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A Visualization Study on the Nursing of Female Menopausal Syndrome Based on CiteSpace

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Abstract: *Background*: With the accelerating global population aging, health issues related to menopausal syndrome in women are becoming increasingly prominent. Although related research and guidelines continue to enrich, problems such as fragmented knowledge and dispersed research efforts constrain the improvement of nursing quality.*Objective*: To analyze and summarize current research trends and hot topics in women's health concerning menopausal syndrome, and to explore the forefront development directions in this field.*Methods*: Based on literature retrieved from the China National Knowledge Infrastructure (CNKI) and Web of Science (WOS) databases from their inception to December 2024, this study ultimately included 639 articles (256 in Chinese, 383 in English). Using CiteSpace software, a bibliometric and visual analysis was conducted to construct knowledge maps of countries, institutions, authors, and keywords. *Results*: The overall publication volume of both Chinese and English literature showed an upward trend. English publications reached 53 in 2024, while Chinese publications peaked at 30 in 2019. The United States led in publication output (117 articles, 21.91%). Among Chinese institutions, the highest publication count was only 2 articles. Keyword analysis revealed that "menopausal syndrome" and "psychological care" were hot topics in Chinese literature (frequencies 51, 40), whereas "symptoms" and "quality of life" were high-frequency keywords in English literature (frequencies 98, 78). The cluster structures were significant ($Q > 0.53$, $S > 0.78$), and burst term analysis indicated an evolution in research focus from symptomatic care towards personalized interventions. *Conclusions*: Knowledge graph visualization can clearly present the development context and hotspot differences in research on nursing care for women with menopausal syndrome, providing a reference for subsequent studies.

Keywords: Menopausal syndrome; Climacteric syndrome; Perimenopausal syndrome; Women's health; Nursing; Citespace; Visual analysis

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1. Introduction

Menopausal syndrome represents a pivotal phase for women transitioning from their reproductive years to

their senior years, typically occurring between the ages of 40 and 65 and marked by menopause [1]. During this period, women experience significant hormonal changes, which can trigger a range of physical and psychological symptoms such as hot flashes, insomnia, and mood swings, severely impacting their quality of life [2]. According to statistics, the number of women in China experiencing menopausal syndrome is projected to reach 210 million by 2030, with over 85% experiencing varying degrees of symptoms, and approximately 5% to 10% suffering from severe symptoms requiring medical intervention [3].

In recent years, there has been increasing attention both domestically and internationally on the care of menopausal syndrome, with a growing body of clinical guidelines and research. China has successively released the "Chinese Guidelines for Menopause Management and Menopausal Hormone Therapy (2023 Edition)" [1] and the "Guidelines for Integrated Traditional Chinese and Western Medicine Diagnosis and Treatment of Menopausal Syndrome (2023 Edition)" [4]. Internationally, nursing norms centered around hormone therapy have also been established. However, research findings in this field are scattered and lack systematic integration, and the research hotspots, collaboration networks, and development trends both domestically and internationally remain unclear.

CiteSpace, a globally renowned visualization software developed and promoted by Professor Chaomei Chen's team, can visually present digital information in a research field, enabling readers to more clearly and intuitively access cutting-edge academic information or predict future research trends and hotspots [5,6]. As a powerful knowledge visualization tool, knowledge graphs can effectively integrate fragmented information and reveal the knowledge structure and development dynamics of a field. This study conducted a visual analysis of literature related to the care of female menopausal syndrome using CiteSpace software, based on the China National Knowledge Infrastructure (CNKI) and Web of Science (WOS) databases. The aim was to systematically review the research status, hot topics, and development trends in this field, providing a reference for future research and clinical practice.

