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RESEARCH ARTICLE

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The trends and hotspots of research on non-pharmacological interventions for labor pain management: a bibliometric analysis

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ABSTRACT

Introduction: This study aimed to examine important points of focus, trends, and depth of research on non-pharmacological interventions for the management of labor pain worldwide from a macro perspective and present an extensive definition of research fields regarding non-pharmacological interventions.

Methods: Bibliometric methods were used in this study. With comprehensive keyword lists, the Web of Science and PubMed databases were searched using different screening strategies for publications made until 25 February 2023.

Results: Studies on non-pharmacological interventions in the management of labor pain have continued to develop since 2003 with great momentum. In this study, the most productive country in research on non-pharmacological interventions was found to be Iran, while Australia, the USA, China, and the United Kingdom were the most notable ones in terms of collaboration. The most prevalently studied non-pharmacological interventions were hydrotherapy and acupuncture. The results of the co-word analysis revealed 5 main themes about this field of research.

Conclusion: The results of this study showed that interest in studies on non-pharmacological interventions in the management of labor pain has increased, the quality of research in the field is high, international collaboration is increasingly higher, and technological approaches have started to emerge in relevant studies.

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Bibliometrics; labor pain; non-pharmacological; pain management

Introduction

While childbirth is considered one of the most significant and special experiences in a woman's life, it is also accepted as a painful event [1]. Labor pain is a part of the vaginal birth process, and it is caused by myometrial ischemia during uterine contractions, cervical, vaginal, and perineal stretching, and the distention of other perineal structures, especially throughout the second stage of labor [2–4]. While pain is a highly subjective experience, it is an undeniable fact that labor pain becomes more intense as the labor process progresses [5,6].

Although labor pain is a physical phenomenon, excessive labor pain can increase fetal-maternal complications. Pain stimulates the respiratory system, increases the respiratory rate, and raises oxygen consumption, while hyperventilation leads to severe respiratory alkalosis. These physiological changes affect the oxygen that is transferred to the fetus and may cause fetal hypoxemia and metabolic acidosis [6]. Additionally, pain, anxiety, and stress during labor can increase the secretion of catecholamines (adrenaline and noradrenaline) Adrenaline can disrupt the secretion of oxytocin. For this reason, uterine contractions can become irregular, slow down, or stop entirely [7]. Therefore, to prevent obstetric complications and additional medical intervention requirements, the main goal of intrapartum care is the management of labor pain [8,9]. The World Health Organization also recommends taking precautions to improve the labor experiences of women by reducing labor pain [10].

In the management of labor pain, both pharmacological and non-pharmacological interventions are used prevalently. Pharmacological interventions include epidural analgesia, spinal analgesia, combined spinal-epidural analgesia, nitrous oxide, and systemic opioids

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[2]. While these pharmacological interventions can usually alleviate labor pain effectively, they have some potential side effects. Pharmacological interventions may reduce women's sense of control and prolong the second stage of labor, increase the probability of further interventions (instrumental labor and cesarean section), and have effects on the mother such as respiratory depression, fever, itching, nausea/vomiting, hypotension, and sedation. Moreover, they have other unwanted effects including reduced fetal heart rate variability, respiratory depression, and neurobehavioral changes [11].

Considering the potential side effects of pharmacological interventions in the management of labor pain, the interest in non-pharmacological interventions has increased. Non-pharmacological interventions that are used in the management of labor pain, led by the American College of Obstetricians and Gynecologists and the World Health Organization, include mind-body interventions (e.g. hydrotherapy, massage, breathing exercises, yoga, music, reflexology, hypnosis, and mindfulness), acupuncture, birthing balls, transcutaneous electrical nerve stimulation (TENS), sterile water injection, aromatherapy, and others [3,4,10,12,13]. These are the most commonly used complementary and alternative medicine methods during childbirth [4]. These interventions may be associated with a shorter duration of labor, more autonomy for the mother and lower rates of drug or medical intervention requirement [2,14]. A Cochrane systematic review, including 415 full systematic reviews and 90 protocols, revealed that non-pharmacological interventions were more inexpensive and easier to implement than pharmacological interventions, and they had minimal side effects on the mother-fetus-newborn or no side effects at all [15]. Thus, non-pharmacological methods that are used in the management of labor pain have received extensive attraction as a research hotspot.

In recent years, some randomized controlled trials [16–18] and meta-analyses [5,19,20] have evaluated the effectiveness of several non-pharmacological interventions on the severity of labor pain. Nevertheless, there is still limited high-quality evidence supporting the effectiveness of non-pharmacological interventions on pain during labor [4]. Additionally, there is a dearth of analyses on the research trends, research depth, and research points of non-pharmacological interventions that are used in the management of labor pain. Therefore, it is needed to contribute an extended definition of this topic from a macro perspective to the published literature.

Bibliometrics provides large amounts of information for researchers to understand the general outlook of scientific fields and studies on certain topics highlights the development trends of research fields, and thus, offers a scientific framework for research to be conducted. Bibliometric analysis allows the statistical analyses of data including co-word and co-occurrence analysis, citation and co-citation analysis, and social network analysis. In addition to these quantitative analyses, additional qualitative analyses such as content/thematic analyses reduce the limitations of bibliometric analyses, identify research themes and enrich the findings [21–23]. Bibliometrics has a broad area of application, and it plays an important role in theoretical and practical scientific studies. With the growth of scientific literature, the time it takes for researchers to review the literature has increased a lot, and it has become more difficult for them to access the entirety of the literature in their field of interest. This influences the effectiveness of research severely. Bibliometric analyses may allow researchers to understand the background of the research field they are interested in fast and get a grasp of the development trends and direction of a topic [24].

There is an increasing trend in bibliometric research in general and in the use of this method in the field of health. In addition, bibliometric analysis is suitable for research areas where quantitative approaches are adopted [25]. In recent years, the literature on the effectiveness of non-pharmacological interventions that are used in the management of labor pain has developed to a great extent. However, the number of studies on the effectiveness of non-pharmacological interventions involving network analyses is limited [5,19]. In a systematic review and Bayesian network analysis of 43 articles from seven databases, Hu et al. investigated and compared the effectiveness and reliability of nine non-pharmacological interventions in alleviating labor pain [5,19]. On the other hand, no bibliometric study that evaluated the basic and conceptual structure of this research field from a macro perspective could be encountered. This article presents a bibliometric analysis to understand the role of non-pharmacological methods in the management of labor pain. Analysis of research trends and hotspots guides researchers by identifying which interventions are being studied more in the management of labor pain and in which areas more information is needed. This article provides a roadmap for future research, helping healthcare professionals make more informed and effective decisions about the management of labor pain. Based on these observations and the review of the relevant literature, we conducted bibliometric analyses to discover the research status of the topic of non-pharmacological interventions that are

used in the management of labor pain, related trends, and research hotspots.

Methods

We used bibliometric methods to investigate studies on non-pharmacological interventions in the management of labor pain. Bibliometric methods allow the revelation of trends, topics of study, and concepts in a field of research [26,27]. Moreover, bibliometric methods also provide information regarding the countries, journals, and influential studies that contribute to the knowledge base of a scientific field based on quantitative measurements. Accordingly, the bibliometric analyses of non-pharmacological interventions that are used in the management of labor pain in this study can provide information about the gaps in research in this field, current topics of research and trends, countries and journals contributing to the development of the field, collaboration networks, and patterns of topics.

Data sources and search strategies

Bibliometric studies can employ databases such as WoS, PubMed, Scopus, and Google Scholar as their data source. Combining different databases is important in terms of presenting the big picture of the relevant literature and preventing bias. However, due to metadata differences in different databases, it is not possible to combine all applicable databases. We used the Web of Science (WoS) and PubMed databases, which are prevalently used in bibliometric studies, as our sources of data [28,29]. The WoS database provides a broad context throughout a long period of time. The PubMed database has a large collection of academic journals in the field of health [30].

Before starting the searches, one of the researchers (TU) prepared a comprehensive list of keywords by reviewing 30 studies on non-pharmacological interventions in the management of labor pain. These 30 studies were research articles and systematic reviews among the ones with the highest numbers of citations. We conducted preliminary work to create suitable keyword indices for both databases. The keyword indices for WoS and PubMed (Appendix A) and the search process are presented in detail in Figure 1. The searches on the WoS database were carried out by OTÇ, and those on the PubMed database were carried out by TU. We continued the searches from the beginning of the study to 25 February 2023. Because such databases are constantly updated, new documents can be added every day. To prevent bias, we did not include

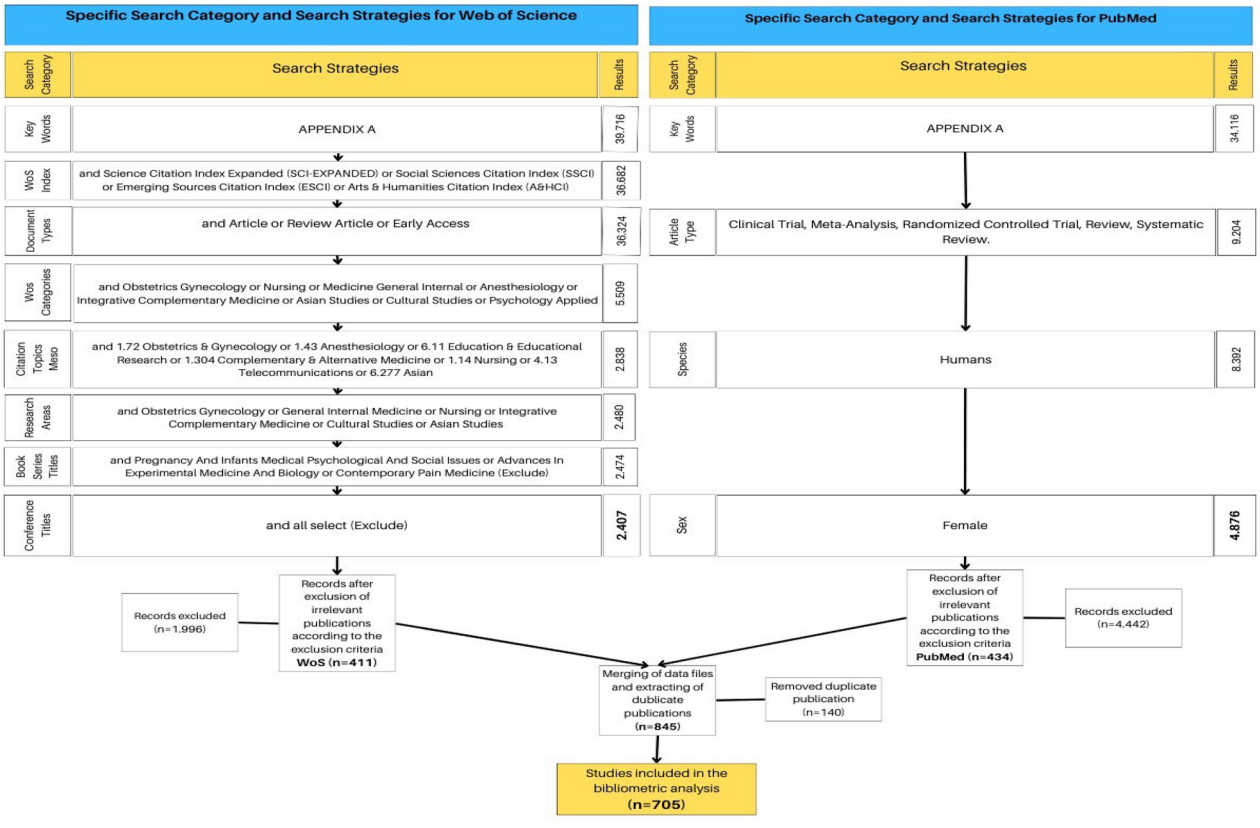

Figure 1. Flow diagram of search strategies and inclusion process of publications.

documents added to the databases after 25 February in the analysis process.

