J. Pub. Health &Tox. Res., 1(1): 1-10 (2023)
https://jphtr.com/index.php/journal

Predisposing Influences Leading to Postpartum Hemorrhage among Mothers and Health Facility Readiness in Mbarara, Uganda

Nshabohurira Agatha, Josephine Gbobbo*, Tella Adedayo* and Turinawe Nelson*

African Centre of Excellence for Public Health and Toxicological Research, University of Port Harcourt, Nigeria.

*Corresponding Authors: Dr. Josephine Gbobbo (ewiyimina@gmail.com; Tel.: +234 803 764 0934)
Dr. Tella Adedayo (adedayo_tella@yahoo.com; Tel.: +234 706 384 1118).
Dr. Turinawe Nelson (turinawe nelson @gmail.com; Tel.: +256 772946840)

Article History

Received: 20 Jun 2023
Accepted: 28 Jun 2023
Published: 01 Sept 2023

Abstract

Background: Globally, maternal mortality has remained unacceptably high with postpartum hemorrhage as the leading cause of maternal deaths All mothers are at risk of postpartum hemorrhage but there are predisposing influences that increase the risk of the mothers having postpartum hemorrhage or dying from it.
Objectives: The aim was to investigate the predisposing influences to postpartum hemorrhage in Mbarara and establish health facility readiness.
Methods: In this descriptive cross-sectional study that was quantitative in nature, 88 mothers attending postnatal care clinic at six weeks and had experienced postpartum hemorrhage in their recent childbirth were enrolled from six Health facilities. Researcher administered questionnaire was used to collect quantitative data.
Results: Majority of the mothers,71 (80.7%) were aged 20-34 years; 69 (78.4%) had attended antenatal care clinic more than four times. The obstetric factor predisposing mothers to postpartum hemorrhage were mainly prolonged labour 57 (64.8%) and multiparous without caesarian section were 41 (46.6%). Only 50%of health facilities assessed were ready to manage postpartum hemorrhage.
Conclusion: The majority of the mothers who experienced postpartum hemorrhage had prolonged labour which could be explained by the three-delay model. Therefore, Health workers need to work continually to ensure that delays at all levels are reduced.

Keywords: Postpartum hemorrhage, mothers, Predisposing influences

How to cite this paper: Nshabohurira, A., Gbobbo, J., Adedayo, T., & Nelson, T. (2023). Predisposing Influences Leading to Postpartum Hemorrhage among Mothers and Health Facility Readiness in Mbarara, Uganda. *Journal of Public Health and Toxicological Research*, *1*(1), 1–10.

Introduction

Globally maternal mortality stands at 211 per 100,000 live births. Maternal mortality remains unacceptably high worldwide with approximately 810 mothers dying on daily basis. Maternal deaths occur due during pregnancy, labour, delivery and postpartum period. Majority of these deaths 94% happened in low-income countries, and these deaths could be averted with improvement in the quality of health care services (WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division, 2019).

The ratio of maternal deaths in Uganda has had a slow decline from 438 /100,000 in 2006 to 336/100000 live births in 2016 (UDHS, 2016). One of the global health priorities is to reduce the maternal mortality ratio from 223 per 100,000 to less than 70 per 100000 in accordance with the United Nations 2030 Sustainable development Goals (WHO, 2019). Excessive bleeding still accounts for most of maternal deaths happening worldwide and is the cause of poor health among mothers even in the United States of America (Corbetta-Rastelli, Friedman, Sobhani, Arditi, Goffman & Wen (2023). Studies done in Africa shows that postpartum hemorrhage is one of the leading cause of morbidity among women of childbearing age Excessive bleeding is one of the top leading causes of serious sickness when mothers are hospitalized for child birth and even causes death and is the number one cause of severe morbidity during hospitalization for birth and even death. It's been noted that most of the mothers dying due to postpartum hemorrhage 90%, could be averted by implementing high impact quality interventions (WHO, 2019). Reducing the preventable obstetric hemorrhage cases will translate into

decline in maternal deaths (Bazirete, Nzayirambaho, Umubyeyi, Uwimana, & Evans, 2020).

Studies have been made on the predisposing influences on postpartum hemorrhage (PPH) in different parts of the world. It has been noted that every woman is at risk of postpartum hemorrhage but there are factors which increase the risk and these may require both the health worker and mother to keep alert and on the lookout. Studies conducted over time indicate that predisposing influences for postpartum hemorrhage include past history of excessive bleeding after birth, maternal age above 35years, Hypertensive disorder, prolonged labour, precipitate labour, multiparity, HIV/AIDS, fibroids anemia and lack of Antenatal care follow up (Marshal & Raynor, 2020). Mothers with above conditions face a greater risk of postpartum hemorrhage than those without. In this study we will look at the individual non obstetric factors such as age, parity, and distance from Health facility and antenatal care follow-up. As already noted, the risk of postpartum hemorrhage increases with age. Mothers who are 35years and above are at a high risk of excessive bleeding after birth. The other factor is the parity of the mother (Habitamu, 2022). Multiparous mothers have greater risk of experiencing of postpartum hemorrhage compared to their counterparts with low parity. Studies have also shown that mothers staying within 5km radius from the health facility are at a better chance of surviving postpartum hemorrhage morbidity and mortality once it has set in. Antenatal care is very vital in prevention of postpartum hemorrhage. However, it has been neglected by both the mothers and the midwives. The mothers tend to attend few antenatal sessions but even those attends tend to get a package that is not complete. When there is poor antenatal care follow up, its effects will manifest through the different levels of cascade of care (Tolossa, Fetensa, Zewde, Besho, & Jidha, 2022).

Taking a look at the obstetric factors predisposing mothers to excessive bleeding after child birth, include mainly prolonged labour, precipitate labour, twin or multiple pregnancy, polyhydramnios, anemia, macrosomia, not initiating breast feeding, HIV and hypertensive disorders. Normal labour usually lasts 8-12 hours. When it stretches beyond this it becomes prolonged labour. It involves overstretching of the uterine muscle leading to inability for the uterus to contract and seal off the wound at the placenta site attachment thus excessive bleeding (Nigussie *et al*., 2022).

