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Original Article

Research Hotspots and Trends in the Prevention and Treatment of Postpartum Hemorrhage: Based on Bibliometric Analysis from 2015 to 2025

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Abstract:

Objective: This study aims to analyze the current situation, research progress and trends in development of postpartum hemorrhage prevention and treatment in the past decade through bibliometrics.

Methods: Web of Science Core Collection was used to collect keywords including postpartum hemorrhage, prevention and treatment from January 1, 2015 to April 28, 2025. The core data such as the number of published papers, authors, journals, institutions, countries, keywords and burst words in the data were calculated. The results were statistically analyzed and displayed in a visual form.

Results: A total of 467 articles were included. The overall number of published articles showed a fluctuating upward trend. The author with the largest number of articles was Sentilhes, Loic, who had close collaborations with other authors. The institution with the largest number of articles was the World Health Organization, and the United States was the country that produced the largest number of articles. There is an obvious imbalance of scientific research information in the field of postpartum hemorrhage prevention and treatment between developed and underdeveloped countries The analysis of keywords and burst words indicated that the main future research hotspots and trends might be the management of the third stage of labor and the multidisciplinary medicalized management of the entire pregnancy cycle for high-risk groups of placenta accreta.

Conclusion: In this study, we innovatively used visualization software and data information mining to conduct bibliometric analysis of articles in the field of Postpartum Hemorrhage prevention and treatment. With the increasing rate of cesarean section year by year, and the improvement and accuracy of diagnostic methods, multi-discipline and full-cycle management for economically backward areas and high-risk groups of placenta accreta are the future development direction of postpartum hemorrhage prevention and treatment.

Keywords Postpartum Hemorrhage, Prevention, Treatment, Placenta Accreta

Key Points

There is no bibliometric study on PPH prevention and treatment in the existing literature.

The prevention and treatment of PPH is an important topic to improve maternal outcome. PPH Bibliometrics can effectively guide the direction of future research.

1. Introduction

Postpartum hemorrhage (PPH), defined as blood loss of more than 500 ml in the female reproductive tract after delivery of the fetus (or more than >1000 ml after cesarean section)[1]. PPH is the leading cause of maternal mortality,

accounting for 25% of maternal deaths globally and 40% in Africa[2]. Severe maternal complications include multiple organ failure, blood transfusions, and perinatal hysterectomy[3]. Therefore, how to prevent and treat PPH in time is a key issue to effectively reduce maternal morbidity and mortality worldwide[3].

Bibliometric analysis can check the quantity and distribution pattern of literature, and help to explore the rules and characteristics of scientific activities[4]. It is a method of identifying medical practice and cultivating new research ideas[5]. Using this approach, on the one hand, can effectively elucidate research patterns, evolutionary trajectories, emerging hotspots, research frontiers, and future trends in specific scientific fields. It can provide scientific basis for researchers to provide future research hotspots, help to grasp the development direction and current situation of the discipline, closely track scientific research, and improve research efficiency[6]. On the other hand, so far, there has been no bibliometric analysis of the knowledge structure and research trends in the key areas of PPH, and the content of visual learning is less, which is worthy of our in-depth discussion.

Based on the above, this study utilized bibliometric techniques to analyze and visualize publications on PPH prevention and treatment in the last decade. The current status, development, and trends of PPH research are described in detail by thoroughly surveying the knowledge structure and citation landscape. This work not only overcomes previous shortcomings and fills existing knowledge gaps, but also provides insights and inspiration for researchers in different disciplines.

Materials and Methods

Search Strategy

Web of Science Core Collection (WoSCC) database was selected as the data source, Science Citation Index Extended (SCI-E) and Social Science Citation Index (SSCI)were used to further screen the literature to ensure the comprehensiveness and accuracy of the retrieved data（**Fig.1**）.The search strategy was TS = （'Postpartum Hemorrhage'）) OR TS = （'Postpartum bleeding'） And TS = （'Prevention'）) OR TS = （'Treatment'）.Article types including "original article" and "Review article". The publication year was restricted from January 1, 2015 to April 28, 2025. Exclusion criteria included reviews, meta-analyses, letters, or conference PPH articles. All included articles were independently checked and verified by two reviewers (XX and XX). Disagreements were resolved through consultation with the third senior evaluator (XX). The primary data for this study were from previously published studies, therefore, the current study was not considered to require additional ethical approval.

