

Postpartum hemorrhage treatments: A bibliometric and bibliographic review, 2016 to 2024



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Abstract Postpartum hemorrhage (PPH) is one of the main causes of maternal mortality, accounting for an estimated 24.5% of deaths each year. The purpose of this study is to analyze the available literature on treatments used in postpartum hemorrhage, period 2016-2024. A bibliometric study was conducted with a descriptive and retrospective literature review regarding the most commonly used treatments for postpartum hemorrhage. Indexed journals published on the Scopus platform during the period 2016-2024 were reviewed. Initially, 1,284 documents were found in the Scopus database published between 2016 and 2024. Deneux-Tharoux was the author with the highest number of contributions in publications with 24 documents. The French National Institute of Health and Medical Research (Inserm) had the largest number of affiliated researchers, with 38. The United States dominated with 300 publications, representing 23.38% of the total. The bibliographic review yielded 20 articles highlighting the most commonly used treatments for PPH cases. In conclusion, early recognition of coagulopathies and providing hemostatic support are crucial strategies to prevent PPH. In this regard, the use of oxytocin, carbetocin, methylergonovine, ergometrine, misoprostol, prostaglandin analogues or tranexamic acid. Likewise, early controlled interventions with intrauterine balloon tamponade are currently more widely recognized methods.

Keywords: postpartum hemorrhage, coagulation time, hemostatic support, oxytocin, intrauterine balloon

1. Introduction

Globally, postpartum hemorrhage (PPH) is the leading cause of pregnancy-related death (James et al., 2022; Hofer et al., 2023). Massive hemorrhage accounts for 24.5% of annual maternal mortality (Drew and Carvalho, 2022). In turn, the PPH mortality rate is directly related to each nation's poverty rate or per capita income. In this context, South Sudan, the Central African Republic, Chad, and Nigeria have the highest PPH mortality rates (Cresswell et al., 2025).

One of the most critical characteristics of massive obstetric hemorrhage, or MOH, is disseminated intravascular coagulation (DIC) (Sugai et al., 2021). In these cases, by professional consensus, oxytocin is used as a preventive measure against possible massive hemorrhage (Sentilhes et al., 2021). Most deaths from PPH can be prevented with systematic methods to reduce the likelihood of occurrence (Ayenew et al., 2024). To do this, medical staff must have a precise understanding of the underlying risk factors, which is why training in preventive measures and management strategies is essential (McAuliffe et al., 2020).

In this regard, the International Federation of Gynecology and Obstetrics (FIGO) and the International Confederation of Midwives (ICM) jointly recognized and accepted the 2020 recommendations of the World Health Organization (WHO) in 2021. Thus, as a first preventive action against PPH, the use of uterotonics during the third stage of all deliveries is recommended. The administration of 10 IU of oxytocin intravenously/intramuscularly in both vaginal deliveries and cesarean sections is also recommended, paying close attention to the cold chain of the medication. In the absence of uterotonic drugs, safe physiological management should be applied (FIGO PPH Technical Working Group et al., 2021).

In this regard, the application of methods and strategies for the early detection of maternal health conditions in the postpartum period is a public health priority. In turn, the application of protocols, means, and equipment to treat and mitigate the development of obstetric hemorrhage is essential (Collins, 2022; Addisu et al., 2023). It should be noted that the specification of new techniques, procedures, and strategies for treatment is based on the collection and analysis of relevant information (Burke et al., 2022). In this regard, in health sciences and nursing, there are various contributions generated by researchers as a result of studies with qualitative approaches, carried out through structured literature reviews (Kraus et al., 2022; Abusaada and Elshater, 2024). However, it is of great interest to learn more about advances in applied, observational, and experimental studies to expand knowledge about the effectiveness of treatments for PPH.

In perspective, records of research conducted on HPP in the Scopus database indicate that from 2000 to 2024, more than 6,000 articles have been published in quartiles Q1, Q2, Q3, and Q4. Twenty-five percent of these articles are review articles that explore the empirical scope of technological and procedural advances in the treatment of HPP. It should be mentioned that among research studies, bibliometric analysis allows for a quantitative approach to the literature published in specific scientific fields; likewise, the use of mathematical and statistical methods contributes to the effective understanding of new knowledge and the achievement of significant advances in various areas (Mukherjee et al., 2022; Donthu et al., 2021). However, when complemented by systematic literature exploration, it enriches the scope of this type of study. Previous studies have addressed the causes, effects, and treatment of HPP from various perspectives. In this regard, it is interesting to highlight the study by Shobhane and Akhter (2021), who conducted a bibliometric analysis in a Bangladeshi journal. One of the findings indicated that the most frequent keywords were “pregnancy,” “preeclampsia,” and “endometriosis.”

The present study aims to explore, through a bibliometric study, scientific performance in relation to the management and prevention of PPH, taking into account the updated literature available in the Scopus database. To this end, the base period has been set from 2016 to 2024, so that the research has been guided by the following questions: What is the trend in bibliometric indicators related to the management and prevention of postpartum hemorrhage in the period 2016-2024? What are the available protocols for the management of postpartum hemorrhage? And what are the available preventive measures for cases of postpartum hemorrhage? The answers will facilitate the identification of current and emerging research guidelines for the academic and professional sectors in the treatment of PPH.

The study methodology is divided into two parts: the first is based on a bibliometric study using recorded information and Elsevier Scopus analysis tools. This includes analysis of authors, journals, results, and citations. This study is complemented by the application of the VOSviewer program. The second part comprises a systematic review (SR) of the literature considering the guidelines of the PRISMA method (2020) (Ioannidis, 2023), with selection criteria in which Q1, Q2, and Q3 quartile articles prevail for in-depth review, as well as applied peer-reviewed articles that directly address the treatment of HPP.

2. Materials and Methods

2.1. Study Design

A descriptive, retrospective bibliometric study was conducted (Passa, 2024), which was complemented with a review of updated literature (Chigbu et al., 2023) and associated with findings on the most commonly used treatment for postpartum hemorrhage during the period 2016-2024.

