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Blood transfusion rates for pregnancy-related haemorrhage in South Asian countries: A scoping review

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Abstract

Background: Haemorrhage is the leading cause of maternal mortality, responsible for at least 27·1% of maternal deaths in lower-income countries. Blood transfusion is a critical intervention for managing haemorrhage, but all South Asian countries face blood supply shortages. Our review aims to summarise transfusion rates for haemorrhagic complications from early pregnancy to the postpartum period in South Asia.

Methods: We conducted a scoping review using PubMed, Web of Science, Embase, and grey literature, supplemented by hand searches. Data extraction focused on study location, total population transfused, cause of haemorrhage, blood transfusion rates and reporting of anaemia. Pooled transfusion rates (PTRs) were calculated for haemorrhagic conditions with multiple studies.

Findings: Forty nine sources were included, primarily from India (59%) and most common study designs were observational (82%). PTRs for specific conditions were: placenta accreta spectrum 97·3%, placenta previa 64·8%, self-terminated pregnancy 60·8% and ectopic pregnancy 49·8%. Single-study data reported transfusion rates of 25% for retained placenta and 92·5% for uterine rupture. PTRs for caesarean section and vaginal deliveries were 8·63% and 1·9% respectively. Only half of the studies reported anaemia status.

Interpretation: We identified high blood transfusion rates for pregnancy-related haemorrhagic events in South Asia as well as notable data gaps and inconsistent anaemia reporting. Our findings highlight the need for region-specific transfusion data to inform blood resource allocation and policy-making. Addressing these gaps and strengthening health systems are vital for improving maternal health outcomes in South Asia.

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RESEARCH IN CONTEXT

Evidence before this study

Before undertaking this study, we conducted a thorough search of three primary databases: PubMed, Embase, and Web of Science. The search was focused on identifying studies that reported rates of emergency blood transfusion due to haemorrhagic complications during pregnancy and the postpartum period in South Asia. The search was conducted on January 25, 2021, and included studies published between 2011 and 2020. The criteria for inclusion were English-language sources that discussed transfusion rates owing to haemorrhage throughout pregnancy and the postpartum period. We excluded sources that were non-generalisable to the entire population, focused on non-ubiquitous interventions, infectious diseases increasing bleeding risk, non-conventional surgical procedures, and studies with fewer than 10 cases in case series. The search terms were tailored to capture the main causes of significant haemorrhage based on clinical experience and WHO guidelines. We noted variability in study

designs and methodologies, introducing potential biases in the evidence. However, no meta-analysis was performed due to the heterogeneity of the data.

Added value of this study

This study provides a comprehensive assessment of blood transfusion rates associated with various haemorrhagic events throughout pregnancy and the postpartum period in South Asia. It adds value by synthesising data from multiple sources, creating a pooled estimate of transfusion rates that is more representative of the region. The study highlights significant regional variations in transfusion rates, which can inform the allocation of blood resources and healthcare planning. Additionally, it identifies critical gaps in the existing literature, such as the lack of data on miscarriages, uterine atony, and anaemia status, and the over-representation of tertiary healthcare settings.

Implications of all the available evidence

The findings of this study, combined with existing evidence, have important implications for both practice and policy. The high transfusion rates observed in conditions like placenta accreta spectrum and uterine rupture underscore the need for improved blood resource allocation in South Asia. The study also suggests the necessity for regional data to accurately model and estimate blood needs for haemorrhagic complications during pregnancy and postpartum. Future research should focus on underrepresented countries within the region, explore secondary healthcare facilities, and include detailed data on anaemia status and blood loss estimation. These steps are crucial for designing strategies to address blood shortages and reduce avoidable maternal deaths, ultimately improving maternal health outcomes in South Asia.

INTRODUCTION

Haemorrhage is the commonest cause of maternal death globally and can occur at any stage of pregnancy, during, and after delivery.[1] Published literature predominantly focuses on treatment and preventive strategies for postpartum bleeding, with insufficient attention drawn to bleeding events at earlier stages.[1] A World Health Organization (WHO) systematic analysis reported that 27·1% of maternal deaths in lower-income countries are haemorrhage-related, with antepartum haemorrhage (APH), intrapartum haemorrhage (IPH), and postpartum haemorrhage (PPH) contributing to 6·5%, 0·9%, and 19·7%, respectively. Additionally, early complications associated with bleeding, such as ectopic pregnancy, miscarriage, and induced abortions contribute to 7·9% of maternal deaths, and are often overlooked.[1] Consideration of all bleeding events that could require transfusion is essential to ensure adequate provision of blood resources.

The United Nations set a Sustainable Development Goal (SDG) target to reduce the global maternal mortality ratio (MMR) to fewer than 70 deaths per 100,000 live births by 2030.[2] Ninety-nine percent of maternal deaths occur in low and lower-middle income countries, and a 2019 global modelling study showed significant blood supply deficits in South Asian countries.[3–4] Furthermore, the South Asian region was reported to have the highest prevalence of anaemia in the world in the same year.[5] India, the

most populous in the region, experienced the largest absolute mismatch with a shortage of 41 million units per year.[4] The country also ranks second globally in the total number of maternal deaths.[3]

Our scoping review aims to identify the rate of blood transfusion due to various haemorrhagic complications throughout pregnancy and the postpartum period in South Asia. By collating regional data, we aim to provide a representative understanding of transfusion rates that will take account of the epidemiological profiles of affected women and support in the estimation of blood needs.

METHODOLOGY

Our scoping review was done using the framework devised by Arksey and O'Malley, who pioneered the standardisation of this research methodology.[6] We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist to report our review.[7]

Eligibility criteria

All English-language sources discussing rates of emergency blood transfusion owing to haemorrhage during pregnancy until the postpartum period, published between 2011 and 2020, were considered in our review. Sources were excluded if felt to be non-generalisable to the entire population, such as if they covered non-ubiquitous interventions (interventional radiology or the use of novel medical equipment), infectious diseases increasing bleeding risk (dengue fever, hepatitis E), blood transfusion in association with non-conventional surgical procedures (myomectomy during caesarean section), and if fewer than 10 cases were included in case series. Sources were also excluded if there were data inconsistencies between abstract and full-text versions, or if they were discussion articles and did not report specific transfusion rates, since they did not answer the original research question. No review protocol was registered or published.

