

KORESPONDENSI

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1. Riwayat Submit
2. Manuskrip yang disubmit
3. Riwayat Review/review substansi
4. Manuskrip setelah review
5. In Press
6. Artikel sudah publish

1. RIWAYAT SUBMIT

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303843-2	fitriani, Labor Pain Intervention Bibliometrics analysis Submit.docx (2)	2024/01/31	Other
305272-1	mpstqj@kovic, Damayanti et al_Full text_49002-Other-304703-1-18-20240206 (1).docx	2024/02/11	Blinded text
305273-1	mpstqj@kovic, Damayanti et al_Title page_Labor Pain Intervention.docx	2024/02/11	Title page
305274-1	mpstqj@kovic, Damayanti et al_WAME_49002-Other-304704-1-18-20240206 (2).docx	2024/02/11	Other
305275-1	mpstqj@kovic, DAM_Blinded text_49002-Other-304703-1-18-20240206 (1).docx	2024/02/11	Blinded text

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Revision	fitriani 2024/02/06 08:22 AM	mpstqj@kovic 2024/02/11 11:55 AM	4	<input type="checkbox"/>

2. MANUSKRIP YANG DISUBMIT

Labor Pain Intervention: Bibliometrics analysis

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Abstract

This study aims to determine the number of publications, citations, and research topics about labor pain intervention trends in the future. The research method applied in this study is Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), using 158,201 scientific articles or proceedings from the Dimensions database. The article review process was assisted by the VOSviewer application. The research found that the trend of labor pain intervention is rising, the citation about labor pain intervention topic is rising, the network visualization on the topic of labor pain intervention informs to find novelty between the unlinked issues, there are four clusters reviewed from the co-occurrence, overlay visualization on labor pain give the trend of the research topic in the future, and the density visualization on the rare topic. The research finding contributes to developing the research roadmap for labor pain intervention.

Keywords: Bibliometrics analysis, Linear regression, PRISMA, Intervention, Labor pain

Background

The pain and anxiety during labor are significant, especially for first-time mothers. It could extend labor duration, increase stress hormones, and affect the mother's and newborn's conditions (1). Some strategies have been developed to deal with labor pain and enhance the satisfaction of the mother's birth experience (2). The intervention for labor pain could be done through pharmacological and non-pharmacological techniques.

The former group includes epidural analgesia, pain control gas, and intravenous opioids. The later non-pharmacology techniques include waterbirth and immersion, transcutaneous electrical nerve stimulation (TENS), aromatherapy, acupuncture and acupressure, and massage techniques. Nowadays, the neuraxial blockade has spinal technique, epidural, and epidural-spinal combined technique, which is the golden standard for patients with labor pain. However, many patients use non-pharmacological techniques as they enable them to have more natural birth techniques (3).

People's interest in labor pain intervention around the world is going down. As stated in (4) and (5), the interest could be tracked using Google Trends by typing labor pain intervention keywords. For example, the search from January 2024 to December 2022 using web browsing in all categories shows the data presented in Figure 1. The data was retrieved on October 28, 2023

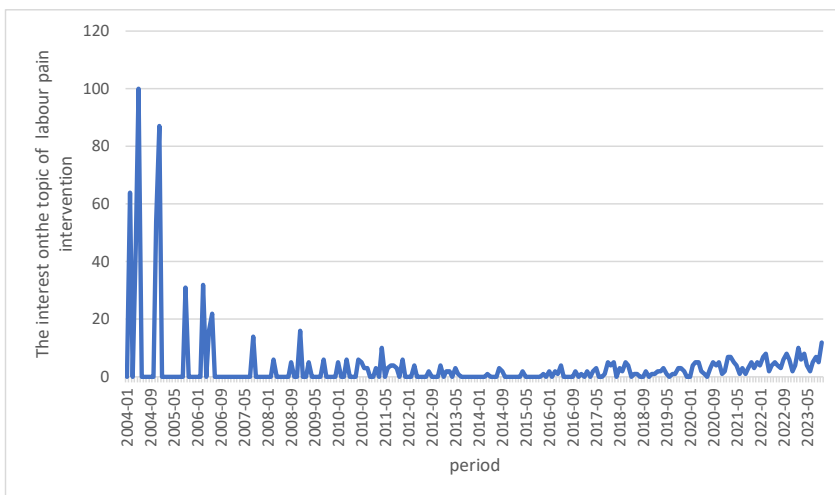


Figure 1. The interest in the topic of labor pain intervention over time (Data source: Google Trends)

Besides duration, its country could also review the interest in labor pain intervention. The interest in the topic by its country is presented in Figure 2. Based on Figure 2, the Philippines is the country with the highest interest in the topic, followed by the United States.

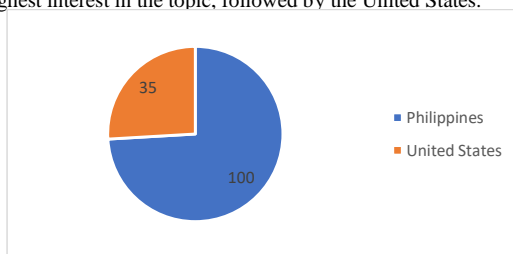


Figure 2. The histogram of interest on the topic of labor pain intervention by the country (Data Source: Google Trends)

The data represent the interest in the general topic of labor pain intervention. On the other hand, researchers must discuss more particular issues, such as scientific publications, scientific articles, and seminar proceedings about labor pain intervention. Therefore, the information about the topic in a

journal article is urgently needed.

In this study, the researcher needs information about trends and novelty for the topic of labor pain intervention in the future. This is due to the emerging problem among researchers. However, a bibliometric analysis of the publication of labor pain intervention to find its trend and novelty hasn't been found. The research questions in this study are (1) how is the growth of the topic of labor pain intervention, (2) how is the growth in the number of citations of the topic of labor pain intervention, (6) how is the network visualization of the topic of labor pain intervention, (7) how is the publication cluster of the topic of labor pain intervention revied by its co-occurrence, (8) how is the overlay visualization of the topic of labor pain intervention, (9) how is the density visualization of labor pain intervention.

Bibliometric analysis is a statistical-based research approach to visualize academic institutions' contribution and development in the research hotspot (6). Bibliometric analysis helps the researcher identify the future area and direction of the research domain using visualization tools (7). Bibliometric analysis has been used by many authors to evaluate the information theory registered in the Scopus database (7), to evaluate the immigration and degradation of the environment (8), and to investigate the topic search trend of the labor pain intervention (9). It means bibliometric analysis is a quantitative scientific method to assess published articles to help researchers identify the trends of development, updates, and hotspots of particular research and contribute to research development in the future for researchers (10).

The research aims to find out the trend of the publication number of labor pain interventions, the number of citations, and the future research direction. The topic related to labor pain intervention is still hard to find. Therefore, bibliometric analysis is needed to update the topic novelty.

Literature review

Pain

Pain is a physiological condition commonly experienced by pregnant mothers during labor (11) due to uterine muscle contraction as an effort to open the cervix and push the infant's head toward the pelvis (12). Labor pain is a subjective experience caused by uterine muscle ischemia, traction of uterine ligaments, traction of ovarium, fallopian tubes, and enlargement of the lower part of the uterus, pelvic floor muscles, and perineum (13). The pain and stress control related to the labor and birth process is one of the crucial problems in the healthcare system (14). With undeniable and intensive pain during the labor process, the pain level may vary according to the mother's physiological and psychological influence (15). The pain impulse is transmitted when the defence is opened and stops when the defence is closed, and the effort to close the defence is the basis for the pain killer (16).

Labor

Labor is a critical yet significant period in a woman's life (17). A companion by a midwife is required to go through a crucial period during the labor process (18). For a women, giving birth could be the most challenging psychological history in her life [19]. The case makes the role of a midwife very prominent in this process (19). It has long-term negative or positive significant effects on a woman's life (20). The difference in culture, religion, and social economy could affect women's perspective on giving birth experience (21). Giving birth is not only about the transition of becoming a mother but also related to the physical and emotional effects in a mother's life (22). The management of midwifery service allows midwives to develop in performing the midwifery service (23).

Methodology

Bibliometric analysis is a research method used in the science of literature and information to evaluate the research performance (24). Bibliometric analysis is fundamental in assessing the research impact of which the study is graded based on the received citation (25).

Data was extracted from <https://app.dimensions.ai/> on October 28, 2023. Preferred Reporting Items for Systematic Reviews and Meta-Analyses [27], or PRISMA, was used to extract the article from the <https://app.dimensions.ai/> database. The flow chart of PRISMA is presented in Figure 3.

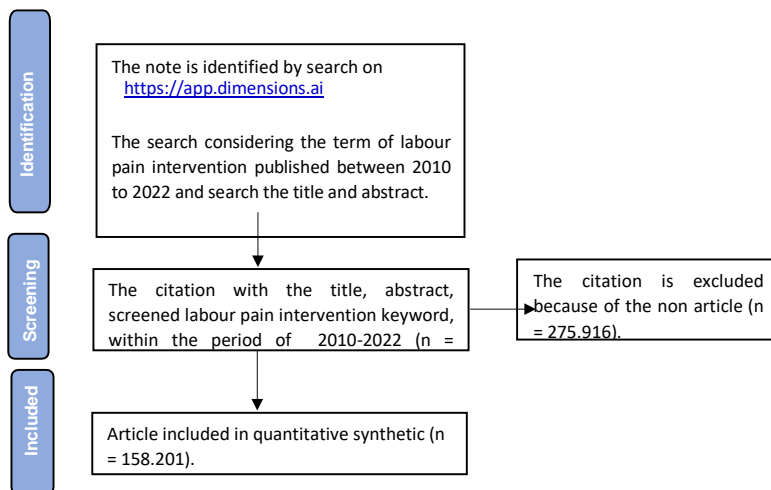


Figure 3. PRISMA Flowchart (26)

The PRISMA method consists of three stages: identification, screening, and inclusion. Stage 1 (Identification) detects 434,117 citations from <https://app.dimensions.ai/> by considering the term labor pain intervention published between 2010 and 2022, especially in the title and abstract. In stage 2 (screening), there are 158,201 citations. By choosing "article" as the publication type, 275,916 citations were excluded. In stage 3 (included), the final sample was 158,201 articles. The data was then analyzed using VOSviewer. VOSviewer is a computer program to make and view bibliometric maps (27). In this study, the analysis was reviewed from the co-occurrence.

The procedure to analyze the co-occurrence is (1) Type of data, on the option of creating a map based on test data. The option was to present an event map based on the textual data. (2) Data source on the option of reading data from reference manager files. The supported files were RIS, EndNote, and RefWorks. (3) Choose RIS file type. (4) Fields from which term will be extracted) on the title and abstract fields) by ignoring the structured abstract and copyright statement labels. (5) Full counting method. (6) The minimum grade for the citation emergence is 10. Out of 7368 terms, 170 terms passed the minimum grade with the calculated relevance score. Based on this score, the most relevant term would be chosen. The default option chose 60% of the applicable term. The number of the chosen terms was 102 terms.

Finding

The search between 2010 and 2022 provides 158,201 scientific article publications. The number of labor pain intervention publications per year is presented in Figure 4.

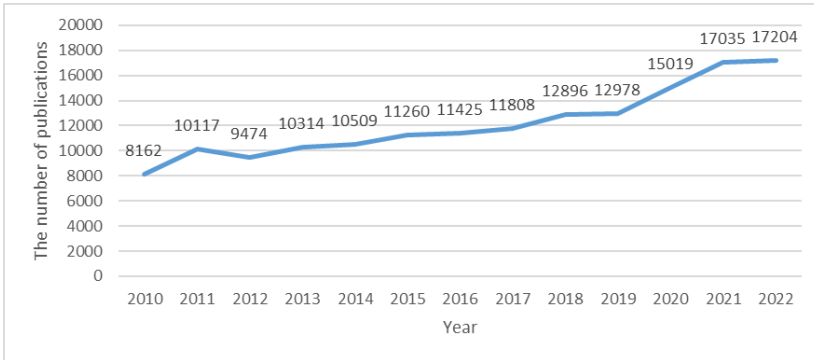
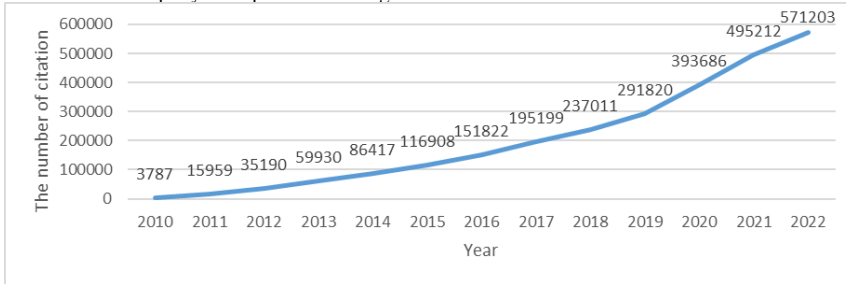


Figure 4. The number of publications about labor pain intervention between 2010 to 2022 (source: <https://app.dimensions.ai/>)

The number of labor pain intervention citations between 2010 to 2022 is 3,139,093. The number of citations per year is presented in Figure 5.



Gambar 5. The number of citations on the topic of labor pain intervention between 2010 to 2022 (source: <https://app.dimensions.ai/>)

The network visualization of the 102 terms is presented in Figure 6.

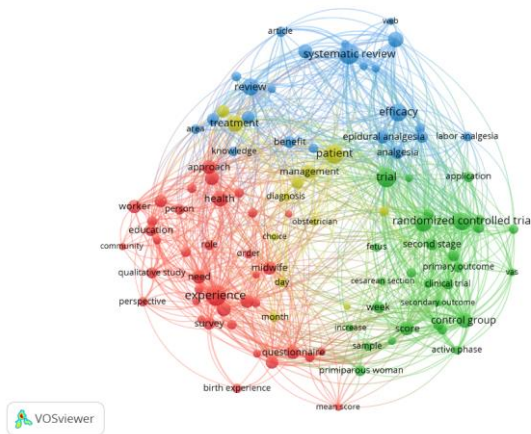


Figure 6. Network visualization (source: VOSviewer and <https://app.dimensions.ai/>)

VOSviewer also provides an overlay visualization map. The overlay visualization of 102 terms is presented in Figure 7.