2.2. Database selection

The selection was based on scientific production related to the most commonly used treatments for postpartum hemorrhage, found in indexed journals registered on the Scopus platform. This database was chosen due to its outstanding following aspects:

- For research execution purposes, Scopus contains more than 23,000 journals, 5,500 of which are of free use; additionally, it provides access to documents published since 1788. Moreover, it includes records of over 210,000 books, 9.8 million conference papers from approximately 120,000 events worldwide, and around 4 million patent records.
- Scopus offers the ability to search for documents using both author names and specific keywords. Additionally, it provides advanced comparison tools that are particularly useful for researchers, academic libraries, and project managers, enabling them to analyze and evaluate scientific publications more effectively.
- For the analysis of scientific documents, Scopus provides authors with the ability to track citations over time, offering the additional option to exclude self-citations for a more accurate assessment of academic impact. It also highlights the most frequently accessed and referenced articles, allowing researchers to identify key publications within their field. Furthermore, the database includes advanced statistical analysis tools that facilitate the evaluation of publication performance and citation metrics. Additionally, it provides detailed information on the h-index of various researchers, which is particularly useful for bibliometric studies, as it helps measure the influence and productivity of scholars in different disciplines.

For all these reasons, the Scopus database ensures greater sensitivity and specificity in search processes, allowing researchers to obtain more precise and relevant results.

The bibliometric study data were collected in November 2024. Studies published between January 2016 and October 2024 were considered, using the following search equation: TITLE-ABS-KEY (postpartum AND hemorrhage AND in AND young AND women) AND PUBYEAR > 2015 AND PUBYEAR < 2025. This yielded an initial number of 1,244 records.

In the second phase of the research, to begin the SR, the number of articles was reduced by applying the second equation configured as follows: TITLE (“Postpartum hemorrhage treatments”) AND PUBYEAR > 2015 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBAREA, “MEDI”) OR LIMIT-TO (SUBAREA, “NURS”)) AND (LIMIT-TO (EXACTKEYWORD, “Postpartum Hemorrhage”) OR LIMIT-TO (EXACTKEYWORD, “Female”) OR LIMIT-TO (EXACTKEYWORD, “Humans”)) AND (LIMIT-TO (LANGUAGE, “English”) OR LIMIT-TO (LANGUAGE, “Spanish”)) AND (LIMIT-TO (PUBSTAGE, “Final”)) AND (LIMIT-TO (DOCTYPE,

“ar”) OR LIMIT-TO (DOCTYPE, ‘re’) OR LIMIT-TO (DOCTYPE, “cp”)). This led to the detailed exploration of 437 documents applying the criteria of the Prisma method.

2.3. Data Collection

To ensure the correct use of each terminology, the 2020 edition of the Health Sciences Descriptors (DeCS) was consulted, available at <https://decs.bvsalud.org/es/>. The selection of analysis units was based on the search descriptors “postpartum hemorrhage” and “treatments.”

Documents published between 2016 and 2024 were selected and arranged chronologically. The most cited authors were then extracted from the database, along with the scientific production categorized by country and sponsoring institution. After identifying 100 potentially relevant scientific articles from the 10 most cited authors, these were carefully reviewed to extract the most frequently applied treatments. The analysis was supported by the VOSviewer software, which facilitated the identification of key research trends.

2.4. Study Variables

For the bibliometric study, the following variables were established: total number of documents per year, most cited authors, scientific production by institution and by country, type of publications, indexed articles by journal, keywords, citations by journal, citations by organization, and citations by document type.

Para la revisión sistemática de la literatura, las variables seleccionadas incluyeron: año de publicación, autor(es), nombre de la revista, clasificación del cuartil y el tratamiento más destacado para la hemorragia posparto (HPP).

2.5. Data Analysis

For this data analysis, the software VOSviewer 1.6.16 was employed, as it is widely used for constructing and visualizing networks of co-authorship, co-citation, and co-occurrence. The analysis incorporated keywords with at least five occurrences in the mapping process, ensuring that the total number of selected keywords did not exceed thirty. As a complement, in the second phase of the study, for the SR, an ordered tabulation of the findings was performed, together with a comprehensive analysis and synthesis of the information extracted. A total of 847 documents were eliminated using the second search equation from the initial 1,284, leading to a detailed review of 437 documents. These articles were examined according to their title, abstract, keywords, and methodology applied, which led to the exclusion of 234 because they were studies not applied with information relevant to this study (189), as well as records with incomplete abstracts (145). This resulted in 183 eligible documents, to which the sole criterion of being in quartiles Q1, Q2, or Q3 was applied, which ultimately facilitated the in-depth review of 20 articles. Figure 1 shows the Prisma flowchart of the study.