Information Sources

PubMed, Embase, and Web of Science were searched on 25 January 2021 to identify relevant sources. The search strategy was formulated after multiple iterations to include the main causes of serious haemorrhage related to pregnancy and the peripartum period based on the authors' clinical experience, supplemented by the WHO manual on the clinical use of blood.[8] Search strategies were limited to the countries of the South Asia region as defined by the World Bank: Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka.[9] **Supplementary Table 1 (see pp 2)** shows our Pubmed search strategy. This was modified to best fit the other databases as necessary: for example, use of 'Emtree' terms for Embase ("Spontaneous abortion" instead of "miscarriage") were used. We also found a small number of records from non-systematic hand searches.

Source Selection

Rayyan, the open-source systematic review research tool, was used to organise sources identified in the database search.[10] Removal of duplicate articles was followed by title and abstract screening, performed independently by two authors using the 'blind on' function, meaning that each person was unable to review the other person's decisions until individual screening was complete. The screening options were 'include', 'exclude', or 'maybe'. In cases of disagreement or a 'maybe' decision, the relevant abstracts were screened by a third reviewer in a separate folder to maintain blinding, and later cross-referenced with the primary screening results. Sources were included for full-text review if: (i) two out of three reviewers chose 'include', (ii) one chose 'include' with the other two reviewers choosing 'maybe', or (iii) if there was a three-way tie with each reviewer making a different decision. The full-text analysis, primarily focusing on transfusion incidence rates was carried out by a single reviewer.

Data Collection & Synthesis

Two reviewers charted the extracted data using a Microsoft Excel 2019 spreadsheet which included: the country of the study, city or region, level of health facility (secondary or tertiary), the size of the population studied and transfused, whether anaemia was discussed, information on transfusion, and the causes of obstetric haemorrhage. Additional columns included were: 'Key information' [Definitions used in the records, information about the setting's context, delivery information, and any restrictions], and 'Reason for exclusion'. If articles contained information on multiple indications for blood transfusion, data was later disaggregated. Where multiple studies reported on transfusion rates for any given indication, results were pooled and a pooled proportion was calculated using the formula below:

Pooled transfusion rate (PTR) (%) = sum of the number of transfused women / sum of the number of women who experienced the haemorrhagic event x100

The study populations were pooled to increase the representativeness of the data across the region since there are likely to be variations within and between states and countries regarding the health state of the populations, healthcare access, and quality.

RESULTS

Study selection

We identified 357 records from our database search: PubMed [n = 100], Embase [n = 183], and Web of Science [n = 74]. After removing 42 duplicates, 315 articles were selected for title and abstract review. During the initial screening, there was a high concordance rate of 79% between the two reviewers' decisions. Following screening by the third reviewer, 193 sources were excluded. A full-text review of 121 sources was performed including three additional articles identified through alternative methods. Seventy-two were excluded based on the wrong outcome, population, type of article, and generalisability.

Finally, 49 studies (45 articles and four conference abstracts) were included for final data extraction and synthesis **(**Fig. 1**).**

Although publications from all eight South Asian nations were sought, only four of them - Bangladesh, India, Nepal, and Pakistan - were represented in the literature, with 59% of the included articles originating from India. Of the included sources, retrospective observational (n = 27) and prospective observational (n = 13) studies were the most prevalent study designs. There were seven randomised controlled trials, all of which evaluated postpartum blood loss using uterotonics. Other study types included were a quasi-experimental (n = 1), and a non-randomised, non-controlled interventional study (n = 1). Almost all studies reported data from single sites. All included data was from tertiary-level hospitals, except a Pakistan-based study on caesarean sections.[11]

Table 1 summarises the themes and topics of the literature included along with their countries of origin. Most of the articles found were about labour and delivery (63%). No articles containing specific transfusion incidence data for miscarriage, lower genital tract injuries, and uterine atony were identified in the scoping review results. There were also no included articles discussing medical or surgical abortion procedures carried out under medical supervision.

Table 1
Summary of included records divided by theme and cause of haemorrhage

Theme	Cause of haemorrhage	Number of articles/conference abstracts	Country setting of study (number of records)
Early pregnancy	Induced medical termination of pregnancy (abortion) without prescription/supervision	5	India (5)
	Ectopic pregnancy	7	India (6) Pakistan (1)
Antenatal/ intrapartum complications	Placenta previa	5	India (3) Pakistan (2)
	Uterine rupture	1	India (1)
Delivery/peripartum	Caesarean section	10	India (3) Nepal (3) Pakistan (4)
	Trial of labour after caesarean (TOLAC)	1	India (1)
	Medical methods to reduce PPH risk (uterotonics and tranexamic acid)	8	Bangladesh (2) India (6)
	Retained placenta	1	Nepal (1)
	Placenta accreta spectrum (PAS)	2	India (1) Pakistan (1)
	Emergency obstetric/peripartum hysterectomy	8	India (2) Nepal (1) Pakistan (5)
	Blood utilisation depending on mode of delivery	1	India (1)
Total number of records included		49	Bangladesh (2) India (29) Nepal (5)

Note: Studies are classified by their primary research theme in Table 1. Studies reporting transfusion rates for multiple conditions may contribute to more than one category in Table 2.

Theme	Cause of haemorrhage	Number of articles/conference abstracts	Country setting of study (number of records)
			Pakistan (13)

Note: Studies are classified by their primary research theme in Table 1. Studies reporting transfusion rates for multiple conditions may contribute to more than one category in Table 2.

There were nine specific haemorrhagic events for which data on blood transfusion rates was available from South Asia in our scoping review. Table 2 **and Supplementary Table 2 (see pp 3–7)** demonstrate the PTR in pregnancy-related haemorrhagic events identified from the specified region. Figure 2 illustrates the PTRs for various pregnancy-related haemorrhagic events to showcase the need for transfusion and the total reported population transfused to highlight the burden and state of documentation. Only one study each for the haemorrhagic complications of uterine rupture and retained placenta was found so these rates have been presented directly. PTRs ranged between 1·9% for vaginal deliveries and 97·3% for women affected by PAS. The cases of termination of pregnancy (TOP) were reported from India only and resulted in an overall transfusion rate of 60·8% [range 15–95%]. The PTR for ectopic pregnancy was also very high at 49·8% [range 15·7–97·3%]. Placenta previa had a consistently high transfusion rate across the six study sites in India and Pakistan, ranging from 40·4 to 84·4%, with a PTR of 64·8%. This was also the case for women affected by the PAS, which had a PTR of 97·3% [range 95–100%].