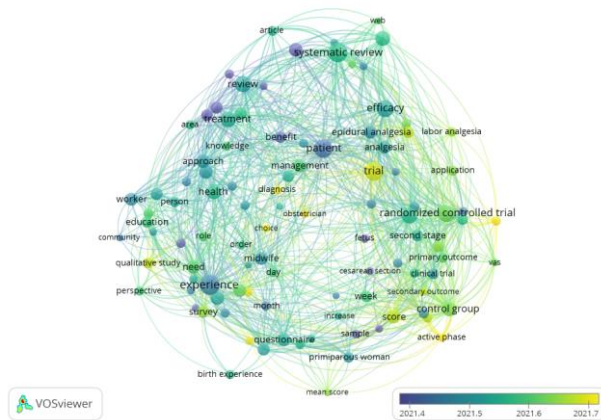


Figure 7. Overlay visualization (source: VOSviewer and <https://app.dimensions.ai/>)

Density visualization of 102 terms is presented in Figure 8.

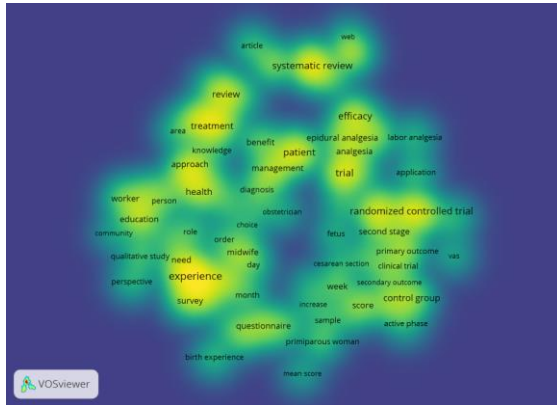


Figure 8. Density visualization (source: VOSviewer dan <https://app.dimensions.ai/>)

Discussion

Figure 4 shows that the number of publications has exponentially increased over time. The lowest publication was in 2010, with 8162 publications. Meanwhile, the highest publication was in 2021, with 17035 publications. The average publication number was 11750. The statistic is presented in Figure 9. Of the 158,201 publications, "Labor Analgesia: A Systematic Review and Meta-Analysis of Non-Pharmacological Complementary and Alternative Approaches to Pain during First Stage of Labor" (28) was the most relevant. It is essential to review the newest article to recommend a feasible and relatively safe method in the clinical management of labor pain management method (29). Therefore, there is a need for the latest publication related to labor pain intervention.

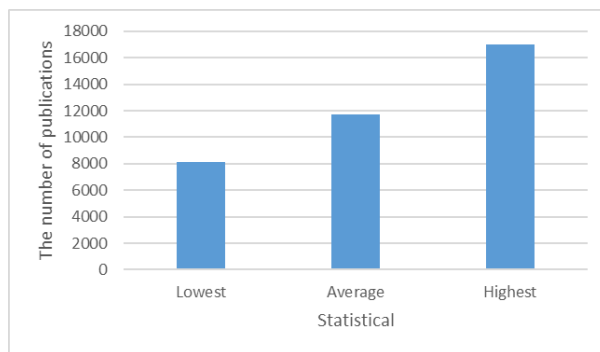


Figure 9. The histogram shows the lowest, average, and highest number of labor pain intervention topics.

Figure 5 shows that the number of citations exponentially increased over time. The lowest citation was in 2010, with 3,787 citations. Meanwhile, the highest number of citations was in 2022, with 571,203. The average citation number was 204,165. The statistic is presented in Figure 10. The research data revealed that from 158,201 publications, a publication entitled "Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the

Global Burden of Disease Study 2010" (30) is the most cited publication. Other authors would frequently cite journals indexed in the reputation index. Therefore, this article could be used as a reference in research explaining labor pain intervention.

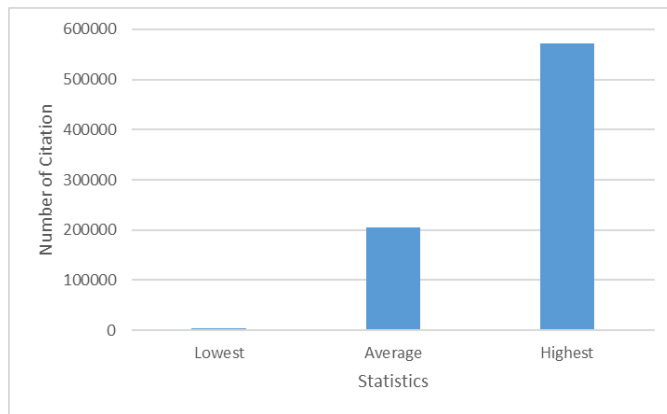


Figure 10. The histogram of the lowest, average, and highest number of citations about labor pain intervention topics.

In the network visualization (Figure 6), two terms linked with a line indicated that the terms were found at the same time in the title and abstract of a publication. In contrast, the two terms are not linked by a line, indicating that the terms aren't simultaneously found in the title and abstract. The research data revealed 102 terms, four clusters, and 3302 links; the total link strength was 7945. Some authors researched women's preference for pain reduction methods during labor (31). Therefore, a novelty for the researcher for the next topic of labor pain intervention could be done from the research on the unlinked terms, such as "relief" and "stage."

The 102 terms categorized in four clusters consist of Cluster 1 (38 terms), Cluster 2 (29 terms), Cluster 3 (23 terms), and Cluster 4 (12 terms). For more detail, the clusters are presented in Table 1.

Table 1. Clusters for the topic of labor pain intervention (Source: VOSviewer and <https://app.dimensions.ai/>)

Cluster	Number of terms	Terms in the cluster member
1	38	Approach, barrier, birth experience, childbirth experience, community, country, cross-sectional study, education, experience, fear, health, hour, implementation, importance, individual, influence, iran, labor pain, mean score, midwife, need, number, order, paper, part, perception, person, perspective, preference, presence, prevalence, qualitative study, questionnaire, reason, role, survey, work, worker.
2	29	Active phase, apgar score, application, cesarean section, clinical trial, comparison, control group, duration, episiotomy, fetus, first stage, increase, intervention group, massage, min, pain score, positive effect, primary outcome, primiparous woman, randomized clinical trial, randomized controlled trial, sample, score, second stage, secondary outcome, significant difference, trial, vas, week.

3	23	Alternative, analgesia, area, article, benefit, body, depression, efficacy, Embase, epidural analgesia, knowledge, labor analgesia, literature, meta-analysis, pain management, parturient, pubmed, review, safety, science, systematic review, total, web.
4	12	Admission, case, choice, condition, day, diagnosis, incidence, management, month, obstetrician, patient, treatment.

The overlay visualization (Figure 7) presents the analysis based on the keyword labor and intervention from 2010 to 2022 to observe the trend of the research title related to labor pain intervention. Based on the overlay visualization map in Figure 7., the yellow terms imply that the keyword represents the author's interest at present (7). Today's interest in research mainly focuses on modern ideas and the influence of the Western method on pain, eventually changing the perception and willingness to deal with labor pain (32). Therefore, the trend of research about pain in labor now focuses on the yellow-colored terms, such as pain score and active phase. Obstetrician.

The density visualization (Figure 8) shows the visualization of the terms' density level, which is indicated by color. Blue indicates the high density, while yellow indicates the low density. The high-density term means that the topic was frequently used in previous research, while the low-density term means that the subject was rarely used in previous research. Pain in labor is mainly ignored, especially in low and middle-income countries (33). Therefore, the suggested research topics of intervention for labor pain from the low-density visualization were experience, epidural analgesia, and efficacy.

Conclusion

The research was completed using bibliometric analysis from the publications about labor pain intervention retrieved from <https://app.dimensions.ai/> from 2010 to 2022. This research shows some findings, such as the trend of publications on the topic of labor pain intervention increased, the number of citations on the subject of labor pain intervention increased, network visualization on the topic of labor pain intervention gives information to find the novelty on the unlinked topics, there are four clusters reviewed from the co-occurrence, overlay visualization on the rarely discussed topic of labor pain intervention.

Although the research contributes to understanding the state-of-the-art development of the publications about labor pain from 2010 to 2022 from <https://app.dimensions.ai/>, this research also found some limitations. The <https://app.dimensions.ai/> database keeps improving the new publications over time. Therefore, the bibliometric analysis of labor pain intervention could be reviewed a few years ahead. Besides, the bibliometric analysis only extracts the scientific publications from the <https://app.dimensions.ai/> database. In further research, some other databases are expected to be added for a more expanded and comprehensive understanding of labor pain intervention.

REFERENCE

- Whitburn LY, Jones LE, Davey M-A, McDonald S. The nature of labour pain: An updated review of the literature. *Women and Birth*. 2019;32(1):28–38.
- Chang C-Y, Gau M-L, Huang C-J, Cheng H. Effects of non-pharmacological coping strategies for reducing labor pain: A systematic review and network meta-analysis. *PLoS One* [Internet]. 2022 Jul 27;17(1):e0261493. Available from: <https://app.dimensions.ai/details/publication/pub.1144869749>
- Czech I, Fuchs P, Fuchs A, Lorek M, Tobolska-Lorek D, Drosdzol-Cop A, et al. Pharmacological and Non-Pharmacological Methods of Labour Pain Relief—Establishment of Effectiveness and Comparison. *Int J Environ Res Public Health* [Internet]. 2018 Jul 27;15(12):2792. Available from: <https://app.dimensions.ai/details/publication/pub.1110525245>
- Akhmad Fauzy S, Supandi ED. Signal Modeling with IG Noise and Parameter Estimation Based on RJMCMC. 2022;
- Prabowo A, Suparman S, Li CS, Janan D. The effect of reading literacy to mathematics comprehension of elementary school students in Indonesia and Malaysia. *Int J Eval & Res*. 2023.

6. Fu Z, Lv J, Gao X, Zhang B, Li Y, ... Research trends and hotspots evolution of cardiac amyloidosis: a bibliometric analysis from 2000 to 2022. *European ... eurjmedres.biomedcentral.com*; 2023.
7. Lam WH, Lam WS, Jaaman SH, Lee PF. Bibliometric Analysis of Information Theoretic Studies. *Entropy*. 2022;24(10).
8. Anuar A, Marwan NF, Smith J, Siriyannun S, Sharif A. Bibliometric analysis of immigration and environmental degradation: evidence from past decades. *Environ Sci Pollut Res*. 2022;29(9):13729–41.
9. Zhang Y, Lim D, Yao Y, Dong C, Feng Z. Global Research Trends in Radiotherapy for Gliomas: A Systematic Bibliometric Analysis. *World Neurosurg*. 2022;161:e355–62.
10. Soyta RB. A bibliometric analysis of publications on covid-19 and older adults. Vol. 25, *Annals of Geriatric Medicine and Research*. ncbi.nlm.nih.gov; 2021. p. 197–203.
11. Il- L, As MPC, For T. Kadar Il-6 Dan Pge2 Pada Ibu Pasca Counter-Pressure Regiosakralis Sebagai Terapi Nyeri Akibat Kontraksi Rahim penilaian menggunakan Numeric Rating Scale mencapai skala intensitas prostaglandin , leukotrien , tromboksan , histamin , bradikinin , substansi. 1883;72:1883–91.
12. Rejeki S, Widayati E, Machmudah M, Yanto A. Decreasing labor pain through sacralist counter-pressure therapy using tennis ball in the mother during the labor process. *Open Access Maced J Med Sci*. 2021;9(T4):83–6.
13. Ningdiah AK, Ningsih AF, Iskandiani L, Lawra C. Literature Review Teknik Mengurangi Nyeri pada Persalinan. In: *Prosiding Seminar Nasional dan CFP Kebidanan Universitas Ngudi Waluyo*. 2022. p. 892–901.
14. Amiri P, Mirghafourvand M, Esmailpour K, Kamalifard M, Ivanbagha R. The effect of distraction techniques on pain and stress during labor: a randomized controlled clinical trial. *BMC Pregnancy Childbirth*. 2019;19:1–9.
15. Deng Y, Lin Y, Yang L, Liang Q, Fu B, Li H, et al. A comparison of maternal fear of childbirth, labor pain intensity and intrapartum analgesic consumption between primiparas and multiparas: A cross-sectional study. *Int J Nurs Sci* [Internet]. 2021 Jul 27;8(4):380–7. Available from: <https://app.dimensions.ai/details/publication/pub.1141166147>
16. Damayanti FN, Mulyanti L, Poddar S. *Juridica Study of Criminal Law on Delegation of Authority of Obstetricians and Gynecologists to Midwives in Health Services*. 2023;
17. Pietrzak J, Mędrzycka-Dąbrowska W, Tomaszek L, Grzybowska ME. A Cross-Sectional Survey of Labor Pain Control and Women's Satisfaction. *Int J Environ Res Public Health* [Internet]. 2022 Jul 27;19(3):1741. Available from: <https://app.dimensions.ai/details/publication/pub.1145256917>
18. Damayanti FN, Absori A, Wardiono K, Rejeki S. The evidence-based midwife professionalism. Vol. 14, *Indian Journal of Forensic Medicine and Toxicology*. revistaamplamente.com; 2020. p. 1877–81.
19. Damayanti FN, Absori A, Wardiono K. Legal protection of midwives based on professional justice in midwifery practices. Vol. 10, *Indian Journal of Public Health Research and Development*. repository.unimus.ac.id; 2019. p. 437–41.
20. Pratiwi IG. Studi Literatur: Metode Non Farmakologis Mengurangi Nyeri Persalinan Dengan Menggunakan Efflurage Massage. *J Kesehat*. 2019;12(1):141–5.
21. Oktiningrum M, Mariyana W, Harjanti AI. Literatur Review: Efektifitas Penatalaksanaan Cemas dan Nyeri Persalinan dengan Teknik Hypnosis. In: *Prosiding Seminar Nasional dan CFP Kebidanan Universitas Ngudi Waluyo*. 2022. p. 849–56.
22. Mascarenhas VHA, Lima TR, Negreiros F dos S, Santos JDM, Moura MÁP, Gouveia MT de O, et al. Scientific evidence on non-pharmacological methods for relief of labor pain. *Acta Paul Enferm*. 2019;32:350–7.