2. Materials and methods

2.1. Data sources

This study selected the CNKI database and the Web of Science (WOS) Core Collection database as sources for Chinese and English literature, respectively. The search time range was set from the establishment of each database until December 2024. The Chinese search formula was: (Topic = menopausal syndrome OR menopausal syndrome syndrome OR perimenopause OR perimenopausal syndrome) AND (Topic = female) AND (Topic = nursing). The corresponding English search formula was: (Ts = ("menopausal syndrome" OR menopause OR "perimenopausal syndrome" OR "perimenopausal period" OR perimenopause)) AND (Ts = (female OR woman OR women)) AND (Ts = (nursing OR care OR caring)). The literature screening criteria were as follows: exclude non-research literature such as conference papers and theses; conduct an initial screening by reading titles and abstracts, followed by a further review of the full text to exclude irrelevant and redundantly published literature. A total of 639 qualified articles were included, comprising 256 Chinese articles and 383 English articles. The bibliographic information of the finally qualified articles was exported in Refworks format (CNKI) and plain text format (WOS), stored in "download_XXX.txt" format for subsequent analysis.

2.2. Research methods

The bibliographic information of the included Chinese and English articles was imported into CiteSpace 6.3.R1 software, respectively, and the literature was formatted. The time span (time slicing) was set from the establishment of the database to December 2024, with a time partition (years per slice) of 3 years; node types (node types) were selected as country, institution, author, cited journal, cited literature, and keywords, etc.; the node selection method was g-index, with k = 25, Top N = 50, Top N% = 10%; the pruning method selected pathfinder and show merged network; the remaining parameters were set to default values for analysis and generation of visual knowledge graphs to scientifically present the research results.

3. Results

3.1. Temporal analysis of publication volume

Both Chinese and English literature showed a significant upward trend in annual publication volume (**Figure 1**). Chinese research experienced a slow start between 1995 and 2008, with an average annual publication of less than 2 articles; it entered a rapid growth phase after 2009, with the average annual publication volume rising to 18 articles and reaching a peak of 30 articles in 2019. English research, after its first publication in 1996, developed slowly until 2006; it entered a steady growth phase from 2007 to 2019 (averaging 12 articles per year); the growth rate accelerated significantly after 2020, with the highest publication volume of 53 articles in 2024.

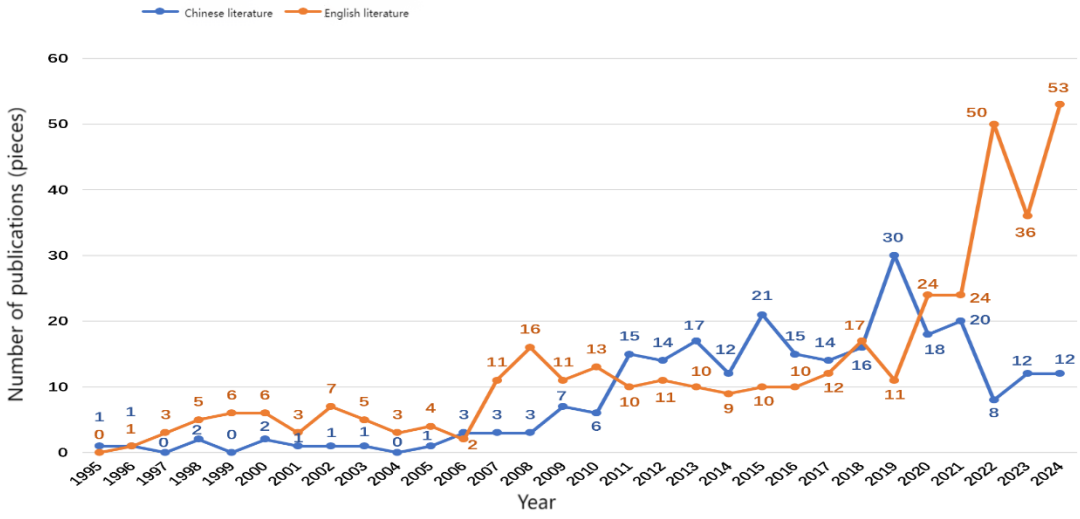

Figure 1. Analysis of the number of Chinese and English publications related to nursing research on female menopausal syndrome.