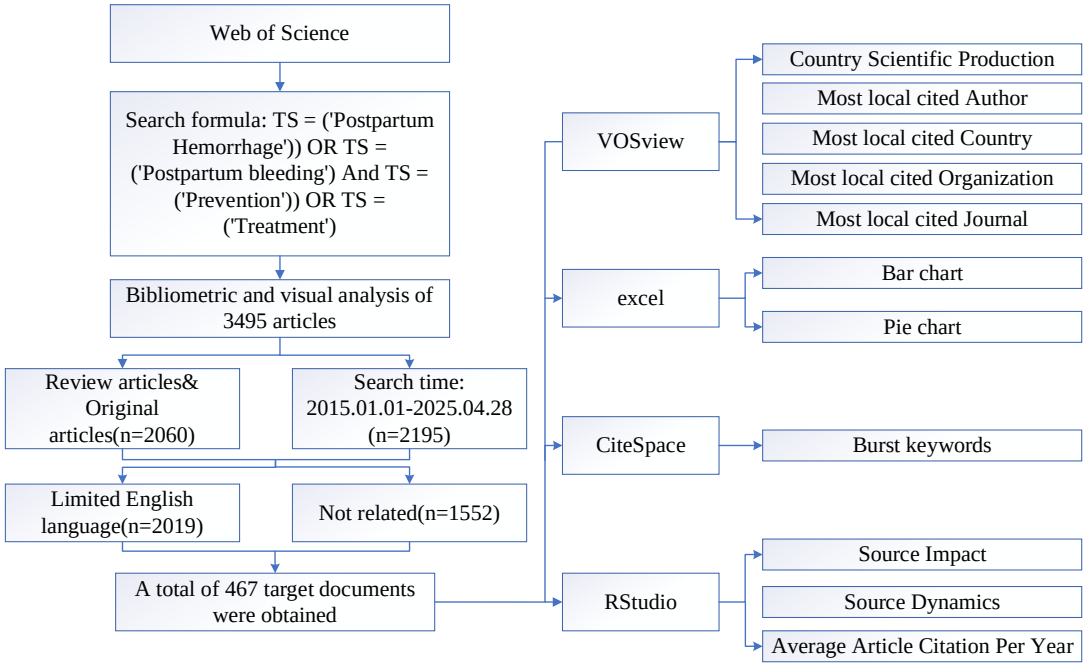

Figure1. Screening flow chart

Citation Analysis

This study strictly followed previous bibliometric literature. In addition to keywords, data were extracted, author, country and institution, title, citation frequency, year which also contains type of study, of publication, journal. The most important information is to focus on the interrelationships of authors, institutions, countries, and keywords in this database. In addition, a systematic literature review was conducted for key words.

Statistical analysis and bibliometric network construction

Data from the included literature were analyzed using Excel software. We selected appropriate parameters in the CiteSpace(Version number:6.3.R1) and VOSviewer(Version number:1.6.20). The CiteSpace clustering algorithm mainly uses noun terms to detect research hotspots, which helps researchers to find explosive words in the atlas, explore research hotspots and grasp research directions. VOSviewer generated a visual map of authors, journals, institutions, countries, references, and keywords related to PPH prevention and treatment research. Meanwhile, R studio was used to analyze the dynamic change of articles and the impact capacity of journals in each country from year to year.

Results

General Situation of Articles

A total of 467 articles related to the treatment or prevention of PPH were collected, and the overall number of published articles showed a dynamic upward trend (**Fig.2A**). Indicating that more and more scholars continue to pay attention to the prevention and treatment of PPH. Among the 467 articles, 381 were research articles and 86 were review articles. The overall performance showed that the number of research articles was higher than that of review articles (**Fig.2B**). Meanwhile, this study also conducted statistics on the citation data of different years. The citation number in 2017 was significantly higher than other years. Further retrieval of the literature of that year indicated that it might be related to the release of the guideline Practice Bulletin No. 183: Postpartum Hemorrhage[7] (**Fig.2C**).