Conversely when there is precipitate labour (happening within three hours), then there is overstimulation of the uterine muscle again leading to inability for the uterus to contract. Another obstetric factor is multiple pregnancy. This again has to do with having the uterus overstretched that it contracts sluggishly. Studies have shown that multiple pregnancy increases the risk of postpartum hemorrhage. The other condition putting the mother at risk is polyhydramnios, which also overstretches the uterus reducing its ability to contract. Midwives must prepare adequately, before conducting delivery of such mothers because the risk of excessive bleeding is paramount. Mothers with hypertensive disorders are also prone to postpartum hemorrhage. It has also been noted that mothers living with HIV are more prone to postpartum hemorrhage and likewise those with anemia even if it is mild. The obstetric factors are having a big baby (macrosomia) and being not able to initiate breastfeeding immediately (Marshal & Raynor, 2020). There is need to look at the health facility factors that have an effect on the morbidity and mortality due to postpartum hemorrhage. Areas of focus in the health facility include the competences and skills of Health care workers, availability of guidelines, whether health workers get regular trainings and mentorship, adequate staffing, availability of supplies and strong referral system. There is need to ascertain that health facilities are prepared to handle obstetric emergencies promptly and appropriately. This information may be used to improve health care messages given to mothers during antenatal care visits to improve quality service delivery. Postpartum hemorrhage is widely known as the most known type of obstetric hemorrhage and contributes to for the majority of the 14 million cases that occur each year worldwide. Research findings show that postpartum hemorrhage accounts for 60%of the maternal deaths in developing countries. Prevalence of Postpartum hemorrhage in Sub- Saharan Africa stands at 10.5%.

PPH in Uganda accounts for 39% of all the maternal deaths that happen in the country and prevalence stands at 6% It has been noted also that one in three pregnant women in Uganda are anemic and this puts them at 50% risk of PPH. In the Ankole Region where the Mbarara district is found, PPH accounts for 39% of all maternal deaths. However, the burden PPH contributes to both maternal morbidity and mortality is not clear.

According to the District Health Information Management System, about 62% of pregnant women attended Antenatal care (ANC) at least one visit during their pregnancy period. This shows that many women are not accessing the vital ANC services as required especially those aimed at reducing the risk of postpartum hemorrhage. Low ANC attendance hinders the mother from receiving a comprehensive packaged that includes Iron supplementation, health education on diet and deworming that is deemed important for her health and that of the baby.

The Ministry of Health with guidance from WHO has built the capacity of health workers on how to prevent, detect and manage PPH especially during childbirth and made sure that emergency medicines and supplies are available; there could be gaps in the health care system that have continued to impact on the PPH related deaths. Despite all these interventions put in place, deaths due to PPH have stagnated over the last 3 years in Ankole region at 29% in 2018, 45% in 2019 and 39% in 2020. The stagnation in reduction of deaths caused by PPH could have been to specific predisposing influences not being attended to. There is limited information about the predisposing influences in Mbarara District and this may affect the way they are addressed. There is need to understand what mothers go through and use information to fine tune messages for sensitizing communities. Inadequate information may hinder patient centered care and effective community sensitization despite the fact that postpartum hemorrhage, its risk factors and lived experiences of survivors have been studied in different parts of the world, there is limited research done in southwestern Uganda. This research would add to knowledge about PPH in Mbarara and may be improve quality of services offered.

Methodology

Research Design

This was a descriptive quantitative cross sectional study. Mothers attending postnatal care who survived postpartum hemorrhage participated in the study.

Study Area
The study was conducted in six Public Health facilities in Mbarara District and Mbarara city. The health facilities include; Mbarara Municipal HCIV, Kakoba HCIII, Bwizibwera HCIV Rubindi HCIII, Kagongi HCIII and Rubaya HCIII. Mbarara is in Southwestern Uganda about 300km from the Capital Kampala. It has a total population of over 379000 people.

Population for the study
Study population is postnatal mothers coming to the Health Facility at 6 weeks for postnatal care who experienced postpartum hemorrhage. A sample was drawn from the population using a formula as highlighted below.
-Sample size is calculated using a standard formula (Kish, 1965) for an infinite population

Giving a sample size of 87.
Ten percent (10%) allowance was added for non-response.

Therefore, this would make the sample size: 87 + 9 = 96 mothers.

Target population for this study are women attending postnatal care at 6 weeks who experienced postpartum hemorrhage during their most recent child birth.

Sample and Sampling Techniques
Participants were identified using purposive sampling from the postnatal clinic. Mothers attending postnatal clinic at 6 weeks were identified purposively.

Inclusion criteria
1. Mothers attending postnatal care at 6 weeks a Public Health facility in Mbarara and experienced postpartum hemorrhage during the recent child birth
2. Mothers that experienced post-partum hemorrhage in the last six days

Exclusion criteria
1. Mothers who came for postnatal care but were not residents of Mbarara.
2. Mothers who experienced excessive bleeding before childbirth

Methods of Data Collection/ Instrumentation The researcher used a semi -structured questionnaire to get information from the participants and it was, researcher administered. The Research Assistant completed the Researcher administered questionnaire 96 mothers expecting to respond to the questions in the questionnaire and instead 88 responded. The questionnaire included three sections: the demographic section, non-obstetric factors and the obstetric factors. Health facility checklist was used to assess health facility readiness to prevent or manage postpartum hemorrhage.

Validity of Instrument
The Researcher made sure that the instrument was submitted to the Research supervisor for review by the Researcher Supervisor and corrections were made as guided and confirmed for face and content validity of the data collection tools. Research Assistants were trained and data collection tools translated to the local language.