3.2. Country distribution and collaboration network

CiteSpace only supports country analysis for English literature. A total of 68 countries were included in the analysis, with 182 connections between nodes and a network density of 0.0799. Countries with a higher number of publications and stronger centrality exhibited closer collaboration relationships (see **Figure 2**). The top 10 countries in terms of publication volume (see **Table 1**) accounted for 68.54% of the total publications. The top three countries were the United States with 117 publications (21.91% of the total output), Australia

with 39 publications (7.30%), and England with 38 publications (7.12%). The United States had an absolute advantage in terms of publication volume. The United States, England, Italy, and South Korea demonstrated strong centrality (> 0.1), with the United States (0.23) having the most prominent academic influence.

Table 1. Top 10 countries by number of English publications related to nursing research on female menopausal syndrome

No.	Country	Number of publications	Percentage (%)	Centrality
1	USA	117	21.91	0.23
2	AUSTRALIA	39	7.30	0.08
3	ENGLAND	38	7.12	0.13
4	ENGLAND/IRAN	24/24	4.49/4.49	0.01/0
5	PEOPLES R CHINA	20	3.75	0.04
6	TURKEY	19	3.56	0.01
7	BRAZIL	18	3.37	0
8	SPAIN/INDIA	15/15	2.81/2.81	0.05/0
9	ITALY/SOUTH KOREA	13/13	2.43/2.43	0.11/0
10	POLAND	11	2.06	0

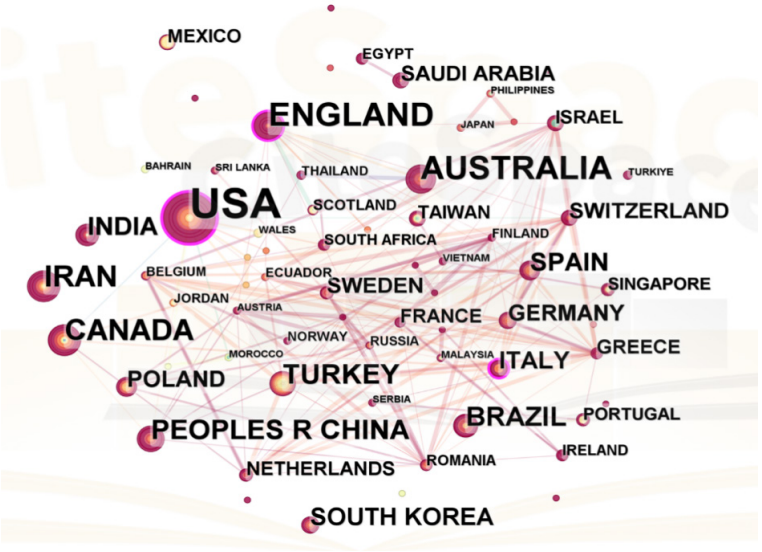

Figure 2. Country analysis of English literature related to nursing research on female menopausal syndrome.

3.3. Analysis of institutional and author collaboration

Institutional analysis indicates that research efforts are relatively dispersed both domestically and internationally. Chinese literature involves 225 institutions, with 97.78% of them publishing only one paper each, resulting in a low network density of 0.0011 and sparse collaborative connections (**Figure 3**). Among English literature, institutions such as Monash University (16 papers, 3.74%), University College London (UCL) (12 papers, 2.80%), University of Toronto (7 papers, 1.64%), and Harvard Medical School (7 papers, 1.64%) have published a relatively large number of papers, but the collaborative network among institutions remains weak (network density of 0.0087) (**Figure 4**).

Figure 3. Analysis of institutions in Chinese literature related to nursing research on female menopausal syndrome.