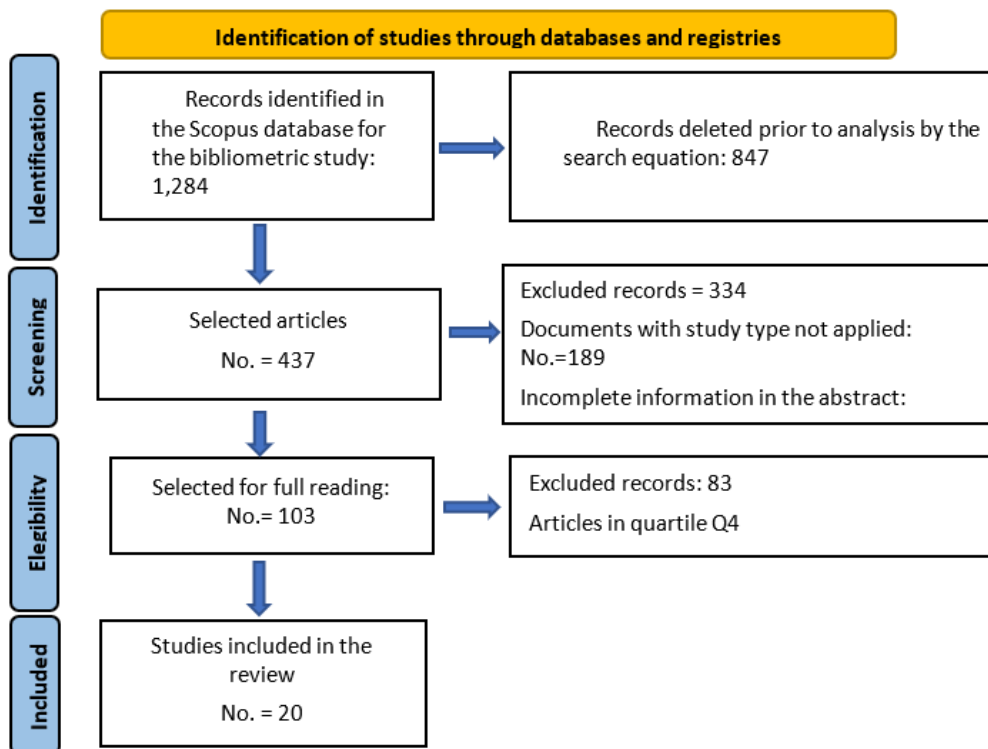


Figure 1 PRISMA flowchart of the study.

3. Results

The presentation of results was structured in two phases. The first phase involved the statistical tabulation of data in the bibliometric study, while the second phase was carried out synthetically for the interpretation of the data obtained from the related literature. In this context, the search was conducted digitally in the Scopus database, focusing on specific fields such as nursing, health sciences, and medicine. The search criteria were limited to articles discussing postpartum hemorrhage (PPH) in women of reproductive age, published between 2016 and 2024, both in English ("postpartum hemorrhage") and Spanish.

The bibliometric study results yielded a total of 1,284 documents. A detailed review of titles, abstracts, and keywords was then conducted, leading to the statistical classification and categorization of the data based on various aspects, such as the number of articles published per year, authors with the highest number of publications, journals with the highest article indexing, affiliations of the first authors, PPH management methods, PPH prevention strategies, and the countries of publication.

Ekin et al. (2015) highlight that PPH is associated with conditions such as a low-lying placenta and prolonged labor. Additionally, increased oxytocin levels and emergency cesarean sections are strong predictors of severe blood loss in women with PPH, alongside uterine atony and abnormal placentation. Similarly, Nyfløt et al. (2017) confirmed that retained placental tissue is a significantly more frequent cause of severe PPH than previously reported. More recently, Xiu Quan et al. (2021) emphasized that PPH remains the leading cause of maternal mortality worldwide.

Upon a detailed examination of PPH prevention and control measures, it was determined that institutional protocols for massive transfusion are essential when unexpected hemorrhage occurs. Point-of-care (POC) technologies, including ultrasound and viscoelastic testing, have emerged as crucial tools during the active phases of PPH management (Sohrabi et al., 2021). Furthermore, tranexamic acid (TXA) has been recommended as a key pharmacological adjunct in PPH treatment. However, current evidence suggests that TXA should not be administered prophylactically before delivery (Al-Dardery et al., 2023).

3.1. Annual publication count

Over the past eight years, research on this treatment has exhibited an approximately sinusoidal trend. In this regard, 2016 marked the beginning with 128 related publications. However, from 2017 onward, an exponential growth pattern was observed, peaking in 2021 with a maximum of 190 related publications. Following this peak, the trend shifted into a semi-curved decline, characterized by a negative slope, indicating a decrease in scientific output on the subject through 2024. This pattern is visually represented in Figure 2 (Picture below).

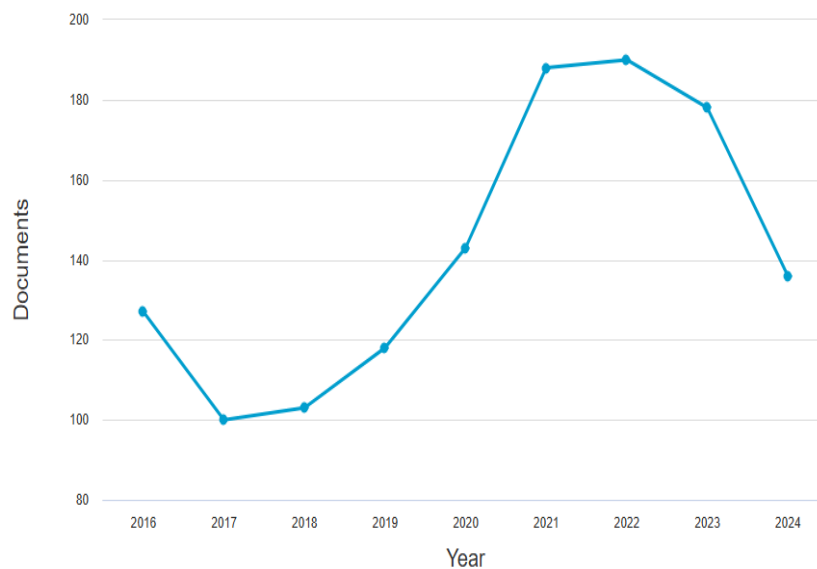


Figure 2: Documents per year.
Source: Scopus Database.

The declining trend observed in recent years suggests the presence of factors that have constrained or restricted the advancement of research in this field of study. This trend may also be interpreted as a diminishing interest in further exploring this construct. One possible explanation is the post-pandemic period, as 2022 marked the peak of research activity within the studied timeframe. Consequently, it can be inferred that the post-pandemic era has had a negative impact, potentially due to

shifts in scientific research policies in the healthcare sector, as well as economic difficulties related to funding. These financial constraints may have limited the availability of resources necessary for continued research and development.

3.2. Most Prominent Researchers Based on Citation Count

The following findings were obtained from the Scopus database regarding the management and prevention of postpartum hemorrhage. Figure 3 illustrates that each horizontal bar represents the number of published documents associated with the researcher's last name and first initial. The analysis includes the ten most prominent researchers, who have published between 13 and 24 documents during the period from 2016 to 2024. The researcher with the highest number of publications was Deneux-Tharaux, with 24 documents, followed by Coomarasamy with 18. In third place is Sentilhes, who accumulated 16 documents, while Collins ranks fourth with 15 publications, indicating a significant dedication to this field of study. Other researchers have also contributed, albeit to a lesser extent; however, Althabe, Henríquez, Oladapo, Winikoff, Bloemenkamp, and Burke stand out with 14 and 13 publications, respectively.