Table 2
Summary of transfusion rates by type of pregnancy-related haemorrhagic event

Pregnancy-Related Haemorrhagic Event	Pooled Study Population Size	Total Population Transfused	Pooled blood Transfusion Rate (%)	Location of studies
Early Pregnancy				
Medical TOP without medical supervision[19–23]	612	372	60·8%	India
Ectopic Pregnancies [24–30]	444	221	49·8%	India, Pakistan
Antenatal/intrapartum complications				
Placenta Previa[31–36]	682	442	64·8%	India, Pakistan
Uterine Rupture [12]	40	37	92·5%	India
Delivery/peripartum				
Placenta Accreta Spectrum (PAS)[33,37,38]	148	144	97·3%	India, Pakistan
Retained Placenta[13]	64	16	25%	Nepal
Caesarean Sections [11,14,16,17,35,36,39–46]	10,117	873	8·6%	Nepal, Pakistan and India
Vaginal Deliveries[15,18,45–49]	6,054	113	1·9%	India, Bangladesh
Others				
Emergency obstetric/peripartum hysterectomies*[50–57]	268	268	100%	India, Nepal, Pakistan

*Note: The literature categorised emergency hysterectomies based on clinical indications (placenta accreta spectrum, uterine atony, uterine rupture, placenta previa, secondary postpartum haemorrhage, placental abruption and chorioamnionitis). After identifying hysterectomies, studies retrospectively determined the indications, noting that all required blood transfusions, leading to 100% transfusion rates for these indications. These overlap with other event categories mentioned in the table but are still reported separately to avoid overestimating pooled transfusion rates of these respective indications.

TOP: Termination of Pregnancy; Note: Bigger bubble sizes might indicate a higher reported burden of haemorrhagic events or more comprehensive documentation, while smaller bubbles might indicate a lower reported burden or limited documentation. Higher pooled blood transfusion rates (PTRs) may

reflect greater transfusion needs, while lower PTRs may reflect lower needs or limited access to blood. Uterine rupture, though typically occurring during labour, may begin in the antepartum period and is thus categorised as an antenatal complication in this review. Similarly, placenta accreta spectrum cases often require transfusions prior to delivery but are generally managed with caesarean sections, hence are positioned separately in the delivery/peripartum phase.

Studies discussing caesarean section, including both elective and emergency procedures, had the largest pooled study population (n = 10,117). The PTR for this group was 8·63% [range 0·4–22·5%]. Vaginal deliveries were associated with relatively lower transfusion rates ranging between 0·1 and 9·1% (PTR 1·87%). Uterine rupture led to blood transfusion in 37 of the 40 patients reported by Singh and Shrivastava.[12] In a Nepalese study of 64 patients with retained placenta post-vaginal delivery, 25% required transfusion as part of their management.[13]

Only half of the included articles discussed the anaemia status or reported the haemoglobin and/or haematocrit values for their study populations. Five out of these had haemoglobin cut-off values as exclusion criteria for their study participants, all of which reported the effect of various medications in reducing PPH.[14–18] Sixteen of the studies reported the volume of blood lost by their study population and others discussed the incidence of PPH within their study population, although a definition for this was not always given.

DISCUSSION

While there is an important focus on postpartum haemorrhage in the global health community, this scoping review demonstrates that emergency blood transfusion is critical to support all stages of pregnancy, including the postpartum period.

Our collated data shows early pregnancy haemorrhagic events had PTRs ranging between 49.8% and 60.8%. In the early gestational period, the main causes of obstetric haemorrhage requiring transfusion are miscarriage, TOP and ruptured ectopic pregnancy. Regarding TOP, our search yielded transfusion data only in cases where women induced the abortion themselves and subsequently sought medical assistance. The PTR was notably high at 60·8%. Institutional TOP, whether with medication or surgical, is expected to result in lower transfusion rates as bleeding complications are likely to be addressed at an earlier stage. Notably, an estimated 73% of TOPs in India in 2015 were medication abortions occurring outside healthcare facilities, often without prescriptions, through drugs obtained from pharmacies and informal vendors.[58] No transfusion incidence data was identified in the scoping review for women who experienced miscarriage. This may be attributed to many reasons including social stigma, inaccurate or absent data reporting as well as publication bias.

A retrospective study from Botswana reported a much lower transfusion rate across four hospitals following either miscarriage or self-induced terminations, at just 9.5%.[59] We cannot directly make comparisons since miscarriage is not differentiated from TOP. The authors discuss the difficulty in

disaggregation due to restrictive abortion laws, implying that women who self-induce a TOP may report a spontaneous miscarriage when seeking care. Although only recorded for approximately half of the women included in the study, nearly two thirds had haemoglobin levels greater than 100g/L, thereby reducing the clinical need for transfusion. In contrast, more than half of all pregnant and non-pregnant women in India are anaemic, demonstrating the importance of using local data when planning services.[60]

Nearly half of the women affected by ectopic pregnancy in studies included in our review required blood transfusion. This is consistent with a study from Kosovo which reported a transfusion requirement of 52% amongst women with ectopic pregnancies.[61] In the USA however, a cross-sectional observational study of women enrolled in Medicaid across 14 states demonstrated that of 101,892 women affected by ectopic pregnancy in five years, just four percent required a blood transfusion. Amongst these women, ethnic minorities were more likely than their white counterparts to require a transfusion.[62] The stark difference between high- and lower-income countries is likely related to availability of diagnostic tests including ultrasound scans, and rapid recourse to surgery if necessary, thereby limiting blood loss.