We conducted the searches on both databases by using advanced search options and without limiting years of publication. Moreover, on both databases, we adopted strategies to include English-language, original articles, and reviews in the analyses. Both WoS and PubMed provide options for filtering while searching to include directly related publications and exclude unrelated ones. In this process, we applied restrictions on the WoS database based on index, document type, WoS categories, citation topics (meso-), research fields, titles of book series, and titles of conferences. On PubMed, we applied restrictions based on article type, species, and sex. According to these restrictions, 2,407 publications on WoS and 4,876 publications on PubMed remained.

Data export and extraction

Using the keyword indices and search strategies, we obtained a comprehensive literature of publications. However, we determined some exclusion criteria to include only studies that focused directly on non-pharmacological interventions in the management of labor pain. Accordingly, studies covering the following topics were excluded:

- Animal studies
- Studies in which non-pharmacological methods are used in pain management for different samples (e.g. chronic pain, cancer pain, postoperative pain, pain in newborns, neuropathic pain)
- Studies in which non-pharmacological methods are used to examine variables other than labor pain (e.g. fetal outcomes, labor induction)

After excluding studies based on the criteria above, the titles, keywords, and abstracts of the remaining publications from WoS and PubMed were reviewed. This information of studies on the WoS database was reviewed by ESB, while that of studies on the PubMed database was reviewed by SB, and these two researchers noted down their reasons for the exclusion of studies. At the next stage, the researchers together examined the exclusion reasons provided by ESB and SB for the studies that were going to be potentially excluded, and they decided on which study would be excluded based on agreement.

After the exclusion of unrelated studies on both databases, we downloaded the full records of the bibliometric parameters of the remaining studies in plain text format. These bibliometric parameters consisted of the number of publications, year of publication, authors, corresponding authors, title, abstract, keywords, institutions, journals, countries, citations, and references. We combined the data files downloaded from the WoS and PubMed databases by transferring them to the web-based Google Sheets platform, and we removed the duplicate publications by examining their titles and authors. After we checked and refined the author and title information of the 705 publications that were included in the bibliometric analyses, we saved the data files as a comma-separated CSV file and made the resulting file ready for analysis (Figure 1).

Data analysis

For the bibliometric analyses, the Microsoft Excel 2016, VOSviewer 1.6.18, and R bibliometrix package programs were used. These programs have practical aspects for different analyses. For example, VOS viewer is a practical program to represent analysis results visually and create maps based on co-occurrence data [31], and it is user-friendly in the interpretations of visuals.

In bibliometric analyses, year of publication, number of publications, and number of citations are among the main measures. The analyses that were carried out based on these measures were guided by the objective of this study. First, the distribution of the publications across the years is presented to demonstrate publication trends. Performance analyses based on the numbers of publications and citations were conducted to determine the most relevant journals, the countries with the highest numbers of publications, and the most influential publications in the examined field. While sorting the journals based on their numbers of publications, we also considered their impact factor (IF) values [32]. The IF of a journal is the "average" number of citations made to the articles published on the journal within a certain period, and it was used as a significant indicator of whether the topic of non-pharmacological methods that are used in the management of labor pain was included in notable journals in the relevant field. We sorted the most influential articles based on the numbers of their local citations. Additionally, the numbers of their global citations are included in this report. Global The number of global citations represents the total number of citations received by a document from all publications indexed in a source (WOS, PubMed…), while the number of local citations refers to the number of citations a document received from other documents in the specific search performed (that is, in the sample of highly specialized papers under review) [26,33]. The

publication performance of countries is presented by visualization based on the countries of the corresponding authors of the publications.

While calculating the frequency distribution of non-pharmacological interventions used in managing labor pain, we conducted a word analysis with author keywords by selecting the minimum frequency value as three and the minimum number of words per year as 5. We prepared a txt file to combine synonymous words while conducting the analysis. Furthermore, to identify trends in non-pharmacological interventions, we created another txt file to exclude words other than those referring to non-pharmacological interventions, uploaded the file to the R bibliometrix package program, and repeated the analyses. We carried out a co-authorship analysis in VOSviewer to determine the collaboration networks among countries. A co-authorship analysis provides information about the collaborations among countries that contribute to scientific advancement in a field [34]. We also analyzed the funding status of publications by country, taking into account the number of publications and financing information. Only WoS data were used in this analysis. Compared to other databases, the WoS database provides more complete funding information of publications [35]. In addition, since funding information started to be added to the WoS database after 2008 [35], the analysis was limited to publications after 2009.

In this study, the collaboration networks among countries are presented with an overlay visualization map and a clustering diagram. While the nodes on the map represent the publication output of each country through the years, the edges represent the numbers of collaborations [36]. Frequency analyses that are conducted with keywords provide information about research hotspots, while trending topic analyses provide information about current topics. However, these analyses do not provide information about other topics that are studied along with the topic of focus or thematic fields. Co-word analyses are useful in eliminating these limitations. In this context, we conducted a co-word analysis. A co-word analysis allows the establishment of relationships between research topics and the presentation of the conceptual structure of the field. In co-word and co-authorship analyses, the size of each node indicates the number of occurrences, whereas the thickness of each age indicates the strength of the relationship [31]. Finally, we thematically examined the results of the co-word analysis to identify specific research areas and the results of the keyword analysis to classify non-pharmacological interventions.

Results

Analyses were conducted on 705 articles examining non-pharmacological interventions used in the management of labor pain, and the descriptive statistics of the analyzed articles are presented under "Main Information about Articles" (Appendix B). Considering the distribution of articles according to years (Figure 2), it is seen that 10 articles were published in total between 1963 and 1985, and there was no noteworthy increase in the number of publications. In the period between 1986 and 2003, it is seen that an increase was experienced in the number of publications, and the research base about non-pharmacological interventions expanded in these years. In 2004–2021, along with annual fluctuations, the increase in the number of publications gained momentum, and the number of publications per year increased substantially. The fluctuations in the number of publications between 2017 and 2022 were worth consideration. In the period, there was a substantial increase in the number of publications between 2019 and 2021, while a considerable decrease was observed in 2022.

Journals including publications of articles about non-pharmacological interventions that are used in the management of labor were examined, and the 10 most relevant journals (Table 1) and the cumulative productivity levels of these journals through time (Figure 3) are presented. As seen in Table 1, the 10 journals with the highest numbers of publications included 202 publications, which corresponded to 29% of all studies included in the analyses. While the publication numbers of other journals were close to each other, the most productive platform in terms of publication numbers was "the Cochrane Database of Systematic Reviews" which is a database for systematic reviews in the field of healthcare services. This platform was followed consecutively by the journals "Midwifery" and "Complementary Therapies in Clinical Practice". The 10 most relevant journals had IF values above 2.

Considering the cumulative productivity of the journals, the first studies on non-pharmacological interventions were published in the journal "Acta Obstetrica et Gynecologica Scandinavica" and "the Cochrane Database of Systematic Reviews." In the following years, "the Cochrane Database of Systematic Reviews" and the journal "Midwifery" became prominent in terms of their cumulative productivity.

The 10 most influential articles according to the number of local citations to studies on non-pharmacological interventions that are used in the management of labor pain in the last 60 years are shown in Table 2. As seen in Table 2, the article with