23. Damayanti FN, Absori A, Wardiono K, Rejeki S. The comparison of midwives professionalism in indonesia and england. *J South India Medicolegal Assoc.* 2020;12(1):4–9.
24. Syros A, Perez OF, Luxenburg D, Cohen JL, Swonger R, Huntley S. The most influential studies concerning revision shoulder arthroplasty research. *J Orthop.* 2022;34:349–56.
25. Pahwa B, Goyal S, Chaurasia B. Understanding anterior communicating artery aneurysms: A bibliometric analysis of top 100 most cited articles. *Cerebrovascular and. synapse.koreamed.org;* 2022.
26. Page MJ, McKenzie JE, Bossuyt P, Boutron I, Hoffmann TC, Mulrow CD, et al. The prisma 2020 statement: An updated guideline for reporting systematic reviews. Vol. 57, *Medicina Fluminensis.* Elsevier; 2021. p. 444–65.
27. van Eck NJ, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics.* 2010;84(2):523–38.
28. Melillo A, Maiorano P, Rachedi S, Caggianese G, Gragnano E, Gallo L, et al. Labor Analgesia: A Systematic Review and Meta-Analysis of Non-Pharmacological Complementary and Alternative Approaches to Pain during First Stage of Labor. *Crit Rev Eukaryot Gene Expr [Internet].* 2022 Jul 27;32(2):61–89. Available from: <https://app.dimensions.ai/details/publication/pub.1142771812>
29. Ashagrie HE, Fentie DY, Kassahun HG. A review article on epidural analgesia for labor pain management: A systematic review. *Int J Surg Open.* 2020;24:100–4.
30. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet [Internet].* 2012 Nov 1;380(9859):2095–128. Available from: <https://app.dimensions.ai/details/publication/pub.1013705877>
31. Alakeely MH, Almutari A khalaf, Alhekail GA, Abuoliat ZA, Althubaiti A, AboItai LA-R, et al. The effect of epidural education on Primigravid Women’s decision to request epidural analgesia: a cross-sectional study. *BMC Pregnancy Childbirth.* 2018;18:1–6.
32. Beigi SM, Valiani M, Alavi M, Mohamadirizi S. The relationship between attitude toward labor pain and length of the first, second, and third stages in primigravida women. *J Educ Health Promot [Internet].* 2019 Jul 27;8(1):130. Available from: <https://app.dimensions.ai/details/publication/pub.1119883917>
33. 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 [Internet].* 2022 Jul 27;74:103312. Available from: <https://app.dimensions.ai/details/publication/pub.1145125858>

3. RIWAYAT REVIEW/REVIEW SUBSTANSI

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- Conflicts of interest
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- Data access
- Author ORCID numbers
- Author contributions

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Labor Pain Intervention: Bibliometrics analysis

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Abstract

This study aims to determine the number of publications, citations, and research topics about labor pain intervention trends in the future. The research method applied in this study is Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), using 158,201 scientific articles or proceedings from the Dimensions database. The article review process was assisted by the VOSviewer application. The research found that the trend of labor pain intervention is rising, the citation about labor pain intervention topic is rising, the network visualization on the topic of labor pain intervention informs to find novelty between the unlinked issues, there are four clusters reviewed from the co-occurrence, overlay visualization on labor pain give the trend of the research topic in the future, and the density visualization on the rare topic. The research finding contributes to developing the research roadmap for labor pain intervention.

Keywords: Bibliometrics analysis, Linear regression, PRISMA, Intervention, Labor pain

Background

The pain and anxiety during labor are significant, especially for first-time mothers. It could extend labor duration, increase stress hormones, and affect the mother's and newborn's conditions (1). Some strategies have been developed to deal with labor pain and enhance the satisfaction of the mother's birth experience (2). The intervention for labor pain could be done through pharmacological and non-pharmacological techniques. The former group includes epidural analgesia, pain control gas, and intravenous opioids. The later non-pharmacology techniques include waterbirth and immersion, transcutaneous electrical nerve stimulation (TENS), aromatherapy, acupuncture and acupressure, and massage techniques. Nowadays, the neuraxial blockade has spinal technique, epidural, and epidural-spinal combined technique, which is the golden standard for patients with labor pain. However, many patients use non-pharmacological techniques as they enable them to have more natural birth techniques (3).

People's interest in labor pain intervention around the world is going down. As stated in (4) and (5), the interest could be tracked using Google Trends by typing labor pain intervention keywords. For example, the search from January 2024 to December 2022 using web browsing in all categories shows the data presented in Figure 1. The data was retrieved on October 28, 2023

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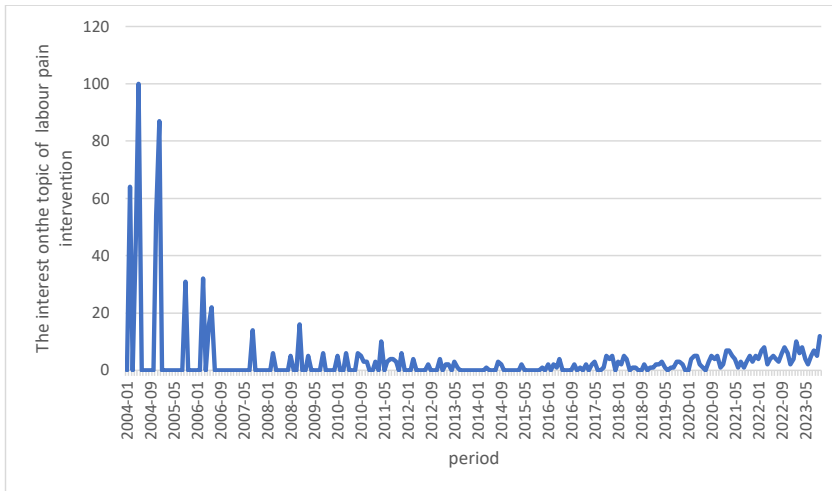


Figure 1. The interest in the topic of labor pain intervention over time (Data source: Google Trends)

Besides duration, its country could also review the interest in labor pain intervention. The interest in the topic by its country is presented in Figure 2. Based on Figure 2, the Philippines is the country with the highest interest in the topic, followed by the United States.

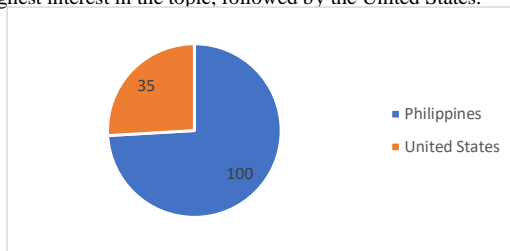


Figure 2. The histogram of interest on the topic of labor pain intervention by the country (Data Source: Google Trends)

The data represent the interest in the general topic of labor pain intervention. On the other hand, researchers must discuss more particular issues, such as scientific publications, scientific articles, and seminar proceedings about labor pain intervention. Therefore, the information about the topic in a journal article is urgently needed.

In this study, the researcher needs information about trends and novelty for the topic of labor pain intervention in the future. This is due to the emerging problem among researchers. However, a bibliometric analysis of the publication of labor pain intervention to find its trend and novelty hasn't been found. The research questions in this study are (1) how is the growth of the topic of labor pain intervention, (2) how is the growth in the number of citations of the topic of labor pain intervention, (6) how is the network visualization of the topic of labor pain intervention, (7) how is the publication cluster of the topic of labor pain intervention revied by its co-occurrence, (8) how is the overlay visualization of the topic of labor pain intervention, (9) how is the density visualization of labor pain intervention.

Bibliometric analysis is a statistical-based research approach to visualize academic institutions' contribution and development in the research hotspot (6). Bibliometric analysis helps the researcher identify the future area and direction of the research domain using visualization tools (7). Bibliometric analysis has been used by many authors to evaluate the information theory registered in the Scopus database (7), to evaluate the immigration and degradation of the environment (8), and to investigate the topic search trend of the labor pain intervention (9). It means bibliometric analysis is a quantitative scientific method to assess published articles to help researchers identify the trends of development, updates, and hotspots of particular research and contribute to research development in the future for researchers (10).

The research aims to find out the trend of the publication number of labor pain interventions, the number of citations, and the future research direction. The topic related to labor pain intervention is still hard to find. Therefore, bibliometric analysis is needed to update the topic novelty.

Literature review

Pain

Pain is a physiological condition commonly experienced by pregnant mothers during labor (11) due to uterine muscle contraction as an effort to open the cervix and push the infant's head toward the pelvis (12). Labor pain is a subjective experience caused by uterine muscle ischemia, traction of uterine ligaments, traction of ovary, fallopian tubes, and enlargement of the lower part of the uterus, pelvic floor muscles, and perineum (13). The pain and stress control related to the labor and birth process is one of the crucial problems in the healthcare system (14). With undeniable and intensive pain during the labor process, the pain level may vary according to the mother's physiological and psychological influence (15). The pain impulse is transmitted when the defence is opened and stops when the defence is closed, and the effort to close the defence is the basis for the pain killer (16).

Labor

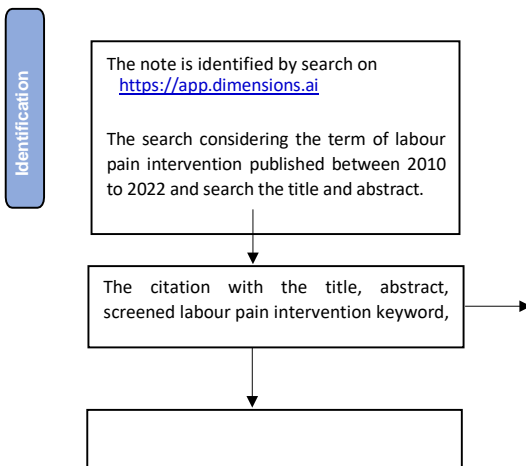
Labor is a critical yet significant period in a woman's life (17). A companion by a midwife is required to go through a crucial period during the labor process (18). For a women, giving birth could be the most challenging psychological history in her life [19]. The case makes the role of a midwife very prominent in this process (19). It has long-term negative or positive significant effects on a woman's life (20). The difference in culture, religion, and social economy could affect women's perspective on giving birth experience (21). Giving birth is not only about the transition of becoming a mother but also related to the physical and emotional effects in a mother's life (22). The management of midwifery service allows midwives to develop in performing the midwifery service (23).

Methodology

Bibliometric analysis is a research method used in the science of literature and information to evaluate the research performance (24). Bibliometric analysis is fundamental in assessing the research impact of which the study is graded based on the received citation (25).

Data was extracted from <https://app.dimensions.ai/> on October 28, 2023. Preferred Reporting Items for Systematic Reviews and Meta-Analyses [27], or PRISMA, was used to extract the article from the <https://app.dimensions.ai/> database. The flow chart of PRISMA is presented in Figure 3.

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The citation is excluded because of the non article (n = 275.916).

Figure 3. PRISMA Flowchart (26)

The PRISMA method consists of three stages: identification, screening, and inclusion. Stage 1 (Identification) detects 434,117 citations from <https://app.dimensions.ai/> by considering the term labor pain intervention published between 2010 and 2022, especially in the title and abstract. In stage 2 (screening), there are 158,201 citations. By choosing "article" as the publication type, 275,916 citations were excluded. In stage 3 (included), the final sample was 158,201 articles. The data was then analyzed using VOSviewer. VOSviewer is a computer program to make and view bibliometric maps (27). In this study, the analysis was reviewed from the co-occurrence.

The procedure to analyze the co-occurrence is (1) Type of data, on the option of creating a map based on test data. The option was to present an event map based on the textual data. (2) Data source on the option of reading data from reference manager files. The supported files were RIS, EndNote, and RefWorks. (3) Choose RIS file type. (4) Fields from which term will be extracted) on the title and abstract fields) by ignoring the structured abstract and copyright statement labels. (5) Full counting method. (6) The minimum grade for the citation emergence is 10. Out of 7368 terms, 170 terms passed the minimum grade with the calculated relevance score. Based on this score, the most relevant term would be chosen. The default option chose 60% of the applicable term. The number of the chosen terms was 102 terms.

Finding

The search between 2010 and 2022 provides 158,201 scientific article publications. The number of labor pain intervention publications per year is presented in Figure 4.

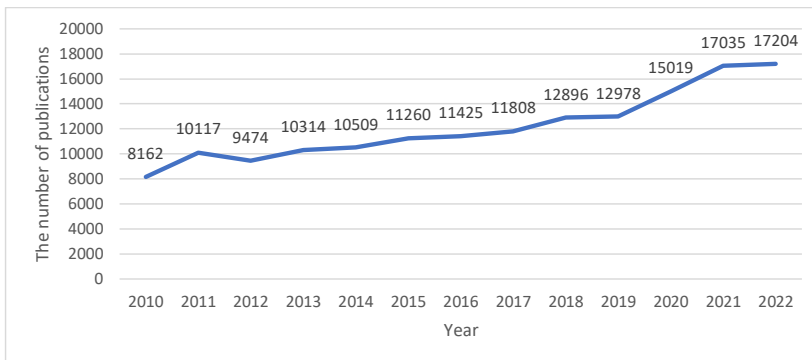
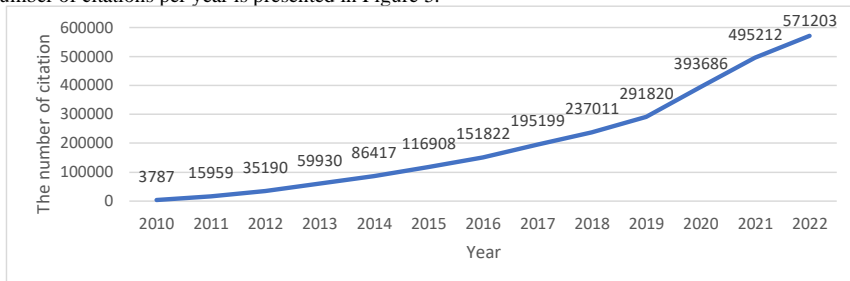


Figure 4. The number of publications about labor pain intervention between 2010 to 2022 (source: <https://app.dimensions.ai/>)

The number of labor pain intervention citations between 2010 to 2022 is 3,139,093. The number of citations per year is presented in Figure 5.



Gambar 5. The number of citations on the topic of labor pain intervention between 2010 to 2022 (source: <https://app.dimensions.ai/>)

The network visualization of the 102 terms is presented in Figure 6.

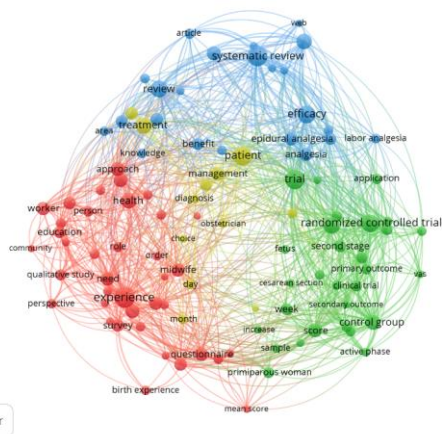


Figure 6. Network visualization (source: VOSviewer and <https://app.dimensions.ai/>)

VOSviewer also provides an overlay visualization map. The overlay visualization of 102 terms is presented in Figure 7.