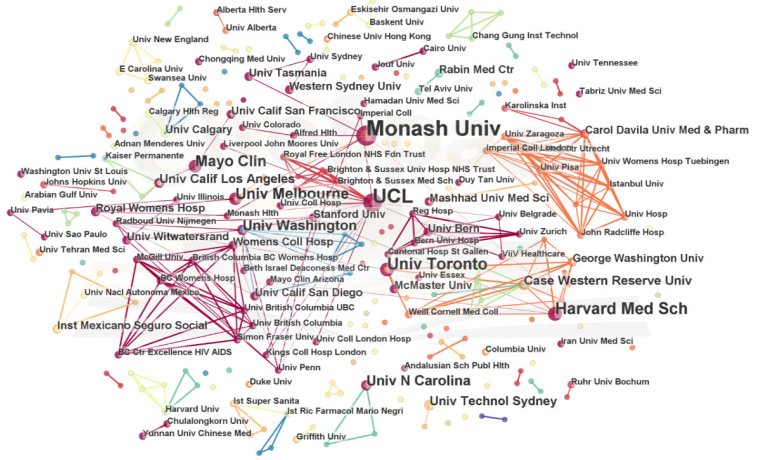

Figure 4. Analysis of institutions in English literature related to nursing research on female menopausal syndrome.

3.4. Author publication and collaboration

There is a total of 285 authors in Chinese literature, with 6 authors (4.21%) having the highest publication count of 2 papers each, and the remaining 279 authors having published only 1 paper each. All authors have a centrality of 0, indicating relatively low influence. However, several closely collaborating teams have begun to emerge. In English literature, there are 294 authors, with Stute, Petra being the most prolific contributor with 6 papers, followed by Hickey, Martha with 4 papers. Stute, Petra also has the highest degree value of 18, indicating a relatively high influence. No authors have a centrality greater than 0.1. Several actively collaborating teams have formed.

The maps illustrate the core authors, collaboration networks, and their strengths. Larger nodes represent authors with a higher number of publications, while thicker lines indicate closer collaborative relationships. In Chinese literature (see **Figure 5**), there are 346 connections with a network density of 0.0088. In English literature (see **Figure 6**), there are 425 connections with a network density of 0.0049. Both suggest that there is room for improvement in the number of publications and the level of collaboration among authors.

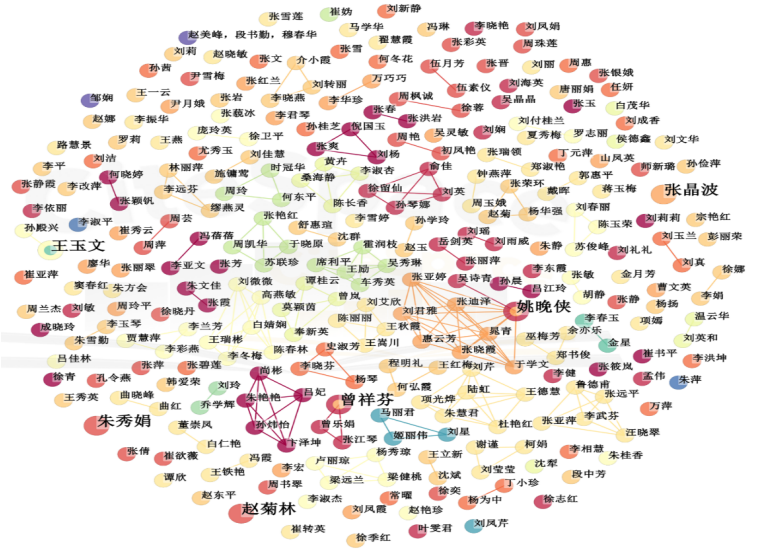

Figure 5. Analysis of authors in chinese literature related to nursing research on female menopausal syndrome.