Our collated data for antenatal haemorrhagic events had PTRs ranging from 64·8%-92·5%. Uterine rupture is one of the most urgent obstetric complications with a high fetomaternal mortality rate if not rapidly diagnosed and treated. Management involves simultaneous delivery of the fetus as well as controlling maternal bleeding, with a possible need for emergency hysterectomy.[63] Although our review included only one article on uterine rupture, studies from Ghana and Ethiopia also report high transfusion rates amongst affected women of 87·8% and 76% respectively.[64–65]

Placenta previa is one of the most common causes of antepartum haemorrhage. When identified during pregnancy, caesarean section is usually recommended, with pre-term emergency delivery being considered depending on the extent of antenatal blood loss. Before and at delivery, significant bleeding can occur, with our analysis indicating that nearly two-thirds of patients with this condition require blood transfusion. Adere et al reported a blood transfusion requirement of 4·3% for placenta previa cases in Addis Ababa, Ethiopia.[66] In contrast, a ten-year retrospective study of blood transfusions in New South Wales, Australia, revealed a much lower transfusion rate of 10·3% for women with placenta previa during pregnancy. Similarly, the transfusion rate at the time of delivery for placenta previa was just 10·1% which may be linked to early detection in the antenatal period allowing antenatal surveillance and pre-operative planning as well as rapid access to emergency caesarean in the case of major bleeding.[67]

Our scoping review revealed that blood transfusion is almost universally necessary for individuals with placenta accreta spectrum (PAS) disorder, the PTR being 97·3%. Upon analysing our three identified sources together, we found that 144 out of 148 affected women required blood transfusion. Similar high transfusion rates have been reported in high-income countries such as the USA. In California, one study reported a transfusion rate of 78% in women affected by the PAS.[68]

We found peripartum and postpartum transfusion rates were often much lower, with the requirement following vaginal delivery averaging just 1·9% and caesarean section 8·6%. In comparison, the aforementioned study from Australia reports lower transfusion rates of 0·98% in normal vaginal delivery, and 1·83% if delivered by caesarean section.[67] A Nepal-based study reported that this number increased to 25% in cases of retained placenta.[13] A high transfusion rate was also reported in a Nigerian study, where 67% of retained placenta cases were treated with blood transfusion.[69] There was no information available on transfusion rates specifically for uterine atony or lower genital tract damage, however these are likely to be the main causes for significant bleeding at vaginal delivery.[70]

Our review shows that transfusion rates are higher for haemorrhagic pregnancy complications compared to vaginal and caesarean births. This situation is further complicated by the three-delay model.[71] In the context of blood transfusions, the first delay (seeking care) arises from difficulty in accurately estimating blood loss at home, with women often losing blood intermittently until decompensation occurs, making it too late to survive the second delay (reaching care).[72] The 'two-hour access' indicator for obstetric postpartum haemorrhage cases emphasises the critical window for resuscitation.[73] The third delay (receiving care) occurs at the first-referral hospital due to issues with blood supplies, storage facilities, out of pocket expenditures, distant blood banks, and the need to transfer patients to higher facilities for adequate care.[74] While labour and delivery may be more predictable and addressed with necessary skills available in many lower-level healthcare facilities, these delays underscore the need for regional data to inform resource distribution and service planning to curb the chain of referrals due to lack of blood availability and reduce the third level of delay for complicated obstetric haemorrhage cases.

Our review also demonstrated variances between studies and regions. Of note, we found that studies from Karnataka, India, reported a higher-than-average blood transfusion rate in nearly all the conditions included in our study, except for caesarean section. Karnataka is also one of a minority of states in the country that has already met the SDG goal of fewer than 70 maternal deaths per 100,000 live births.[75] The state ranks fourth amongst Indian states for the number of blood banks in the country, with a total of 272 governmental and private blood banks.[76] This higher availability may ensure that doctors can adequately meet the demand for blood transfusions, compared to facilities where blood is scarce.

This review, while comprehensive, is subject to certain limitations. The data we have identified comes from just four of the eight nations within the South Asian region. Likely owing to the higher availability of research resources and an increased tendency to manage complex cases, most published data comes from tertiary healthcare settings. This may not reflect transfusion requirements at secondary or primary level of healthcare facilities. The data on termination of pregnancy is derived from self-induced cases in India. We anticipate that this overestimates transfusion requirements in the South Asia region, compared to medically supervised procedures. Those done unsafely are likely to be performed with a degree of secrecy, such that getting medical attention afterwards may be viewed as a last resort, made only when bleeding becomes hazardous and therefore apply to a minority of women. In our scoping review, there is

a notable lack of data on miscarriages and conditions of uterine rupture and placental abruption limiting our understanding of their impact on transfusion needs. The variability in study designs and methodologies across the included studies introduces potential biases and inconsistencies in data interpretation.

Our work excels in transforming data from single-centre studies into a comprehensive analysis. By pooling the best available evidence, we provide estimates of blood transfusion rates to inform blood resource planning across South Asia, while acknowledging limitations in geographical representation and healthcare settings. This approach reduces the impact of discrepancies related to healthcare access, quality, and population health across different regions and within countries. To enhance the applicability of findings, forthcoming studies should promote exploration in the countries not yet represented, along with secondary healthcare facilities. Incorporating details such as anaemia status or pre-transfusion haemoglobin levels, and estimating blood loss, when possible, can further aid in predicting the necessary blood volume. This expanded scope can help model and estimate unmet blood needs for acute haemorrhage during pregnancy and postpartum, informing policy makers to design strategies to address shortages and reduce avoidable maternal deaths.

CONCLUSION

We identified high blood transfusion rates for various haemorrhagic complications throughout pregnancy and postpartum in South Asia, notably for conditions such as PAS and uterine rupture and the women who self-terminate pregnancies and seek medical assistance. However, there is a lack of data for all complications particularly uterine atony and miscarriages, along with inconsistent reporting on anaemia status. Our findings provide detailed data of transfusion rates, which can help in estimating regional needs and informing better blood resource allocation. Addressing these research gaps, strengthening health systems, and implementing preventative measures are crucial for improving maternal health outcomes in South Asia.

Declarations

Declaration of interests

We declare no competing interests

Role of the funding source:

We declare no funding sources

Ethics approval and consent to participate

Not applicable. This scoping review synthesised previously published literature and did not involve primary data collection from human participants.

Consent for publication

Not applicable. No identifiable individual participant information is reported.