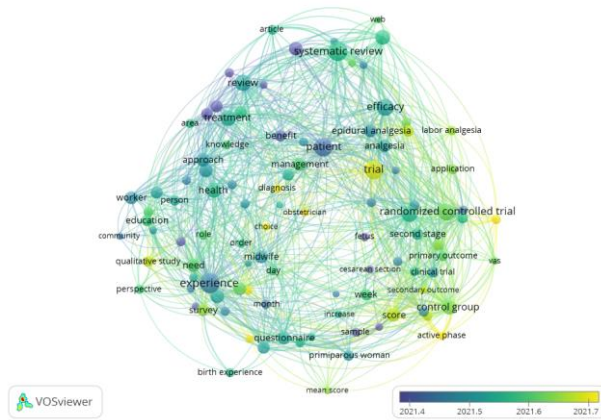


Figure 7. Overlay visualization (source: VOSviewer and <https://app.dimensions.ai/>)

Density visualization of 102 terms is presented in Figure 8.

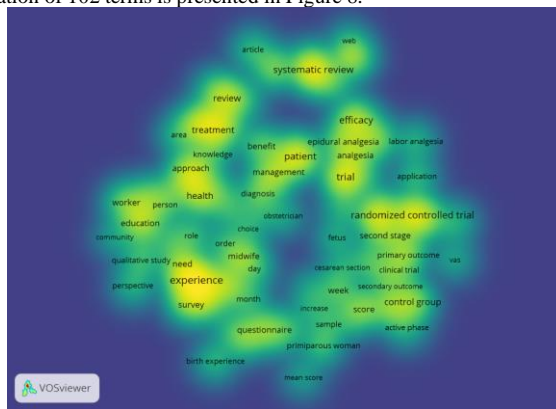


Figure 8. Density visualization (source: VOSviewer dan <https://app.dimensions.ai/>)

Discussion

Figure 4 shows that the number of publications has exponentially increased over time. The lowest publication was in 2010, with 8162 publications. Meanwhile, the highest publication was in 2021, with 17035 publications. The average publication number was 11750. The statistic is presented in Figure 9. Of the 158,201 publications, "Labor Analgesia: A Systematic Review and Meta-Analysis of Non-Pharmacological Complementary and Alternative Approaches to Pain during First Stage of Labor" (28) was the most relevant. It is essential to review the newest article to recommend a feasible and relatively safe method in the clinical management of labor pain management method (29). Therefore, there is a need for the latest publication related to labor pain intervention.

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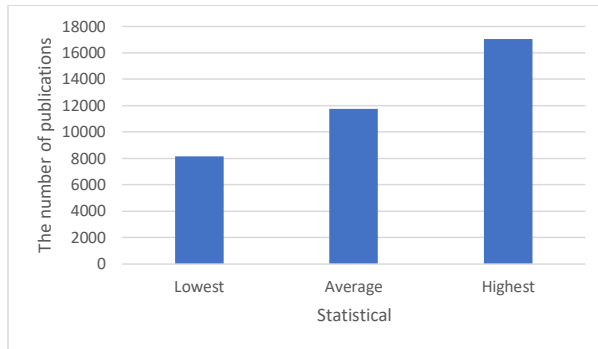


Figure 9. The histogram shows the lowest, average, and highest number of labor pain intervention topics.

Figure 5 shows that the number of citations exponentially increased over time. The lowest citation was in 2010, with 3,787 citations. Meanwhile, the highest number of citations was in 2022, with 571,203. The average citation number was 204,165. The statistic is presented in Figure 10. The research data revealed that from 158,201 publications, a publication entitled "Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010" (30) is the most cited publication. Other authors would frequently cite journals indexed in the reputation index. Therefore, this article could be used as a reference in research explaining labor pain intervention.

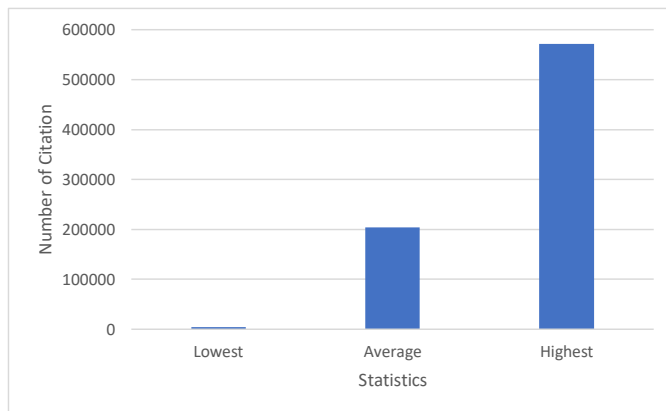


Figure 10. The histogram of the lowest, average, and highest number of citations about labor pain intervention topics.

In the network visualization (Figure 6), two terms linked with a line indicated that the terms were found at the same time in the title and abstract of a publication. In contrast, the two terms are not linked by a line, indicating that the terms aren't simultaneously found in the title and abstract. The research data revealed 102 terms, four clusters, and 3302 links; the total link strength was 7945. Some authors researched women's preference for pain reduction methods during labor (31). Therefore, a novelty for the researcher for the next topic of labor pain intervention could be done from the research on the

unlinked terms, such as "relief" and "stage."

The 102 terms categorized in four clusters consist of Cluster 1 (38 terms), Cluster 2 (29 terms), Cluster 3 (23 terms), and Cluster 4 (12 terms). For more detail, the clusters are presented in Table 1.

Table 1. Clusters for the topic of labor pain intervention (Source: VOSviewer and <https://app.dimensions.ai/>)

Cluster	Number of terms	Terms in the cluster member
1	38	Approach, barrier, birth experience, childbirth experience, community, country, cross-sectional study, education, experience, fear, health, hour, implementation, importance, individual, influence, iran, labor pain, mean score, midwife, need, number, order, paper, part, perception, person, perspective, preference, presence, prevalence, qualitative study, questionnaire, reason, role, survey, work, worker.
2	29	Active phase, apgar score, application, cesarean section, clinical trial, comparison, control group, duration, episiotomy, fetus, first stage, increase, intervention group, massage, min, pain score, positive effect, primary outcome, primiparous woman, randomized clinical trial, randomized controlled trial, sample, score, second stage, secondary outcome, significant difference, trial, vas, week.
3	23	Alternative, analgesia, area, article, benefit, body, depression, efficacy, Embase, epidural analgesia, knowledge, labor analgesia, literature, meta-analysis, pain management, parturient, pubmed, review, safety, science, systematic review, total, web.
4	12	Admission, case, choice, condition, day, diagnosis, incidence, management, month, obstetrician, patient, treatment.

The overlay visualization (Figure 7) presents the analysis based on the keyword labor and intervention from 2010 to 2022 to observe the trend of the research title related to labor pain intervention. Based on the overlay visualization map in Figure 7., the yellow terms imply that the keyword represents the author's interest at present (7). Today's interest in research mainly focuses on modern ideas and the influence of the Western method on pain, eventually changing the perception and willingness to deal with labor pain (32). Therefore, the trend of research about pain in labor now focuses on the yellow-colored terms, such as pain score and active phase. Obstetrician.

The density visualization (Figure 8) shows the visualization of the terms' density level, which is indicated by color. Blue indicates the high density, while yellow indicates the low density. The high-density term means that the topic was frequently used in previous research, while the low-density term means that the subject was rarely used in previous research. Pain in labor is mainly ignored, especially in low and middle-income countries (33). Therefore, the suggested research topics of intervention for labor pain from the low-density visualization were experience, epidural analgesia, and efficacy.

Conclusion

The research was completed using bibliometric analysis from the publications about labor pain intervention retrieved from <https://app.dimensions.ai/> from 2010 to 2022. This research shows some findings, such as the trend of publications on the topic of labor pain intervention increased, the number of citations on the subject of labor pain intervention increased, network visualization on the topic of labor pain intervention gives information to find the novelty on the unlinked topics, there are four clusters reviewed from the co-occurrence, overlay visualization on the rarely discussed topic of labor pain intervention.

Although the research contributes to understanding the state-of-the-art development of the publications about labor pain from 2010 to 2022 from <https://app.dimensions.ai/>, this research also found some limitations. The <https://app.dimensions.ai/> database keeps improving the new publications

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over time. Therefore, the bibliometric analysis of labor pain intervention could be reviewed a few years ahead. Besides, the bibliometric analysis only extracts the scientific publications from the <https://app.dimensions.ai/> database. In further research, some other databases are expected to be added for a more expanded and comprehensive understanding of labor pain intervention.

Ethical Clearance

The research obtained ethical permission from the Health Research Ethics Commission, Faculty of Nursing and Health Sciences, Muhammadiyah University, Semarang No. 180/KE/08/2023

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Conflicts of interest

The authors declare that this research was conducted without any conflict of interest.

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Data access

The data used in this research was accessed via <https://app.dimensions.ai/>, <https://trends.google.co.id/>, and VOSviewer.

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Author contributions

The first and second authors understand the ideas presented, develop a theory. The third author performed the calculations, verifying the analysis method. The fourth author investigated the topic of iron deficiency anemia and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

REFERENCE

1. Whitburn LY, Jones LE, Davey MA, McDonald S. The nature of labour pain: An updated review of the literature. *Women and Birth*. 2019;32(1):28–38.
2. Chang CY, Gau ML, Huang CJ, Cheng H min. Effects of non-pharmacological coping strategies for reducing labor pain: A systematic review and network meta-analysis. *PLoS ONE* [Internet]. 2022 Jul 27;17(1):e0261493. Available from: <https://app.dimensions.ai/details/publication/pub.1144869749>
3. Czech I, Fuchs P, Fuchs A, Lorek M, Tobolska-Lorek D, Drosdzol-Cop A, et al. Pharmacological and Non-Pharmacological Methods of Labour Pain Relief—Establishment of Effectiveness and Comparison. *International Journal of Environmental Research and Public Health* [Internet]. 2018 Jul 27;15(12):2792. Available from: <https://app.dimensions.ai/details/publication/pub.1110525245>
4. Akhmad Fauzy S, Supandi ED. Signal Modeling with IG Noise and Parameter Estimation Based on RJMCMC. 2022;
5. Prabowo A, Suparman S, Li CS, Janan D. The effect of reading literacy to mathematics comprehension of elementary school students in Indonesia and Malaysia. *Int J Eval & Res*. 2023.
6. Fu Z, Lv J, Gao X, Zhang B, Li Y, ... Research trends and hotspots evolution of cardiac amyloidosis: a bibliometric analysis from 2000 to 2022. *European ... eurjmedres.biomedcentral.com*; 2023.

7. Lam WH, Lam WS, Jaaman SH, Lee PF. Bibliometric Analysis of Information Theoretic Studies. *Entropy*. 2022;24(10).
8. Anuar A, Marwan NF, Smith J, Siriyanun S, Sharif A. Bibliometric analysis of immigration and environmental degradation: evidence from past decades. *Environmental Science and Pollution Research*. 2022;29(9):13729–41.
9. Zhang Y, Lim D, Yao Y, Dong C, Feng Z. Global Research Trends in Radiotherapy for Gliomas: A Systematic Bibliometric Analysis. *World Neurosurgery*. 2022;161:e355–62.
10. Soyta RB. A bibliometric analysis of publications on covid-19 and older adults. Vol. 25, *Annals of Geriatric Medicine and Research*. ncbi.nlm.nih.gov; 2021. p. 197–203.
11. Il- L, As MP regiosacral C pressure, For T. Kadar Il-6 Dan Pge2 Pada Ibu Pasca Counter-Pressure Regiosakralis Sebagai Terapi Nyeri Akibat Kontraksi Rahim penilaian menggunakan Numeric Rating Scale mencapai skala intensitas prostaglandin , leukotrien , tromboksan , histamin , bradikinin , substansi. 1883;72:1883–91.
12. Rejeki S, Widayati E, Machmudah M, Yanto A. Decreasing labor pain through sacralist counter-pressure therapy using tennis ball in the mother during the labor process. *Open Access Macedonian Journal of Medical Sciences*. 2021;9(T4):83–6.
13. Ningdiah AK, Ningsih AF, Iskandiani L, Lawra C. Literature Review Teknik Mengurangi Nyeri pada Persalinan. In: *Prosiding Seminar Nasional dan CFP Kebidanan Universitas Ngudi Waluyo*. 2022. p. 892–901.
14. Amiri P, Mirghafourvand M, Esmailpour K, Kamalifard M, Ivanbagha R. The effect of distraction techniques on pain and stress during labor: a randomized controlled clinical trial. *BMC pregnancy and childbirth*. 2019;19:1–9.
15. Deng Y, Lin Y, Yang L, Liang Q, Fu B, Li H, et al. A comparison of maternal fear of childbirth, labor pain intensity and intrapartum analgesic consumption between primiparas and multiparas: A cross-sectional study. *International Journal of Nursing Sciences* [Internet]. 2021 Jul 27;8(4):380–7. Available from: <https://app.dimensions.ai/details/publication/pub.1141166147>
16. Damayanti FN, Mulyanti L, Poddar S. Juridica Study of Criminal Law on Delegation of Authority of Obstetricians and Gynecologists to Midwives in Health Services. 2023;
17. Pietrzak J, Mędrzycka-Dąbrowska W, Tomaszek L, Grzybowska ME. A Cross-Sectional Survey of Labor Pain Control and Women's Satisfaction. *International Journal of Environmental Research and Public Health* [Internet]. 2022 Jul 27;19(3):1741. Available from: <https://app.dimensions.ai/details/publication/pub.1145256917>
18. Damayanti FN, Absori A, Wardiono K, Rejeki S. The evidence-based midwife professionalism. Vol. 14, *Indian Journal of Forensic Medicine and Toxicology*. revistaamplamente.com; 2020. p. 1877–81.
19. Damayanti FN, Absori A, Wardiono K. Legal protection of midwives based on professional justice in midwifery practices. Vol. 10, *Indian Journal of Public Health Research and Development*. repository.unimus.ac.id; 2019. p. 437–41.
20. Pratiwi IG. Studi Literatur: Metode Non Farmakologis Mengurangi Nyeri Persalinan Dengan Menggunakan Efflurage Massage. *Jurnal kesehatan*. 2019;12(1):141–5.
21. Oktiningrum M, Mariyana W, Harjanti AI. Literatur Review: Efektifitas Penatalaksanaan Cemas dan Nyeri Persalinan dengan Teknik Hypnosis. In: *Prosiding Seminar Nasional dan CFP Kebidanan Universitas Ngudi Waluyo*. 2022. p. 849–56.
22. Mascarenhas VHA, Lima TR, Negreiros F dos S, Santos JDM, Moura MÁP, Gouveia MT de O, et al. Scientific evidence on non-pharmacological methods for relief of labor pain. *Acta Paulista de Enfermagem*. 2019;32:350–7.

