce D, M J, Mm G, et al. Breast cancer statistics, 2019. *Ca A Cancer J Clin.* 2019;69(6). doi:10.3322/caac.21583
4. Harbeck N, Penault-Llorca F, Cortes J, et al. Breast cancer. *Nat Rev Dis Primers.* 2019;5(1):1–31. doi:10.1038/s41572-019-0111-2
5. McEvoy MP, Ravetch E, Patel G, et al. Prevention of Breast Cancer-Related Lymphedema. *Clin Breast Cancer.* 2021;21(2):128–142. doi:10.1016/j.clbc.2021.02.009
6. Zhang XW, Hou WB, Pu FL, et al. Acupuncture for cancer-related conditions: an overview of systematic reviews. *Phytomedicine.* 2022;106:154430. doi:10.1016/j.phymed.2022.154430
7. Mazor M, Lee K, Dhruva A, et al. Menopausal-related symptoms in women one year after breast cancer surgery. *J Pain Symptom Manage.* 2018;55(4):1138–1151.e1. doi:10.1016/j.jpainsymman.2017.11.030
8. Cui L, Fan P, Qiu C, et al. Single institution analysis of incidence and risk factors for post-mastectomy pain syndrome. *Sci Rep.* 2018;8:11494. doi:10.1038/s41598-018-29946-x
9. Pilevarzadeh M, Amirshahi M, Afsargharehbagh R, et al. Global prevalence of depression among breast cancer patients: a systematic review and meta-analysis. *Breast Cancer Res Treat.* 2019;176(3):519–533. doi:10.1007/s10549-019-05271-3
10. Birch S, Lee MS, Alraek T, et al. Evidence, safety and recommendations for when to use acupuncture for treating cancer related symptoms: a narrative review. *Integr Med Res.* 2019;8(3):160–166. doi:10.1016/j.imr.2019.05.002
11. Abbasi J. Can acupuncture keep women on their breast cancer drugs? *JAMA.* 2018;320(8):744–746. doi:10.1001/jama.2018.11068
12. Hershman DL, Unger JM, Greenlee H, et al. Effect of acupuncture vs sham acupuncture or waitlist control on joint pain related to aromatase inhibitors among women with early-stage breast cancer: a randomized clinical trial. *JAMA.* 2018;320(2):167–176. doi:10.1001/jama.2018.8907

13. Ge L, Wang Q, He Y, et al. Acupuncture for cancer pain: an evidence-based clinical practice guideline. *Chin Med*. 2022;17(1):8. doi:10.1186/s13020-021-00558-4
14. Chien TJ, Liu CY, Fang CJ, et al. The maintenance effect of acupuncture on breast cancer-related menopause symptoms: a systematic review. *Climacteric*. 2020;23(2):130–139. doi:10.1080/13697137.2019.1664460
15. Liu C, Yu R, Zhang J, et al. Research hotspot and trend analysis in the diagnosis of inflammatory bowel disease: a machine learning bibliometric analysis from 2012 to 2021. *Front Immunol*. 2022;13:972079. doi:10.3389/fimmu.2022.972079
16. Thompson DF, Walker CK. A descriptive and historical review of bibliometrics with applications to medical sciences. *Pharmacotherapy*. 2015;35(6):551–559. doi:10.1002/phar.1586
17. Li R, Sun J, Hu H, et al. Research trends of acupuncture therapy on knee osteoarthritis from 2010 to 2019: a bibliometric analysis. *J Pain Res*. 2020;13:1901–1913. doi:10.2147/JPR.S258739
18. Pei Z, Chen S, Ding L, et al. Current perspectives and trend of nanomedicine in cancer: a review and bibliometric analysis. *J Control Release*. 2022;352:211–241. doi:10.1016/j.jconrel.2022.10.023
19. Cai M, Ni Z, Yuan Z, et al. Past and present: a bibliometric study on polycystic ovary syndrome. *J Ovarian Res*. 2023;16(1):42. doi:10.1186/s13048-022-01072-3