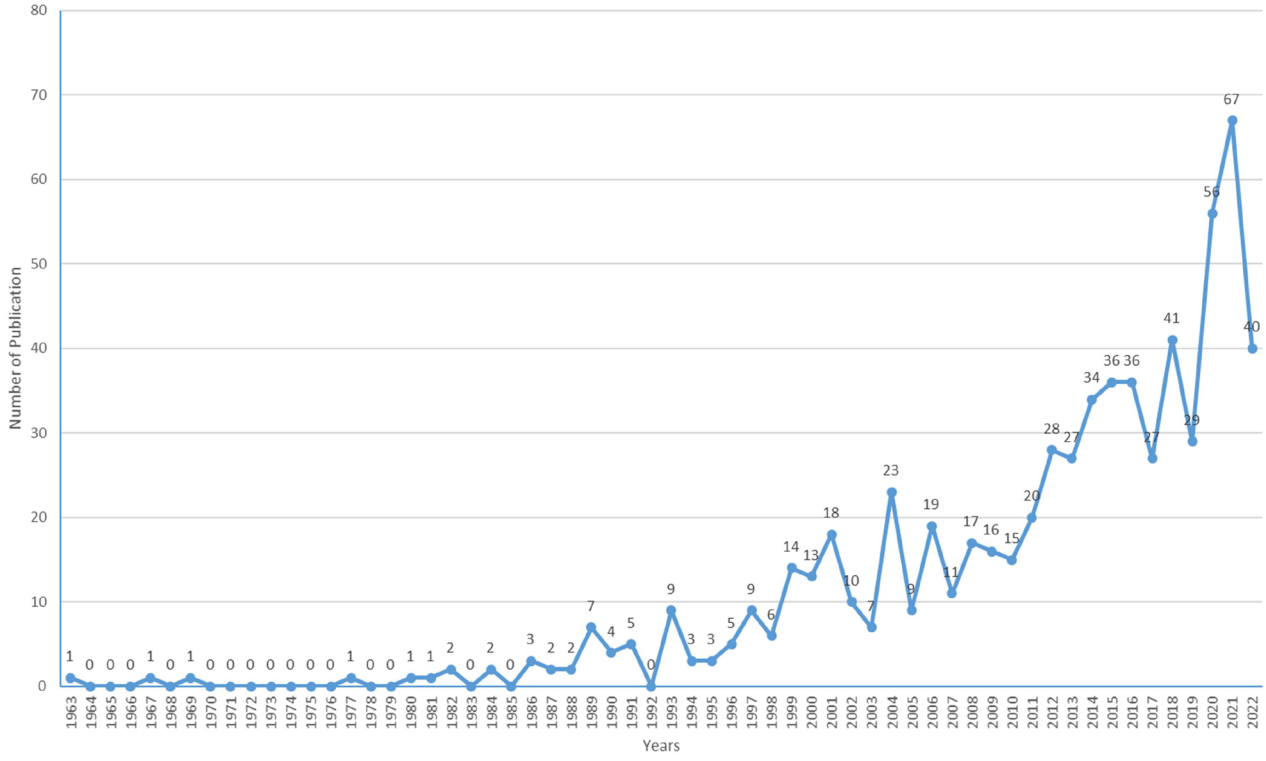

Figure 2. Distribution of publications by years (1963–2022).
Note: Publications in 2023 are not presented in this graph for the sake of comprehensibility and to prevent bias.

Table 1. Ten most relevant sources in terms of publication numbers (1963–2023).

Ranking	Sources	Counts	Impact Factor (2022)
1	Cochrane database of systematic reviews	33	8.4
2	Midwifery	32	2.7
3	Complementary therapies in clinical practice	21	3.0
4	BMC pregnancy and childbirth	21	3.1
5	Birth-issues in perinatal care	20	2.5
6	Women and birth	18	3.8
7	Journal of midwifery & womens health	16	2.7
8	Acta obstetricia et gynecologica scandinavica	16	4.3
9	Bjog-an international journal of obstetrics and gynecology	13	5.8
10	Journal of alternative and complementary medicine	12	2.6

the most frequent local citations, along with the greatest number of global citations, was the Cochrane systematic review titled "Pain management for women in labor: an overview of systematic reviews", which had 46 local and 304 global citations. Table 2 also shows that most of the articles with the highest numbers of local citations were randomized controlled trials and Cochrane systematic reviews.

Figure 4 presents the geographical distribution of articles on non-pharmacological interventions that are used in the management of labor pain published since 1963. This distribution map was created with reference to the countries of the corresponding authors.

There were publications on non-pharmacological interventions in the management of labor pain from 50 different countries. As seen on the map, the countries with the highest numbers of publications were, respectively, Iran, the USA, Australia, China, the UK, Brazil, and Turkey.

Table 3 shows the funding status and ratio of the studies published on non-pharmacological interventions in the management of labor pain between 2009 and 2023 according to the countries. According to this, Iran ranks first with 31 funded publications with a rate of 67.39%. It can be said that a significant portion of the publications in Iran are funded. Australia ranks second with 27 funded publications and 58.70%. According to the number of funded publications, the United Kingdom, the USA and China follow these countries. The funded publication rates of these countries are 30.43%, 26.09%, and 23.91%, respectively. Türkiye stands out with a low rate of 4.35% with only 2 out of 30 publications funded.

Non-pharmacological interventions used in the management of labor pain, their frequency of research, and their classification according to the amount of resources are shown in Table 4. Caughey and Tilden (2004) were taken as reference in classifying the methods according to the amount of resources [8]. The most commonly analyzed interventions with low resource requirements are acupressure (f=58), massage (f=56) and music therapy (f=32). On the other hand, hydrotherapy (f=122),

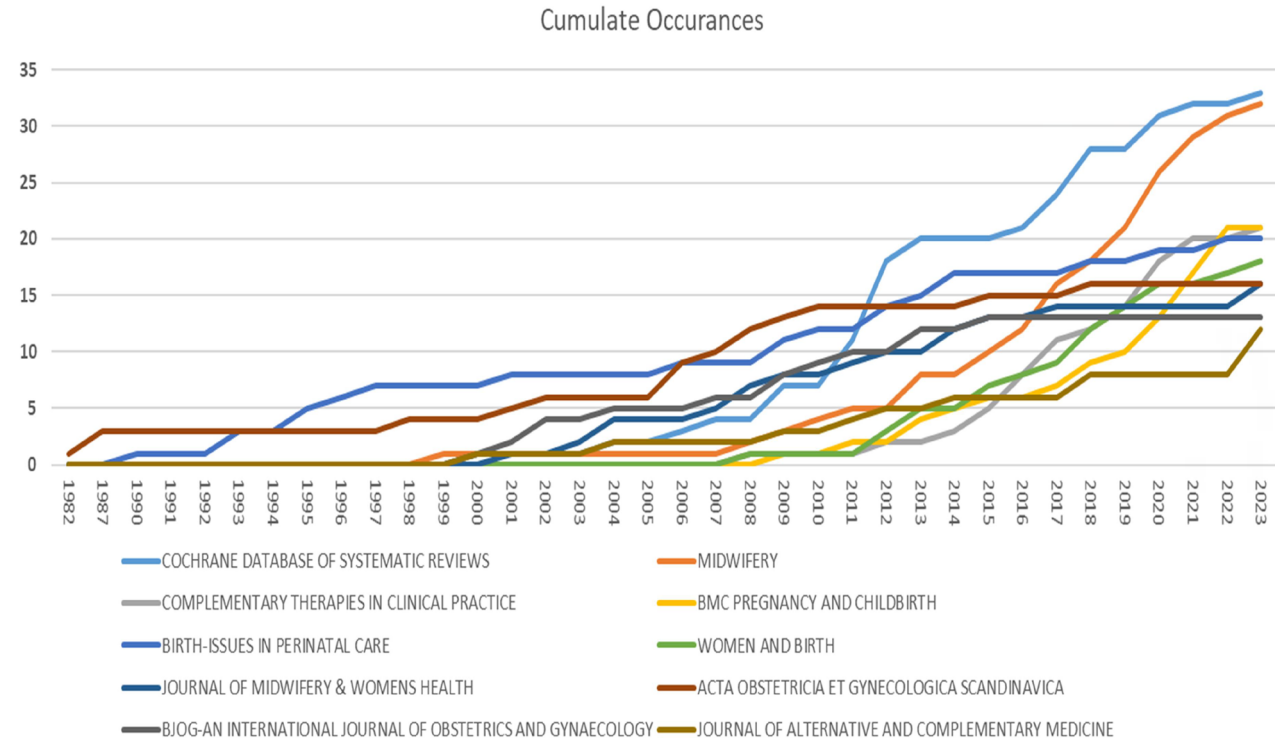

Figure 3. Cumulative productivity of most relevant journals.

Table 2. Articles on non-pharmacological interventions that are used in the management of labor pain with greatest numbers of local citations (1963–2023).

Rank	Articles	Local citations	Global citations	Types of articles
1	Jones, L., Othman, M., Dowswell, T., Alfirevic, Z., Gates, S., Newburn, M., … & Neilson, J. P. (2012). Pain management for women in labor: an overview of systematic reviews. *Cochrane Database of Systematic Reviews*, (3).	44	304	Cochrane Systematic Review
2	Skilnand, E., Fossen, D., & Heiberg, E. (2002). Acupuncture in the management of pain in labor. *Acta Obstetricia et Gynecologica Scandinavica*, *81*(10), 943–948.	37	62	Randomized Controlled Trial
3	Cluett, E. R. og Burns, E.(2009). Immersion in water in labor and birth. *The Cochrane Database of Systematic Reviews*, *2*.	35	135	Cochrane Systematic Review
4	Ramnerö, A., Hanson, U., & Kihlgren, M. (2002). Acupuncture treatment during labor—a randomized controlled trial. *BJOG: an International Journal of Obstetrics and Gynecology*, *109*(6), 637–644.	33	62	Randomized Controlled Trial
5	Lee, M. K., Chang, S. B., & Kang, D. H. (2004). Effects of SP6 acupressure on labor pain and length of delivery time in women during labor. *Journal of Alternative & Complementary Medicine*, *10*(6), 959–965.	32	73	Randomized Controlled Trial
6	Simkin, P., & Bolding, A. (2004). Update on nonpharmacologic approaches to relieve labor pain and prevent suffering. *Journal of Midwifery & Women's Health*, *49*(6), 489–504.	31	139	Systematic Review
7	Smith, C. A., Collins, C. T., Cyna, A. M., & Crowther, C. A. (2003). Complementary and alternative therapies for pain management in labor *Cochrane Database of Systematic Reviews*, *2*.	30	148	Cochrane Systematic Review
8	Tournaire, M., & Theau-Yonneau, A. (2007). Complementary and alternative approaches to pain relief during labor. *Evidence-based complementary and alternative medicine*, *4*(4), 409–417.	26	82	Randomized Controlled Trial
9	Chang, M. Y., Wang, S. Y., & Chen, C. H. (2002). Effects of massage on pain and anxiety during labor: a randomized controlled trial in Taiwan. *Journal of advanced nursing*, *38*(1), 68–73.	25	79	Randomized Controlled Trial
10	Måtensson, L., & Wallin, G. (1999). Labor pain treated with cutaneous injections of sterile water: a randomized controlled trial. BJOG: An International Journal of Obstetrics & Gynecology, 106(7), 633–637.	24	51	Randomized Controlled Trial

acupuncture ($f=103$) and hypnosis ($f=44$) are the most commonly analyzed interventions with medium resource requirements. Additionally, although interventions with low resource requirements were more diverse, interventions with moderate resource requirements ($f=433$) were studied more than interventions with low resource requirements ($f=313$).

The trending interventions among non-pharmacological interventions that are used in the management of labor pain in recent years are presented in Figures 5 and 6.