Reliability of the Instruments
The reliability of the instrument, which is ability of its consistency or stability, was determined using Cronbach Alpha. First, eight (8) copies of the questionnaire were administered to eight women that is 10% of the sample size and these women are not part of the research participants. These were women of the same characteristics in a different community. The data collected was used to assess for reliability using the Pearson Moment Correlation Coefficient and a reliability index of 0.8 which proved the instrument reliability

Data analysis
Quantitative data was collected to identify the predisposing influences of PPH and the data collected was manually checked to ensure that they are complete and consistent. Data was entered into an open data toolkit (ODK) and exported to STATA version 15 (Stata Corp, Texas, USA) for analysis. Individual non obstetric factors, obstetric, non-obstetric characteristics for study participants and health facility factors were described as frequency of occurrence.

Ethical considerations
The Research proposal was submitted to the University of Port Harcourt for onward submission to the Research Ethics committee for approval before data collection can commence and the approval was received allowing the researcher to go ahead and collect data.

The researcher also submitted her proposal to the 'Mbarara University of Science and Technology Research Ethics committee in Uganda for review and approval and approval to collect data in the area.

The Researcher ensured that participants first sign an informed consent before participating in the study. Participating in this study was voluntary and there was no penalty for anyone who declines from participating in the study. Consent for voice recording was also taken and ensure that data collected both written and audio were kept under key and lock to be accessed by the researcher and the supervisors and the data will be kept for five years. Confidentiality and anonymity were observed at all times.

Research clearance letter was sought from the District Health officer to carry out research in the area and also obtain permission from the health facility in- charge to conduct the study in the selected health facilities.

Results

This section covers findings under individual non obstetric fact obstetric factors and health facility factors.

Individual
A total of 88 mothers from six public health facilities in this study in Mbarara District and Mbarara City participated in the study. The distribution of individual non obstetric factors is as detailed in Table 1.

Majority of mothers 71(80.7%) who responded in this study were 20-34years of age. It was noted that 77 % were married and 78.4% of them were Banyankole. The most dominant religions were Catholicism and Anglican. Findings showed

that majority 53(60.2%) of the mothers interviewed were living in the 5km radius from the health facility.

Table 1: Individual non obstetric factors of study participants (N=88)

Variable	Frequency (n)	Percent (%)
Age in years		
<20	10	11.4
20-34	71	80.7
≥35	7	8.0
Marital status		
Married	77	87.5
Single	8	9.1
Separated	3	3.4
Religion		
Catholic	35	39.8
Anglican	29	33.0
Muslim	13	14.8
Seventh Day Adventist	5	5.7
Others	6	6.8
Tribe		
Munyankole	69	78.4
Mukiga	10	11.4
Muganda	6	6.8
Others	3	3.4
Location of mother's residence		
Within 5km to hospital	53	60.2
≥ 5km to hospital	35	39.8

Obstetric influences predisposing mothers to postpartum hemorrhage

Results in this section are summarized in form of tables, graphs and charts. Table 2 shows the distribution of different variables predisposing mothers to postpartum hemorrhage.

Most of the mothers who had experienced postpartum hemorrhage 41(46.6%) were multiparous without history of caesarian section. Majority of the mothers 69 (78.4%) had attended antenatal care more than 4 times during pregnancy.

It was noted that, 16 (18.2%) of women had gestational hypertension. Those that had anemia during pregnancy were 6(6.8%) and 7(8%) were living with HIV/AIDS. Majority of the mothers 83 (94.3%) had a singletone pregnancy and 77.3% had spontaneous vaginal delivery. Mothers who had a caesarian section were 20(22.7%) and 32 (36.4) were referred to another health facility.

Figure 1 shows the progress of labour among mothers who had experienced postpartum hemorrhage.

From figure 1, it was noted that 57(64.8%) of the mothers had prolonged labour 10(11.4%) had precipitate labour and 21 (23.8%) had normal labour.

Mothers were also interviewed about the birth weight of their babies (most recent baby) whom they were delivering when they experienced the postpartum hemorrhage.

Figure 2 summarizes the birth weights of babies born to mothers who experienced postpartum hemorrhage.

Majority of the mothers 62(70.5%) breast fed their babies within one hour of life and 26(29.5%) were not able to breastfeed within 1hr.

Table 2. Obstetric factors of study participants (N=88)

Variable	Frequency (n)	Percentage (%)
Parity		
Multiparous without caesarian section	41	46.6
Non multiparous	31	35.2
Multiparous with caesarian section	16	18.2
Antenatal care attendance		
No visit	0	0
One to three visits	19	21.6
Four or more visists	69	78.4
Gestational hypertension	16	18.2
Anemia in pregnancy	6	6.8
HIV/AIDS in pregnancy	7	8.0
multiple or twin pregnancy	5	5.7
Singleton pregnancy	83	94.3
Spontaneous vaginal delivery	68	77.3
Caesarian section	20	22.7
Referred to another health facility	32	36.4

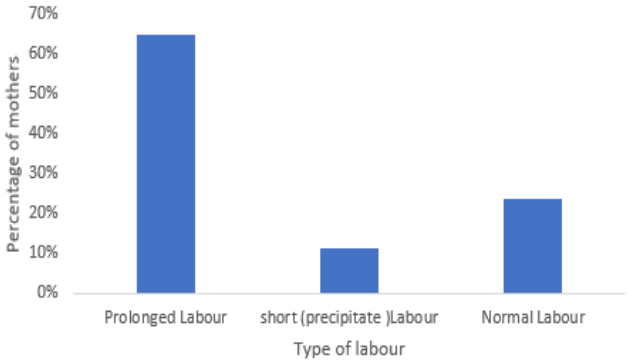


Figure 1: Progress of labour for mothers who experienced PPH

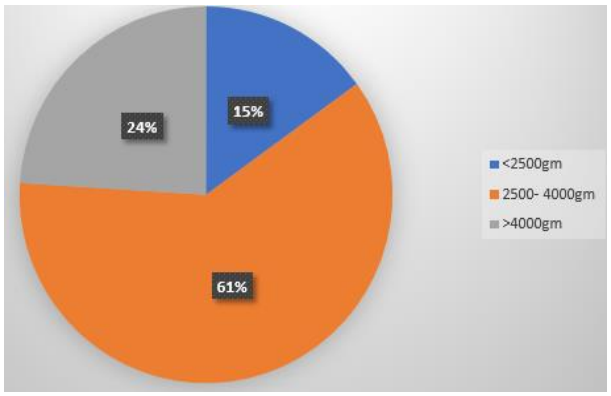


Figure 2: Pie chart showing birth weight.