23. Damayanti FN, Absori A, Wardiono K, Rejeki S. The comparison of midwives professionalism in indonesia and england. *Journal of South India Medicolegal Association*. 2020;12(1):4–9.
24. Syros A, Perez OF, Luxenburg D, Cohen JL, Swonger R, Huntley S. The most influential studies concerning revision shoulder arthroplasty research. *Journal of Orthopaedics*. 2022;34:349–56.
25. Pahwa B, Goyal S, Chaurasia B. Understanding anterior communicating artery aneurysms: A bibliometric analysis of top 100 most cited articles. *of Cerebrovascular and. synapse.koreamed.org*; 2022.
26. Page MJ, McKenzie JE, Bossuyt P, Boutron I, Hoffmann TC, Mulrow CD, et al. The prisma 2020 statement: An updated guideline for reporting systematic reviews. Vol. 57, *Medicina Fluminensis*. Elsevier; 2021. p. 444–65.
27. Van Eck NJ, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*. 2010;84(2):523–38.
28. Melillo A, Maiorano P, Rachedi S, Caggianese G, Gragnano E, Gallo L, et al. Labor Analgesia: A Systematic Review and Meta-Analysis of Non-Pharmacological Complementary and Alternative Approaches to Pain during First Stage of Labor. *Critical Reviews in Eukaryotic Gene Expression* [Internet]. 2022 Jul 27;32(2):61–89. Available from: <https://app.dimensions.ai/details/publication/pub.1142771812>
29. Ashagrie HE, Fentie DY, Kassahun HG. A review article on epidural analgesia for labor pain management: A systematic review. *International Journal of Surgery Open*. 2020;24:100–4.
30. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet* [Internet]. 2012 Nov 1;380(9859):2095–128. Available from: <https://app.dimensions.ai/details/publication/pub.1013705877>
31. Alakeely MH, Almutari A khalaf, Alhekail GA, Abuoliat ZA, Althubaiti A, AboItai LAR, et al. The effect of epidural education on Primigravid Women’s decision to request epidural analgesia: a cross-sectional study. *BMC pregnancy and childbirth*. 2018;18:1–6.
32. Beigi SM, Valiani M, Alavi M, Mohamadirizi S. The relationship between attitude toward labor pain and length of the first, second, and third stages in primigravida women. *Journal of Education and Health Promotion* [Internet]. 2019 Jul 27;8(1):130. Available from: <https://app.dimensions.ai/details/publication/pub.1119883917>
33. Beyable AA, Bayable SD, Ashebir YG. Pharmacologic and non-pharmacologic labor pain management techniques in a resource-limited setting: A systematic review. *Annals of Medicine and Surgery* [Internet]. 2022 Jul 27;74:103312. Available from: <https://app.dimensions.ai/details/publication/pub.1145125858>

4. MANUSKRIP SETELAH REVIEW

Labor Pain Intervention: Bibliometrics analysis

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Abstract

This study aims to determine the number of publications, citations, and research topics about labor pain intervention trends in the future. The research method applied in this study is Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), using 158,201 scientific articles or proceedings from the Dimensions database. The article review process was assisted by the VOSviewer application. The research found that the trend of labor pain intervention is rising, the citation about labor pain intervention topic is rising, the network visualization on the topic of labor pain intervention informs to find novelty between the unlinked issues, there are four clusters reviewed from the co-occurrence, overlay visualization on labor pain give the trend of the research topic in the future, and the density visualization on the rare topic. The research finding contributes to developing the research roadmap for labor pain intervention.

Keywords: Bibliometrics analysis, Linear regression, PRISMA, Intervention, Labor pain

Background

The pain and anxiety during labor are significant, especially for first-time mothers. It could extend labor duration, increase stress hormones, and affect the mother's and newborn's conditions (1). Some strategies have been developed to deal with labor pain and enhance the satisfaction of the mother's birth experience (2). The intervention for labor pain could be done through pharmacological and non-pharmacological techniques. The former group includes epidural analgesia, pain control gas, and intravenous opioids. The later non-pharmacology techniques include waterbirth and immersion, transcutaneous electrical nerve stimulation (TENS), aromatherapy, acupuncture and acupressure, and massage techniques. Nowadays, the neuraxial blockade has spinal technique, epidural, and epidural-spinal combined technique, which is the golden standard for patients with labor pain. However, many patients use non-pharmacological techniques as they enable them to have more natural birth techniques (3).

People's interest in labor pain intervention around the world is going down. As stated in (4) and (5), the interest could be tracked using Google Trends by typing labor pain intervention keywords. For example, the search from January 2024 to December 2022 using web browsing in all categories shows the data presented in Figure 1. The data was retrieved on October 28, 2023

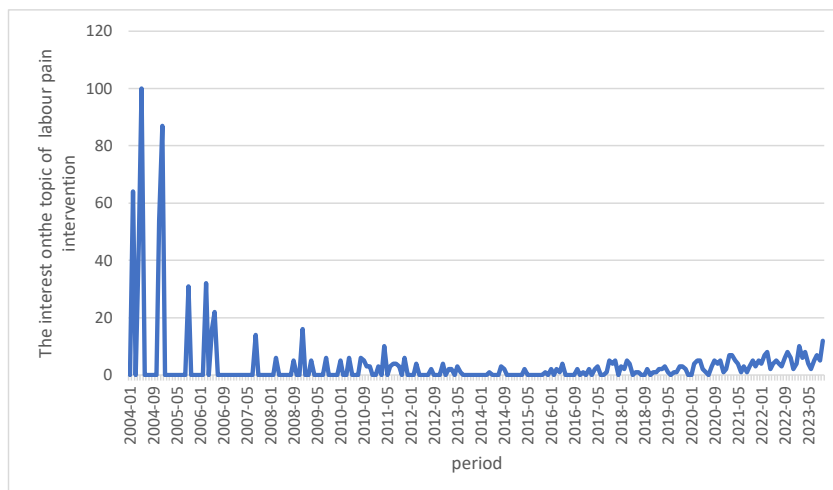


Figure 1. The interest in the topic of labor pain intervention over time (Data source: Google Trends)

Besides duration, its country could also review the interest in labor pain intervention. The

interest in the topic by its country is presented in Figure 2. Based on Figure 2, the Philippines is the country with the highest interest in the topic, followed by the United States.

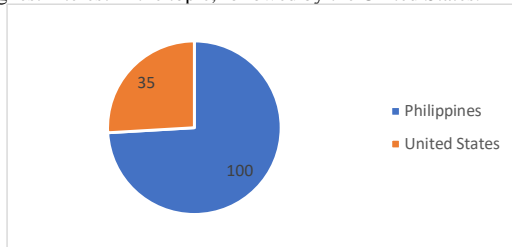


Figure 2. The histogram of interest on the topic of labor pain intervention by the country (Data Source: Google Trends)

The data represent the interest in the general topic of labor pain intervention. On the other hand, researchers must discuss more particular issues, such as scientific publications, scientific articles, and seminar proceedings about labor pain intervention. Therefore, the information about the topic in a journal article is urgently needed.

In this study, the researcher needs information about trends and novelty for the topic of labor pain intervention in the future. This is due to the emerging problem among researchers. However, a bibliometric analysis of the publication of labor pain intervention to find its trend and novelty hasn't been found. The research questions in this study are (1) how is the growth of the topic of labor pain intervention, (2) how is the growth in the number of citations of the topic of labor pain intervention, (6) how is the network visualization of the topic of labor pain intervention, (7) how is the publication cluster of the topic of labor pain intervention revied by its co-occurrence, (8) how is the overlay visualization of the topic of labor pain intervention, (9) how is the density visualization of labor pain intervention.

Bibliometric analysis is a statistical-based research approach to visualize academic institutions' contribution and development in the research hotspot (6). Bibliometric analysis helps the researcher identify the future area and direction of the research domain using visualization tools (7). Bibliometric analysis has been used by many authors to evaluate the information theory registered in the Scopus database (7), to evaluate the immigration and degradation of the environment (8), and to investigate the topic search trend of the labor pain intervention (9). It means bibliometric analysis is a quantitative scientific method to assess published articles to help researchers identify the trends of development, updates, and hotspots of particular research and contribute to research development in the future for researchers (10).

The research aims to find out the trend of the publication number of labor pain interventions, the number of citations, and the future research direction. The topic related to labor pain intervention is still hard to find. Therefore, bibliometric analysis is needed to update the topic novelty.

Literature review

Pain

Pain is a physiological condition commonly experienced by pregnant mothers during labor (11) due to uterine muscle contraction as an effort to open the cervix and push the infant's head toward the pelvis (12). Labor pain is a subjective experience caused by uterine muscle ischemia, traction of uterine ligaments, traction of ovarium, fallopian tubes, and enlargement of the lower part of the uterus, pelvic floor muscles, and perineum (13). The pain and stress control related to the labor and birth process is one of the crucial problems in the healthcare system (14). With undeniable and intensive pain during the labor process, the pain level may vary according to the mother's physiological and psychological influence (15). The pain impulse is transmitted when the defence is opened and stops when the defence is closed, and the effort to close the defence is the basis for the pain killer (16).

Labor

Labor is a critical yet significant period in a woman's life (17). A companion by a midwife is required to go through a crucial period during the labor process (18). For a women, giving birth could be the most challenging psychological history in her life [19]. The case makes the role of a midwife very prominent in this process (19). It has long-term negative or positive significant effects on a woman's life (20). The (21) difference in culture, religion, and social economy could affect women's perspective on giving birth experience . Giving birth is not only about the transition of becoming a mother but also related to the physical and emotional effects in a mother's life (22). The management of midwifery service allows midwives to develop in performing the midwifery service (23).

Methodology

Bibliometric analysis is a research method used in the science of literature and information to evaluate the research performance (24). Bibliometric analysis is fundamental in assessing the research impact of which the study is graded based on the received citation (25).

Data was extracted from <https://app.dimensions.ai/> on October 28, 2023. Preferred Reporting Items for Systematic Reviews and Meta-Analyses [27], or PRISMA, was used to extract the article from the <https://app.dimensions.ai/> database. The flow chart of PRISMA is presented in Figure 3.

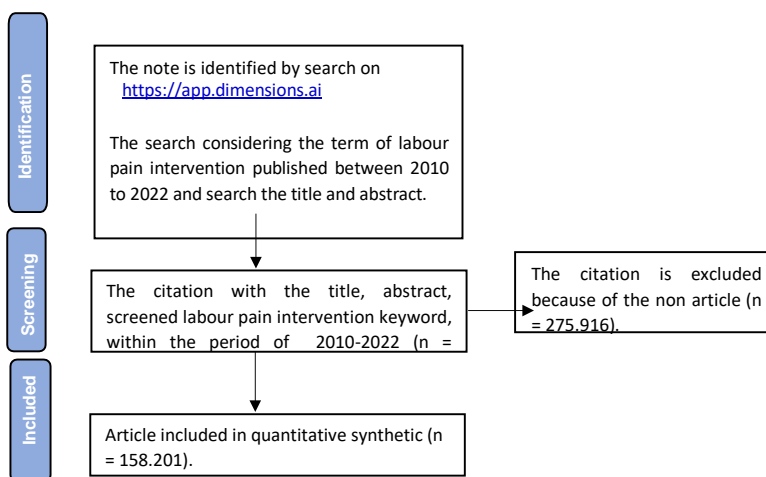


Figure 3. PRISMA Flowchart (26)

The PRISMA method consists of three stages: identification, screening, and inclusion. Stage 1 (Identification) detects 434,117 citations from <https://app.dimensions.ai/> by considering the term labor pain intervention published between 2010 and 2022, especially in the title and abstract. In stage 2 (screening), there are 158,201 citations. By choosing "article" as the publication type, 275,916 citations were excluded. In stage 3 (included), the final sample was 158,201 articles. The data was then analyzed using VOSviewer. VOSviewer is a computer program to make and view bibliometric maps (27). In this study, the analysis was reviewed from the co-occurrence.

The procedure to analyze the co-occurrence is (1) Type of data, on the option of creating a map based on test data. The option was to present an event map based on the textual data. (2) Data source on the option of reading data from reference manager files. The supported files were RIS, EndNote,

and RefWorks. (3) Choose RIS file type. (4) Fields from which term will be extracted) on the title and abstract fields) by ignoring the structured abstract and copyright statement labels. (5) Full counting method. (6) The minimum grade for the citation emergence is 10. Out of 7368 terms, 170 terms passed the minimum grade with the calculated relevance score. Based on this score, the most relevant term would be chosen. The default option chose 60% of the applicable term. The number of the chosen terms was 102 terms.

Finding

The search between 2010 and 2022 provides 158,201 scientific article publications. The number of labor pain intervention publications per year is presented in Figure 4.

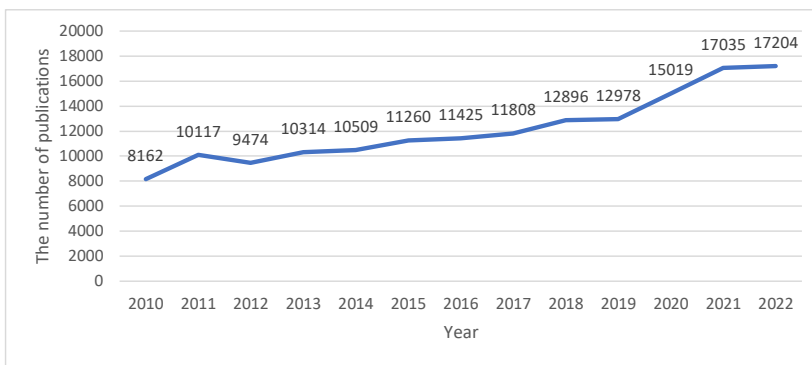
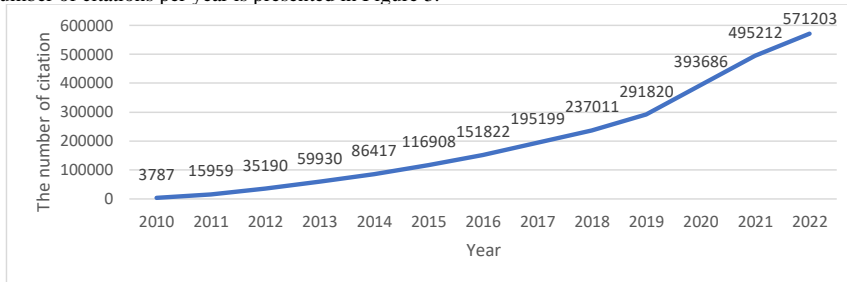


Figure 4. The number of publications about labor pain intervention between 2010 to 2022 (source: <https://app.dimensions.ai/>)

The number of labor pain intervention citations between 2010 to 2022 is 3,139,093. The number of citations per year is presented in Figure 5.