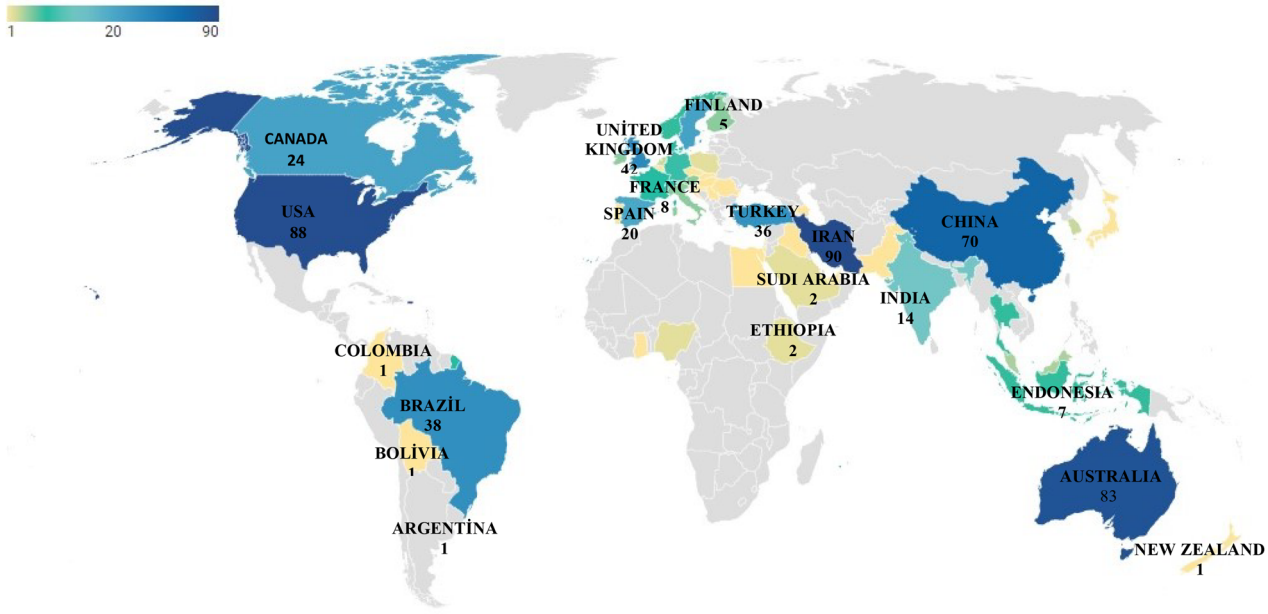

Figure 4. Scientific productivity of countries about non-pharmacological interventions that are used in the management of labor pain (1963–2023).

Table 3. Twenty countries with the highest funding for research on non-pharmacological interventions in the management of labor pain and their funding rates.

Country	Number of funded publications	Number of publications (2009-2023)	% of funded publications
Iran	31	46	67.39
Australia	27	43	58.70
United kingdom	14	25	30.43
United States	12	26	26.09
China	11	27	23.91
Brazil	7	22	15.22
Sweden	7	12	15.22
Spain	6	16	13.04
Canada	6	9	13.04
Taiwan	3	4	6.52
Türkiye	2	30	4.35
Indonesia	2	7	4.35
Denmark	2	4	4.35
Ireland	2	3	4.35
Thailand	2	3	4.35
Wales	2	2	4.35
Germany	1	6	2.17
Singapore	1	3	2.17
Ethiopia	1	2	2.17
South Korea	1	2	2.17

Figure 5 shows trending topics in intervention methods, whereas Figure 6 shows general trends in research on non-pharmacological interventions. While the edges represent the places of topics on the timeline, the nodes represent the frequencies of topics in the years when they were trending. Additionally, longer edges indicate that the topic remained relevant. In Figure 5, it is seen that TENS and acupuncture have been studied for a long time, and new studies are also being conducted about these topics. It is seen that especially with the advancement of technology nowadays, the topic of virtual reality has become prominent as a trending intervention method. The trends in recent years also included massage ($f=15$), yoga ($f=9$), reflexology ($f=5$), and aromatherapy ($f=12$).

As seen in Figure 6, the topics of TENS, analgesia, water birth, pain relief, low back pain, and labor analgesia have been studied for a long time and continue to be studied today. Among the trends observed in recent years, there are the concepts of midwifery ($f=20$), massage ($f=15$), systematic review ($f=14$), and prenatal ($f=4$).

The cluster diagram created based on the results of the co-authorship analysis representing international collaboration is shown in Figure 7, whereas the collaboration networks distributed based on the timeline are presented in Figure 8. In the map, it is seen that Australia, the USA, China, and the UK were prominent countries in terms of publication numbers and collaborations among studies on non-pharmacological interventions that are used in the management of labor pain, they played a central role, and they had the broadest collaboration networks with other countries. Although, in particular, Brazil and Iran had high numbers of publications, they were relatively outside the center of the map based on the results of the co-authorship analysis. Collaboration networks based on the timeline provide information on current connections. Accordingly, while the collaboration network of the countries in the blue areas used to be strong in earlier years, it can be stated that in recent years, the studies of authors from countries in the yellow cluster such as Iran and China, as well as their collaboration

Table 4. Classification of non-phamakological interventions in resource quantity, and frequency of interventions.

Rank	Low-resource interventions	f	Rank	Moderate-resource interventions	f
1	Acupressure/shiatsu/ Sanyinjiao/auricular acupressure	58	1	Hydrotherapy/ immersion bath/ water birth/birth pool	122
2	Massage	56	2	Acupuncture therapy/ acupuncture/ auriculotherapy/ electroacupuncture	103
3	Music/music therapy/ auditory stimulation/ singing	32	3	Hypnosis/ hypnotherapy/ hypnotism / self-hypnosis	44
4	Prenatal education/ antenatal education/ childbirtheducation	28	4	Sterile water blocks/ sterile water injections	39
5	Relaxation techniques/ relaxation therapy	27	5	Aromatherapy/ essence/essential oil/volatile oils	35
6	Cognitive Behavioral Therapy/ psychotherapy/ psychology therapy	25	6	Transcutaneous electric nerve stimulation/TENS/ electric stimulation	34
7	Walking/exercise/ movement/position	23	7	Yoga meditation	23
8	Breathing exercises/ breathing technique	11	8	Homeopathy/herbal medicine/herbs	17
9	Heat therapy/hot temperature	11	9	Biofeedback	9
10	Reflexology/ musculoskeletal manipulations	8	10	Virtual reality	7
11	Cold temperature/ice	7		Total	**433**
12	Mindfulness/awareness	5			
13	Imagery	5			
14	Therapeutic touch	4			
15	Ginger/fruit/chewing gum	4			
16	Spirituality/Islamic prayer	3			
17	Birth ball	3			
18	Dance	2			
19	Art therapy	1			
	Total	313			

networks, became more prominent. Furthermore, it is seen that new studies started to be conducted in recent years in countries such as Saudi Arabia, Malaysia, Ireland, and Ethiopia.

A co-word analysis was carried out using the keywords included in the studies that were examined in this study. Results are presented in Figure 9. The results of the common word analysis were examined thematically. The emerging themes and sub-themes are presented in Table 5. Our analyses revealed that the research fields under the main field of non-pharmacological interventions in the management of labor pain were distributed under five themes. These themes were research methods for some techniques, the most frequently used methods in pain management, midwifery and nursing interventions, the general trends in complementary and alternative methods, pregnancy and postpartum processes, and research on the pregnancy and postpartum periods. Research methods and midwifery and nursing interventions, and the most commonly used methods in labor management were the two largest themes. In addition, sub-themes related to the themes are also presented in Table 5. The areas in the sub-themes indicate more specific aspects of the research areas in the main themes.

Discussion

This study employed bibliometric and visual analysis methods to investigate publications on non-pharmacological interventions that are used in the management of labor pain. Study results revealed which methods are more effective or popular in the management of labor pain, identification of less studied areas, gaps and potential opportunities for future research, countries' contribution and collaboration on studies, and the most funded methods. By providing an in-depth understanding of nonpharmacological interventions used in the management of labor pain, such bibliometric analysis can both improve current practices and provide direction for future research and practice. This helps healthcare professionals make more informed and effective decisions and can ultimately contribute to better health outcomes for patients.

Our analyses suggested that the number of studies relevant to the topic showed a slow increase up to 2003, and this research field was a developing field. The production of articles on the subject accelerated after 2004 and can be attributed to the increased use of evidence-based medicine [37]. In another literature review, the most important publication criteria in the field of reproductive medicine between 2003 and 2012 were examined, and a growth rate of 58% was found in the literature on obstetrics and gynecology after 2003 [38]. In addition to this, the fluctuations in the number of publications in the following years were noteworthy. This finding was confirmed by the results of another study examining research trends in the management of labor pain in the last 10 years [39]. These results were probably related to the complexity of conducting these studies. Studies in this field require advanced levels of methodological knowledge and substantial funds, and they take a long time to conduct [40]. Additionally, especially interventional studies in the perinatal field are more complicated to conduct due to some ethical issues and the difficulty of including a sufficient number of pregnant women agreeing to participate.