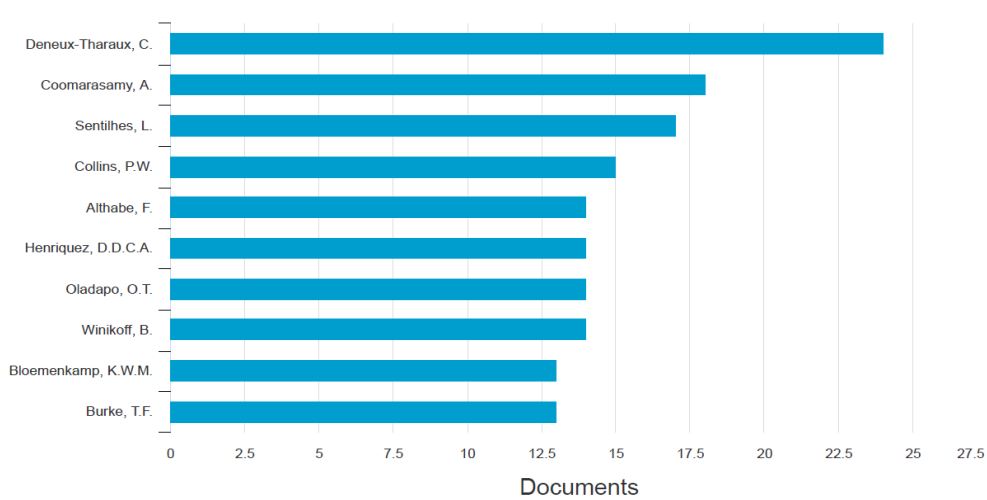


Figure 3 Researcher publication count.
Source: Scopus Database

3.3. Scientific production by institution

In this section, the information was organized based on the primary author's institutional affiliation. As shown in Figure 4, the horizontal bars indicate the institutions with the highest level of participation. Regarding the number of affiliated researchers, the leading institution was the French National Institute of Health and Medical Research Institut National de la Santé et de la Recherche Médicale (Inserm) with 38, followed by the Université Paris Cité (University of the City of Paris) with 37. The third position was held by the AP-HP Assistance Publique-Hôpitaux de Paris (Public Assistance AP-HP – Paris’ Hospitals) with 35. Harvard Medical School ranked fourth with 27, while the World Health Organization (WHO) occupied the fifth position with 26. Other notable institutions included Massachusetts General Hospitals, Leids Universitair Medisch Centrum, Stanford University School of Medicine, and Monash University with 25, 23, 23, and 22 researchers, respectively.

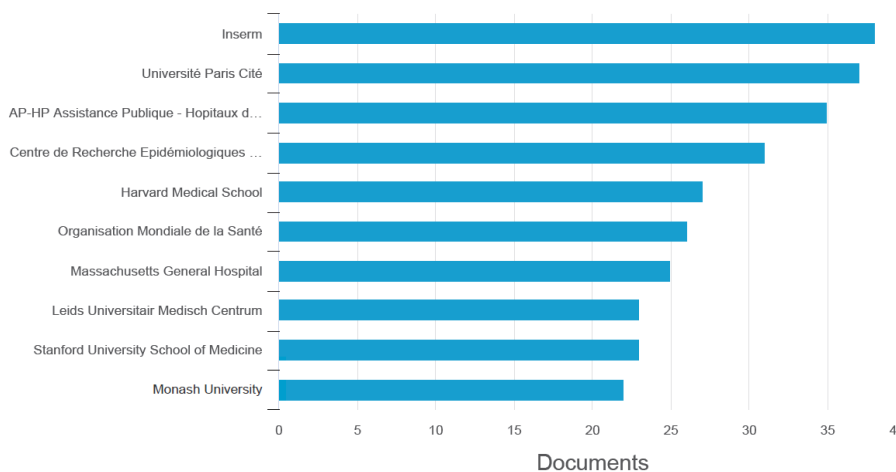


Figure 4 Institutions with the highest number of affiliations based on the identified publications.
Source: Scopus’ Database.



3.4. Scientific production by country

The global distribution of scientific production related to the management of postpartum hemorrhage or obstetric hemorrhage is largely dominated by the United States, with 300 studies (23.38%) indexed in Scopus between 2016 and 2024. In a somewhat distant second position is China, with 150 (11.69%) publications, representing half the output of the leading global power. The United Kingdom ranks third with 120 (9.35%) publications, while France holds fourth place with 90 (7.01%) publications, all of them combined accounting for 51.43% of the total. Table 1 presents a detailed distribution of the ten leading countries that have contributed to research on this topic at the global level.

Table 1 Top ten countries with the highest scientific production on postpartum hemorrhage worldwide.

Country	Number of Documents
United States of America	300
China	150
United Kingdom	120
France	90
Japan	63
Australia	63
India	60
Switzerland	60
The Netherlands	48
Brazil	46

3.5. Type of Publications

The publications obtained from the applied review were classified into three categories: the majority, 86.7%, consisted of research articles, followed by review papers at 12.20%. Lastly, the publications presented as a result of many conferences addressing the studied topic accounted for 1.10%. Figure 5 illustrates this percentage distribution.

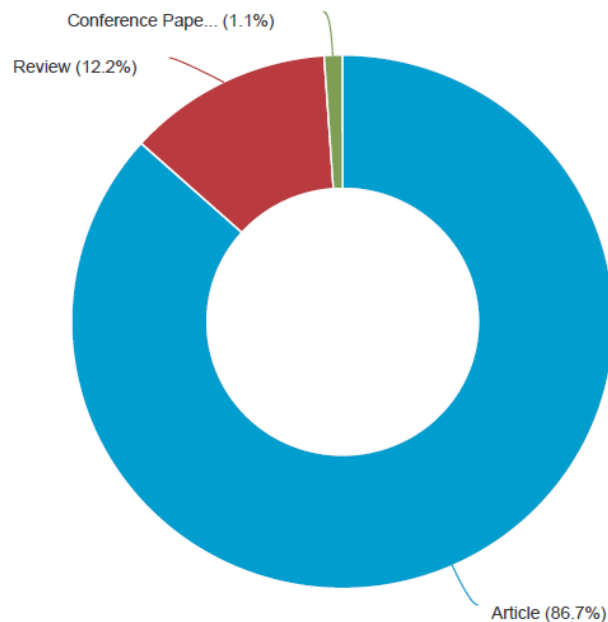


Figure 5 Percentage distribution of the types of documents produced during the study period related to the addressed topic.