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Data availability

All data analysed in this review were extracted from published sources. The study-level extracted data and search strategy are provided in the supplementary materials.

References

1. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller AB, Daniels J et al (2014) Global causes of maternal death: a WHO systematic analysis. Lancet Glob Health 2(6):e323–e333
2. World Health Organization. Strategies towards ending preventable maternal mortality (EPMM) [Internet]. Geneva: World Health Organization (2015) [cited 2024 Jun 9]. 44 p. Available from: https://iris.who.int/handle/10665/153544
3. Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group, and UNDESA/Population Division [Internet]. [cited 2024 Jun 9]. Available from: https://www.who.int/publications-detail-redirect/9789240068759
4. Roberts N, James S, Delaney M, Fitzmaurice C (2019) The global need and availability of blood products: a modelling study. Lancet Haematol 6(12):e606–e615
5. Safiri S, Kolahi AA, Noori M, Nejadghaderi SA, Karamzad N, Bragazzi NL et al (2021) Burden of anemia and its underlying causes in 204 countries and territories, 1990–2019: results from the Global Burden of Disease Study 2019. J Hematol Oncol 14(1):185
6. Arksey H, O'Malley L (2005) Scoping studies: towards a methodological framework. Int J Soc Res Methodol 8(1):19–32
7. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D et al (2018) PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Ann Intern Med 169(7):467–473.

10.7326/M18-0850

8. World Health Organization. The Clinical use of blood in medicine, obstetrics, pediatrics, surgery and anesthesia, trauma and burns [Internet]. World Health Organization (2001) [cited 2023 Oct 1]. Available from: https://www.who.int/publications-detail-redirect/WHO-BTS-99.2
9. The World Bank World Bank Country and Lending Groups – World Bank Data Help Desk [Internet]. [cited 2024 Jun 9]. Available from: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups
10. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A (2016) Rayyan—a web and mobile app for systematic reviews. Syst Rev 5(1):210
11. Abbas S, Mughal S, Hussain SNF, Hossain N (2019) Blood transfusion and high-order cesarean delivery; Report from a developing country. Pak J Med Sci 35(6):1520–1525
12. Singh A, Shrivastava C (2015) Uterine Rupture: Still a Harsh Reality! J Obstet Gynaecol India 65(3):158–161
13. Marahatta R (2012) Retained placenta–a major cause of maternal morbidity. Nepal Med Coll J NMCJ 14(1):41–45
14. Cecilia M, Vijayaselvi R, Bansal R, Lakshmi L, Jose R (2018) Ten units intravenous oxytocin over 2–4 h is as effective as 30 units over 8–12 h in preventing postpartum hemorrhage after cesarean section: A randomized controlled trial. Indian J Pharmacol 50(5):279–283
15. Chaudhuri P, Biswas J, Mandal A (2012) Sublingual misoprostol versus intramuscular oxytocin for prevention of postpartum hemorrhage in low-risk women. Int J Gynecol Obstet 116(2):138–142
16. Chaudhuri P, Mandi S, Mazumdar A (2014) Rectally administrated misoprostol as an alternative to intravenous oxytocin infusion for preventing post-partum hemorrhage after cesarean delivery. J Obstet Gynaecol Res 40(9):2023–2030
17. Yaliwal RG, Biradar AM, Dharmarao PS, Kori SS, Mudanur SR, Patil NG et al (2020) A Randomized Control Trial of 3 IU IV Oxytocin Bolus with 7 IU Oxytocin Infusion versus 10 IU Oxytocin Infusion During Cesarean Section for Prevention of Postpartum Hemorrhage. Int J Womens Health 12:1091–1097
18. Gohil JT, Tripathi B (2011) A Study to Compare the Efficacy of Misoprostol, Oxytocin, Methyl-ergometrine and Ergometrine-Oxytocin in Reducing Blood Loss in Active Management of 3rd Stage of Labor. J Obstet Gynaecol India 61(4):408–412
19. Panda R, Pattanaik T, Panigrahy P, Sahu MC (2016) Scenario of Self Medication for Medical Abortion in a Tertiary Care Centre. Int J Pharm Sci Rev Res 39(1):63–65
20. Nivedita K, Shanthini F (2015) Is It Safe to Provide Abortion Pills over the Counter? A Study on Outcome Following Self-Medication with Abortion Pills. J Clin Diagn Res 9(1):QC01–4
21. Sarojini, Ashakiran TR, Bhanu BT, Radhika (2017) Over-the-counter MTP Pills and Its Impact on Women's Health. J Obstet Gynaecol India 67(1):37–41