Analyzing the most relevant journals in a field can help researchers select appropriate journals to which they could send their articles for review. We found that the Cochrane Database of Systematic Reviews, a

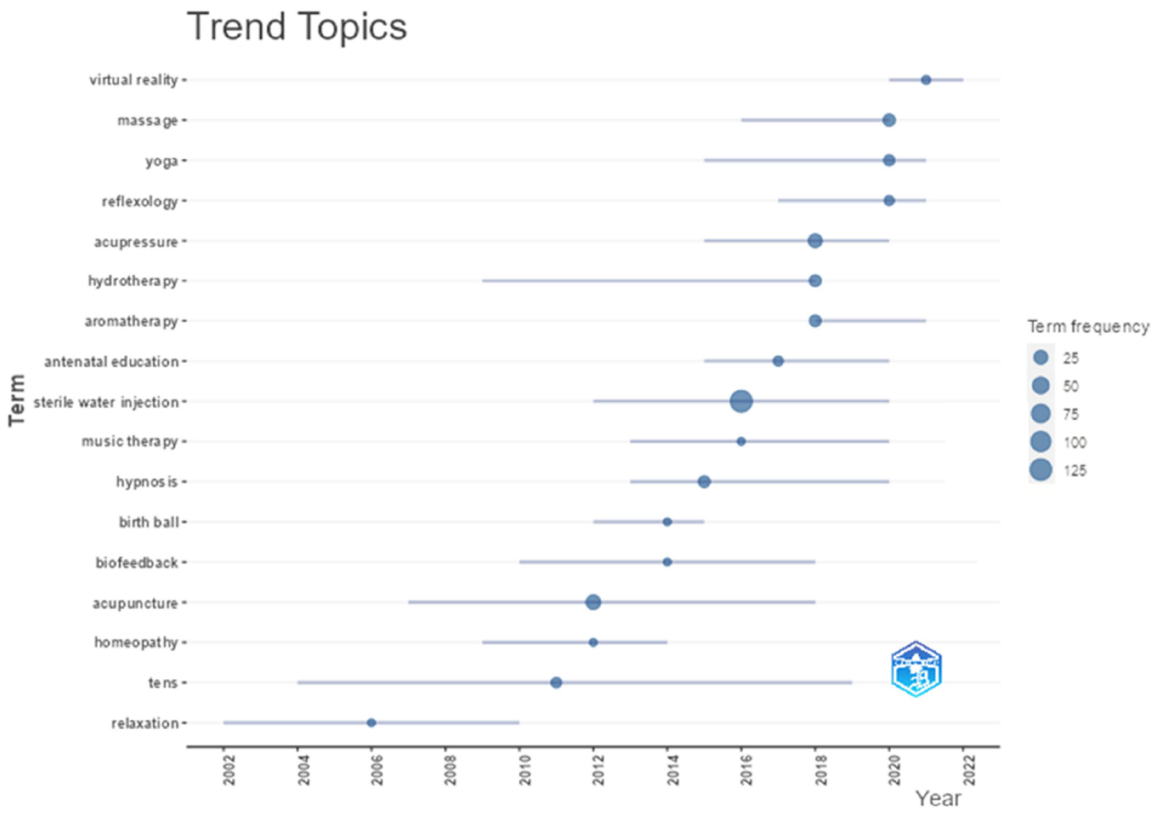

Figure 5. Trending non-pharmacological interventions.

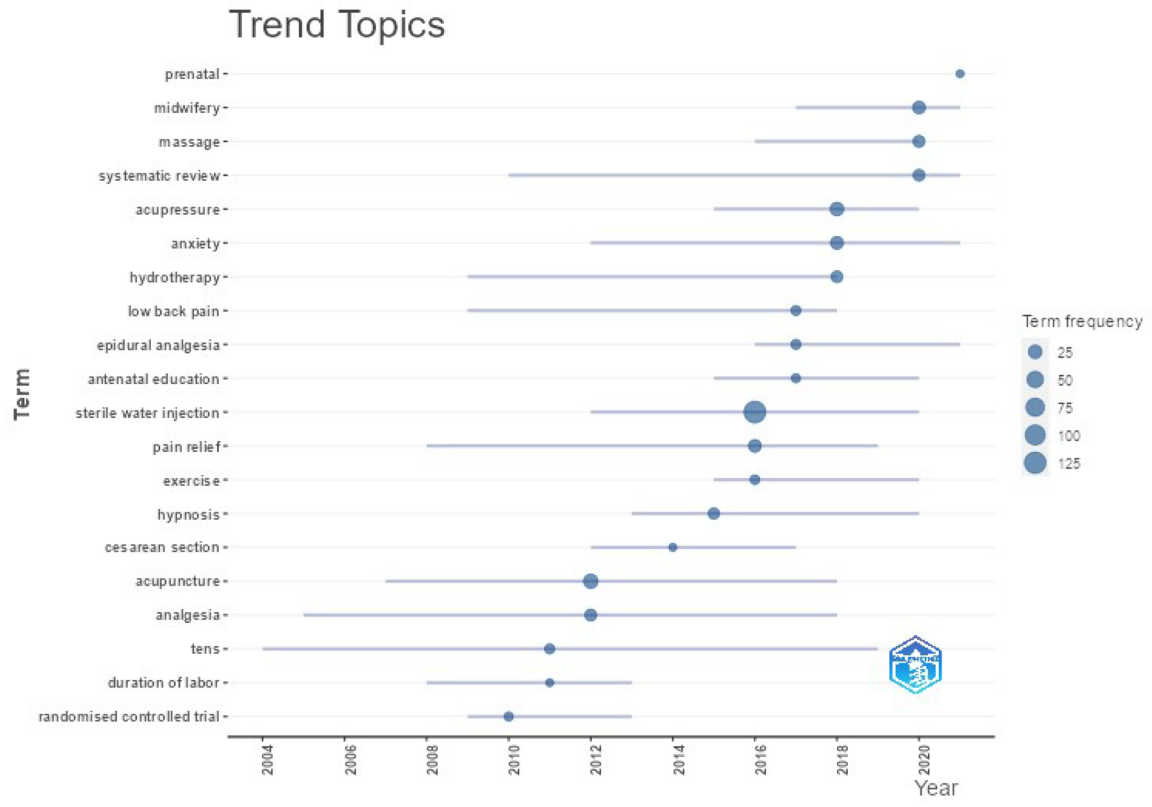

Figure 6. General trending topics about non-pharmacological interventions that are used in the management of labor pain.

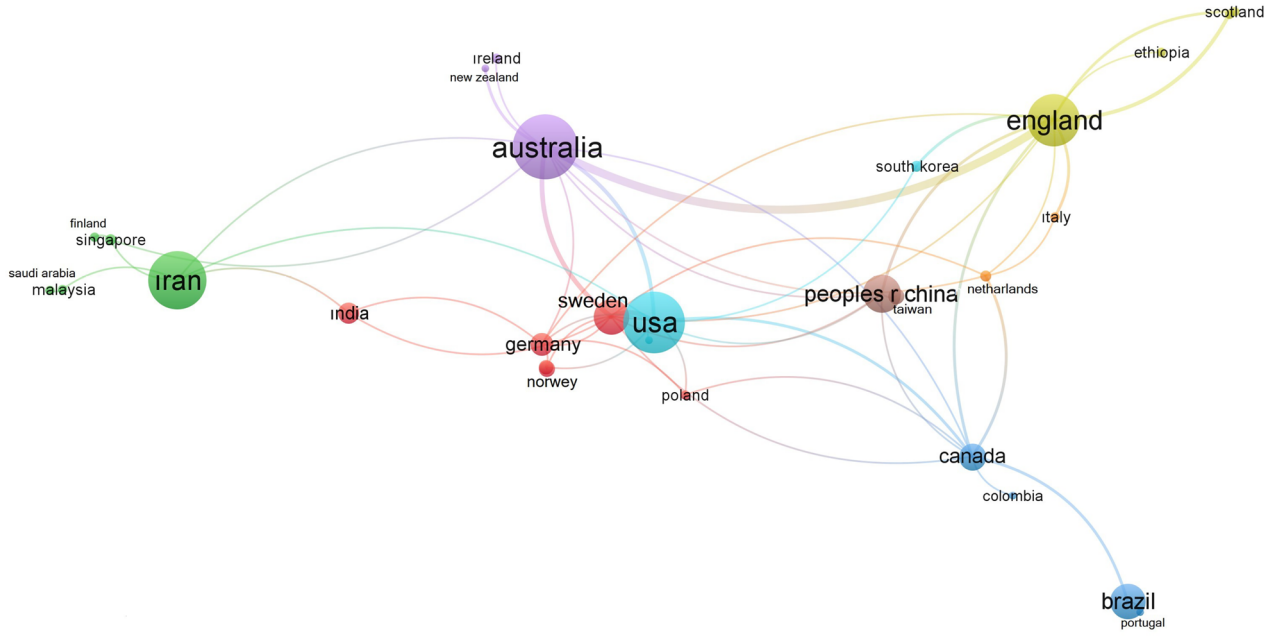

Figure 7. Co-authorship analysis cluster diagram (among countries).

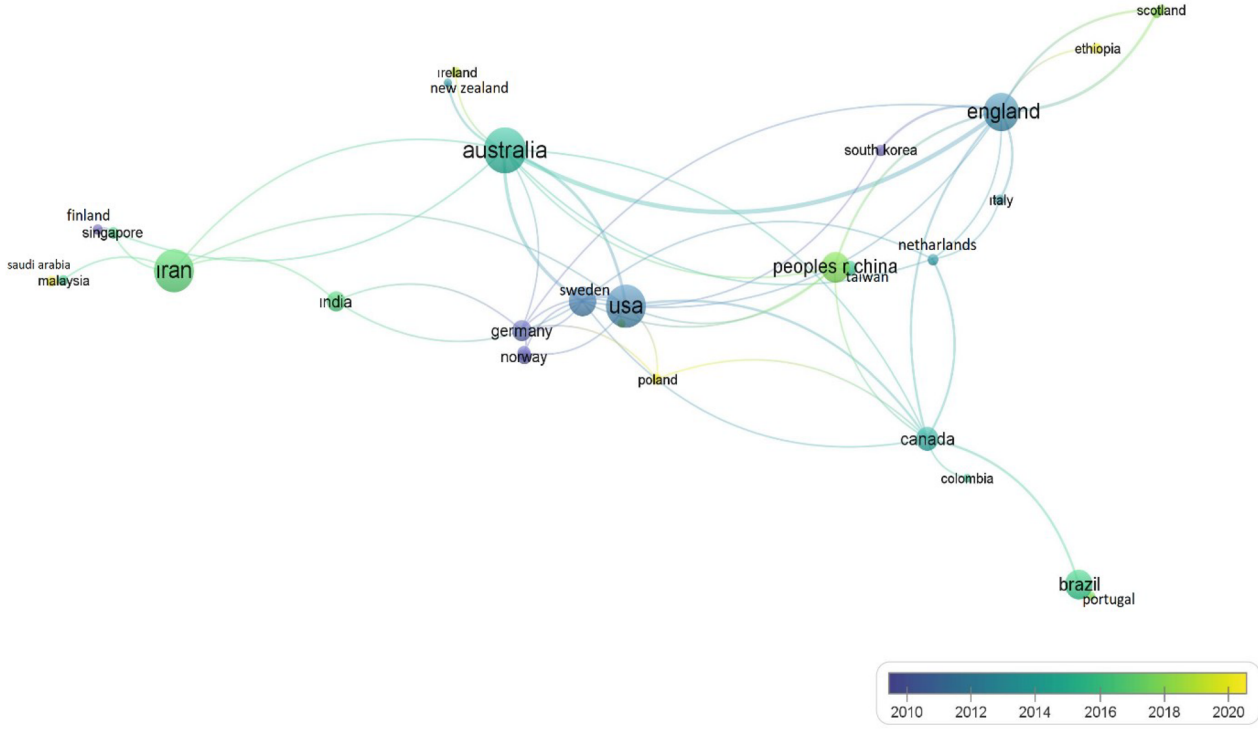

Figure 8. Overlay visualization of co-authorship network between countries.