Source: Scopus Database.

3.6. Indexed articles by the main organizations during the 2016-2024 period.

A relevant aspect is the contribution that each journal has made through the publication of documents with a significant impact on the addressed topic. In this regard, it was determined that the International Journal of Gynecology and Obstetrics, from the United Kingdom (Q1), contributed a total of 89 publications, reaching its highest participation in 2016. In second place was BMC Pregnancy and Childbirth, del Reino Unido (Q1), with a total of 71 documents, and in third place was Journal of Maternal Fetal and Neonatal Medicine, also from the United Kingdom (Q2), with a total of 54 documents. The fourth position was held by European Journal of Obstetrics and Gynecology and Reproductive Biology, from Ireland (Q2), which contributed a total of 38 documents, and finally, BJOG an International Journal of Obstetrics and Gynaecology, del Reino Unido (Q1), from the United Kingdom (Q1), with 36 publications. Figure 6 illustrates the annual production trend of each organization.



3.8. Analysis of citations by journal

This section shows the impact generated by each journal involved in the study, in relation to citations made by researchers who have addressed the topic of postpartum hemorrhage. In this regard, nine publications or papers stood out, on which most researchers have focused their attention. First, the International Journal of Gynecology and Obstetrics from the United Kingdom (Q1) stands out with 90 documents, 921 citations, and a link strength of 201. It is dedicated to addressing aspects such as obstetrics and gynecology, as well as other related topics. Second is the UK's BMC Pregnancy and Childbirth (Q1) with 70 documents, 1,049 citations, and a link strength of 92. It specializes in the selection and dissemination of biomedical aspects of pregnancy, breastfeeding, childbirth, maternal health, maternity care, and sociological trends and aspects of pregnancy and childbirth.

Other journals that contributed valuable documents for researchers were the American Journal of Obstetrics, from the United States of America (Q1), which considers issues related to the study of women's health and well-being, with a particular focus on physical, mental, and emotional health. This journal delves into aspects of maternal-fetal medicine, perinatology, and general gynecology with minimally invasive therapies, among others. Figure 8 highlights the leading journals that have published articles related to the subject of study.

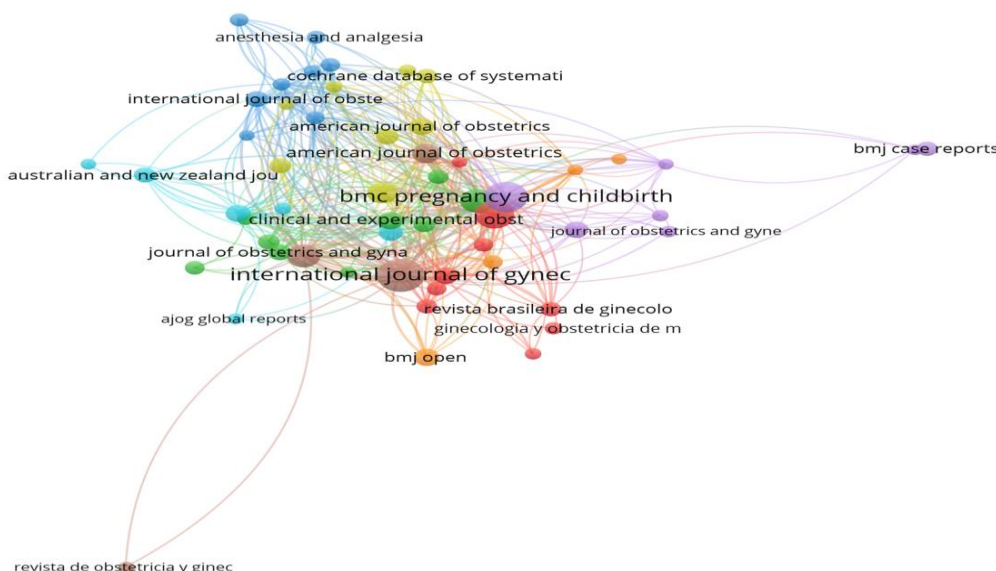


Figure 8: Journals with the highest number of indexed articles cited in similar studies. Source: Scopus Database.

3.9. Analysis of the citations by organizations

Just as there are journals responsible for publishing highly relevant articles, there are also organizations that promote the development and growth of research on topics related to the management and treatment of postpartum hemorrhage. In this regard, it was found that the vast majority of the articles cited are associated with Harvard Medical School in Boston, with 16 documents, 258 citations, and 27 link strengths. This covers research areas such as gynecology, gynecological oncology, maternal-fetal medicine, obstetric nursing, reproductive endocrinology and infertility, and women's health. Other important organizations are Gynuity Health Projects in New York and the Concep Foundation, with offices in Bangkok, Thailand, and Geneva, Switzerland. Figure 9 includes the organizations that stood out in the bibliometric analysis.



Figure 9 Organizations that promoted the highest number of indexed found in similar research. Source: Scopus Database.



3.10. Citation analysis by document

Another noteworthy aspect concerns the information on the documents that have been considered when supporting criteria and approaches related to postpartum hemorrhage treatment. First, a reference to Sentilhes *et al.* (2016b) is made, with 208 citations and 64 lines of force with their publication under the title of “Postpartum Haemorrhage: Prevention and Treatment”, which can be found in the journal Expert Review of Hematology. These authors conducted a literature review to propose a management strategy based on the objectives established through the dynamic assessment of coagulation. The second position was held by Evensen (2017a) with 146 citations and 49 lines of force, in his work entitled “Postpartum Hemorrhage: Prevention and Treatment”, published in Am. Fam. Physician, which consisted of a literature review aimed to present evidence-based recommendations for the prevention and appropriate response to postpartum hemorrhage. The said research is aimed at medics providing prenatal, intrapartum, and postpartum care. In third place is Ende (2021) with 103 citations. In the publication titled “Risk Factors for Atonic Postpartum Hemorrhage: A Systematic Review and Meta-analysis”, published in Obstetrics & Gynecology, this research aims to identify and quantify the risk factors for atonic postpartum hemorrhage. These details can be observed in Figure 10.