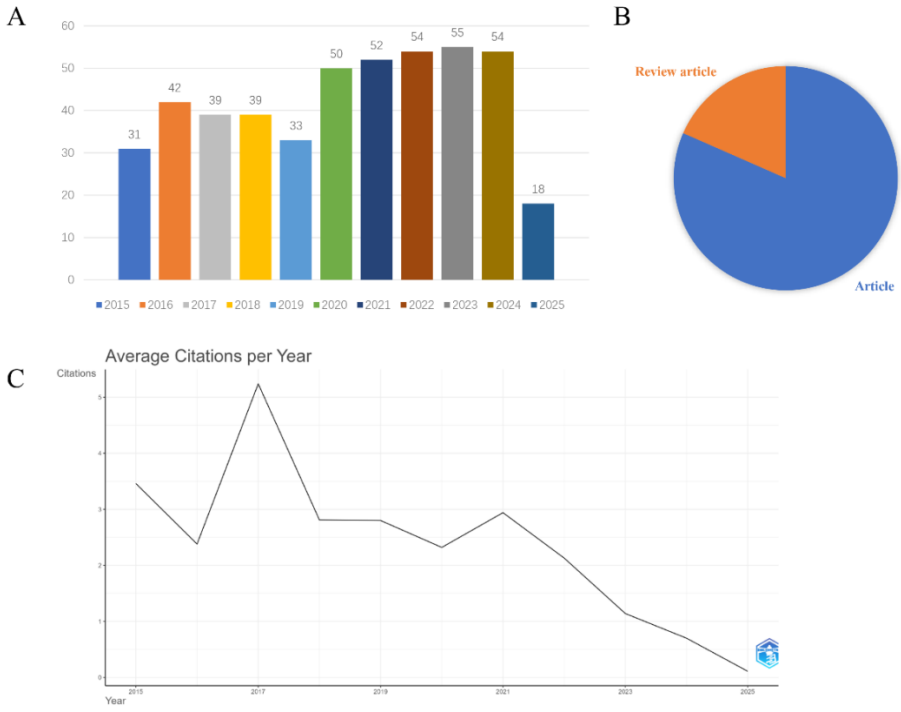

Figure2. Annual number of articles in PPH field from 2015 to 2025(A), Types and percentage of articles in PPH field(B), Average Citations of articles in PPH field from 2015 to 2025(C).

General situation of countries and institutions in the field of PPH

The global reach of countries involved in PPH management illustrates the importance of this disease, which affects maternal morbidity and

mortality (**Fig.3A**). However, the high incidence caused by regional differences in prevention and treatment methods needs the attention of researchers and policy makers[8] (**Fig.3B**). A total of 1282 institutions in 90 countries participated and published 467 articles on PPH prevention and treatment. Among them, researchers from 10 countries published more than 20 articles, the total number of citations was more than 300 times, and the average paper was cited more than 6 times. The top three countries for literature citation and literature coupled citation are the United States, China and the England. Citations of the top three countries were 2944, 637 and 2081 times respectively (Table 1), indicating that the United States has strong scientific research creativity and potential value in this field (**Fig.3B**, **3C**). Among the 1,282 institutions, 109 institutions published at least 3 papers. The top three institutions were World Health Organization, University of London, London School of Hygiene & Tropical Medicine and University of Bordeaux. The institutions collaborated closely with each other, demonstrating the value of collaborative research (**Fig.3D**) (Table 2).