secondary database in the Cochrane Library, ranked first. In a study which focused on the Cochrane Database, it was shown that pain was one of the most frequently studied variables in studies included on the database [41]. Additionally, clinical practice and research are published in the Cochrane database, making it a suitable platform for studies on pain management in labor [42]. This shows that Cochrane systematic reviews are a significant source of references in the field, and they contribute to the literature substantially [42]. Another journal with significant contributions to the field based on its local citations was the journal Midwifery, which was in the second place among the most relevant journals in the research field

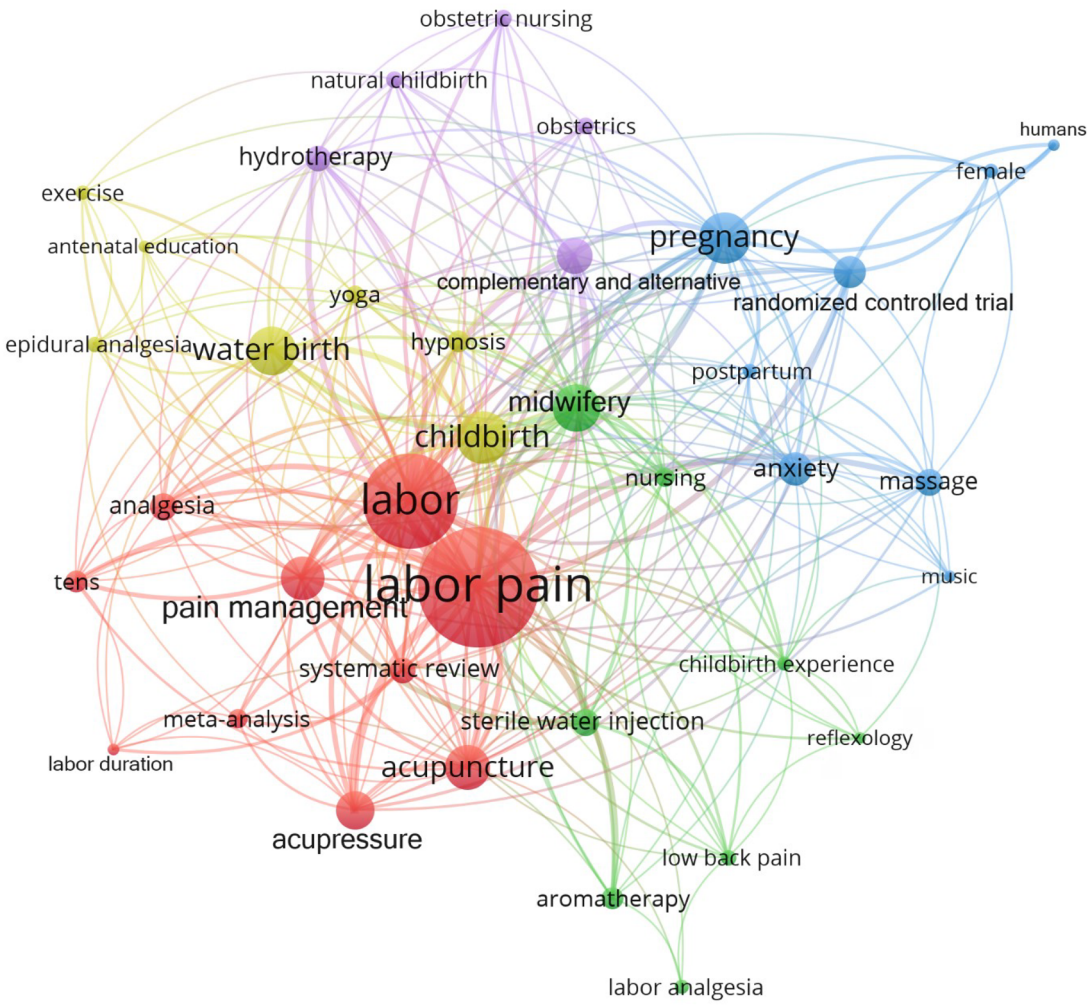

Figure 9. Co-word analysis.

Table 5. Research themes related to non-pharmacological interventions in the management of labor pain.

Theme	Colour	More frequent codes	Prevailing sub-categories
Research methods for some techniques	Red	labor pain (130), labor (108), pain management (32), acupuncture (32), acupressure (26), analgesia (15), systematic review (14), meta-analysis (10), tens (7), labor duration (5)	Research methods and assessment, pain management in labor, pain reduction strategies in labor, non-pharmacological interventions and strategies
Midwifery and nursing interventions	Green	midwifery (34), sterile water injection (20), nursing (17), aromatherapy (12), low back pain (11), childbirth experience (6), labor analgesia (6), reflexology (5)	Midwifery and nursing perspectives, use of sterile water injections in labor pain, aromatherapy and childbirth experience, low back pain management in labor, labor analgesia and holistic approaches
The most frequently used methods in labor management.	Yellow	childbirth (50), water birth (49), hypnosis (12), epidural analgesia (7), exercise (6), yoga (9), antenatal education (5)	Comparison of pharmacological and non-pharmacological interventions, pre-pregnancy education and preparation for birth, relaxation methods used in labor pain, pain control in the birth process, physical exercise and labor pain
The general trends in complementary and alternative methods	Purple	complementary and alternative medicine (26), hydrotherapy (20), obstetrics (12), obstetric nursing (9), natural childbirth (8)	Natural birth and non-pharmacological methods, labor pain management from the perspective of obstetric nurses, use of different techniques in labor pain
Research on the pregnancy and postpartum periods	Blue	pregnancy (37), Anxiety (21), randomized controlled trial (19), massage (19), postpartum (6), music (5), female (5), humans (4)	Anxiety management in labor pain, methods of coping with labor pain trained during pregnancy, postnatal care and support, experimental studies in pain management

of non-pharmacological interventions and showed a rapid rise in publication numbers in recent years based on its cumulative productivity. This finding is consistent with the study finding of Wahyuningsih et al. [39]. This journal mainly covers publications by midwives and maternity care providers. The positive

trend in the journal can be attributed to the interest of midwives in the management of labor pain in their research [43,44], and the increase in clinical studies in the field of midwifery [45,46]. A previous study examining 100 articles in the field of midwifery indexed on WoS also showed that the journal Midwifery produced the greatest number of publications in this field [47].

Considering countries focusing on non-pharmacological interventions in labor pain, Iran was found to be the most productive and the most funded country. This contrasts with the finding in another bibliometric study examining pain management in childbirth that the most productive country was the USA [39]. This difference may be due to the fact that the authors of the cited study only scanned the Scopus database and examined the last 10 years. Traditional medicine is a fundamental component of Iranian culture [48]. In Iran, Persian Medicine is a popular branch of complementary and alternative medicine, and it has a broad area of usage [49]. This is also confirmed by studies showing that complementary and alternative medicine has a wide range of use in Iran [50,51]. Australia, the UK, the USA and China are among the other top five countries where studies are most funded; this shows that research in these countries is more funded than in other top countries. This is most likely a result of these countries' more developed economies and higher funding of scientific research budgets. A positive correlation was also found between per capita income and the number of articles in the fields of nursing, psychiatry and endocrinology [35,52,53]. As a matter of fact, it is known that developing countries contribute less to the production of research literature than developed countries due to lack of resources, insufficient representation in journal editorial boards and lack of international cooperation [35]. Regarding collaborations among countries, Australia, the US, and China were also dominant in this sense Iran with the highest number of publications, was found to increase its collaborations only in recent years. This showed that Iran had a large volume of research in this field, but its impact was relatively small.

We determined that interventions with moderate resource requirements (hydrotherapy, acupuncture, and hypnosis) were used more frequently in pain management during labor. The fact that there are many studies showing the effectiveness of these interventions worldwide shows the widespread use of these interventions [54,55]. Although these interventions require more resources, they have been the subject of intense research due to their effectiveness in managing labor pain. Additionally, the history of hydrotherapy, acupuncture, and hypnosis in labor dates back to ancient times [56–58]. The fact that there have been previous studies on these interventions may have led to new studies focusing on this field and expanding the research based on existing knowledge. Additionally, the clinical effectiveness of interventions with medium resource requirements may be more clearly visible or have a broader impact [8]. This may cause researchers to focus more on these interventions.

Our results also showed that trending interventions in recent years include virtual reality, massage, yoga, reflexology, and aromatherapy. With today's advancing technology, it is seen that virtual reality has been added to pain management interventions during birth [14,59,60]. In addition, mind-body interventions (massage, yoga, reflexology and aromatherapy), which generally have a relaxing effect and relieve the person of pain and stress [61], have begun to be widely included in research [14,62,63]. In the systematic review conducted by Hu et al. using network analysis and analyzing 43 articles, the effectiveness of these interventions was examined because they are frequently used, and positive results were obtained regarding their effectiveness [5].

Considering keywords and key phrases that are frequently used together in studies on non-pharmacological methods in the management of labor pain, we derived main themes under this main research field. One of these themes was considered to offer information about the level of evidence on the effectiveness of some non-pharmacological interventions (acupuncture, acupressure, TENS). It is accepted that sources of the greatest level of evidence are the systematic reviews and meta-analyses of several large-scale randomized clinical studies with high methodological quality [64]. The clustering of the keywords acupuncture, acupressure, and TENS with the keywords systematic review and meta-analysis showed the increasing level of evidence in this field. This result was in agreement with the results reported by several other researchers [65–68]. Another theme of research revealed that scientists in the fields of midwifery and nursing have made a significant contribution to the information shared in this field. Midwives and nurses have important and active roles in pain management during labor. For this reason, several studies have focused on the effectiveness of midwifery and nursing interventions [19,69]. This research hotspot also showed that researchers who are midwives or nurses are not limiting themselves to the context of basic medical knowledge, but they also pay great importance to clinical studies. These directions of research may have an important role in the development of research fields about non-pharmacological interventions in the management of labor pain.