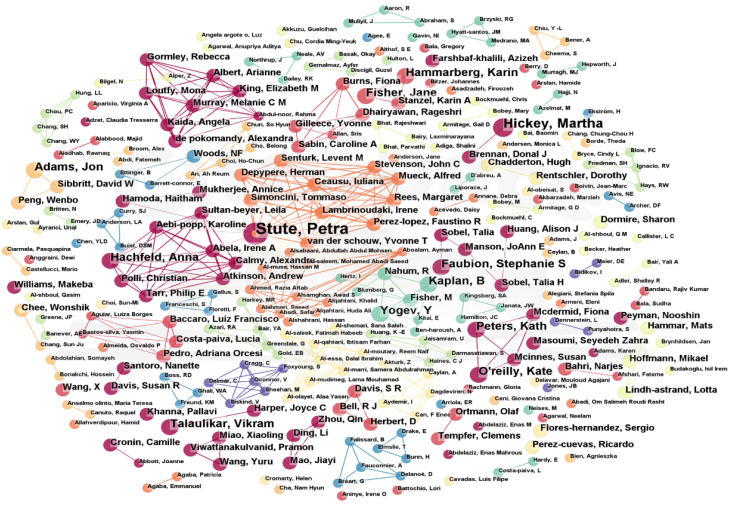

Figure 6. Analysis of authors in English literature related to nursing research on female menopausal syndrome.

3.5. Keyword co-occurrence

In Chinese literature, there are a total of 10 keywords with a frequency of occurrence ≥ 10, with the top three being menopausal syndrome (51), perimenopause (42), and psychological care (40). The top three keywords in terms of centrality are perimenopause (0.52), nursing (0.37), and psychological care (0.29), representing the core content and hot topics of the research (see **Table 2**). In English literature, there are 38 keywords with a frequency of occurrence ≥ 10, with "symptoms" being the most frequent (98) and "vasomotor symptoms" having the highest centrality (0.16) (see **Table 3**), fully reflecting their importance and influence. The co-occurrence map for Chinese literature has 181 nodes and 389 connections, with a network density of 0.0239; the map for English literature has 270 nodes and 773 connections, with a network density of 0.0213 (see **Figures 7** and **8**).

Table 2. Top 10 keywords by frequency of occurrence in Chinese literature related to nursing research on female menopausal syndrome

No.	Keyword	Frequency (times)	Centrality	No.
1	Menopausal Syndrome	51	0.4	1
2	Perimenopause	42	0.52	2
3	Psychological Nursing	40	0.29	3
4	Nursing	35	0.37	4
5	Nursing Intervention	31	0.15	5
6	Women	25	0.12	6
7	Quality of Life	20	0.14	7
8	Anxiety	18	0.09	8
9	Depression/Sleep Quality	17/17	0.11/0.02	9
10	Health Education/Depressive Disorder	15/15	0.08/0.07	10

Table 3. Top 10 keywords by frequency of occurrence in English literature related to nursing research on female menopausal syndrome

No.	Keyword	Frequency	Centrality
1	symptoms	98	0.12
2	postmenopausal women	81	0.10
3	quality of life	78	0.13
4	health	69	0.06
5	hormone replacement therapy	60	0.14
6	vasomotor symptoms	51	0.16
7	women	49	0.14
8	women's health	41	0.07
9	hormone therapy	40	0.06
10	prevalence	39	0.06

Figure 7. Keyword analysis of Chinese literature related to nursing research on female menopausal syndrome.

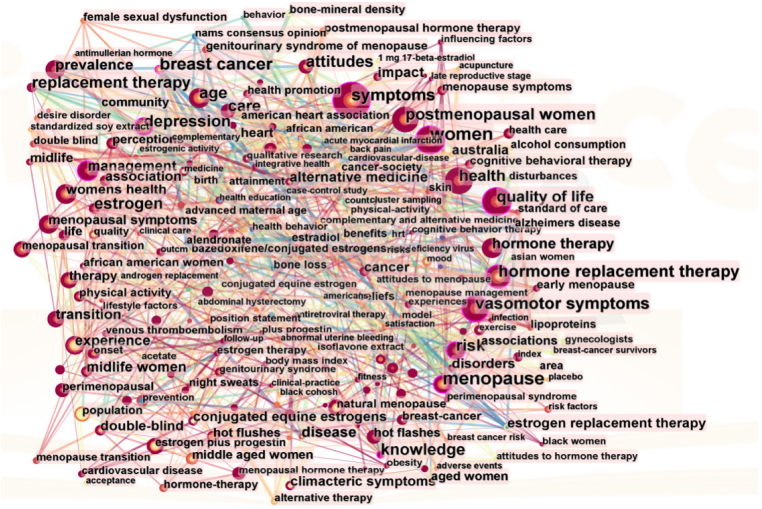

Figure 8. Keyword analysis of English literature related to nursing research on female menopausal syndrome.