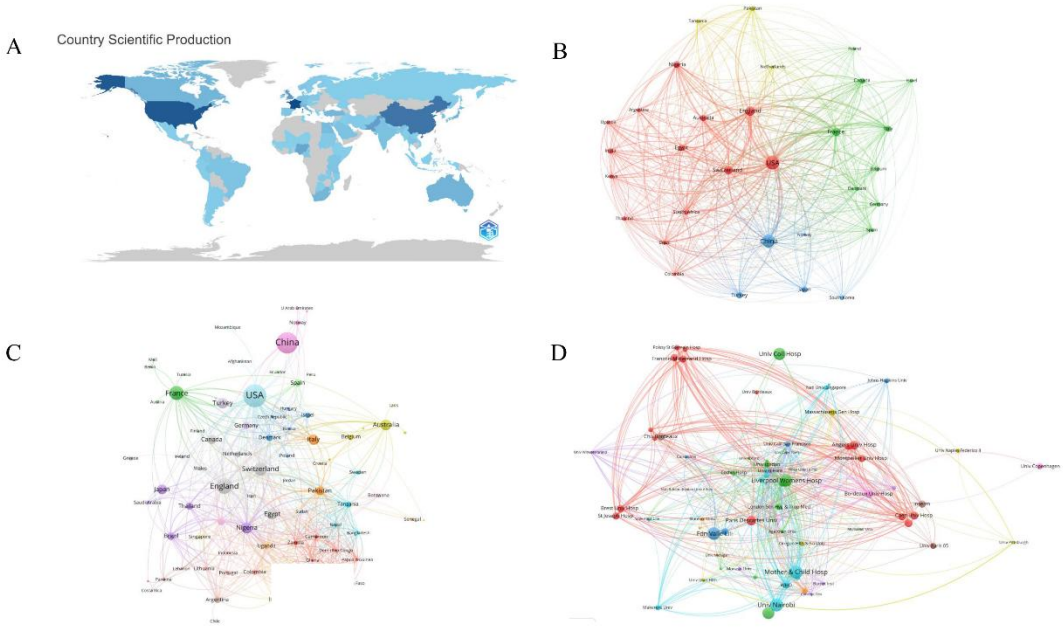

Figure3. Geographic distribution of publications in PPH field from 2015 to 2025(A), Network visualization of citation countries/regions(B), Network visualization of co-citation countries/regions(C), Network visualization of citation organization(D).

Table1 Leading countries in PPH based on the number of publications

Rank	Country	Documents	Citation	Average citation/publication
1	USA	106	2944	27.77
2	China	92	637	6.92
3	England	50	2081	41.62
4	France	40	1332	33.30
5	Switzerland	37	635	17.16
6	Nigeria	25	1278	51.12
7	Egypt	24	1280	53.33
8	Australia	24	303	12.63
9	Turkey	24	228	9.5
10	Italy	21	449	21.38

Table2 Leading Organization in PPH diagnosis based on the number of publications

Rank	Organization	Documents	Citation	Average citation/publication
1	World Health Organization	13	307	23.62
2	The London School of Hygiene	13	239	18.38

	& Tropical Medicine			
3	University of Bordeaux	12	391	32.58
4	Monash University	11	93	8.45
5	University of Liverpool	10	404	40.40
6	Gynuity Health Projects	9	182	20.22
7	University of Birmingham	9	190	21.11
8	University of Ibadan	9	231	25.67
9	University of Toronto	8	108	13.50
10	University of Nairobi	8	1075	134.38

General situation of authors and journals in the field of PPH

Among the 467 articles, a total of 2,538 researchers were involved, among them 54 authors published at least three articles (Table 3). Among researchers, Sentilhes, Loic, Deneux-Tharaux, Catherine and Roberts, Ian each published more than 10 articles. Sentilhes, Loic published articles on PPH in both Lancet and NEJM, indicating his significant contribution and influence in this field [9,10](**Fig. 4A**).

In the field of competence, Journal of Maternal-Fetal & Neonatal Medicine（IF=1.8）、International Journal of Gynecology & Obstetrics（IF=2.6）and BMC Pregnancy & Childbirth（IF=2.8）the top three journals published the most articles (**Fig. 4B**), with the number of articles published being 32, 28 and 23, respectively, while the average number of citations of American Journal of Obstetrics and Gynecology(IF=8.7) was higher than that of other journals, indicating its potential great impact value and academic connotation (Table 4). Among them, the H-index of Journal of Maternal-Fetal & Neonatal Medicine was 12, which was higher than that of other journals (**Fig.4C**), and its publication volume was also much higher than that of other journals (**Fig.4D**).