Health facility readiness

All health facilities had oxytocin and misoprostol but none had the heat stable carbetocin (Table 3). The two Health Centres had IVs blood products available during the data collection period to the health facility. Only one out of six health facilities

lacked Intravenous fluids. Only 1(16.7%) of the health facilities had the anti-shock garment and tranexamic acid. Concerning the PPH preventive measures, all Health facilities were giving iron supplements and deworming mothers who attended ANC. Health education on nutrition during pregnancy was given in all Health facilities. However only 3 (50%) of the health facilities were able to do haemoglobin estimation for mothers attending antenatal care services. As far as the knowledge and skills of Health workers were concerned, all health facilities had the current guidelines, 4(66.7%) of them had had continuous medical education in the last 6months and only one had a training for the staff and a mentorship in the last one year.

Table 3: Availability of supplies, medicines, and health services essential for prevention and management of post-partum haemorrhage at health facilities (N=6)

Variable	Frequency	Percentage
Uterotonic drugs available		
Oxytocin	6	100
Carbetocin	0	0
Misoprostol	6	100
PPH management measures available		
IV fluids	5	83.3
Blood products	2	100
Anti-shock garment	1	16.7
Tranexamic acid	1	16.7
PPH prevention measures available		
Iron supplementation	6	100
Deworming	6	100
Health education on nutrition during pregnancy	6	100
Hb estimation during pregnancy	3	50
Knowledge and skills of health workers		
Availability of PPH guidelines	6	100
Held CMEs on PPH in the last six months	4	66.7
Training on PPH in the last one year	1	16.7
Mentorship on PPH	1	16.7
Availability of skilled staff		
24-hour coverage	6	100
Staffing adequate as per staffing structure	2	33.3
Emergency preparedness		
Complete emergency tray with checklist	5	83.3
Skilled health workers to manage PPH	6	100
Standby transport means/ambulance	3	50

All health facilities had staff coverage across the 24 hours, although the staffing was as low as 33.3% concerning readiness and preparedness five Health facilities had a complete emergency tray with a check list updated. Health workers were skilled to manage PPH, however there was a challenge of a standby means of transport for referral. Only 3(50%) Health facilities had a standby means of transportation or ambulance to take patients to the next level when referred.

Discussion

Non obstetric factors predisposing mothers to postpartum hemorrhage

Under the non-obstetric factors there was location of mother's residence, their age, religion and tribe. In this study majority of the mothers 71(81.7%) who experienced postpartum hemorrhage were aged 20-34 years. This shows that even young mothers are at risk of postpartum hemorrhage. In this study it was noted that It was found out that most mothers 53(60.2%) lived within 5km radius from the health facility and 35(39.8%) outside the 5km radius from the health facility. This shows that access to basic emergency obstetric services was averagely better. This could have greatly contributed to the survival of these mothers, since most mothers were travelling a short distance from their homes to the health facility. This could have contributed to the survival of these women since postpartum hemorrhage is very fatal. Concerning the religion, mothers who had experienced excessive bleeding there was almost equal distribution across the dominant faith. That means that mothers across different religions were at risk of PPH in Mbarara. In this study most of the participants 69(78.4%) were Banyankole by tribe, this was in line with the normal distribution in the Mbarara population. A geo-referenced cross-sectional study conducted in Rutsiro district in the Western province of Rwanda with a sample size of 360 mothers revealed that mothers within 5km radius form the health facility were more likely to attend Antenatal care four times than those from afar. For every 1km away from the health facility there would be 19% declined in attendance. Limited attendance to antenatal care meant missing out on some important services (Dusingizimana *et al*., 2023). For mothers therefore staying a long distance from the health facility, there is a risk of missing out on some of the Antenatal services that would be helpful in the bid to reduce the risk of obstetric hemorrhage.

Obstetric factors predisposing mothers to postpartum hemorrhage

The factors under this section are those identified during pregnancy, such as parity, number of Antenatal visits gestational hypertension, anemia and HIV/AIDS. There are those that we focus on during labour and delivery that included progress of labour and the type of delivery. After delivery the birth weight of the baby and whether breast feeding was immediate (within one hour) were also assessed. Most of the mothers interviewed were multiparous without cesarian section 41(46.6%), non-multiparous were 31(35.2) and multiparous with previous cesarian section were 16(18.2%). This study finding is in harmony with the research conducted in India. An observational prospective study conducted in India revealed that of mothers who got postpartum hemorrhage, 50% were multiparous women (Muhal *et al*., n.d.). In this study 65% of the mothers who got postpartum hemorrhage were multiparous. This could mean that risk increases with parity. In understanding this finding more, it's important to note that multiparity therefore increases chances of the risk of postpartum hemorrhage. This is because through every pregnancy the uterus stretches, and during labour and delivery contracts and maintains ability to contract. However, as it overstretches over a given number of pregnancies, it loses

contractability. This puts mother at risk of post-partum hemorrhage. However, it can't be under estimated that of the mothers who experienced postpartum hemorrhage 35.2% of them were delivering for the first time. This is an eye opener for Health workers to keep alert and prepared knowing that every mother no matter the parity is at risk and give the prime gravidas special attention.