Gambar 5. The number of citations on the topic of labor pain intervention between 2010 to 2022 (source: <https://app.dimensions.ai/>)

The network visualization of the 102 terms is presented in Figure 6.

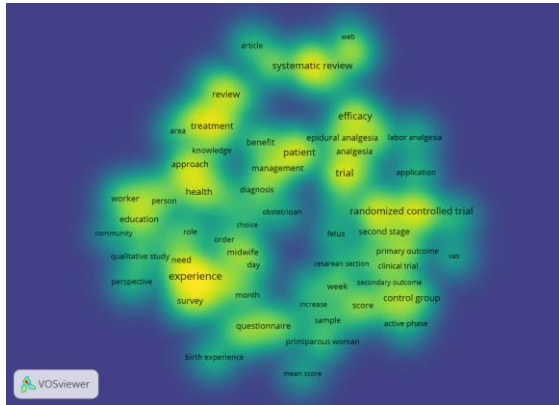


Figure 8. Density visualization (source: VOSviewer dan <https://app.dimensions.ai/>)

Discussion

Figure 4 shows that the number of publications has exponentially increased over time. The lowest publication was in 2010, with 8162 publications. Meanwhile, the highest publication was in 2021, with 17035 publications. The average publication number was 11750. The statistic is presented in Figure 9. Of the 158,201 publications, "Labor Analgesia: A Systematic Review and Meta-Analysis of Non-Pharmacological Complementary and Alternative Approaches to Pain during First Stage of Labor" (28) was the most relevant. It is essential to review the newest article to recommend a feasible and relatively safe method in the clinical management of labor pain management method (29). Therefore, there is a need for the latest publication related to labor pain intervention.

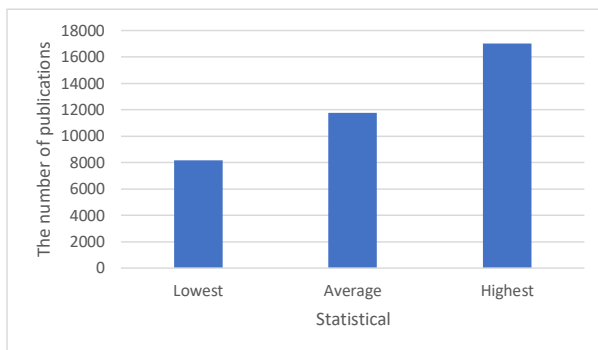


Figure 9. The histogram shows the lowest, average, and highest number of labor pain intervention topics.

Figure 5 shows that the number of citations exponentially increased over time. The lowest citation was in 2010, with 3,787 citations. Meanwhile, the highest number of citations was in 2022, with 571,203. The average citation number was 204,165. The statistic is presented in Figure 10. The research data revealed that from 158,201 publications, a publication entitled "Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the

Global Burden of Disease Study 2010" (30) is the most cited publication. Other authors would frequently cite journals indexed in the reputation index. Therefore, this article could be used as a reference in research explaining labor pain intervention.

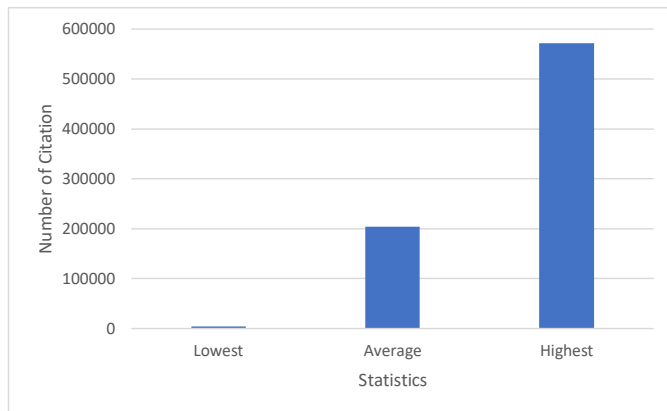


Figure 10. The histogram of the lowest, average, and highest number of citations about labor pain intervention topics.

In the network visualization (Figure 6), two terms linked with a line indicated that the terms were found at the same time in the title and abstract of a publication. In contrast, the two terms are not linked by a line, indicating that the terms aren't simultaneously found in the title and abstract. The research data revealed 102 terms, four clusters, and 3302 links; the total link strength was 7945. Some authors researched women's preference for pain reduction methods during labor (31). Therefore, a novelty for the researcher for the next topic of labor pain intervention could be done from the research on the unlinked terms, such as "relief" and "stage."

The 102 terms categorized in four clusters consist of Cluster 1 (38 terms), Cluster 2 (29 terms), Cluster 3 (23 terms), and Cluster 4 (12 terms). For more detail, the clusters are presented in Table 1.

Table 1. Clusters for the topic of labor pain intervention (Source: VOSviewer and <https://app.dimensions.ai/>)

Cluster	Number of terms	Terms in the cluster member
1	38	Approach, barrier, birth experience, childbirth experience, community, country, cross-sectional study, education, experience, fear, health, hour, implementation, importance, individual, influence, iran, labor pain, mean score, midwife, need, number, order, paper, part, perception, person, perspective, preference, presence, prevalence, qualitative study, questionnaire, reason, role, survey, work, worker.
2	29	Active phase, apgar score, application, cesarean section, clinical trial, comparison, control group, duration, episiotomy, fetus, first stage, increase, intervention group, massage, min, pain score, positive effect, primary outcome, primiparous woman, randomized clinical trial, randomized controlled trial, sample, score, second stage, secondary outcome, significant difference, trial, vas, week.
3	23	Alternative, analgesia, area, article, benefit, body, depression, efficacy, Embase, epidural analgesia, knowledge, labor analgesia, literature, meta-analysis, pain

management, parturient, pubmed, review, safety, science, systematic review, total, web.

4 12 Admission, case, choice, condition, day, diagnosis, incidence, management, month, obstetrician, patient, treatment.

The overlay visualization (Figure 7) presents the analysis based on the keyword labor and intervention from 2010 to 2022 to observe the trend of the research title related to labor pain intervention. Based on the overlay visualization map in Figure 7., the yellow terms imply that the keyword represents the author's interest at present (7). Today's interest in research mainly focuses on modern ideas and the influence of the Western method on pain, eventually changing the perception and willingness to deal with labor pain (32). Therefore, the trend of research about pain in labor now focuses on the yellow-colored terms, such as pain score and active phase. Obstetrician.

The density visualization (Figure 8) shows the visualization of the terms' density level, which is indicated by color. Blue indicates the high density, while yellow indicates the low density. The high-density term means that the topic was frequently used in previous research, while the low-density term means that the subject was rarely used in previous research. Pain in labor is mainly ignored, especially in low and middle-income countries (33). Therefore, the suggested research topics of intervention for labor pain from the low-density visualization were experience, epidural analgesia, and efficacy.

Conclusion

The research was completed using bibliometric analysis from the publications about labor pain intervention retrieved from <https://app.dimensions.ai/> from 2010 to 2022. This research shows some findings, such as the trend of publications on the topic of labor pain intervention increased, the number of citations on the subject of labor pain intervention increased, network visualization on the topic of labor pain intervention gives information to find the novelty on the unlinked topics, there are four clusters reviewed from the co-occurrence, overlay visualization on the rarely discussed topic of labor pain intervention.

Although the research contributes to understanding the state-of-the-art development of the publications about labor pain from 2010 to 2022 from <https://app.dimensions.ai/>, this research also found some limitations. The <https://app.dimensions.ai/> database keeps improving the new publications over time. Therefore, the bibliometric analysis of labor pain intervention could be reviewed a few years ahead. Besides, the bibliometric analysis only extracts the scientific publications from the <https://app.dimensions.ai/> database. In further research, some other databases are expected to be added for a more expanded and comprehensive understanding of labor pain intervention.

Ethical Clearance

The research obtained ethical permission from the Health Research Ethics Commission, Faculty of Nursing and Health Sciences, Muhammadiyah University, Semarang No. 180/KE/08/2023

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Conflicts of interest

The authors declare that this research was conducted without any conflict of interest.

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Data access

The data used in this research was accessed via <https://app.dimensions.ai/>, <https://trends.google.co.id/>, and VOSviewer.

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Author contributions

The first and second authors understand the ideas presented, develop a theory. The third author performed the calculations, verifying the analysis method. The fourth author investigated the topic of iron deficiency anemia and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

REFERENCE

1. Whitburn LY, Jones LE, Davey M-A, McDonald S. The nature of labour pain: An updated review of the literature. *ACM. Elsevier*; 2019;32(1):28–38. DOI: <https://doi.org/10.1016/j.wombi.2018.03.004>
2. Chang C-Y, Gau M-L, Huang C-J, Cheng H. 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
3. Czech I, Fuchs P, Fuchs A, Lorek M, Tobolska-Lorek D, Drosdzol-Cop A, et al. Pharmacological and Non-Pharmacological Methods of Labour Pain Relief—Establishment of Effectiveness and Comparison. *IJERPH*. 2018;15(12):2792. DOI: 10.3390/ijerph15122792
4. Akhmad Fauzy S, Supandi ED. Signal Modeling with IG Noise and Parameter Estimation Based on RJMCMC. 2022; DOI: 10.13189/ms.2022.100614
5. Prabowo A, Suparman S, Li CS, Janan D. The effect of reading literacy to mathematics comprehension of elementary school students in Indonesia and Malaysia. *Int J Eval & Res*. 2023; DOI: 0.11591/ijere.v12i1.25714
6. Fu Z, Lv J, Gao X, Zhang B, Li Y. Research trends and hotspots evolution of cardiac amyloidosis: a bibliometric analysis from 2000 to 2022. *European. eurjmedres.biomedcentral.com*; 2023; DOI: 10.1186/s40001-023-01026-5
7. Lam WH, Lam WS, Jaaman SH, Lee PF. Bibliometric Analysis of Information Theoretic Studies. *Entropy*. 2022;24(10). DOI: 10.3390/e24101359
8. Anuar A, Marwan NF, Smith J, Sิริyanun S, Sharif A. Bibliometric analysis of immigration and environmental degradation: evidence from past decades. *Environ Sci Pollut Res*. 2022;29(9):13729–41. DOI: 10.1007/s11356-021-16470-1
9. Zhang Y, Lim D, Yao Y, Dong C, Feng Z. Global Research Trends in Radiotherapy for Gliomas: A Systematic Bibliometric Analysis. *World Neurosurg*. 2022;161:e355–62. DOI: 10.1016/j.wneu.2022.02.001
10. Soyatas RB. A bibliometric analysis of publications on covid-19 and older adults. *Ann Geriatr Med Res*. 2021;25(3):197–203. DOI: 10.4235/agmr.21.0060
11. Buerengen T, Bernitz S, Øian P, Dalbye R. Association between one-to-one midwifery care in the active phase of labour and use of pain relief and birth outcomes: A cohort of nulliparous women. *Midwifery*. 2022;110:103341. DOI: 10.1016/j.midw.2022.103341
12. Rejeki S, Widayati E, Machmudah M, Yanto A. Decreasing labor pain through sacralist counter-pressure therapy using tennis ball in the mother during the labor process. *Open Access Maced J Med Sci*. 2021;9(T4):83–6. DOI: 10.3889/oamjms.2021.5817
13. Xu N, Chen S, Liu Y, Jing Y, Gu P. The Effects of Virtual Reality in Maternal Delivery: Systematic Review and Meta-analysis. *JMIR Serious Games*. 2022;10(4):e36695. DOI: 10.2196/36695
14. Amiri P, Mirghafourvand M, Esmaeilpour K, Kamalifard M, Ivanbagha R. The effect of distraction

techniques on pain and stress during labor: a randomized controlled clinical trial. *BMC pregnancy and childbirth*. 2019;19:1–9. DOI: <https://doi.org/10.1186/s12884-019-2683-y>