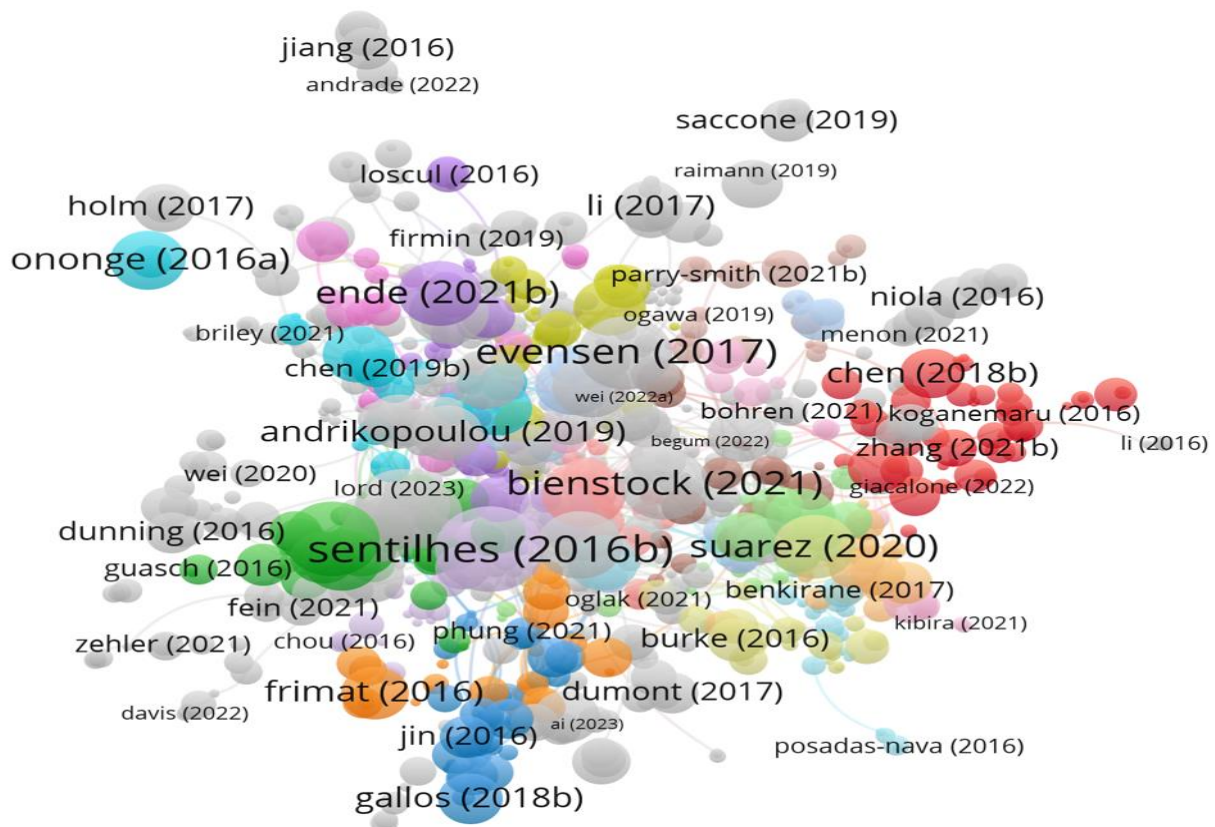


Figure 10 Document Citation Analysis.
Source: Scopus Database.

3.11. Systematic literature review

To specify the relevant findings associated with the topic under study, a review of related publications in the Scopus database was conducted. A detailed exploration was carried out, focusing on publications involving the prominent authors identified in the bibliometric study. The summarized information is presented in Table 2.

Table 2 Outstanding articles on postpartum hemorrhage treatments in the period of 2016-2024.

Year	Author(s)	Journal	Quartile	Notable Treatment
2022	Castiblanco-Montañez et al.	<i>Rev Cuid</i>	Q2	For the treatment of PPH, the use of misoprostol with oxytocin or carbetocin alone is recommended, as well as the combination of ergometrine with oxytocin, depending on the volume of the bleeding.
2022	Kumaraswami y Butwick	<i>Best Pract Res Clin Anaesthesiol.</i>	Q1	Tranexamic acid (TXA) has become a crucial pharmacological complement for managing PPH; however, its role in reducing hemorrhage-related morbidity in high-resource countries remains unclear.