Antenatal care attendance was good, given that most of the mothers 69(78.4%) had attended more than four times. All mothers had attended antenatal care clinic at least one with 19(11.6%) attending one to three times during the pregnancy period. Studies conducted elsewhere in Ethiopia and Nigeria showed that antenatal care attendance reduced the risk of PPH. (Tolossa *et al*. 2022). This poses a big challenge on the quality of antenatal care services being offered since majority of mothers who had PPH had attended regularly in the public Health facilities where the antenatal care services were being offered. It could be that the mothers may not have got a comprehensive package during antenatal care period. Mothers are presumed to have received a few services during antenatal care period that may not be protective enough. From the in-depth interviews conducted, mothers lacked knowledge on postpartum hemorrhage, most of them didn't know about risk factors of PPH. In this regard therefore, mothers could have attended antenatal care and missed out on the key interventions such as interactive Health education sessions, hemoglobin estimation and iron supplementation. World Health Organization recommends eight visits as the standard visits a mother should attend antenatal care. However according to this study, the number of times for attending care are only helpful if the mother receives a comprehensive package. The comprehensive package includes Nutritional counseling; general health education talks; screening key diagnostic tests;(HIV, Syphilis and Hepatitis); other laboratory tests (Hemoglobin estimation, blood grouping, and urinalysis; giving out iron supplements, providing intermittent prophylaxis therapy (IPT) for prevention against malaria; deworming; physical assessment of the mother and fetal well-being. there were gaps in the health care system during labour and delivery.

This study found out that 16(18.2%) of mothers had gestational hypertension and this could have increased their risk of postpartum hemorrhage. Gestational hypertension increases chances of postpartum hemorrhage and therefore it's important for mothers to be aware about it and take appropriate caution to deliver in Hospital under the care of skilled birth attendants. With this percentage of mothers with gestation hypertension, it's also important to note that screening for hypertensive disorders should be intensified and necessary measures adhered to. There is also need for creating community awareness and sensitization so that people are empowered to recognize the signs early, seek appropriate care and provide support for mothers at risk. Since hypertensive disorders and complications are the leading causes of maternal mortality, it is important to know or also find out the risk factors in common among these mothers, so that the underlying cause is appropriately addressed (Ononge, 2016). In relation to research conducted elsewhere gestational hypertension puts mothers at risk of postpartum and remains prevalent. This is in line with a case control study conducted in China where by mothers with hypertension were followed up in comparison with healthy mothers by doing regular platelet count tests over the pregnancy period and it was noted that in the hypertensive mothers there was abnormal coagulation along the progress of pregnancy compared to those healthy mothers (Li, Liu, Yun, Song, 2022). In this study, the research was not able to compare this prevalence of gestational hypertension with the health mothers but this can further be studied.

It was noted by the Researcher that 6(6.8%) of mothers had anemia during pregnancy. Although this study was not able to assess the severity of the anemia during pregnancy, it's important to note even mild anemia predisposes mothers to postpartum hemorrhage. A cross sectional study was conducted in Kisugu HCIV among the pregnant women and revealed that 28.5% of them had anemia (Mahamoud, Mwambi, Oyet, Segujja, Webbo, Okiria, & Taremwa 2020). Also a cross sectional study conducted in 2016 in Mbarara Regional Referral Hospital revealed that prevalence of anemia in mothers attending antenatal care clinics was 62.5%. This was quite high prevalence, may be also due to the hospital being a referral site for specialized services. In this regard it is still very important to note that anemia is still prevalent and extra caution required for the mothers by the health care providers (Hamson, Ngonzi, Julius, Emmanuel, & Ronald, 2016). A cohort study conducted in America in women of gestational age less than 23 weeks revealed that even mothers with mild anemia of 10g/dl to 10.9g/dl were at risk of postpartum hemorrhage. So, this shows that no matter the grade anemia is at it could lead to postpartum hemorrhage. (Burwick *et al*., 2022) This study has therefore revealed that 6.8% of mothers who experienced postpartum hemorrhage had anemia in pregnancy. This proportion may go even higher since in this study only mothers whose hemoglobin estimation done were noted. There are some women whose Hemoglobin estimation was not done during their recent pregnancy. This result therefore calls for deliberate effort to improve Hemoglobin estimation for mothers during the antenatal period, sensitize them about the risk for the same and improve on nutritional counselling and other propylitic support like deworming and intermittent preventive therapy against malaria especially in highly endemic areas.

It was observed that 7 (8%) of mothers who participated in the study were HIV positive. Prevalence of HIV in antenatal is 6.4% in Uganda and there are issues around disclosure of the HIV status to spouses and the important others (Ngonzi, Mugyenyi, Kivunike, Mugisha, Salongo, Masembe, & Bajunirwe, 2019). In this study the number of mothers who experienced postpartum hemorrhage 8% of them were HIV positive and may be could be more since some mothers may fear to disclose to the Researcher their HIV status. This calls for intensive screening for all mothers for HIV and those found to be HIV positive supported to have a safe delivery and uninterrupted postnatal care period. Mothers in this study who were HIV positive and go postpartum care may not have received any special health care support to prevent postpartum hemorrhage because this aspect has not been well emphasized. The chances of maternal death from PPH when the mother was infected with HIV was well over 50%. This is because HIV increases the risk of antepartum infection, it is plausible that body temperature was a marker of intrapartum infection, such as chorioamnionitis, which increases the risk uterine atony and postpartum hemorrhage. Therefore, in the care for mothers living with HIV, let there be deliberate efforts to prevent and control postpartum hemorrhage and let the mothers be enlightened about the possible risks involved.

Majority of mothers 68(77.3%) who had experienced postpartum hemorrhage had had singleton pregnancy. Although other studies have shown that multiple pregnancy increases the risk of postpartum hemorrhage, in this study, it shows that even more mothers with singleton pregnancy are getting postpartum hemorrhage. A case control study in Rwanda that recruited 430 mothers revealed that multiple pregnancy had a significant contribution towards a mother having postpartum hemorrhage (Bizarete *et al*., 2022). This study revealed the fact that even mothers with singleton pregnancy are at risk and the risk could be due to other factors that this study is looking at. This still calls for Health workers to try and detect mothers with high risk early but also not neglect those who seem not to be at risk.