15. Deng Y, Lin Y, Yang L, Liang Q, Fu B, Li H, et al. A comparison of maternal fear of childbirth, labor pain intensity and intrapartum analgesic consumption between primiparas and multiparas: A cross-sectional study. *Int J Nurs Sci*. 2021;8(4):380–7. DOI: 10.1016/j.ijnss.2021.09.003
16. Damayanti FN, Mulyanti L, Poddar S. Juridical Study of Criminal Law on Delegation of Authority of Obstetricians and Gynecologists to Midwives in Health Services. *J Huk Novelty*. 2023;14(2):272–87. DOI: 10.26555/novelty.v14i2.a25748
17. Pietrzak J, Mędrzycka-Dąbrowska W, Tomaszek L, Grzybowska ME. A Cross-Sectional Survey of Labor Pain Control and Women's Satisfaction. *Int J Environ Res Public Health*. 2022;19(3):1741. DOI: 10.3390/ijerph19031741
18. Damayanti FN, Absori A, Wardiono K, Rejeki S. The evidence-based midwife professionalism. *IJFMT*. 2020;14(3):1877–81. DOI: 10.37506/ijfnt.v14i3.10699
19. Damayanti FN, Absori A, Wardiono K. Legal protection of midwives based on professional justice in midwifery practices. *IJPHRD*. 2019;10(4):437–41. DOI: 10.5958/0976-5506.2019.00734.4
20. Heelan-Fancher L, Edmonds JK. Intrapartum Nurses' Beliefs Regarding Birth, Birth Practices, and Labor Support. *J Obstet Gynecol Neonatal Nurs*. 2021;50(6):753–64. DOI: 10.1016/j.jogn.2021.07.004
21. Burns E, Feeley C, Hall PJ, Vanderlaan J. Systematic review and meta-analysis to examine intrapartum interventions, and maternal and neonatal outcomes following immersion in water during labour and waterbirth. *BMJ Open*. 2022;12(7):e056517. DOI: 10.1136/bmjopen-2021-056517
22. Mascarenhas VHA, Lima TR, Negreiros F dos S, Santos JDM, Moura MÁP, Gouveia MT de O, et al. Scientific evidence on non-pharmacological methods for relief of labor pain. *Acta Paul Enferm. SciELO Brasil*; 2019;32:350–7. DOI: <https://doi.org/10.1590/1982-0194201900048>
23. Damayanti FN, Absori A, Wardiono K, Rejeki S. The comparison of midwives professionalism in indonesia and england. *J South India Med Assoc*. 2020;12(1):4–9. DOI: 10.26555/novelty.v14i2.a25748
24. Syros A, Perez OF, Luxenburg D, Cohen JL, Swonger R, Huntley S. The most influential studies concerning revision shoulder arthroplasty research. *J Orthop*. 2022;34:349–56. DOI: 10.1016/j.jor.2022.09.019
25. Pahwa B, Goyal S, Chaurasia B. Understanding anterior communicating artery aneurysms: A bibliometric analysis of top 100 most cited articles. *J Cerebrovasc Endovasc Neurosurg*. 2022; DOI: 10.7461/jcen.2022.E2022.01.001
26. Page MJ, McKenzie JE, Bossuyt P, Boutron I, Hoffmann TC, Mulrow CD, et al. The prisma 2020 statement: An updated guideline for reporting systematic reviews. *Med Flum*. 2021;57(4):444–65. DOI: 10.21860/medflum2021_264903
27. Van Eck NJ, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*. 2010;84(2):523–38. DOI: 10.1007/s11192-009-0146-3
28. Melillo A, Maiorano P, Rachedi S, Caggianese G, Gragnano E, Gallo L, et al. Labor Analgesia: A Systematic Review and Meta-Analysis of Non-Pharmacological Complementary and Alternative Approaches to Pain during First Stage of Labor. *Crit Rev Eukaryot Gene Expr*. 2022;32(2):61–89. DOI: 10.1615/critreveukaryotgeneexpr.2021039986
29. Ashagrie HE, Fentie DY, Kassahun HG. A review article on epidural analgesia for labor pain management: A systematic review. *Int J Surg Open*. 2020;24:100–4. DOI: <https://doi.org/10.1016/j.ijso.2020.04.007>

30. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*. 2012;380(9859):2095–128. DOI: 10.1016/s0140-6736(12)61728-0
31. Alakeely MH, Almutari A khalaf, Alhekail GA, Abuoliat ZA, Althubaiti A, AboItai LA-R, et al. The effect of epidural education on Primigravid Women’s decision to request epidural analgesia: a cross-sectional study. *BMC Pregnancy Childbirth*. 2018;18:1–6. DOI: <https://doi.org/10.1186/s12884-018-1766-5>
32. Beigi SM, Valiani M, Alavi M, Mohamadirizi S. The relationship between attitude toward labor pain and length of the first, second, and third stages in primigravida women. *J educ health promot*. 2019;8(1):130. DOI: 10.4103/jehp.jehp_4_19
33. 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*. 2022;74:103312. DOI: 10.1016/j.amsu.2022.103312

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6. ARTIKEL SUDAH PUBLISH



Labour Pain Intervention: A Bibliometrics Analysis

Fitriani Nur Damayanti,¹ Zulvi Wiyanti,² Satria Pranata,³ Ariyani Lutfitasari¹

Abstract

Pain and anxiety during childbirth are significant concerns during labour, especially in first-time mothers. This can increase labour time, increase stress hormones and affect the condition of the mother and newborn. This study aimed to determine trends in the number of publications on labour pain interventions, the number of citations and the direction of future research topics. The research method applied in this study was Preferred reporting items for systematic reviews and meta-analyses (PRISMA) which uses 158,201 scientific articles or proceedings sourced from the Dimensions database. Articles were reviewed by using the VOSviewer application. The results of the research revealed that the number of publications on the topic of labour pain intervention had an upward trend, the number of citations on the topic of labour pain intervention had increased. Network visualisation on the topic of labour pain intervention provided information to find newness on topics that were not yet connected, there were 4 clusters reviewing it from co-occurrence, overlay visualisation on the topic of labour pain intervention provided a trend towards future research topics, density visualisation on a topic that was still rare. The conclusion from the results of this research is that it contributes to the development of a research roadmap on labour pain interventions.

Key words: Bibliometrics analysis; Linear regression; PRISMA; Intervention; Labour pain.

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Introduction

The pain and anxiety during labour are significant, especially for first-time mothers. It could extend labour duration, increase stress hormones and affect the mother's and newborn's conditions.¹ Some strategies have been developed to deal with labour pain and enhance the satisfaction of the mother's birth experience.² The intervention for labour pain could be done through pharmacological and non-pharmacological techniques. The former group includes epidural analgesia, pain control gas and intravenous opioids. The later non-pharmacology techniques include waterbirth and immersion, transcutaneous electrical nerve stimulation (TENS), aro-

matherapy, acupuncture and acupressure and massage techniques. Nowadays, the neuraxial blockade has spinal technique, epidural and epidural-spinal combined technique, which is the golden standard for patients with labour pain. However, many patients use non-pharmacological techniques as they enable them to have more natural birth techniques.³

Pain is a physiological condition commonly experienced by pregnant mothers during labour⁴ due to uterine muscle contraction as an effort to open the cervix and push the infant's head toward the pelvis.³ Labour pain is a subjective experience

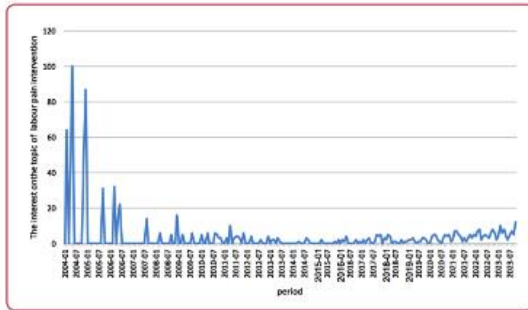


Figure 1: The interest in the topic of labour pain intervention over time (Data source: Google Trends)

caused by uterine muscle ischaemia, traction of uterine ligaments, traction of ovary, fallopian tubes and enlargement of the lower part of the uterus, pelvic floor muscles and perineum.⁶ The pain and stress control related to the labour and birth process is one of the crucial problems in the healthcare system.⁷ With undeniable and intensive pain during the labour process, the pain level may vary according to the mother's physiological and psychological influence.⁸ The pain impulse is transmitted when the defence is opened and stops when the defence is closed and the effort to close the defence is the basis for the pain killer.⁹

Labour is a critical yet significant period in a woman's life.¹⁰ A companion by a midwife is required to go through a crucial period during the labour process.¹¹ For a woman, giving birth could be the most challenging psychological history in her life. The case makes the role of a midwife very prominent in this process.¹² It has long-term negative or positive significant effects on a woman's life.¹³ The difference in culture, religion and social economy could affect women's perspective on giving birth experience.¹⁴ Giving birth is not only about the transition of becoming a mother but also related to the physical and emotional effects in a mother's life.¹⁵ The management of midwifery service allows midwives to develop in performing the midwifery service.¹⁶

Public interest in labour pain interventions worldwide is declining. As stated in Figure 1,^{17, 18} this interest can be tracked using Google Trends by typing in the keyword labour pain intervention. The search was carried out from January 2004 to December 2022 using web browsing in

all categories showing the data presented in Figure 1. Data was taken on 28 October 2023.

Besides duration, there are differences in the interest between countries. According to the *Google Trends*, the Philippines is the country with the highest interest in the topic, followed by the United States. The data represent the interest in the general topic of labour pain intervention. On the other hand, researchers must discuss more particular issues, such as scientific publications, scientific articles and seminar proceedings about labour pain intervention. The researcher needs information about trends and novelty for the topic of labour pain intervention in the future in scientific journal articles. However, a bibliometric analysis of the publication of labour pain intervention to find its trend and novelty hasn't been found. The research questions in this study were: (1) is there growth on the topic of labour pain intervention, (2) what is the growth in the number of citations of the topic of labour pain intervention, (3) the network visualisation of the topic of labour pain intervention, (4) the publication cluster of the topic of labour pain intervention revised by its co-occurrence, (5) the overlay and (6) the density visualisation of the topic of labour pain intervention.

Bibliometric analysis is a statistical-based research approach to visualise academic institutions' contribution and development in the research hotspot.¹⁹ Bibliometric analysis helps the researcher identify the future area and direction of the research domain using visualisation tools.²⁰ Bibliometric analysis has been used by many authors to evaluate the information theory

registered in the *Scopus* database,²⁰ to evaluate the immigration and degradation of the environment²¹ and to investigate the topic search trend of the labour pain intervention.²² It means bibliometric analysis is a quantitative scientific method to assess published articles to help researchers identify the trends of development, updates and hotspots of particular research and contrib-

ute to research development in the future for researchers.²³

The research aimed to find out the trend of the publication number of labour pain interventions, the number of citations and the future research direction.

Methods

Bibliometric analysis was used in the science of literature and information to evaluate the research performance.²⁴ Bibliometric analysis was used in assessing the research impact of which the study is graded based on the received citation.²⁵ Data was extracted from <https://app.dimensions.ai/> database on 28 October 2023. Preferred reporting items for systematic reviews and meta-analyses (PRISMA),^{26,27} was used to extract the article from the database. The flow chart of PRISMA is presented in Figure 2.

The PRISMA method consisted of three stages: identification, screening and inclusion. Stage 1 (identification) detected 434,117 citations by considering the term labour pain intervention published between 2010 and 2022, especially in the title and abstract. In stage 2 (screening), there were 158,201 citations. By choosing "ar-

title" as the publication type, 275,916 citations were excluded. In stage 3 (included), the final sample was 158,201 articles. The data was then analysed using *VOSviewer*. *VOSviewer* is a computer program to make and view bibliometric maps.²⁷ In this study, the analysis was reviewed from the co-occurrence.

The procedure to analyse the co-occurrence was: (1) type of data, on the option of creating a map based on text data. The option was to present an event map based on the textual data. (2) Data source on the option of reading data from reference manager files. The supported files were *RIS*, *EndNote* and *RefWorks*. (3) Choose *RIS* file type. (4) Fields from which term will be extracted on the title and abstract fields by ignoring the structured abstract and copyright statement labels. (5) Full counting method. (6) The minimum

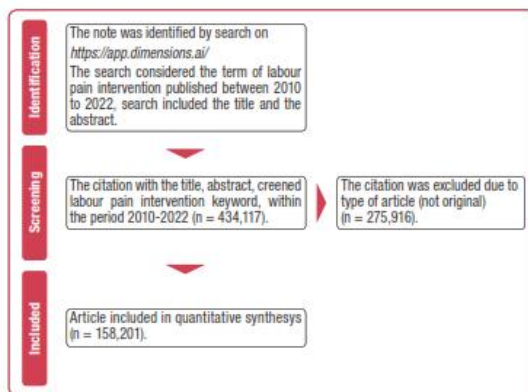


Figure 2. Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flowchart²⁸

grade for the citation emergence was 10. Out of 7368 terms, 170 terms passed the minimum grade with the calculated relevance score. Based on this

score, the most relevant term were chosen. The default option chose 60 % of the applicable term. The number of the chosen terms was 102.

Results

The search between 2010 and 2022 provided 158,201 scientific article publications. The number of labour pain intervention publications per year is presented in Figure 3.

The number of labour pain intervention citations between 2010 to 2022 was 3,139,093. The number of citations per year is presented in Figure 4.

The network visualisation of the 102 terms is presented in Figure 5.

The 102 terms categorised in four clusters consist of Cluster 1 (38 terms), Cluster 2 (29 terms), Cluster 3 (23 terms) and Cluster 4 (12 terms). For more detail, the clusters are presented in Table 1.

VOSviewer also provided an overlay visualisation map. The overlay visualisation of 102 terms is presented in Figure 6.

Density visualisation of 102 terms is presented in Figure 7.

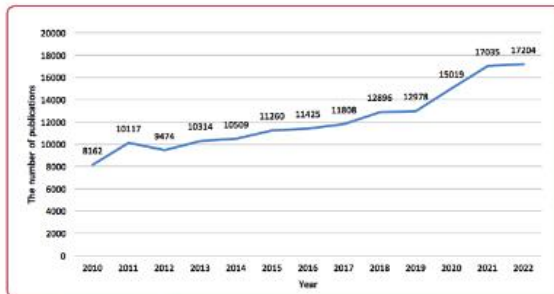


Figure 3: The number of publications about labour pain intervention between 2010 to 2022

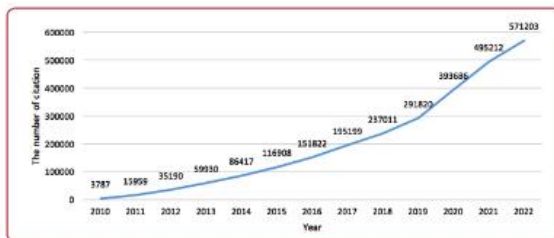


Figure 4: The number of citations on the topic of labour pain intervention between 2010 to 2022

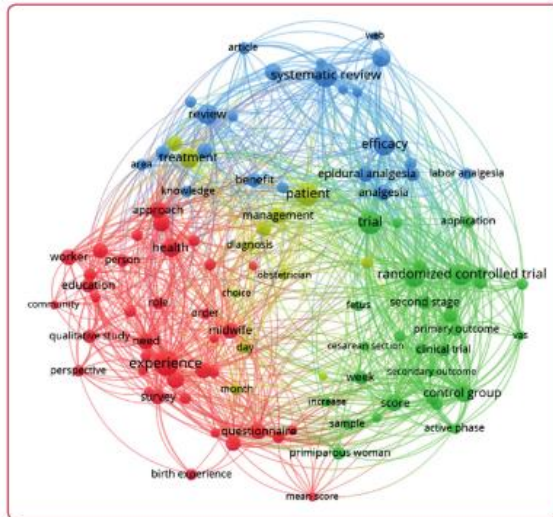


Figure 5. Network visualisation in the topic of labour pain intervention (source: VOSviewer and <https://app.dimensions.ai/>)

Table 1: Clusters for the topic of labour pain intervention

Cluster	N	Terms in the cluster member
1	38	Approach, barrier, birth experience, childbirth experience, community, country, cross-sectional study, education, experience, fear, health, hour, implementation, Importance, Individual, influence, Iran, labour pain, mean score, midwife, need, number, order, paper, part, perception, person, perspective, preference, presence, prevalence, qualitative study, questionnaire, reason, role, survey, work, worker.
2	29	Active phase, Apgar score, application, cesarean section, clinical trial, comparison, control group, duration, episiotomy, foetus, first stage, increase, intervention group, massage, min, pain score, positive effect, primary outcome, primiparous woman, randomised clinical trial, randomised controlled trial, sample, score, second stage, secondary outcome, significant difference, trial, vas, week.
3	23	Alternative, analgesia, area, article, benefit, body, depression, efficacy, Embase, epidural analgesia, knowledge, labour analgesia, literature, meta-analysis, pain management, parturient, PubMed, review, safety, science, systematic review, total, web.
4	12	Admission, case, choice, condition, day, diagnosis, incidence, management, month, obstetrician, patient, treatment.