3.6. Keyword clustering

The modularity Q value represents the network map structure, while the average silhouette S value indicates the clarity of clustering. A Q value greater than 0.3 signifies a significant clustering structure, and an S value greater than 0.5 indicates reasonable clustering, while an S value greater than 0.7 suggests high clustering credibility [7]. The Chinese literature generated eight clusters (see **Figure 9**), with smaller cluster label numbers indicating a larger number of included keywords, reflecting research hotspots relatively clearly. The Q value is 0.5482 (> 0.3), and the S value is 0.8376 (> 0.7), indicating that the research themes among clusters are well-defined, with a significant structure and high credibility. The English literature clustering analysis generated 12 clusters (see **Figure 10**), with Q = 0.5347 and S = 0.7803, indicating a reasonable and credible clustering structure.

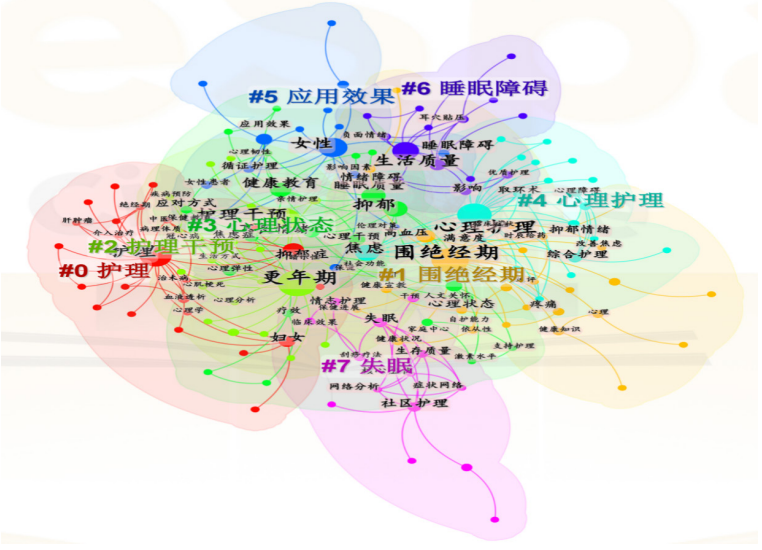

Figure 9. Cluster analysis of keywords in Chinese literature related to nursing research on female menopausal syndrome.

Figure 10. Cluster analysis of keywords in English literature related to nursing research on female menopausal syndrome.

3.7. Keyword bursts

Figure 11 shows that 24 burst terms (γ = 0.4) were generated in Chinese literature, with "nursing" (3.02), "application effectiveness" (2.86), "psychological state" (2.47), and "psychological care" (2.24) demonstrating strong burst intensities. "Nursing" and "menopausal syndrome" have persisted for over a decade since their first appearance in 1996, representing the longest duration. From 2005 onwards, ten burst terms, including "women", "depression" and "community care", emerged as the second tier, appearing sequentially. In 2018, seven burst terms, such as "application effectiveness", "female patients" and "hypertension" formed the third tier, receiving concurrent attention and persisting until 2022. Starting from 2019, burst terms from the fourth tier, including "negative emotions" "psychological state" "health knowledge" "compliance" and "coping strategies" have emerged and persisted to the present. **Figure 12** illustrates that 25 burst terms (γ = 0.2) were generated in English literature. "Hormone replacement therapy" first appeared in 1996 and persisted for the longest duration of six years. From 1997 to 1998, five burst terms, including "estrogen replacement therapy", "prevention" and "knowledge", emerged as the second stage. The third stage, spanning from 2002 to 2016, saw the sequential emergence of ten burst terms, such as "midlife", "hot flushes", and "postmenopausal hormone therapy". Since 2016, the fourth stage has witnessed the sequential appearance of nine burst terms, including "risk factors", "menopause transition" and "hormone therapy", with five burst terms, namely "menopause symptoms", "prevalence", and "menopausal hormone therapy", persisting to the present.