It has been noted that 32(36.4%) of the mothers who participated in this study had been referred to another Health facility. This could have been due to prolonged labour or any other complication that finally drove them into postpartum hemorrhage. Mothers were usually referred to a higher-level facility in case they needed interventions not offered at that level like Cesarian section and blood transfusion. However sometimes a Health facility may have skilled personnel but lack medicines and other emergency supplies. It has been noted also that sometimes the newborn may need referral necessitating that the mother is moved with the baby to a higher-level facility. This may compromise the healing and recovery of the mother predisposing the mother to more risks. A qualitative study conducted in Tanzania revealed that lengthy referrals increased the risk of postpartum hemorrhage. This was made worse if the health facility receiving the mother was not ready to receive due to medical supply challenge (Albeity, Pembe, Kwezi, Massawe, Hanson & Baker, 2019). There were still challenges with the referral system given the fact that of all the health facilities followed up only 50% had a stand by means of transport or ambulance. This increased the delay to reach the health facility.

In case of labour progress, most mothers 57(64.8%) reported to have had prolonged labour whereas 10(11.4%) had precipitate labour and 21(23.8%) had normal labour. This could be an indicator that labour monitoring by Health worker was not being done well. It is possible that majority of the mothers who got PPH got it because of this prolonged labour. When a mother experiences prolonged labour, there is an effect on the uterine muscles. They tend to be sluggish reducing their contractibility after child birth. It could also be explained by the possibility that the pronged labor raised the danger of laceration to the pelvic blood vessels and soft tissue. This significantly lessened the ability of the uterus to contract. This in turn caused uterine atony, the leading cause of PPH in the majority of mothers. May be if monitoring was being done well Health workers would have taken appropriate action on time. There should have been no reason of monitoring a woman more than 12 hours in labour without taking action. However poor monitoring could happen may be due to lack of skills in labour monitoring; poor documentation on the partograph and may be disorganized handover system from one shift to another. It could also be due to the fact that the mother coming to the health facility late gave wrong information about the onset of labour that affects the whole labour monitoring process. A study conducted in Ethiopia revealed that prolonged labour was among the most significant factors contributing to postpartum hemorrhage (Zenebe *et al*., 2023). It could be that mothers could have delayed to reach the health facility, started laboring from home and stayed there waiting may be to get support from their husband or wanting to reduce the Hospital stay. In this study prolonged labour was one of the major factors predisposing mothers to postpartum hemorrhage. It was also bought out even in the qualitative part of the study that looked at lived experiences of survivors. It was also noted that 11.4%of the mothers who got postpartum hemorrhage had precipitate labour. This is a key finding although this research didn't go in the detail to find out the cause of this precipitate labour. Precipitate labour is known to cause uterine atony. However, a study conducted among primigravidae in Cameroon showed that there was no significant relationship between duration of labour and postpartum hemorrhage. It was also noted that this induction of labour and augmentation had no effect of causing postpartum hemorrhage.

In this study, 24% of the mothers had macrocosmic babies (>4000mgs). Having a big baby or multiple pregnancy causes overstretching of the uterus and affects its ability to contract predisposing mothers to postpartum hemorrhage. These mothers were already at risk of PPH and may need to be counseled by Health worker to opt for delivery by C-section contrary to vaginal delivery. Cesarean section would be helpful because it reduces the work of the uterus contracting and retracting. A study conducted in France, enrolled all women who had attempted to have a vaginal birth for a baby of 4000gm or more and found that they were more prone to postpartum hemorrhage than those who were giving birth to smaller babies. The risk was however reduced if it was not the first time, they were delivering vaginally a big baby (Fuchs *et al*., 2013). This is important to note that these mothers could have got postpartum hemorrhage due to delivering of a big baby. This may call for counselling and support for mothers whose estimated birth weight could be more than 4000gms. They should be counselled appropriately and supported to choose the safest mode of delivery.

Concerning breast feeding within the first hour of life, 62(70.5%) of mothers were able to breast feed with in the first hour of life. As per the World Health organization standards all mothers, should breastfeed their babies immediately after birth. Almost 30% of the mothers were not able to breast feed immediately, this could be due to the complications encountered after delivery or it could be due to the fact that mother has not been supported by Health worker to initiate breastfeeding. Both ways the baby missed the nutritious colostrum and the mother missed the natural release of natural oxytocin. This could have greatly contributed to the survival of these women since breastfeeding increases release of oxytocin that causes the uterus to contract thus preventing postpartum hemorrhage. In general research has shown that skin-to-skin contact and prompt initiation of breastfeeding may be the most the reliable avenues to reduce risk for postpartum hemorrhage and increase likelihood of long-term exclusive breastfeeding (Davis & Nelson, n.d.). Early initiation of breastfeeding not only allows the baby to access the nutrition colostrum but also stimulate oxytocin that supports contraction the uterus and reduces bleeding.

In view of the above discussion, prolonged labour seemed to be the major catalyst for postpartum haemorrhage in the obstetric factors focused on in this chapter and this meant there was need to improve the quality of care offered to all mothers.

Health facility factors

All Health facilities had oxytocin and misoprostol but none had the heat stable Carbetocin. This was because it had not been supplied through the National supplies system like was done for other drugs. Carbetocin would be helpful especially for health facilities with unstable power supply. Oxytocin is a uterotonic drug used in prevention and management of PPH and must be kept in cold chain. Misoprostol is also uterotonic used in management of postpartum haemorrhage. Availability of these uterotonics that at least mothers were able to get prophylactic treatment against PPH during birth and that these health facilities can support to stabilize a mother experiencing postpartum haemorrhage. Heat stable Carbetocin is meant to be at Heat stable uterotonic to be used in remote areas where cold chain is not available. It has not been widely used in the public health facility because of its cost. Having uterotonics and administering them appropriately in controlling and preventing postpartum haemorrhage has great impact on the mother and conversely the baby.

The two Health Centre IVs that had blood products available at the time of the visit to the health facility that meaning that, these facilities were set to give transfusion for mothers who have experienced PPH. Only one out of six health facilities lacked Intravenous fluids. This meant that this health facility was not prepared to handle obstetric emergency especially postpartum hemorrhage. This could be due to the fact that there was a stock out following limited supply by the National medical stores. Only 1(16.7%) of the health facilities had the anti-shock garment. This was a gap, although the innovation was new, it should be wide spread so that it would help to control bleeding during transit to a referral health centre or as the medical team prepares. Availability of the garment is important as more health workers know how to use it. A study done in Ethiopia showed that only 59% of the health workers were able to fix the anti-shock garment when needed to intervene (Gashaw, Tefera, Assefaw, Temesgen, Ayalew, Dessie, Berihun, & Habtie, 2023). There fore, as focus is put on acquiring the equipment, all health workers must be trained so that once they are available at the Health facility, they are ready for use especially in referral or as the mother waits for Specialist review or intervention.