2023	Gallos et al.	<i>N Engl J Med</i>	Q1	An international essay demonstrated that using a calibrated field indicator, combined with a set of other treatments (oxytocin and tranexamic acid) and supported by a multifaceted implementation strategy, significantly reduced the risk of the primary outcome.
2020	Butwick, et al.	<i>Transfusion</i>	Q1	The potential effectiveness of tranexamic acid and fibrinogen concentrate was considered as a complement for the prevention and treatment of PPH.
2019	Pacheco et al.	<i>Semin. Perinatol</i>	Q1	Along with the proper surgical control and a correct transfusion of blood products, the use of pharmacological agents (tranexamic acid) and coagulation concentrates (fibrinogen concentrates and prothrombin complex concentrates) results in improved hemostasis and reduced hemorrhage-related mortality.
2017	Evensen et al.	<i>Am. Fam. Physician</i>	Q2	The use of oxytocin after childbirth is the most important and effective component of this practice. Oxytocin is more effective than misoprostol for the prevention and treatment of uterine atony and has fewer adverse effects.
2016a	Sentilhes et al.	<i>Expert Rev. Hematol</i>	Q2	When available, oxytocin is considered to be the first-line drug for both the prevention and treatment of PPH, while peripartum hysterectomy remains the definitive life-saving procedure if pharmacological and resuscitative measures fail.
2017	Newsome et al.	<i>Tech Vasc Interv Radiol</i>	Q3	Transcatheter uterine artery embolization is a non-surgical, minimally invasive, extremely safe, and effective treatment made for controlling excessive bleeding of the female reproductive tract, generally after all conservative measures have failed.
2022	Escobar et al.	<i>Int J Gynecol Obstet</i>	Q1	It is recommended to use uterotonics to prevent PPH during the third stage of labor in all deliveries. Likewise, oxytocin (10 IU intravenously/intramuscularly [IV/IM]) is recommended for PPH prevention in both vaginal and cesarean deliveries. In these environments where oxytocin is used, it is important to maintain focus on its cold chain, while in settings where oxytocin is not available or its quality is not guaranteed, the use of other injectable uterotonics is recommended, such as ergometrine/methyl-ergometrine 200 µg IM/IV, where applicable.
2020	Watkins y Stem	<i>JAAPA-J AM ACAD PHYS</i>	Q2	Two essential initial interventions for postpartum hemorrhage are the administration of oxytocin and the uterine massage. Bimanual uterine compression can also be performed. Early administration of the antifibrinolytic tranexamic acid has been proven to reduce the maternal mortality due to postpartum hemorrhage. Uterine atony is managed with the addition of ergonovine, carboprost, and misoprostol.
2018	Henríquez et al.	<i>J Thromb Haemost.</i>	Q1	Early intrauterine balloon tamponade usage can improve maternal outcomes. Fluid restoration with crystalloids and colloids is inevitable in the early stages of postpartum hemorrhage, but close monitoring would be ideal to prevent the risk of dilutional coagulopathy.
2019	Vogel et al.	<i>BMJ Global Health</i>	Q1	In 2012, WHO recommended oxytocin 10 IU, administered intravenously or intramuscularly, as the best uterotonic choice for preventing PPH in all women. Over the past decade, significant advances were made to prevent and treat PPH, like early distribution of prophylactic misoprostol for self-administration after childbirth, administration of oxytocin with Uniject, and care packages for PPH treatment. Additionally, large multi-country essays have been made on the topic of tranexamic acid for PPH treatment and a heat-stable formulation of carbetocin for PPH prevention.
2021	D'Alton et al.	<i>Expert Rev. Med. Devices</i>	Q2	If abnormal postpartum uterine bleeding occurs, an initial conservative treatment begins, which includes uterine massage and administration of oxytocin. If these initial treatments fail to restore the uterine tone and control the bleeding, additional treatments are implemented. These include therapeutic doses of uterotonic medications. Often, the next available intervention is the insertion of a uterine balloon tamponade (UBT) device to apply direct pressure to the vasculature by expanding against the inner walls for 12 to 24 hours.
2020	Althabe et al.	<i>Int J Gynecol Obstet</i>	Q1	The first-line response package for PPH includes uterotonics, isotonic crystalloids, tranexamic acid, and uterine massage. The refractory PPH response package includes aortic or bimanual uterine compression, the non-pneumatic anti-shock garment, and intrauterine balloon tamponade (IBT).

2020	Suarez et al.	<i>Am. J. Obstet. Gynecol MFM</i>	Q1	Uterine balloon tamponade has a high success rate in treating severe postpartum hemorrhage and appears to be safe, even though more experimental studies must be done
2016b	Sentilhes et al.	<i>Eur. J. Obstet. Gynecol. Reprod. Biol</i>	Q2	Oxytocin is the first-line prophylactic drug, regardless of the form of delivery (Grade A). A slow dose of 5 or 10 IU can be administered (Grade A), either IV or IM (professional consensus). If oxytocin does not control the bleeding, the administration of sulprostone is recommended within 30 minutes after the diagnosis of the PPH (Grade C). In cases where sulprostone fails, intrauterine balloon tamponade can be performed before resorting to surgery or interventional radiology. Tranexamic acid may be used at a dose of 1 g, which can be repeated once if the first one is ineffective, for PPH treatment when the bleeding persists after the administration of suprostone (professional consensus), although its clinical value in the obstetric field has not been demonstrated yet.
2023	Jones et al.	<i>Am. J. Obstet. Gynecol MFM</i>	Q1	Pharmacotherapy remains the first-line preventive option for PPH. These therapies can be done both individually and combined, acting additively or in synergy to prevent PPH. There is strong evidence that supports the use of Oxytocin, the first-line uterotonics agent in the United States for PPH prevention. The use of second-line uterotonics such as methylergonovine, misoprostol, and carboprost in combination with oxytocin has an additive or synergistic effect, and greatly reduces the risk of PPH compared to Oxytocin alone.
2023	Roberts et al.	<i>Am. J. Obstet. Gynecol MFM</i>	Q1	Evidence that early treatment with tranexamic acid reduces deaths from postpartum hemorrhage has significant implications for obstetric care worldwide. Tranexamic acid may also play an important role in preventing PPH, but more evidence is needed to fully assess the balance of risks and benefits.
2024	Mackwe y Ocnade	<i>Best Pract Res Clin Obstet Gynaecol</i>	Q1	The International Federation of Gynecology and Obstetrics (FIGO), in its recent recommendations for 2024, has supported the World Health Organization's (WHO) care bundle approach meant for PPH treatment in care centers. The first-response package includes uterine massage, uterotonics, intravenous fluids (isotonic crystalloids), early intravenous tranexamic acid, and escalation if the bleeding continues. The refractory PPH response package consists of several non-surgical interventions such as an intrauterine balloon tamponade, bimanual uterine or aortic compression, non-pneumatic anti-shock garments, and pelvic arterial embolization. Lastly, surgical intervention includes compressive suture techniques and uterine and internal artery ligation as well as hysterectomy
2023	Bell et al.	<i>J Thromb Haemost</i>	Q1	PPH often occurs due to obstetric complications, but it can be exacerbated by impaired or unbalanced hemostasis. The role of the viscoelastic hemostatic assays (VHA) in the point of care is to monitor the deterioration of the hemostasis and guide the replacement of procoagulant blood products during PPH is evolving, although these technologies are not available in most maternity units. VHAs can also detect hypofibrinogenemia thanks to dilution or acute obstetric coagulopathy and guide the fibrinogen replacement. The role of the VHAs in guiding fresh frozen plasma is less clear, but normal results suggest this fresh frozen plasma may not be required.