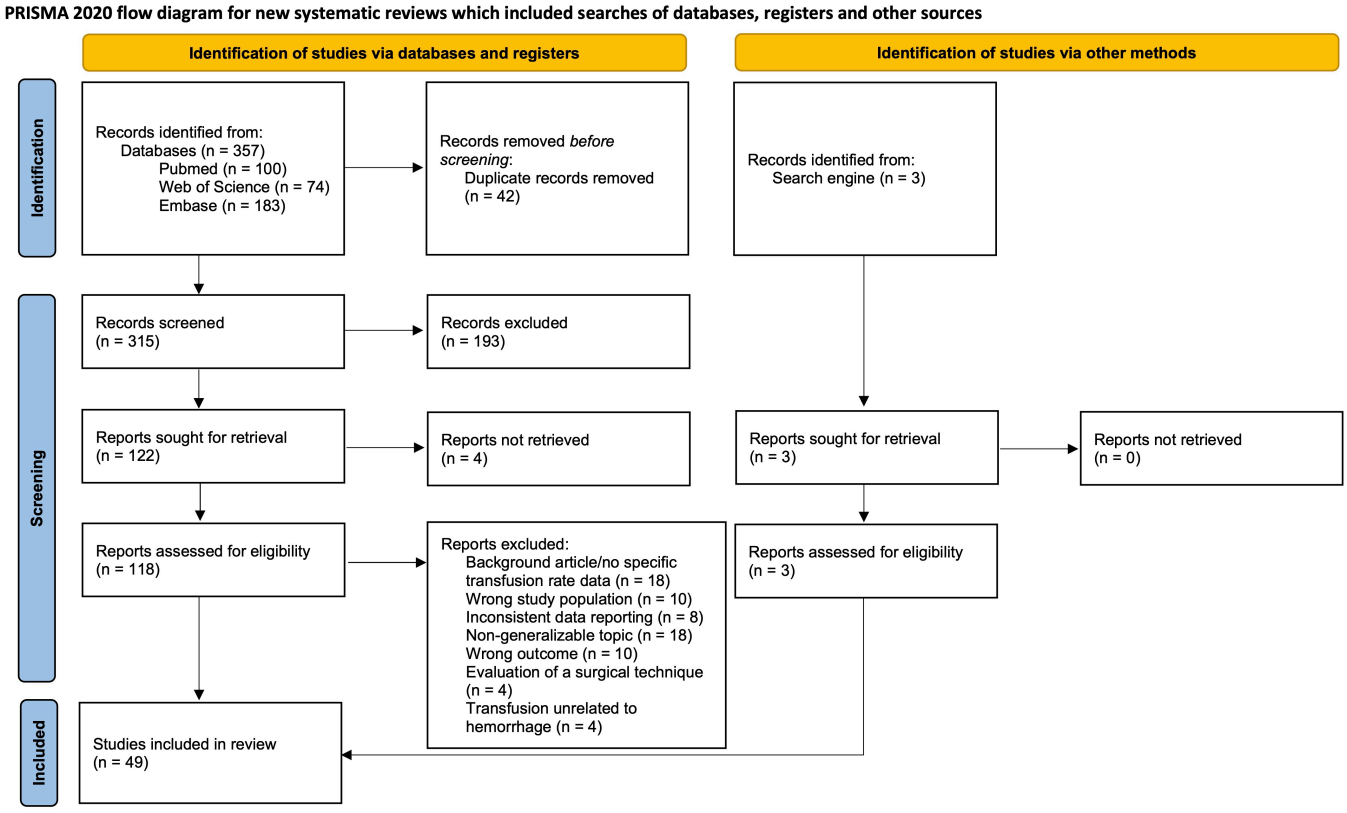
22. Srivastava M, Srivastava A, Namrata K (2018) Abortion pills as over-the-counter drugs- a boon or a curse. J Evol Med Dent Sci 7(07):820–823
23. Mohanraj U, Aruna Sundaram U (2017) Over-the-counter abortion pill and its impact on maternal health. J Evol Med Dent Sci 6(35):2888–2892
24. Gaddagi R, Chandrashekhar A (2012) A Clinical Study of Ectopic Pregnancy. J Clin Diagn Res 6(5):867–869
25. George SM, Soman A, Thankachi VJ, Bavan D (2015) Emergency laparotomy and death in ectopic pregnancy: A rarity nowadays? A descriptive study of ectopic pregnancy cases in a tertiary care Hospital. J Evol Med Dent Sci 4(12):2037–2049
26. Ranji GG, Usha Rani G, Varshini S (2018) Ectopic Pregnancy: Risk Factors, Clinical Presentation and Management. J Obstet Gynaecol India 68(6):487–492
27. Sarbhai V, Bhatacharya R, Ajmani SN, Paul M (2015) Ectopic Pregnancy: Five_Year Analysis in a Tertiary Care Hospital of Delhi. J Evol Med Dent Sci 4(102):16801–16805
28. Tahmina S, Daniel M, Solomon P (2016) Clinical Analysis of Ectopic Pregnancies in a Tertiary Care Centre in Southern India: A Six-Year Retrospective Study. J Clin Diagn Res JCDR 10(10):QC13–QC16
29. Shaikh A, Shah S (2017) A Retrospective - Two Years Study of Ectopic Pregnancy in a Tertiary Care Hospital. Med Forum Mon 28(7):75–77
30. Verma I, Priya P, Chugh C, Kaur H, Sood D (2019) Clinical presentation and outcome of ectopic pregnancies in a tertiary care rural hospital. Int J Reprod Contracept Obstet Gynecol 8(2):692–696
31. Aziz F, Ahmad R (2017) Maternal and fetal outcome in placenta praevia. Med Forum Mon 23(3):88–92
32. Trivedi K, Singh SB, Bhagat M, Kumari R (2017) Maternal and perinatal outcome in cases of placenta previa- an observational record-based study in a tertiary care hospital in Jharkhand. J Evol Med Dent Sci 6(44):3411–3414
33. Wasim T, Bushra N, Riaz S, Iqbal HI (2020) Fetomaternal outcome in patients with placenta previa. Pak J Med Sci 36(5):952–957
34. Bhatt AD, Meena A, Desai MR (2014) Maternal and Perinatal Outcome in Cases of Placenta Previa. Int J Sci Res 3(1):299–301
35. Hussain M, Azeem MI, Yusaf A, Abdul Q (2015) Evaluation of Blood Reservation and Use for Caesarean Sections in a tertiary maternity hospital in Pakistan. Pak J Med Health Sci 9(1):5–9
36. Goundan A, Kalra JK, Raveendran A, Bagga R, Aggarwal N (2011) Descriptive study of blood transfusion practices in women undergoing cesarean delivery. J Obstet Gynaecol Res 37(10):1277–1282
37. Das P, Das C (2012) O164 Placenta Percreta: Retrospective Analysis of 12 Cases Over Last 11 Years. Int J Gynecol Obstet 119(S3):S318–S318
38. Mahmood S, Iqbal N, Omer MA, Goraya MIS, Riaz AZ (2019) Urological Management of Placenta Percreta A five year Review. Pak J Med Health Sci 13(3):811–814