This study had some inevitable limitations. First of all, although we conducted our searches on the WoS and PubMed databases, the numbers of publications from various countries were still limited. There are other databases that could be used for bibliometric analyses such as Scopus, CINAHL, and Embase. Second of all, our access strategy might not have covered all relevant references due to the usage of different forms of the same concepts in article keywords by authors, and thus, our findings might not be comprehensive. Nonetheless, because the number of publications included in our analyses was sufficiently high, we believe that our findings reflect the general state of this field and relevant trends.

Conclusion

According to the results of our bibliometric analyses, the trend in worldwide research literature production on the topic of non-pharmacological interventions used in the treatment of labor pain is positive. Publishing articles in journals with high impact factor values indicates that their quality is high. This study has shown that Iran, Australia, the UK, the USA and China play a leading role and that cooperation between countries is increasing day by day. In the study, it was determined that interventions requiring moderate resources (hydrotherapy, acupuncture and hypnosis) were used more frequently in studies, and virtual reality has also been included in studies in recent years. Future research is needed to promote the development and advancement of non-pharmacological interventions for the treatment of labor pain. In order to meet the needs of women in labor pain and to provide care with effective and reliable methods by health professionals, studies with international collaborations and comparison of different methods may be useful.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

References

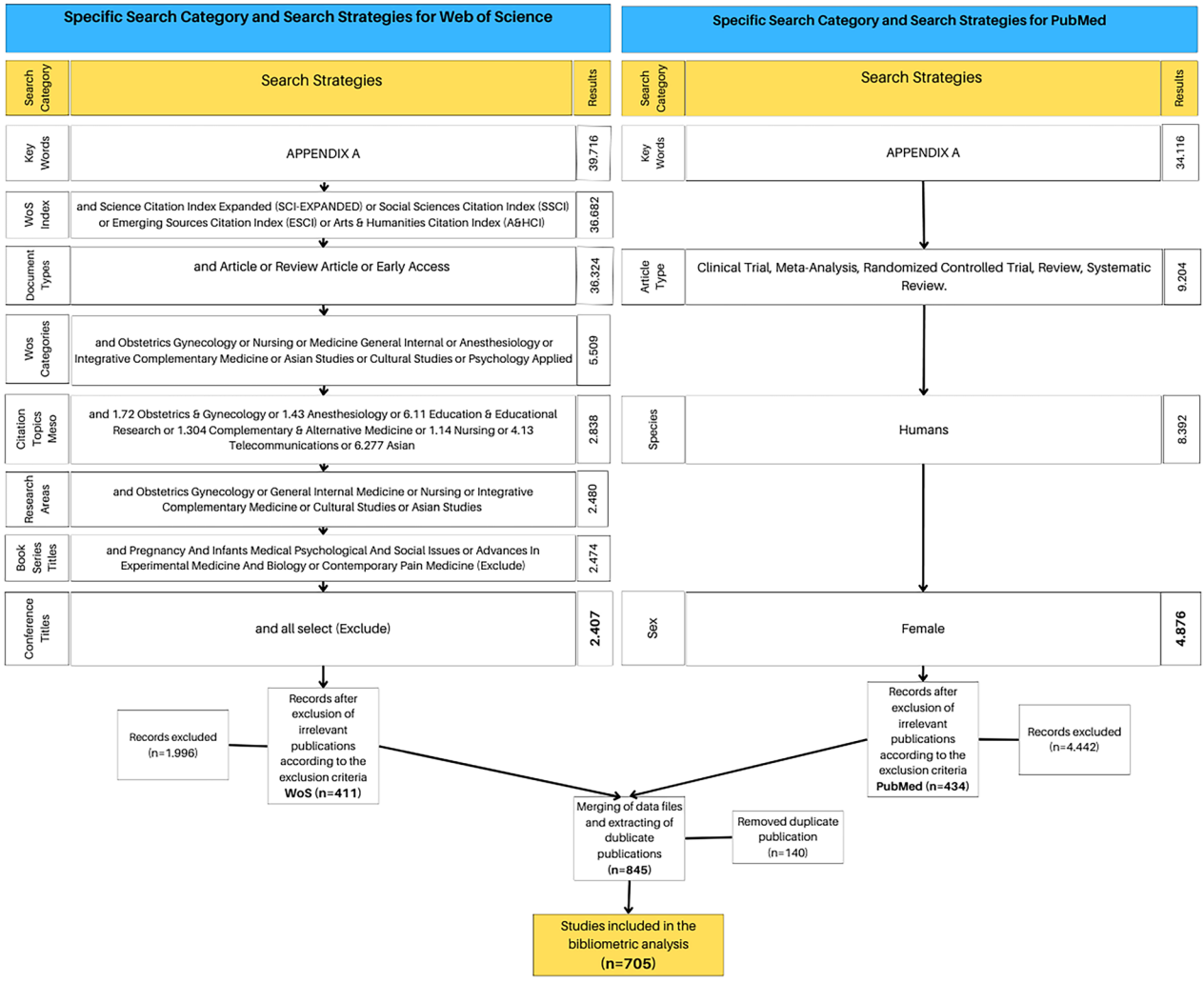
[1] Leinweber J, Fontein-Kuipers Y, Karlsdottir SI, et al. Developing a woman-centered, inclusive definition of positive childbirth experiences: a discussion paper. Birth. 2023;50(2):1–17. doi:10.1111/birt.12666
[2] Beyable AA, Bayable SD, Ashebir YG. Pharmacologic and non-pharmacologic labor pain management techniques in a resource-limited setting: a systematic review. Ann Med Surg (Lond). 2022;74:103312. doi:10.1016/j.amsu.2022.103312
[3] Farnham T. Reviewing pain management options for patients in active labor. Nursing. 2020;50(6):24–30. doi:10.1097/01.NURSE.0000662352.97953.cd
[4] Zuarez-Easton S, Erez O, Zafran N, et al. Pharmacological and non-pharmacological options for pain relief during labor: an expert review. Am J Obstet Gynecol. 2023;228(5S):S1246–S1259. doi:10.1016/j.ajog.2023.03.003
[5] Hu Y, Lu H, Huang J, et al. Efficacy and safety of non-pharmacological interventions for labour pain management: a systematic review and bayesian network meta-analysis. J Clin Nurs. 2021;30(23-24):3398–3414. doi:10.1111/jocn.15865
[6] Cohen WR, Friedman EA. The latent phase of labor. Am J Obstet Gynecol. 2023;228(5S):S1017–S1024. doi:10.1016/j.ajog.2022.04.029
[7] Šanjug J, Kuna K, Goldštajn MŠ, et al. Relationship between COMT gene polymorphism, anxiety, and pain perception during labour. J Clin Med. 2023;12(19):6298. doi:10.3390/jcm12196298
[8] Caughey AB, Tilden E. Nonpharmacologic approaches to management of labour pain. UpToDate Waltham, MA: upToDate 2004.
[9] Gülümser C, Yassa M, Group W, et al. Clinical management of uterine contraction abnormalities; an evidence-based intrapartum care algorithm. BJOG. 2022; doi:10.1111/1471-0528.16727
[10] WHO. WHO recommendations on intrapartum care for a positive childbirth experience: world Health Organization; 2018
[11] Wray S, Arrowsmith S, Sharp A. Pharmacological ınterventions in labor and delivery. Annu Rev Pharmacol Toxicol. 2023;63(1):471–489. doi:10.1146/annurev-pharmtox-051921-122822
[12] Smith CA, Collins CT, Cyna AM, et al. Complementary and alternative therapies for pain management in labour. Cochrane Database Syst Rev. 2006;2006(4):CD003521. doi:10.1002/14651858.CD003521.pub2
[13] Practice CoO. ACOG committee opinion no. 766: approaches to limit intervention during labor and birth. Obstet Gynecol. 2019;133:e164–e173.
[14] Nori W, Kassim MAK, Helmi ZR, et al. Non-pharmacological pain management in labor: a systematic review. J Clin Med. 2023;12(23):7203. doi:10.3390/jcm12237203
[15] Jones L, Othman M, Dowswell T, et al. Pain management for women in labour: an overview of systematic