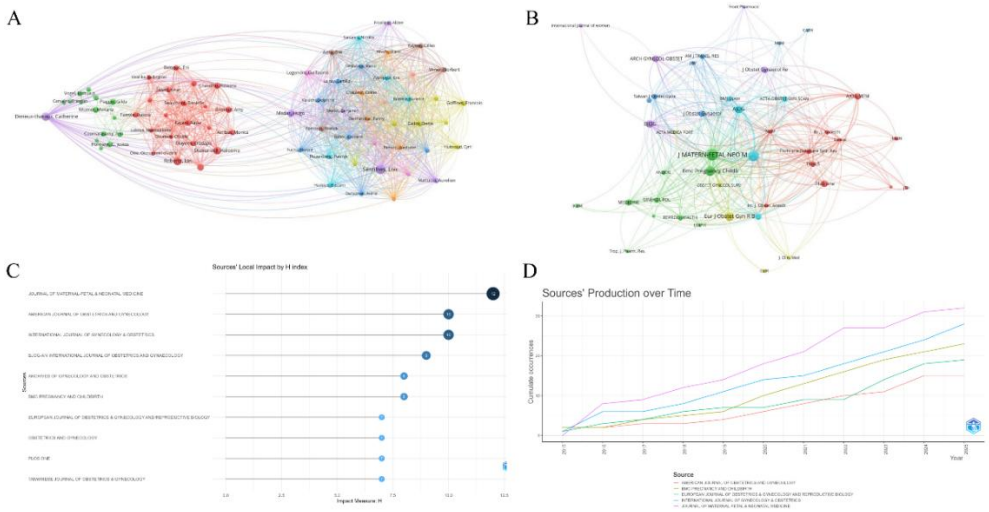

Figure4. Network visualization of citation authors（A）,citation journals(B), Journals Local impact by H index in PPH area(C), Journals production in PPH area between 2015 to 2025(D).

Table3 Leading Authors in PPH diagnosis based on the number of publications

Rank	Author	Documents	Citation	Average citation/publication
1	Sentilhes, Loic	16	750	46.88
2	Deneux, Catherine	12	687	57.25
3	Roberts, Ian	11	1036	94.18
4	Shakur, Haleema	10	137	13.70
5	Madar, Hugo	8	301	37.63

6	Ker, Katharine	8	194	24.25
7	Chaudhri, Rizwana	7	975	139.29
8	Brenner, Amy	7	77	11.00
9	Kayani, Aasia	6	974	162.33
10	Piaggio, Gilda	6	938	156.33

Table4 Leading Journal in PPH diagnosis based on the number of publications

Rank	Source	Documents	Citation	Average citation/publication
1	Journal of Maternal-Fetal & Neonatal Medicine	32	343	10.72
2	International Journal of Gynecology & Obstetrics	28	361	12.89
3	BMC Pregnancy & Childbirth	23	200	8.70
4	European Journal of Obstetrics & Gynecology and Reproductive Biology	19	304	16.00
5	American Journal of Obstetrics and Gynecology	15	524	34.93
6	BJOG-An International Journal Of Obstetrics And Gynaecology	14	379	27.07
7	Archives of Gynecology and Obstetrics	11	122	11.09
8	Plos One	11	190	17.27
9	American Journal Of Obstetrics & Gynecology MFM	10	55	5.50
10	Journal Of Obstetrics And Gynecology	10	77	7.70

Keywords and breakout words

By focusing on keywords in the field of PPH, it can be seen that oxytocin is the top word, in addition, tranexamic acid, carbetocin and other drugs that promote uterine contraction are high-frequency words. Oxytocin is the first-line tocolytic agent for the prevention of PPH in the United States(Table 5). The use of second-line uterotonic agents such as methylergonovine, misoprostol, and carboprost in combination with oxytocin has additive or synergistic effects and may reduce the risk of preventing postpartum hemorrhage to a greater extent than oxytocin alone[11] . Breakout words can effectively reflect the future development trend in this field. The third stage of labor[12], placenta accreta and placenta percreta ranked higher, suggesting that the prevention and treatment of PPH in the future field can be started from these aspects[13] (**Fig.5A**).

PPH is a clinically important cause of maternal complications and mortality. Thus, prompt identification of patients at risk for PPH, routine aggressive management of the third stage of labor, rapid assessment of blood loss, appropriate patient monitoring, and management of PPH are important (**Fig.5B**).