In this study only one Health facility out of six had Tranexamic acid. Tranexamic acid is currently used in management of postpartum haemorrhage and helped to control excessive bleeding by blocking the enzymatic breakdown of fibrin. The updated WHO recommendation on the use of tranexamic acid for management of post-partum hemorrhage focuses the importance of giving tranexamic acid promptly and no more than three hours after delivery (Brenner, Ker, Shakur-Still, & Roberts, 2019). Several studies have proved that tranexamic acid was cost effective and therefore should be used. Therefore, five health facilities missing this medicine on their emergency tray meant that they are not ready to handle postpartum hemorrhage emergencies. When there are stock outs of emergency medicines and supplies, it literally meant delay number three which is about mother delaying to receive appropriate care. However, the emergency drugs checklist was marked as complete especially at HCIII since tranexamic acid has not been put on the essential medicines list at Health Centre III level.

Concerning the PPH preventive measures, all Health facilities were giving iron supplements and deworming mothers who attended ANC. Health education on nutrition during pregnancy was being done in all Health facilities. However only 3 (50%) of the health facilities were able to do Haemoglobin estimation for mothers attending antenatal care services. Some of these health facilities lacked equipment for doing the tests, others lack reagents. This means that very many mothers are attending antenatal care but don't have a chance to know their haemoglobin level since their nearest health facility doesn't have the service. Therefore, it meant that mothers with mild forms of anaemia may be missed and if no intervention is put in place, they could end up with severe anaemia or worse still postpartum haemorrhage. Health facilities not doing the haemoglobin estimation were lacking equipment and others logistics like curvets that had not been supplied by National medical stores.

As far as the knowledge and skills of health workers were concerned, all health facilities had the current guidelines, that is "The Maternal and essential new born clinical guidelines, 2022". It was noted in four health facilities (66.7%) of them had had continuous medical education for Health workers in the last 6months and only one health facility had had a training for the staff and a mentorship in the last one year. Training would have helped the health workers to grasp the new updates and then mentorships would help to check whether health workers are practicing according to the guidance or they need more support. This generally shows that the health workers were not being updated as required. Postpartum haemorrhage management requires staff to regularly do drills and simulations. The current available guidelines are available but health workers they need a refresher training to understand and implement the concepts especially the management of postpartum haemorrhage. There is need to embrace changes that have been provided in the current guidelines. When Health workers understand the guidelines, there is smooth transition in implementation.

All health facilities had staff coverage across the 24 hours, although the staffing was as low as 33.3%. There is inadequate staffing especially for critical cadres like Midwives and Doctors. With this low staffing it means that either some Health workers have to work over 24 hours without rest. This compromises quality of services offered and may put a Health worker at risk of making errors. There may be also a gap in monitoring mothers during labour and in the postpartum period. This poses a risk of mothers experiencing postpartum hemorrhage that may be recognised in late stages. Concerning readiness preparedness all Health facilities had a complete emergency tray with a check list updated except one health facility which had no stock of intravenous fluids. This means that Health facilities were ready to offer emergency obstetric care in case of a life-threatening event. Health workers were skilled manage PPH, however there was a challenge of a standby means of transport for referral. Only 3(50%) Health facilities had a standby means of transport or ambulance to take them the next level when referred. Lack of standby means of transport causes a lot of delay before reaching the referral site. Some mothers are asked to find their own means of transport. Some mothers would even come to the health facility without any money and when referral to a high-level facility is done, they become so stuck. In case of PPH mother may arrive at the referral site too late for any intervention to be meaningful. These study findings are in line with the results of a qualitative study conducted in Tanzania which revealed that Health workers were stressed by the fact that the health facilities had low preparedness levels to manage postpartum

hemorrhage. This was brought about by inadequate supply of medicines and other supplies causing the health workers to offer suboptimal care to mothers experiencing excessive bleeding (Al-beity *et al*., 2020). This may explain why mothers continue to die due to postpartum hemorrhage especially in resource limited settings. Limited medical supplies and equipment humper the ability of the health workers to offer quality services to mothers.

Conclusion

From the study findings, demographically mothers aged 20- 34 years of age accounting for over 70% were seen to have experienced postpartum hemorrhage. This is different from the phenomenon of having the risk to postpartum hemorrhage more in mothers above 35years. This means that mothers at different ages are at risk of suffering postpartum hemorrhage. In line with other studies, most mothers who experienced postpartum hemorrhage were multiparous women. It is also important to note that majority of mothers who experienced postpartum hemorrhage and survived were living within 5km from the health facility. In view of the above therefore the individual non obstetric factors in this case age, parity and distance from the facility may not impact on the excessive bleeding in isolation and should be considered in relation with the other factors that affect or hinder control of postpartum hemorrhage.

In this study majority of the mothers who experienced excessive bleeding had attended antenatal care visits more than four times. It may be that the quality of antenatal care services was not comprehensive enough to prepare mothers for child birth and postpartum period. In this study one of the obstetric factors that stood out was prolonged labour. It was noted that prolonged labour was more prevalent in many women who experienced postpartum hemorrhage than precipitate labour and normal labour. Prolonged labour somewhat had a delay caused by both the health worker and the mother and therefore prevention should focus on addressing the three delays.

Health facilities unable to do hemoglobin estimation for mothers attending antenatal care due to lack of Hemoglobin estimation equipment and other laboratory logistics. There were also limited supplies of intravenous fluids and tranexamic acid that are important in the management of postpartum hemorrhage. This was a major gap, because it meant that health facilities were not able to quickly detect low hemoglobin levels were or even manage to control excessive bleeding. Guidelines generally available but health workers have not had a formal training on the same. This had impact on how the health workers prevent, control and manage postpartum hemorrhage. Health workers lacked knowledge on how to use the anti-shock garment.