39. Darnal N, Dangal G (2020) Maternal and Fetal Outcome in Emergency versus Elective Caesarean Section. J Nepal Health Res Counc 18(2):186–189
40. Priyadarshini R, Saraswathi K, Kumari V (2015) Comparative study of maternal outcome in emergency versus elective caesarean section. J Evol Med Dent Sci 4(91):15637–15639
41. Suwal A, Shrivastava VR, Giri A (2013) Maternal and fetal outcome in elective versus emergency cesarean section. JNMA J Nepal Med Assoc 52(192):563–566
42. Ismail S (2019) Placenta accreta: anesthetic management and resuscitation strategies. Anaesth Pain Intensive Care 18(4):371–376
43. Malik N, Gupta A, Dahiya D, Nanda S, Singhal SR, Perumal V (2021) Caesarean Delivery in the Second Stage: Incidence, Effect, and How to Address Rising Rates. J Gynecol Surg 37(1):10–15
44. Singh B, Adhikari N, Ghimire S, Dhital S (2013) Post-operative drop in hemoglobin and need of blood transfusion in cesarean section at Dhulikhel Hospital, Kathmandu University Hospital. Kathmandu Univ Med J KUMJ 11(42):144–146
45. Kathpalia SK, Chawla J, Harith AK, Gupta P, Anveshi A (2016) Blood transfusion practices among delivery cases: A retrospective study of two years. Med J Armed Forces India 72(Suppl 1):S43–S45
46. Soni A, Sharma C, Verma S, Justa U, Soni PK, Verma A (2015) A prospective observational study of trial of labor after cesarean in rural India. Int J Gynecol Obstet 129(2):156–160
47. Kabir N, Akter D, Daisy TA, Jesmin S, Razzak M, Tasnim S et al (2015) Efficacy and Safety of Carbetocin in Comparison to Oxytocin in the Active Management of Third Stage of Labour Following Vaginal Delivery: An Open Label Randomized Control Trial. Bangladesh J Obstet Gynaecol 30(1):3–9
48. Nasreen H, Nahar S, Al Mamun M, Afsana K, Byass P (2011) Oral misoprostol for preventing postpartum haemorrhage in home births in rural Bangladesh: how effective is it? Glob Health Action ;4(1)
49. Roy P, Sujatha MS, Bhandiwad A, Biswas B (2016) Role of Tranexamic Acid in Reducing Blood Loss in Vaginal Delivery. J Obstet Gynaecol India 66(Suppl 1):246–250
50. Bano A, Saleem S (2015) Is uterine atony still a leading indication for obstetrical hysterectomy? Int J Gynecol Obstet 131(Suppl 5):E537–E538
51. Basnet P, Agrawal A, Rai R, Joshi R, Thakur A (2015) Peripartum hysterectomy and analysis of risk factors. Int J Gynecol Obstet 131(Suppl 5):E477–E478
52. Rasul S, Tahir S, Gul A, Riaz L (2015) Clinical analysis of emergency peripartum hysterectomy, a 5 years review. Int J Gynecol Obstet 131(Suppl 5):E535–E536
53. Fatima T, Qayyum F, Tabassum Z (2019) Ten Years Experience and Review of Postpartum Hysterectomy Cases in Fauji Foundation Hospital Lahore. Pak J Med Health Sci 13(1):37–39
54. Fawad A, Islam A, Naz H, Nelofar T, Abbasi UN (2015) Emergency Peri Partum Hysterectomy -- A Life Saving Procedure. J Ayub Med Coll Abbottabad JAMC 27(1):143–145
55. Tahmina S, Daniel M, Gunasegaran P (2017) Emergency Peripartum Hysterectomy: A 14-Year Experience at a Tertiary Care Centre in India. J Clin Diagn Res JCDR 11(9):QC08–QC11

56. Javed L, Haider S, Aslam S, Zia M, Wasim T (2016) Causes of Emergency Obstetric Hysterectomy in A Tertiary Care Center. Pak J Med Health Sci 10(4):1248–1251
57. Halesha B, Raju V, Chandrashekar K, Sahana K (2013) Emergency Peripartum Hysterectomy: A Retrospective Study at a Tertiary Care Hospital in Karnataka. Indian J Public Health Res Dev 4(3):103–106
58. Singh S, Shekhar C, Acharya R, Moore AM, Stillman M, Pradhan MR et al (2018) The incidence of abortion and unintended pregnancy in India, 2015. Lancet Glob Health 6(1):e111–e120
59. Tsima BM, Melese T, Mogobe KD, Chabaesele K, Rankgoane G, Nassali M et al (2016) Clinical use of blood and blood components in post-abortion care in Botswana. Transfus Med 26(4):278–284
60. Ministry of Health and Family Welfare, Government of India National Family Health Survey, India. 2021 [cited 2024 Jun 9]. National Family Health Survey (NFHS-5). Available from: https://rchiips.org/nfhs/factsheet_NFHS-5.shtml
61. Gashi A, Elshani B, Latifi H, Sopa G, Ismajli J, Sherifi A (2021) Ectopic Pregnancy - An 8-year survey. Ginekol Położ Med Proj 4(62):1–4
62. Stulberg DB, Cain L, Dahlquist IH, Lauderdale DS (2016) Ectopic pregnancy morbidity and mortality in low-income women, 2004–2008. Hum Reprod 31(3):666–671
63. Togioka BM, Tonismae T Uterine Rupture. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 [cited 2024 Jun 9]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK559209/
64. Fofie C, Baffoe P (2010) A Two-Year Review of Uterine Rupture in a Regional Hospital. Ghana Med J 44(3):98–102
65. Astatikie G, Limenih MA, Kebede M (2017) Maternal and fetal outcomes of uterine rupture and factors associated with maternal death secondary to uterine rupture. BMC Pregnancy Childbirth 17(1):117
66. Adere A, Mulu A, Temesgen F (2020) Neonatal and Maternal Complications of Placenta Praevia and Its Risk Factors in Tikur Anbessa Specialized and Gandhi Memorial Hospitals: Unmatched Case-Control Study. J Pregnancy 2020(1):1–9
67. Patterson JA, Roberts CL, Bowen JR, Irving DO, Isbister JP, Morris JM et al (2014) Blood transfusion during pregnancy, birth, and the postnatal period. Obstet Gynecol 123(1):126–133
68. Panigrahi AK, Yeaton-Massey A, Bakhtary S, Andrews J, Lyell DJ, Butwick AJ et al (2017) A Standardized Approach for Transfusion Medicine Support in Patients With Morbidly Adherent Placenta. Anesth Analg 125(2):603–608
69. Onwudiegwu U, Makinde ON (1999) Retained placenta: a cause of reproductive morbidity in Nigeria. J Obstet Gynaecol J Inst Obstet Gynaecol 19(4):355–359
70. Hossain N, Shah T, Khan N, Shah N, Khan NH (2011) Transfusion of blood and blood component therapy for postpartum haemorrhage at a tertiary referral center. JPMA J Pak Med Assoc 61(4):343–345