20. Jiao H, Ding R, Jin P, et al. Knowledge mapping of international research on acupuncture for chronic pain: a bibliometric analysis. *J Pain Res*. 2022;15:3711–3728. doi:10.2147/JPR.S392796
21. Xiang H, Li J, Li B, et al. Trends of acupuncture therapy on depression from 2011 to 2020: a bibliometric analysis. *Front Psychol*. 2021;12:721872. doi:10.3389/fpsyg.2021.721872
22. Dong R, Wang H, Ye J, et al. Publication trends for alzheimer's disease worldwide and in china: a 30-year bibliometric analysis. *Front Hum Neurosci*. 2019;13:259. doi:10.3389/fnhum.2019.00259
23. Giordano SH, Elias AD, Gradishar WJ. NCCN guidelines updates: breast cancer. *J Natl Compr Canc Netw*. 2018;16(5S):605–610. doi:10.6004/jccn.2018.0043
24. Hershman DL, Unger JM, Crew K. Acupuncture for aromatase inhibitor-related joint pain among breast cancer patients. *JAMA*. 2018;320(21):2270–2271. doi:10.1001/jama.2018.16744
25. Khosla A, Desai D, Singhal S, et al. Racial and regional disparities in deaths in breast cancer. *Med Oncol*. 2023;40(7):210. doi:10.1007/s12032-023-02083-w
26. Singer DS, Jacks T, Jaffee EAUS. “Cancer MOONSHOT” to accelerate cancer research. *Science*. 2016;353(6304):1105–1106. doi:10.1126/science.aai7862
27. Lancet T. Reforming research in China. *Lancet*. 2007;369(9565):880. doi:10.1016/S0140-6736(07)60419-X
28. Greenlee H, DuPont-Reyes MJ, Balneaves LG, et al. Clinical practice guidelines on the evidence-based use of integrative therapies during and after breast cancer treatment. *CA Cancer J Clin*. 2017;67(3):194–232. doi:10.3322/caac.21397
29. Bao T, Seidman AD, Piulson L, et al. A phase IIA trial of acupuncture to reduce chemotherapy-induced peripheral neuropathy severity during neoadjuvant or adjuvant weekly paclitaxel chemotherapy in breast cancer patients. *Eur J Cancer*. 2018;101:12–19. doi:10.1016/j.ejca.2018.06.008
30. Deng G, Chan Y, Sjoberg D, et al. Acupuncture for the treatment of post-chemotherapy chronic fatigue: a randomized, blinded, sham-controlled trial. *Support Care Cancer*. 2013;21(6):1735–1741. doi:10.1007/s00520-013-1720-z
31. Lesi G, Razzini G, Musti MA, et al. Acupuncture as an integrative approach for the treatment of hot flashes in women with breast cancer: a prospective multicenter randomized controlled trial (AcCliMaT). *J Clin Oncol*. 2016;34(15):1795–1802. doi:10.1200/JCO.2015.63.2893
32. Hervik J, Mjåland O. Acupuncture for the treatment of hot flashes in breast cancer patients, a randomized, controlled trial. *Breast Cancer Res Treat*. 2009;116(2):311–316. doi:10.1007/s10549-008-0210-3
33. Bokmand S, Flyger H. Acupuncture relieves menopausal discomfort in breast cancer patients: a prospective, double blinded, randomized study. *Breast*. 2013;22(3):320–323. doi:10.1016/j.breast.2012.07.015
34. Walker EM, Rodriguez AI, Kohn B, et al. Acupuncture versus venlafaxine for the management of vasomotor symptoms in patients with hormone receptor-positive breast cancer: a randomized controlled trial. *J Clin Oncol*. 2010;28(4):634–640. doi:10.1200/JCO.2009.23.5150
35. Mao JJ, Xie SX, Farrar JT, et al. A randomised trial of electro-acupuncture for arthralgia related to aromatase inhibitor use. *Eur J Cancer*. 2014;50(2):267–276. doi:10.1016/j.ejca.2013.09.022