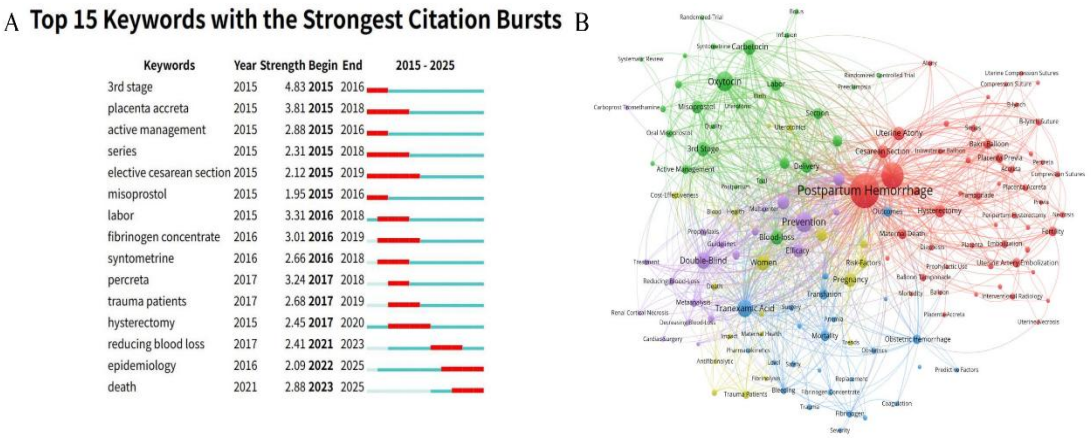

Figure5. Top 10 burst words for PPH prevention and treatment(A),Network visualization of co-occurrence keywords(B).

Table5 Keywords occurrences

Rank	Keywords	Occurrences
1	Postpartum Hemorrhage	225
2	Oxytocin	71
3	Tranexamic Acid	56
4	Carbetocin	47
5	Cesarean Section	36
6	Uterine Atony	33
7	Misoprostol	32
8	Vaginal Delievery	27
9	Prevention	24
10	Maternal Mortality	24

Discussion

The results of this study indicate that PPH remains a high concern and life-threatening disease for pregnant women, highlighting the critical importance of early prevention and timely treatment to reduce maternal morbidity and mortality. We highlight several key findings. First of all, the overall number of PPH publications fluctuates. Although authors from all over the world publish articles, there is still a clear difference in the geographical distribution of published articles between developed and underdeveloped countries. The true scale and health impact of this complex obstetric problem have thus not been fully assessed. Secondly, keywords focused on suggesting that oxytocin, tranexamic acid, carbetocin and other drugs were the top methods for the prevention and treatment of PPH, suggesting that in clinical management, practitioners should be trained to be familiar with the indications and contraindication of the corresponding drugs, so as to effectively prevent the further deterioration of PPH. Finally, the breakout words were mainly concentrated in the third stage of labor, placenta accreta, placenta percreta and other directions, suggesting that in the further prevention and treatment of PPH in the future, we can start from the corresponding direction of management. At the same time, placenta accreta and other people are high-risk groups that need to be focused on prevention.

Despite efforts to identify patients with increased risk of PPH, but this kind of life-threatening complications usually occurs when there is no identifiable risk factors for women. Therefore, vigilance is essential after all deliveries. In this study, developed countries such as the United States and the England have far more publications on the prevention and treatment of PPH. However, most maternal deaths caused by PPH occur in developing countries, where more than one third of pregnant women are affected[14]. The prevention and treatment of PPH is an important topic worldwide. However, the poor control of morbidity and mortality caused by regional medical imbalance deserves attention[15]. Although improvements in services and health care in low - and middle-income countries have significantly reduced the number of obstetric hemorrhage and related deaths in the past few years, in Africa[16], due to the prevalence of malaria, lack of diet and anemia is prevalent in many areas, affecting the basic health of pregnant women and increasing the incidence of PPH [17-20].

The increasing incidence of PPH suggests that guidelines are not fully implemented and can lead to delayed treatment or suboptimal care, which is increasingly reported in 30-90% of PPH cases[21,22]. It is believed that delayed diagnosis and treatment of PPH directly affects the severity of bleeding, the development of complications such as coagulopathy, and leads to higher morbidity and mortality[23,24]. In addition to recognition delay, other factors such as skilled care during labor, timely recognition of labor progression[25,26], delivery volume and specialized management in the maternity ward are also associated with the severity of PPH. The problem of delayed labor and stagnation should be identified in time before postpartum hemorrhage occurs, so as to facilitate preventive labor management[12,27]. Before the occurrence of postpartum hemorrhage, the surgeon should be aware of the preventive use of hemostatic drugs such as oxytocin and carbetocin[28,29], and blood transfusion therapy

should also be used as soon as possible to control the degree of risk and move the threshold forward[30,31]. Therefore, we can see that the treatment of PPH should be the management of the whole cycle, which should not only treat the basic diseases of pregnant women before pregnancy, but also control their complications during pregnancy. Finally, timely and rapid blocking of further deterioration of PPH during delivery can effectively prevent the occurrence of disease.