4. Discussion

Blood vessels' rupture, whether veins, arteries, or capillaries, leads to the unexpected release of blood; this is known as bleeding, which, in significant quantities, is considered a hemorrhage. In women, the final stage of pregnancy is childbirth or delivery, which can be either eutocic (natural) or dystocic (complicated). Both focus on the birth of the baby, and due to various causes, excessive bleeding may occur within the first 24 hours after delivery; this is known as postpartum hemorrhage.

In this order of ideas, PPH can be effectively prevented and managed through early controlled interventions with an intrauterine balloon tamponade (Henriquez et al., 2018; Suarez et al., 2020). However, D'Alton et al. (2021), it a secondary option if the initial phase, involving uterine massage and therapeutic oxytocin administration, is unsuccessful. From the perspective of Althabe et al. (2020), this first phase should comprehend the correct use of uterotonics, isotonic crystalloids, and tranexamic acid, in addition to the aforementioned uterine massages. Furthermore, Roberts et al. (2023) emphasize that early treatment with tranexamic acid reduces postpartum hemorrhage-related mortality. This is in line with the guidelines

outlined by Ayenew et al. (2024) and McAuliffe et al. (2020) when they refer to the use of systematic methodologies to prevent HPP, most of which are the result of applied and experimental research.

According to the findings of Sentilhes et al. (2016), oxytocin is the first-line prophylactic uterotonic drug, regardless of the form of the delivery. However, in the guidelines established by the WHO in 2012, it is considered a preventive measure for PPH (Vogel et al., 2019). Similarly, emphasis is placed on the early distribution of prophylactic misoprostol for self-administration after childbirth, the administration of oxytocin via Uniject, and care bundles for hemorrhage management. This aligns with the subsequent findings of Sentilhes et al. (2021), who confirm the use of these drugs as highly effective measures in the treatment of HPP.

Considering the contributions of Castiblanco-Montañez et al. (2022), Kumaraswami & Butwick (2022), Gallos et al. (2023), Butwick et al. (2020), Pacheco et al. (2019), and Evensen et al. (2017), which are extensively complemented by the findings of Jones et al. (2023), pharmacotherapy remains the first-line preventive option for PPH. This includes the individual administration of oxytocin, carbetocin, methylergonovine, ergometrine, misoprostol, prostaglandin analogs, or tranexamic acid. In the same way, combination therapies are available, acting additively, infra-additively, or synergistically to prevent postpartum hemorrhage. It is important to highlight that the use of methylergonovine, misoprostol, and carboprost in combination with oxytocin has an additive or synergistic effect, as well as a greater reduction in the risk of postpartum hemorrhage prevention compared to oxytocin alone.

It is essential to highlight the work of Makwe & Ocnade (2024), which follows the guidelines of FIGO and WHO (2020). Additionally, it should be noted that the first-response package includes uterine massage, uterotonics, intravenous fluids (isotonic crystalloids), early intravenous tranexamic acid, and escalation if the bleeding persists. It is essential to highlight the work of Makwe & Ocnade (2024), which follows the guidelines of FIGO and WHO (2020). Additionally, it should be noted that the first-response package includes uterine massage, uterotonics, intravenous fluids (isotonic crystalloids), early intravenous tranexamic acid, and escalation if bleeding persists. The refractory PPH response package consists of non-surgical interventions such as an intrauterine balloon tamponade, an uterine or bimanual aortic compression, non-pneumatic anti-shock garments, and a pelvic arterial embolization.

On the other hand, it is important to highlight that surgical interventions include suture techniques for ligation of the uterine and internal iliac arteries, and hysterectomy. This aligns directly with the findings of Escobar et al. (2022) and Sentilhes et al. (2016), who also considered the option of ranscatheter uterine artery embolization and the use of other uterotonic injectables. In certain cases, the administration of ergometrine/methylergometrine 200 µg IM/IV is appropriate.

In general, the findings are aligned with the specifications outlined by FIGO PPH Technical Working Group et al. (2022), in the joint statement with the ICM in support of the guidelines directed by the WHO (2020), highlighting the use of uterotonic drugs such as oxytocin for first-line treatment of severe bleeding resulting from PPH. This supports the contributions made by Vogel et al. (2019), Castiblanco-Montañez et al. (2022), Gallos et al. (2023), Evense et al. (2017), Senthilhes et al. (2016a), Escobar et al. (2022), Watkins and Stem (2020), D'Alton et al. (2021), Senthilhes et al. (2016b), and Jones et al. (2023).

5. Conclusions

The bibliometric analysis revealed that various studies have been conducted on the early treatment of PPH, which allowed the establishment of phases for its proper management. In that regard, a progressive decline in the fatal effects of PPH has been observed, all thanks to the advancements in scientific research driven by the high mortality rate of women after childbirth.

The review of available literature published in the last five years highlights the use of oxytocin as the first-line uterotonic agent for PPH prevention. This indicates that pharmacotherapy remains the primary preventive option for postpartum hemorrhages, while also emphasizing the role of tranexamic acid. Additionally, intrauterine balloon tamponade is a highly viable intervention that should be considered as an immediate response if the risk of massive bleeding remains.

However, particular socioeconomic conditions due to low per capita income in countries such as Somalia, South Sudan, the Central African Republic, and Haiti, among others, pose severe limitations to the implementation of the guidelines outlined by the WHO. These nations face a lack of resources in their health systems due to the absence of government budgets and the difficulty in accessing aid from international non-governmental organizations. In addition to this, both internal and external conflicts in these nations, as well as their general instability, prevent a significant reduction in HPP mortality rates.

Finally, although significant progress has been made in this area, further field studies, observational research, and experimental trials with control groups are required to be made to fully assess the effectiveness of these drugs. Likewise, future researchers are encouraged to explore the effectiveness of safe alternative or combined therapies for PPH in out-of-hospital and rural clinical settings.

Ethical considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

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