71. Thaddeus S, Maine D (1994) Too far to walk: maternal mortality in context. Soc Sci Med 1982 38(8):1091–1110
72. Hancock A, Weeks AD, Lavender DT (2015) Is accurate and reliable blood loss estimation the 'crucial step' in early detection of postpartum haemorrhage: an integrative review of the literature. BMC Pregnancy Childbirth 15(1):230
73. World Health Organization, United Nations Population Fund, Mailman School of Public Health (2009) Averting Maternal Death and Disability, United Nations Children's Fund (UNICEF). Monitoring emergency obstetric care: a handbook. Surveill Soins Obstétricaux Urgence Man Util. ;152
74. Knight HE, Self A, Kennedy SH (2013) Why Are Women Dying When They Reach Hospital on Time? A Systematic Review of the 'Third Delay'. PLoS ONE 8(5):e63846
75. Special Bulletin on Maternal Mortality in India 2018-20 [Internet]. Government of India; [cited 2024 Feb 14]. Available from: https://censusindia.gov.in/census.website/data/SRSMMB
76. Ministry of Health and Family Welfare Operational Blood Banks In The Country [Internet]. 2022 [cited 2024 Jun 9]. Available from: https://pib.gov.in/Pressreleaseshare.aspx?PRID=1810996

Figures



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Figure 1

Figure 1: PRISMA 2020 flow chart of the scoping review process

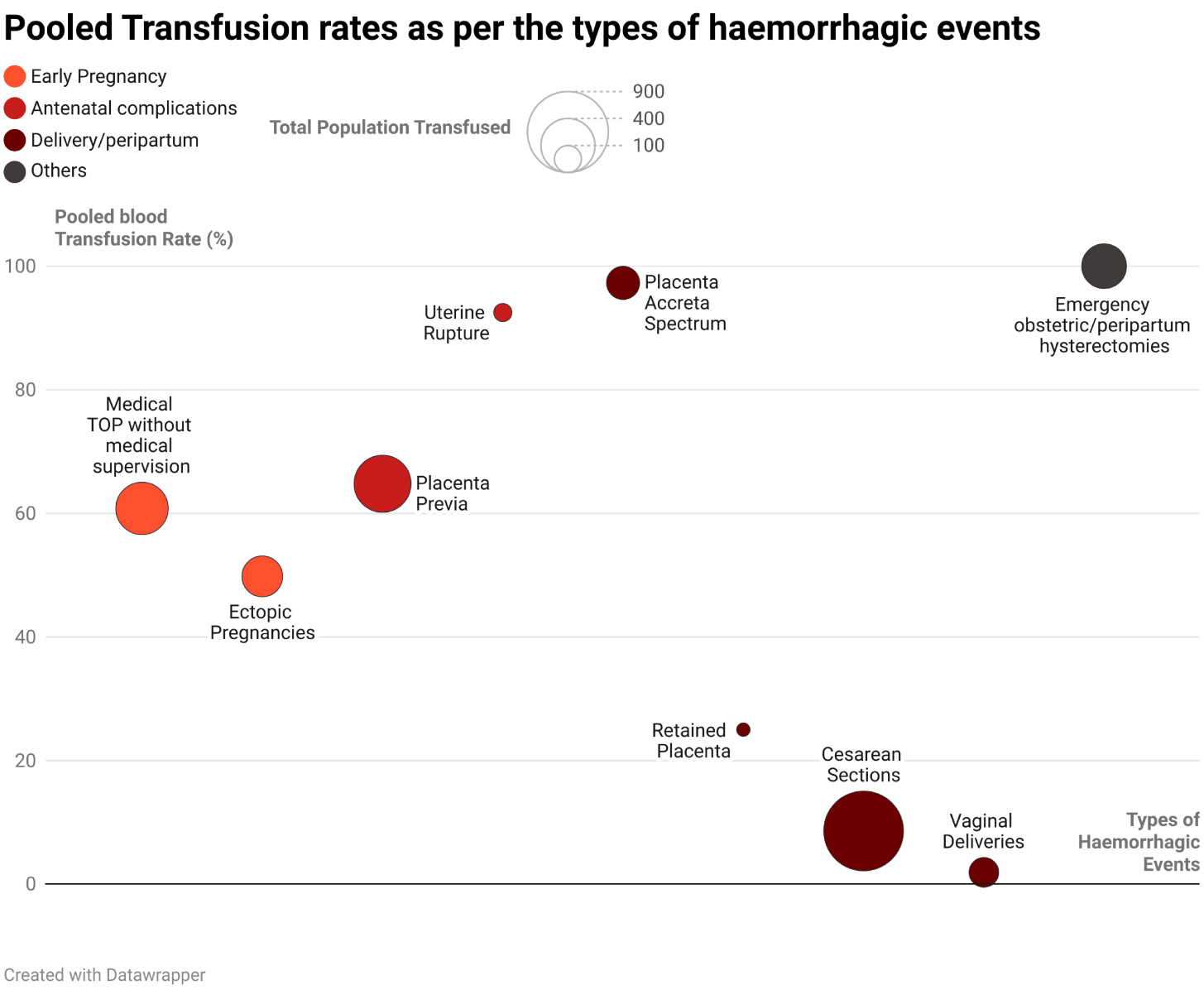


Figure 2

Figure 2: Pooled blood transfusion rates for various pregnancy-related haemorrhagic events

TOP: Termination of Pregnancy; Note: Bigger bubble sizes might indicate a higher reported burden of haemorrhagic events or more comprehensive documentation, while smaller bubbles might indicate a lower reported burden or limited documentation. Higher pooled blood transfusion rates (PTRs) may reflect greater transfusion needs, while lower PTRs may reflect lower needs or limited access to blood. Uterine rupture, though typically occurring during labour, may begin in the antepartum period and is thus

categorised as an antenatal complication in this review. Similarly, placenta accreta spectrum cases often require transfusions prior to delivery but are generally managed with caesarean sections, hence are positioned separately in the delivery/peripartum phase.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryMaterial.pdf