36. Molassiotis A, Bardy J, Finnegan-John J, et al. Acupuncture for cancer-related fatigue in patients with breast cancer: a pragmatic randomized controlled trial. *J Clin Oncol*. 2012;30(36):4470–4476. doi:10.1200/JCO.2012.41.6222
37. Garcia MK, McQuade J, Haddad R, et al. Systematic review of acupuncture in cancer care: a synthesis of the evidence. *J Clin Oncol*. 2013;31(7):952–960. doi:10.1200/JCO.2012.43.5818
38. He Y, Guo X, May BH, et al. Clinical evidence for association of acupuncture and acupressure with improved cancer pain: a systematic review and meta-analysis. *JAMA Oncol*. 2020;6(2):271–278. doi:10.1001/jamaoncol.2019.5233
39. Portenoy RK. Treatment of cancer pain. *Lancet*. 2011;377(9784):2236–2247. doi:10.1016/S0140-6736(11)60236-5
40. Lyman GH, Greenlee H, Bohlke K, et al. Integrative therapies during and after breast cancer treatment: ASCO endorsement of the SIO clinical practice guideline. *J Clin Oncol*. 2018;36(25):2647–2655. doi:10.1200/JCO.2018.79.2721
41. B K, L G, C S, et al. Comparison of the clinical effectiveness of treatments for aromatase inhibitor-induced arthralgia in breast cancer patients: a systematic review with network meta-analysis. *Crit Rev Oncol Hematol*. 2023;181. doi:10.1016/j.critrevonc.2022.103898.
42. Li QW, Yu MW, Yang GW, et al. Effect of acupuncture in prevention and treatment of chemotherapy-induced nausea and vomiting in patients with advanced cancer: study protocol for a randomized controlled trial. *Trials*. 2017;18(1):185. doi:10.1186/s13063-017-1927-2
43. Qw L, Mw Y, Xm W, et al. Efficacy of acupuncture in the prevention and treatment of chemotherapy-induced nausea and vomiting in patients with advanced cancer: a multi-center, single-blind, randomized, sham-controlled clinical research. *Chin Med*. 2020;15. doi:10.1186/s13020-020-00333-x
44. Carpenter JS, Johnson D, Wagner L, et al. Hot flashes and related outcomes in breast cancer survivors and matched comparison women. *Oncol Nurs Forum*. 2002;29(3):E16–25. doi:10.1188/02.ONF.E16-E25
45. Mom CH, Buijs C, Willems PHB, et al. Hot flashes in breast cancer patients. *Crit Rev Oncol Hematol*. 2006;57(1):63–77. doi:10.1016/j.critrevonc.2005.04.009
46. Kronenberg F. Hot flashes: phenomenology, quality of life, and search for treatment options. *Exp Gerontol*. 1994;29(3–4):319–336. doi:10.1016/0531-5565(94)90012-4

47. Filshie J, Bolton T, Browne D, et al. Acupuncture and self acupuncture for long-term treatment of vasomotor symptoms in cancer patients--audit and treatment algorithm. *Acupunct Med.* 2005;23(4):171–180. doi:10.1136/aim.23.4.171
48. de Valois B, Young T, Thorpe P, et al. Acupuncture in the real world: evaluating a 15-year NADA auricular acupuncture service for breast cancer survivors experiencing hot flushes and night sweats as a consequence of adjuvant hormonal therapies. *Support Care Cancer.* 2022;30(6):5063–5074. doi:10.1007/s00520-022-06898-7
49. Bottomley A, Therasse P. Quality of life in patients undergoing systemic therapy for advanced breast cancer. *Lancet Oncol.* 2002;3(10):620–628. doi:10.1016/s1470-2045(02)00876-8
50. Rosenberg SM, Stanton AL, Petrie KJ, et al. Symptoms and symptom attribution among women on endocrine therapy for breast cancer. *Oncologist.* 2015;20(6):598–604. doi:10.1634/theoncologist.2015-0007