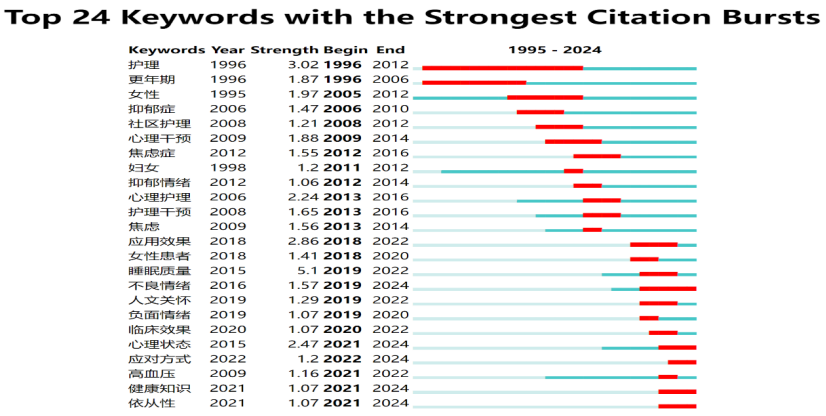

Figure 11. Burst analysis of keywords in Chinese literature related to nursing research on female menopausal syndrome.

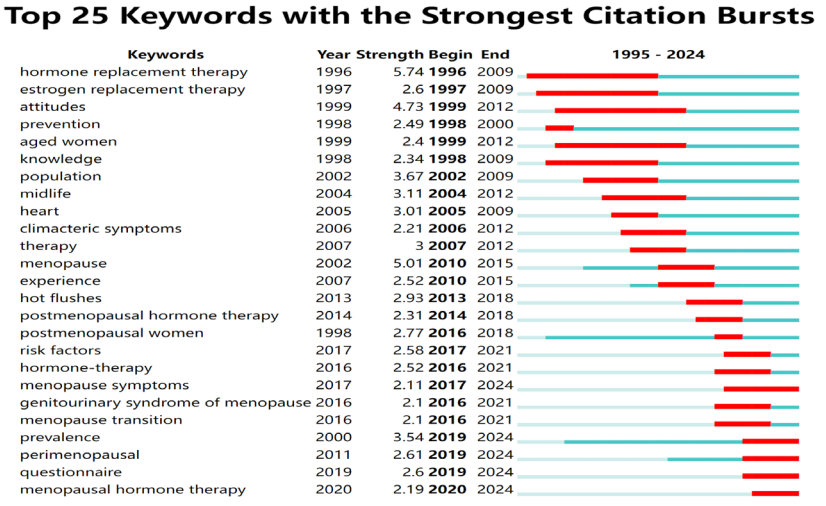

Figure 12. Burst analysis of keywords in English literature related to research on nursing for female menopausal syndrome.

4. Discussion

4.1. Uneven distribution of research strength with emerging international collaboration patterns

This study visually reveals the uneven distribution of global research strength in the field of nursing for female menopausal syndrome through knowledge mapping. The United States holds an absolute dominant position in terms of both publication volume and academic influence. In contrast, China, despite a relatively late start in this field, has witnessed rapid growth since 2009, possibly attributed to the goals and commitments outlined in the United Nations' "Future Compact (2024)", and the implementation of a series of plans and programs such as the "Healthy China Initiative (2019–2030)", the "Maternal and Child Safety Enhancement Plan (2021–2025)", the "Reproductive Health Promotion Action Plan (2023–2025)", and the "Outline for the Development of Chinese Women (2021–2030)" [8–15]. However, domestic research institutions are characterized by their small scale and scattered distribution, with sparse collaborative networks among institutions and a scarcity of high-producing author teams, severely constraining the output of high-quality research outcomes and the enhancement of academic influence. In the future, it is imperative to strengthen

collaboration among domestic institutions and actively integrate into the international collaboration network centered around the United States to facilitate knowledge exchange and resource sharing.