reviews. Cochrane Database of Systematic Reviews. 2012; doi:10.1002/14651858.CD009234.pub2
[16] Hakala M, Rantala A, Pölkki T. Women's perceptions of counselling on pain assessment and management during labour in Finland: a cross-sectional survey. Midwifery. 2022;114:103471. doi:10.1016/j.midw.2022.103471
[17] Rantala A, Hakala M, Pölkki T. Women's perceptions of the pain assessment and non-pharmacological pain relief methods used during labor: a cross-sectional survey. Eur J Midwifery. 2022;6:21. doi:10.18332/ejm/146136
[18] Rodrigues VA, Abreu YR, Santos CA, et al. Nonpharmacological labor pain management methods and risk of cesarean birth: a retrospective cohort study. Birth. 2022;49(3):464–473. doi:10.1111/birt.12617
[19] Chang C-Y, Gau M-L, Huang C-J, et al. Effects of non-pharmacological coping strategies for reducing labor pain: a systematic review and network meta-analysis. PLoS One. 2022;17(1):e0261493. doi:10.1371/journal.pone.0261493
[20] Thomson G, Feeley C, Moran VH, et al. Women's experiences of pharmacological and non-pharmacological pain relief methods for labour and childbirth: a qualitative systematic review. Reprod Health. 2019;16(1):71. doi:10.1186/s12978-019-0735-4
[21] Kokol P, Vošner HB. Discrepancies among scopus, web of science, and PubMed coverage of funding information in medical journal articles. J Med Libr Assoc. 2018;106(1):81–86. doi:10.5195/jmla.2018.181
[22] Kokol P, Završnik J, Vošner HB. Bibliographic-based identification of hot future research topics: an opportunity for hospital librarianship. Journal of Hospital Librarianship. 2018;18(4):315–322. doi:10.1080/15323269.2018.1509193
[23] Kokol P, Kokol M, Zagoranski S. Machine learning on small size samples: a synthetic knowledge synthesis. Sci Prog. 2022;105(1):368504211029777. doi:10.1177/00368504211029777
[24] Bogilović S, Černe M. The intellectual structure and outlooks for individual creativity research: a bibliometric analysis for the period 1950–2016. In: Roni Reiter-Palmon VLK, James C. Kaufman Hrsg, editors. Individual creativity in the workplace. Amsterdam: Elsevier; 2018: 153–188.
[25] Kokol P, Blažun Vošner H, Završnik J. Application of bibliometrics in medicine: a historical bibliometrics analysis. Health Info Libr J. 2021;38(2):125–138. doi:10.1111/hir.12295
[26] Aria M, Cuccurullo C. Bibliometrix: an R-tool for comprehensive science mapping analysis. Journal of İnformetrics. 2017;11(4):959–975. doi:10.1016/j.joi.2017.08.007
[27] Heersmink R, van den Hoven J, van Eck NJ, et al. Bibliometric mapping of computer and information ethics. Ethics Inf Technol. 2011;13(3):241–249. doi:10.1007/s10676-011-9273-7
[28] Xie H, Niu N, Ming Z, et al. Evolving landscape of research on cancer-related cognitive impairment: a bibliometric analysis. Asia Pac J Oncol Nurs. 2023;10(5):100217. doi:10.1016/j.apjon.2023.100217
[29] Wang X, Zhang Z, He X, et al. Mapping publication status and exploring hotspots in a research field: rheumatoid arthritis with depression. J Adv Nurs. 2020;76(11):3003–3013. doi:10.1111/jan.14504
[30] Sánchez AD, de la Cruz Del Río Rama M, García JÁ. Bibliometric analysis of publications on wine tourism in the databases scopus and WoS. European Research on Management and Business Economics. 2017;23(1):8–15. doi:10.1016/j.iedeen.2016.02.001
[31] Van Eck N, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. scientometrics. 2010;84(2):523–538. doi:10.1007/s11192-009-0146-3
[32] [Anonym]. Journal citation reports. In: clarivate Analytics; 2022
[33] Batista-Canino RM, Santana-Hernández L, Medina-Brito P. A scientometric analysis on entrepreneurial intention literature: delving deeper into local citation. Heliyon. 2023;9(2):e13046. doi:10.1016/j.heliyon.2023.e13046
[34] Sun L, Rahwan I. Coauthorship network in transportation research. Transportation Research Part A: policy and Practice. 2017;100:135–151. doi:10.1016/j.tra.2017.04.011
[35] Kokol P, Železnik D, Završnik J, et al. Nursing research literature production in terms of the scope of country and health determinants: a bibliometric study. J Nurs Scholarsh. 2019;51(5):590–598. doi:10.1111/jnu.12500
[36] McAllister JT, Lennertz L, Atencio Mojica Z. Mapping a discipline: a guide to using VOSviewer for bibliometric and visual analysis. Science & Technology Libraries. 2022;41(3):319–348. doi:10.1080/0194262X.2021.1991547
[37] You S. Perspective and future of evidence-based medicine. Stroke Vasc Neurol. 2016;1(4):e000032–164.
[38] Aleixandre-Benavent R, Simon C, Fauser BC. Trends in clinical reproductive medicine research: 10 years of growth. Fertil Steril. 2015;104(1):131–137. e135. doi:10.1016/j.fertnstert.2015.03.025
[39] Wahyuningsih IR, Putri NA, Sariayu MD, et al. The management of delıvery paın: a bıblıometrıc analysıs. Placentum J Ilmiah Kes Apl. 2023;11(2):185–193. doi:10.20961/placentum.v11i2.77264
[40] Hong SJ, Yoon DY, Cho YK, et al. Characteristics and quality of radiologic randomized controlled trials: a bibliometric analysis between 1995 and 2014. AJR Am J Roentgenol. 2016;206(5):917–923. doi:10.2214/AJR.15.15640
[41] Wieland LS, Manheimer E, Sampson M, et al. Bibliometric and content analysis of the cochrane complementary medicine field specialized register of controlled trials. Syst Rev. 2013;2(1):51. doi:10.1186/2046-4053-2-51
[42] [Anonym]. Cochrane Database of Systematic Reviews. In. Cochrane Library
[43] Klomp T, De Jonge A, Hutton EK, et al. Perceptions of labour pain management of Dutch primary care midwives: a focus group study. BMC Pregnancy Childbirth. 2016;16(1):6. doi:10.1186/s12884-015-0795-6
[44] Nursanti R. The role of midwives in overcoming labor pain. In First International Conference on Health, Social Sciences and Technology (ICOHSST 2020): Atlantis Press; 2021: 27–31 doi:10.2991/assehr.k.210415.007
[45] Watson R, Tomietto M, Mikkonen K. Increasing the use of experimental methods in nursing and midwifery education research. Nurse Educ Pract. 2023;70:103674. doi:10.1016/j.nepr.2023.103674
[46] Harris C, Hare N, McCabe L, et al. A novel research competency framework for clinical research nurses and midwives. Nurse Res. 2023;31. doi:10.7748/nr.2023.e1900
[47] Li T, Zeng Y, Fan X, et al. A bibliometric analysis of research articles on midwifery based on the web of

science. J Multidiscip Healthc. 2023;16:677–692. doi:10.2147/JMDH.S398218
[48] Yazdi N, Salehi A, Vojoud M, et al. Use of complementary and alternative medicine in pregnant women: a cross-sectional survey in the South of Iran. J Integr Med. 2019;17(6):392–395. doi:10.1016/j.joim.2019.09.003
[49] Moeini R, Mozaffarpur SA, Mojahedi M, et al. The prevalence of complementary and alternative medicine use in the general population of babol, North of Iran, 2018. BMC Complement Med Ther. 2021;21(1):113. doi:10.1186/s12906-021-03281-7
[50] Mehrolhassani MH, Setayesh M, Yazdi-Feyzabadi V, et al. Identification of drivers and affecting factors in the future of persian medicine: the cross-impact analysis method. European Journal of Integrative Medicine. 2024;65:102316. doi:10.1016/j.eujim.2023.102316
[51] Behnood-Rod A, Khoshkbejari MAP, Pourzargar P, et al. Complementary and alternative medicine use among Iranian patients attending urban outpatient general practices. Complement Ther Clin Pract. 2018;30:58–63. doi:10.1016/j.ctcp.2017.12.008
[52] Zhang J, Chen X, Gao X, et al. Worldwide research productivity in the field of psychiatry. Int J Ment Health Syst. 2017;11(1):20. doi:10.1186/s13033-017-0127-5
[53] Zhao X, Ye R, Zhao L, et al. Worldwide research productivity in the field of endocrinology and metabolism—a bibliometric analysis. Endokrynol Pol. 2015;66(5):434–442. doi:10.5603/EP.2015.0054
[54] Catsaros S, Wendland J. Hypnosis-based interventions during pregnancy and childbirth and their impact on women's childbirth experience: a systematic review. Midwifery. 2020;84:102666. doi:10.1016/j.midw.2020.102666
[55] Landolt AS, Milling LS. The efficacy of hypnosis as an intervention for labor and delivery pain: a comprehensive methodological review. Clin Psychol Rev. 2011;31(6):1022–1031. doi:10.1016/j.cpr.2011.06.002
[56] Cowan E, Heale R, Horrigan J, et al. Hydrotherapy as a nursing ıntervention for labour pain: a literature review. DRHJ. 2017;1:121–132. doi:10.28984/drhj.v1i0.10
[57] Schlaeger JM, Gabzdyl EM, Bussell JL, et al. Acupuncture and acupressure in labor. J Midwifery Womens Health. 2017;62(1):12–28. doi:10.1111/jmwh.12545
[58] Bhagat V, Menon S. The efficacy of using hypnosis to reduce anxiety and pain in obstetrics and gynecology patients. Rese J Pharm and Technol. 2020;13(1):347–352. doi:10.5958/0974-360X.2020.00070.0
[59] Wong MS, Spiegel BM, Gregory KD. Virtual reality reduces pain in laboring women: a randomized controlled trial. Am J Perinatol. 2020;38(S 01):e167–e172. doi:10.1055/s-0040-1708851
[60] Hajesmaeel-Gohari S, Sarpourian F, Shafiei E. Virtual reality applications to assist pregnant women: a scoping review. BMC Pregnancy Childbirth. 2021;21(1):249. doi:10.1186/s12884-021-03725-5
[61] Smith CA, Levett KM, Collins CT, et al. Relaxation techniques for pain management in labour. Cochrane Database Syst Rev. 2018;2018(3). doi:10.1002/14651858.CD009514.pub2
[62] Candy B, Armstrong M, Flemming K, et al. The effectiveness of aromatherapy, massage and reflexology in people with palliative care needs: a systematic review. Palliat Med. 2020;34(2):179–194. doi:10.1177/0269216319884198
[63] Bo S, Li L, Wang C, et al. Effect of mind map assisting midwife-led labor on pain management and childbirth outcome. Int J Clin Exp Med. 2020;13:2790–2797.
[64] Burns PB, Rohrich RJ, Chung KC. The levels of evidence and their role in evidence-based medicine. Plast Reconstr Surg. 2011;128(1):305–310. doi:10.1097/PRS.0b013e318219c171
[65] Chen Y, Xiang X-Y, Chin KHR, et al. Acupressure for labor pain management: a systematic review and meta-analysis of randomized controlled trials. Acupunct Med. 2021;39(4):243–252. doi:10.1177/0964528420946044
[66] Raana HN, Fan X-N. The effect of acupressure on pain reduction during first stage of labour: a systematic review and meta-analysis. Compl Ther Clin Pract. 2020;39:101126. doi:10.1016/j.ctcp.2020.101126
[67] Smith CA, Collins CT, Levett KM, et al. Acupuncture or acupressure for pain management during labour. Cochrane Database Syst Rev. 2020. doi:10.1002/14651858.CD009232.pub2
[68] Thuvarakan K, Zimmermann H, Mikkelsen MK, et al. Transcutaneous electrical nerve stimulation as a pain-relieving approach in labor pain: a systematic review and meta-analysis of randomized controlled trials. Neuromodulation. 2020;23(6):732–746. doi:10.1111/ner.13221
[69] Adams J, Frawley J, Steel A, et al. Use of pharmacological and non-pharmacological labour pain management techniques and their relationship to maternal and infant birth outcomes: examination of a nationally representative sample of 1835 pregnant women. Midwifery. 2015;31(4):458–463. doi:10.1016/j.midw.2014.12.012

Appendices

Appendix A.



Appendix B. Research data overview

Description	Results
Main information about data	
Timespan	1963:2023
Sources (Journals, Books, etc)	203
Documents	705
Annual Growth Rate %	3,03
Document Average Age	12,6
References	18.517
Document contents	
Keywords Plus (ID)	1.448
Author's Keywords (DE)	1.646
Authors	
Authors	2.153