51. Sicart CSVA, Luz RPC, Rizzi SKL, et al. Effect of acupuncture in myelosuppression and quality of life in women with breast cancer undergoing chemotherapy: a randomized clinical study. *Support Care Cancer.* 2023;31(3):156. doi:10.1007/s00520-023-07616-7
52. Napadow V, Makris N, Liu J, et al. Effects of electroacupuncture versus manual acupuncture on the human brain as measured by fMRI. *Hum Brain Mapp.* 2005;24(3):193–205. doi:10.1002/hbm.20081
53. Yang M, Wan Y, Jiang X, et al. Electro-acupuncture promotes accumulation of paclitaxel by altering tumor microvasculature and microenvironment in breast cancer of mice. *Front Oncol.* 2019;9:576. doi:10.3389/fonc.2019.00576
54. Jiang X, Tian Y, Xu L, et al. Inhibition of triple-negative breast cancer tumor growth by electroacupuncture with encircled needling and its mechanisms in a mice xenograft model. *Int J Med Sci.* 2019;16(12):1642–1651. doi:10.7150/ijms.38521
55. Hershman DL, Lacchetti C, Dworkin RH, et al. Prevention and management of chemotherapy-induced peripheral neuropathy in survivors of adult cancers: American Society of Clinical Oncology clinical practice guideline. *J Clin Oncol.* 2014;32(18):1941–1967. doi:10.1200/JCO.2013.54.0914
56. Seretny M, Currie GL, Sena ES, et al. Incidence, prevalence, and predictors of chemotherapy-induced peripheral neuropathy: a systematic review and meta-analysis. *Pain.* 2014;155(12):2461–2470. doi:10.1016/j.pain.2014.09.020
57. Han X, Wang L, Shi H, et al. Acupuncture combined with methylcobalamin for the treatment of chemotherapy-induced peripheral neuropathy in patients with multiple myeloma. *BMC Cancer.* 2017;17(1):40. doi:10.1186/s12885-016-3037-z
58. Bower JE, Ganz PA, Irwin MR, et al. Do all patients with cancer experience fatigue? A longitudinal study of fatigue trajectories in women with breast cancer. *Cancer.* 2021;127(8):1334–1344. doi:10.1002/cncr.33327
59. ZY, LL, LH, et al. Effects of acupuncture on cancer-related fatigue: a meta-analysis. *Support Care Cancer.* 2018;26(2). doi:10.1007/s00520-017-3955-6
60. Lv Z, Liu R, Su K, et al. Acupuncture ameliorates breast cancer-related fatigue by regulating the gut microbiota-gut-brain axis. *Front Endocrinol.* 2022;13:921119. doi:10.3389/fendo.2022.921119
61. L J, F R, G X, et al. Acupuncture improves immunity and fatigue after chemotherapy in breast cancer patients by inhibiting the Leptin/AMPK signaling pathway. *Support Care Cancer.* 2023;31(9). doi:10.1007/s00520-023-07967-1
62. White AR, Filshie J, Cummings TM. International Acupuncture Research Forum. Clinical trials of acupuncture: consensus recommendations for optimal treatment, sham controls and blinding. *Complement Ther Med.* 2001;9(4):237–245. doi:10.1054/ctim.2001.0489
63. Linde K, Niemann K, Schneider A, Meissner K. How large are the nonspecific effects of acupuncture? A meta-analysis of randomized controlled trials. *BMC Med.* 2010;8. doi:10.1186/1741-7015-8-75
64. Xh Z, Cc F, Lj P, et al. Electroacupuncture attenuates neuropathic pain and comorbid negative behavior: the involvement of the dopamine system in the amygdala. *Front Neurosci.* 2021;15. doi:10.3389/fnins.2021.657507.