Other risk factors for PPH are closely related to the type of hemorrhage that occurs. With the increase in cesarean section rate and the increase in the number of miscarriages, the risk of placenta implantation will gradually increase, and at the same time, the chance of PPH will also greatly increase[32]. PAS disease is caused by abnormal or missing Nitabuch layer, make the trophoblast cells invade the myometrium (placental weight)[33]. Massive bleeding after attempted placental removal is the most common complication and can lead to significant maternal morbidity and, ultimately, maternal death. The factor most commonly associated with improved clinical outcomes in PAS is specialist MDT engagement[34]. Therefore, local health providers must be informed and involved in providing overall healthcare for patients with a high likelihood of PAS at birth, including referral to specialized diagnostic imaging services to confirm or rule out the diagnosis, so that the appropriate patient can be referred to a well-funded professional service and, ideally, the surgical team should be involved in the ultrasound assessment[35]. The sonographer should be involved in the surgical procedure or should be aware of the intraoperative findings[36]. Based on this, the clinical condition of the patient, and the additional resources available must be considered when selecting a surgical procedure.

Advantages and Disadvantages

The first limitation of this study is that it only focuses on English publications in the WoSCC database. However, WOS includes comprehensive types of articles, rich content, and authoritative articles. A small number of studies or non-English language articles may not be included in this database, but this does not affect the accuracy, trend, or value of the results. Secondly, the content of this study is more inclined to data listing, and the results are more inclined to holistic and summary data form, which is not conducive to refined project comparison. However, considering that PPH itself is a comprehensive topic, comparison from a macro perspective is more conducive to the positioning of researchers in the field of global scope, and the key information that needs to be paid attention to according to the results. Finally, the number of citations does not fully reflect the quality of a publication, as it takes time for papers to be cited more frequently. The study mainly included articles from the last decade. However, some manuscripts that are older may receive more citations, so influential manuscript scripts may take several years to generate citations. The purpose of this study is to explore the current situation and the future trend of PPH topics from the past 10 years, and to better reflect the authenticity and predictive value of the authenticity stage research results.

The advantages of this study are mainly reflected in the following aspects. First, the strength of this study lies in the innovative use of the current bibliometric methods to discuss the prevention and treatment of PPH affecting maternal and infant outcomes, and there are no relevant articles in the field of PPH. Secondly, through the WOS database, the current situation of PPH, trend words, and future development trends in this field are clearly displayed in various aspects using visual maps. Using the characteristics of burst words, the specific measures of placenta accreta in PPH are explored in depth, which can effectively provide data support and research direction for follow-up researchers. Finally, the comprehensive information of this study suggests that the imbalance of medical resources is an important factor affecting PPH, which has important scientific significance for the prevention and treatment of PPH worldwide.

Conclusion

This study is an innovative analysis of published articles on the prevention and treatment of PPH, and visual data information mining in this field. The research in this field mainly focuses on the prevention and treatment of PPH. Future research may focus on the prevention and treatment of PPH through full-cycle management in pregnant women without high-risk factors. In addition, for high-risk patients with placenta accreta,

comprehensive MDT can improve the prognosis of patients with PPH and reduce adverse outcomes. Finally, the visualization results can serve as a reference for further guideline development, a starting point for more formal knowledge synthesis, and can provide higher-value support and new evidence.

Declarations

Consent for Publication

We agree to the publication of the study results.

Availability of Data and Materials

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

Xiaojun Guo and Yongfei Yue were responsible for the study design, data extraction and analysis, and article writing. Yulu Wang was responsible for research design and direction. Yuanmin He Tao was responsible for the study design and direction. Jun Yan were responsible for research design and revision, paper review and guidance.

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Not applicable.

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