4.2. Divergent research hotspots reflecting different nursing philosophies

Keyword clustering, which extracts cluster label words using the log-likelihood ratio (LLR) sorting algorithm based on the intrinsic similarity of keywords, serves as a core summary and highly condensed representation of research papers [16,17]. The frequency of these keywords reflects the hot topics of concern among scholars in the field [18]. The research method of dividing keywords into multiple network clusters represents a further in-depth exploration of keyword co-occurrence. The results of keyword and cluster analysis reveal significant differences in research hotspots between Chinese and English literature, reflecting distinct nursing philosophies and cultural backgrounds. Chinese research highly focuses on practical topics such as “psychological nursing” and “nursing interventions”, forming characteristic clusters like “traditional Chinese medicine (TCM) conditioning” and “community nursing”, highlighting the importance of traditional medicine in symptom relief and the role of primary healthcare services in China, consistent with the orientation of the “International Clinical Practice Guidelines for Traditional Chinese Medicine” [19]. In contrast, English research places greater emphasis on pathological mechanisms and precise treatment plans such as “vasomotor symptoms” and “hormone replacement therapy”, focusing on “quality of life” and long-term health outcomes, aligning closely with the “personalized hormone therapy” and “whole-cycle health management” concepts advocated by the International Menopause Society [20]. These differences suggest that future research should strengthen dialogue and complementarity between Western and traditional Chinese medicine, leveraging the holistic conditioning advantages of TCM while deepening evidence-based research on the effectiveness and safety of modern medical treatment plans.

4.3. Research frontiers shifting towards personalization and long-term management

Burst words, which refer to vocabulary that experiences a sudden increase in frequency within a specific time period, reflect the cutting-edge dynamics in a research field during that period [21]. Burst word analysis clearly demonstrates the dynamic evolution of research frontiers in this field. In recent years, terms such as “application effectiveness” and “compliance” have emerged as burst words in Chinese research, indicating a shift from descriptive studies to in-depth evaluations of the effectiveness, feasibility, and patient self-management efficacy of interventions. In English research, burst words like “risk factors” and “menopause transition” mark a forward-looking shift from mere symptom treatment to health risk prediction and management throughout the entire process of menopausal syndrome at the international frontier. Notably, although artificial intelligence and digital health technologies have not directly become high-frequency burst words, their concepts are implicitly embedded in trends such as intelligent assessment and remote monitoring, suggesting that combining information technology to achieve personalized and intelligent health management for menopausal syndrome will be an important future development direction [22].

5. Prospects and limitations

This study systematically reveals the research status and frontiers in the field of nursing for female menopausal syndrome through knowledge mapping but also acknowledges certain limitations. Firstly, the data sources are limited to the CNKI and WOS core collection databases, potentially failing to fully cover

important materials such as gray literature. Secondly, the semantic parsing depth of CiteSpace software for Chinese vocabulary is limited, possibly affecting the precision of cluster labels. Based on the findings of this study, future research in this field can be further expanded in the following aspects:

(1) Deepening research content

Future research should strengthen interdisciplinary collaboration, particularly the deep integration of Western and traditional Chinese medicine, promote the standardization and evidence-based development of TCM nursing plans, and conduct in-depth research on long-term health outcomes throughout the entire cycle of menopausal syndrome.

(2) Innovating research methods

Explore the application of artificial intelligence, big data, and digital health technologies in nursing for menopausal syndrome. For example, develop intelligent risk assessment models and construct personalized health management platforms to achieve a transition from "group-based" nursing to "precision" management.

(3) Expanding data dimensions

Subsequent research can incorporate more diverse data sources (such as clinical data, patient-reported outcomes, etc.) and combine advanced text mining techniques like natural language processing for deeper knowledge discovery, constructing a dynamically updated knowledge system to provide more robust support for clinical practice and policy formulation. In conclusion, promoting the development of nursing research for female menopausal syndrome towards collaboration, intelligence, and precision is an inevitable trend to enhance the health level of women with menopausal syndrome globally.

Disclosure statement

The authors declare no conflict of interest.

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