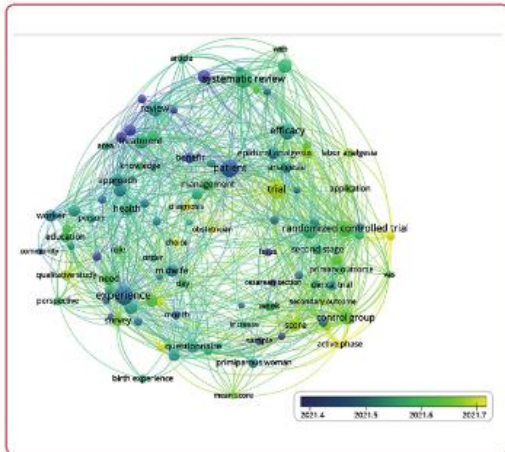


Figure 6: Overlay visualisation in the topic of labour pain intervention (source: VOSviewer and <https://app.dimensions.ai/>)

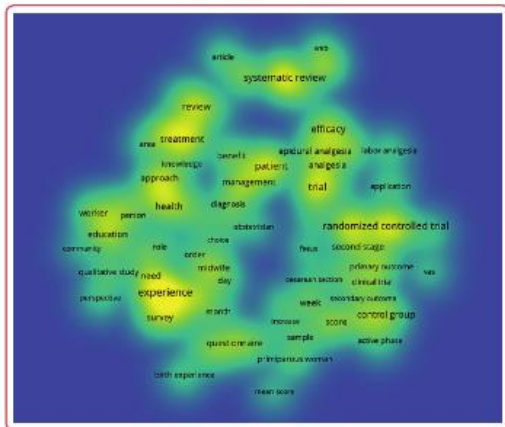


Figure 7: Density visualisation in the topic of labour pain intervention (source: VOSviewer and <https://app.dimensions.ai/>)

Discussion

From the research results obtained, searches from 2010 to 2022 produced 158,201 scientific article publications, showed that the number of publications related to delivery pain interventions increased exponentially from year to year. The lowest publication was in 2010, with 8162 publications. Meanwhile, the highest publication was in 2021, with 17035 publications. The average publication number was 11,750. Of the 158,201 publications, "Labor analgesia: a systematic review and meta-analysis of non-pharmacological complementary and alternative approaches to pain during first stage of labor" was the most relevant.²⁸ It is essential to review the newest article to recommend a feasible and relatively safe method in the clinical management of labour pain management method.²⁹ Therefore, there is a need for the latest publication related to labour pain intervention.

The number of citations increased over time. The lowest number was in 2010, with 3,787 citations. Meanwhile, the highest number of citations was in 2022, 571,203 citations. The average citation number was 204,165. The research data revealed that from 158,201 publications, a publication entitled "Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010" was the most cited publication.³⁰ Other authors would frequently cite journals indexed in the reputationable database with higher citation index.

In the network visualisation (Figure 5), two terms linked with a line indicated that the terms were found at the same time in the title and abstract of a publication. In contrast, the two terms were not linked by a line, indicating that the terms weren't simultaneously found in the title and abstract. The research data revealed 102 terms, four clusters and 3302 links; the total link strength was 7945. Some authors researched women's preference for pain reduction methods during labour.³¹ Therefore, a novelty for the researcher for the next topic of labour pain intervention could be done from the research on the unlinked terms, such as "relief" and "stage."

The overlay visualisation presented the analysis based on the keyword labour and intervention from 2010 to 2022 to observe the trend of the research title related to labour pain intervention. Based on the overlay visualisation, the yellow terms imply that the keyword represents the author's interest at present.²⁰ Today's interest in research mainly focuses on modern ideas and the influence of the Western method on pain, eventually changing the perception and willingness to deal with labour pain.³² Therefore, the trend of research about pain in labour now focuses on the yellow-coloured terms, such as pain score and active phase.

The density visualisation showed the visualisation of the terms' density level, which is indicated by colour. Blue indicates the high density, while yellow indicates the low density. The high-density term means that the topic was frequently used in previous research, while the low-density term means that the subject was rarely used in previous research. Pain in labour is mainly ignored, especially in low and middle-income countries.³³ Therefore, the suggested research topics of intervention for labour pain from the low-density visualisation were experience, epidural analgesia and efficacy.

Conclusion

The research was completed using bibliometric analysis from the publications about labour pain intervention retrieved from <https://app.dimensions.ai/> from 2010 to 2022. This research showed some interesting findings, such as the trend of publications on the topic of labour pain intervention increased, as well as the number of citations on the subject of labour pain intervention. Network visualisation on the topic of labour pain intervention gave information to find the novelty on the unlinked topics, there were four clusters reviewed from the co-occurrence, overlay visualisation on the rarely discussed topic of labour pain intervention. The conclusion from the results of this research is the development of a research roadmap regarding labour pain intervention.

Ethics

The research obtained ethical permission from the Health Research Ethics Commission, Faculty of Nursing and Health Sciences, Muhammadiyah University, Semarang, Indonesia, decision No 180/KE/08/2023, dated 22 August 2023.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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Data access

The data used in this research was accessed via <https://app.dimensions.ai/>, <https://trends.google.co.id/>, and *VOSviewer*. The data that support the findings of this study are available from the corresponding author upon reasonable individual request.

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References

1. Whitburn LY, Jones LE, Davey MA, McDonald S. The nature of labour pain: An updated review of the literature. *Women Birth*. 2019 Feb;32(1):28-38. doi: 10.1016/j.wombi.2018.03.004.
2. Chang CY, Gau ML, Huang CJ, Cheng H. 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.
3. Czech I, Fuchs P, Fuchs A, Lorek M, Tobolska-Lorek D, Drosdzol-Cop A, et al. Pharmacological and non-pharmacological methods of labour pain relief—establishment of effectiveness and comparison. *Int J Environ Res Public Health*. 2018;15(12):2792. doi: 10.3390/ijerph15122792.
4. Akhmad Fauzy S, Supandi ED. Signal modeling with IG noise and parameter estimation based on RJMC. *Math Stat*. 2022;10(6):1285-92. doi: 10.13189/ms.2022.100614.
5. Prabowo A, Suparman S, Li CS, Janan D. The effect of reading literacy to mathematics comprehension of elementary school students in Indonesia and Malaysia. *Int J Eval Res*. 2023;12(1):546-54. doi: 0.11591/ijere.v12i1.25714.
6. Fu Z, Lv J, Gao X, Zhang B, Li Y, Xu X, et al. Research trends and hotspots evolution of cardiac amyloidosis: a bibliometric analysis from 2000 to 2022. *Eur J Med Res*. 2023 Feb 20;28(1):89. doi: 10.1186/s40001-023-01026-5.

7. Lam WH, Lam WS, Jaaman SH, Lee PF. Bibliometric analysis of information theoretic studies. *Entropy (Basel)*. 2022 Sep 25;24(10):1359. doi: 10.3390/e24101359.
8. Anuar A, Marwan NF, Smith J, Sireyanun S, Sharif A. Bibliometric analysis of immigration and environmental degradation: evidence from past decades. *Environ Sci Pollut Res*. 2022;29(9):13729–41. doi: 10.1007/s11356-021-16470-1.
9. Zhang Y, Lim D, Yao Y, Dong C, Feng Z. Global research trends in radiotherapy for gliomas: a systematic bibliometric analysis. *World Neurosurg*. 2022;161:e355–62. doi: 10.1016/j.wneu.2022.02.001.
10. Soyatas RB. A bibliometric analysis of publications on covid-19 and older adults. *Ann Geriatr Med Res*. 2021;25(3):197–203. doi: 10.4235/agmr.21.0060.
11. Buerengen T, Bernitz S, Ølan P, Dalbye R. Association between one-to-one midwifery care in the active phase of labour and use of pain relief and birth outcomes: A cohort of nulliparous women. *Midwifery*. 2022;110:103341. doi: 10.1016/j.midw.2022.103341.
12. Rejeki S, Widayati E, Machmudah M, Yanto A. Decreasing labor pain through sacralist counter-pressure therapy using tennis ball in the mother during the labor process. *Open Access Maced J Med Sci*. 2021;9(T4):83–6. doi: 10.3889/oajmms.2021.5817.
13. Xu N, Chen S, Liu Y, Jing Y, Gu P. The effects of virtual reality in maternal delivery: systematic review and meta-analysis. *JMIR Serious Games*. 2022;10(4):e36695. doi: 10.2196/36695.
14. Amiri P, Mirghafourvand M, Esmailpour K, Kamalifard M, Ivanbagha R. The effect of distraction techniques on pain and stress during labor: a randomized controlled clinical trial. *BMC Pregnancy Childbirth*. 2019;19:1–9. doi: 10.1186/s12884-019-2683-y.
15. Deng Y, Lin Y, Yang L, Liang Q, Fu B, Li H, et al. A comparison of maternal fear of childbirth, labor pain intensity and intrapartum analgesic consumption between primiparas and multiparas: A cross-sectional study. *Int J Nurs Sci*. 2021;8(4):380–7. doi: 10.1016/j.ijnss.2021.09.003.
16. Damayanti FN, Mulyanti L, Poddar S. Juridical study of criminal law on delegation of authority of obstetricians and gynecologists to midwives in health services. *J Huk Novelty*. 2023;14(2):272–87. doi: 10.26555/novelty.v14i2.a25748.
17. Pietrzak J, Mędrzycka-Dąbrowska W, Tomaszek L, Grzybowska ME. A cross-sectional survey of labor pain control and women's satisfaction. *Int J Environ Res Public Health*. 2022;19(3):1741. doi: 10.3390/ijerph1903174.
18. Damayanti FN, Absori A, Wardiono K, Rejeki S. The evidence-based midwife professionalism. *IJFMT*. 2020;14(3):1877–81. doi: 10.37506/ijfnt.v14i3.10699.
19. Damayanti FN, Absori A, Wardiono K. Legal protection of midwives based on professional justice in midwifery practices. *IJPHRD*. 2019;10(4):437–41. doi: 10.5958/0976-5506.2019.00734.4.
20. Heelan-Fancher L, Edmonds JK. Intrapartum nurses' beliefs regarding birth, birth practices, and labor support. *J Obstet Gynecol Neonatal Nurs*. 2021;50(6):753–64. doi: 10.1016/j.jogn.2021.07.004.
21. Burns E, Feeley C, Hall PJ, Vanderlaan J. Systematic review and meta-analysis to examine intrapartum interventions, and maternal and neonatal outcomes following immersion in water during labour and waterbirth. *BMJ Open*. 2022;12(7):e056517. doi: 10.1136/bmjopen-2021-056517.
22. Mascarenhas VHA, Lima TR, Negreiros F dos S, Santos JDM, Moura MAP, Gouveia MT de O, et al. Scientific evidence on non-pharmacological methods for relief of labor pain. *Acta Paul Enferm. SciELO Brasil*; 2019;32:350–7. doi: 10.1590/1982-0194201900048.
23. Damayanti FN, Absori A, Wardiono K, Rejeki S. The comparison of midwives professionalism in Indonesia and England. *J South India Med Assoc*. 2020;12(1):4–9. doi: 10.26555/novelty.v14i2.a25748.
24. Syros A, Perez OF, Luxenburg D, Cohen JL, Swonger R, Huntley S. The most influential studies concerning revision shoulder arthroplasty research. *J Orthop*. 2022;34:349–56. doi: 10.1016/j.jor.2022.09.019.
25. Pahwa B, Goyal S, Chaurasia B. Understanding anterior communicating artery aneurysms: A bibliometric analysis of top 100 most cited articles. *J Cerebrovasc Endovasc Neurosurg*. 2022. doi: 10.7461/jcen.2022.E2022.01.001.
26. Page MJ, McKenzie JE, Bossuyt P, Boutron I, Hoffmann TC, Mulrow CD, et al. The prisma 2020 statement: An updated guideline for reporting systematic reviews. *Med Flum*. 2021;57(4):444–65. doi: 10.21860/med-flum.2021.264903.
27. Van Eck NJ, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*. 2010;84(2):523–38. doi: 10.1007/s11192-009-0146-3.
28. Melillo A, Maiorano P, Rachedi S, Caggianese G, Gragnano E, Gallo L, et al. Labor analgesia: a systematic review and meta-analysis of non-pharmacological complementary and alternative approaches to pain during first stage of labor. *Crit Rev Eukaryot Gene Expr*. 2022;32(2):61–89. doi: 10.1615/critrevukaryotgeneexpr.2021039986.
29. Ashagrie HE, Fentie DY, Kassahun HG. A review article on epidural analgesia for labor pain management: A systematic review. *Int J Surg Open*. 2020;24:100–4. doi: https://doi.org/10.1016/j.ijso.2020.04.007.
30. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*. 2012;380(9859):2095–128. doi: 10.1016/s0140-6736(12)61728-0.
31. Alakeely MH, Almutari A, Khalaf, Alhakeil GA, Abuoliat ZA, Althubaiti A, Aboltai LA-R, et al. The effect of epidural education on Primigravid Women's decision to request epidural analgesia: a cross-sectional study. *BMC Pregnancy Childbirth*. 2018;18:1–6. doi: 10.1186/s12884-018-1766-5.
32. Beigi SM, Valiani M, Alavi M, Mohamadirizi S. The relationship between attitude toward labor pain and length of the first, second, and third stages in primigravida women. *J Educ Health Promot*. 2019;8(1):130. doi: 10.4103/jehp.jehp_4_19.
33. 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*. 2022;74:103312. doi: 10.1016/j.amsu.2022.103312.