Acknowledgments

With great gratitude, I appreciate the following for their tireless backing accorded to me in accomplishing this work**:** Supervisors Dr. Josephine Gbobbo, Dr. Tella Adedayo and Dr. Turinawe Nelson for their immense technical guidance. I appreciate African Centre of Excellence for Public Health and Toxicological Research, University of Port Harcourt for offering me a partial scholarship under World Bank that enabled me pursue this course and learnt more about research. Special thanks to the course Coordinator, Dr. Faith Diorgu, the Centre leader Prof. Daprim Ogaji for their unending support. Lecturers in the midwifery division at ACEPUTOR for their holistic support; I recognize Ms. Amumpaire Jenninah for her highly valuable input in collecting data; I deeply recognize my course mates especially Julli *et al* abrah (Nigeria), Atim Irene (Uganda) and Atuheire Confidence (Uganda) for their holistic support throughout the course; My research Assistants; To all my colleagues, my parents and my spouse s for moral and financial support.

Funding

The research was funded by the researcher herself although World Bank supported me with tuition and accommodation during the course of study.

Competing Interest

No conflict of interest

References

Al-beity, F., Pembe, A. B., Kwezi, H. A., Massawe, S. N., Hanson, C., & Baker, U. (2020). "We do what we can do to save a woman" health workers' perceptions of health facility readiness for management of postpartum haemorrhage. *Global Health Action*, *13*(1). https://doi.org/10.1080/16549716.2019.1707403.

Bazir Bazirete O., Nzayirambaho, M., Umubyeyi, A., Uwimana, M. C., & Evans, M. (2020). Influencing factors for prevention of postpartum hemorrhage and early detection of childbearing women at risk in Northern Province of Rwanda: Beneficiary and health worker perspectives. *BioMed Central Pregnancy and Childbirth*, *20*(1). https://doi.org/10.1186/s12884-020-03389-7

Burwick, R. M., Newman, R. A., & Rincon, M. (2022). Mild anemia and risk of postpartum hemorrhage or blood transfusion in preeclampsia. *American Journal of Obstetrics and Gynecology*, *226*(1), S281–S282. https://doi.org/10.1016/j.ajog.2021.11.478

Corbetta-Rastelli, C. M., Friedman, A. M., Sobhani, N. C., Arditi, B., Goffman, D., & Wen, T. (2023). Postpartum hemorrhage trends and outcomes in the United States, 2000–2019. *Obstetrics & Gynecology*, *141*(1), 152-161.

Davis, J., & Nelson, S. (n.d.). Association between breastfeeding, oxytocin, and risk of association between breastfeeding, oxytocin, and risk of postpartum hemorrhage postpartum hemorrhage. https://scholarworks.uark.edu/nursuht

Dusingizimana, T., Ramilan, T., Weber, J. L., Iversen, P. O., Mugabowindekwe, M., Ahishakiye, J., & Brough, L. (2023). Predictors for achieving adequate antenatal care visits during pregnancy: A cross-sectional study in rural Northwest Rwanda. *BioMed Central Pregnancy and Childbirth*, *23*(1). https://doi.org/10.1186/s12884-023-05384-0

Gashaw Kettema, W., Tefera Ayele, Z., Assefaw Geremew, M., Temesgen Assefa, K., Ayalew Yimer, S., Dessie Liyew, A., Berihun Erega, B., & Habtie Dagnaw, E. (2023). Knowledge, utilization, and associated factors of nonpneumatic antishock garments for management of postpartum hemorrhage among maternity ward health care professionals in South Wollo Zone health facilities, Ethiopia, 2021: A cross-sectional study design. *Obstetrics and Gynecology International*, *2023*. https://doi.org/10.1155/2023/8247603

Habitamu, D., Goshu, Y. A., & Zeleke, L. B. (2019). The magnitude and associated factors of postpartum hemorrhage among mothers who delivered at Debre Tabor general hospital 2018. *BioMed Central Research Notes*, *12*(1). https://doi.org/10.1186/s13104-019-4646-9

Hamson, K., Ngonzi, J., Julius, M., Emmanuel, B., & Ronald, M. (2016). Prevalence, morphological types and factors associated with anemia among mothers attending antenatal clinic at Mbarara regional referral hospital, South Western Uganda.

Li, N., Liu, Y., Yun, A., & Song, S. (2022). Correlation of Platelet Function with Postpartum Hemorrhage and Venous Thromboembolism in Patients with Gestational Hypertension Complicated with Diabetes. *Computational and Mathematical*

Methods in Medicine, *22*(1). https://doi.org/10.1155/2022/2423333

Mahamoud, N. K., Mwambi, B., Oyet, C., Segujja, F., Webbo, F., Okiria, J. C., & Taremwa, I. M. (2020). Prevalence of anemia and its associated socio-demographic factors among pregnant women attending an antenatal care clinic at Kisugu Health Center IV, Makindye Division, Kampala, Uganda. *Journal of blood medicine*, 13-18.

Marshal, J., Raynor, M. (2020). Myles textbook for midwives . Elsevier (INR). https://www.amazon.com/MYLES-TEXTBOOK-MIDWIVES-ACCESS-CODE/dp/0702076430

Muhal, P., Kumar Gurjar, A., Sharma, G., Ashdhir, P., & Ashdhir Professor, P. (n.d.). Impact of postpartum hemorrhage in maternal near miss cases. *European Journal of Molecular & Clinical Medicine*, *9*(8).

Ngonzi, J., Mugyenyi, G., Kivunike, M., Mugisha, J., Salongo, W., Masembe, S., ... & Bajunirwe, F. (2019). Frequency of HIV status disclosure, associated factors and outcomes among HIV positive pregnant women at Mbarara Regional Referral Hospital, southwestern Uganda. *Pan African Medical Journal*, *32*(1).

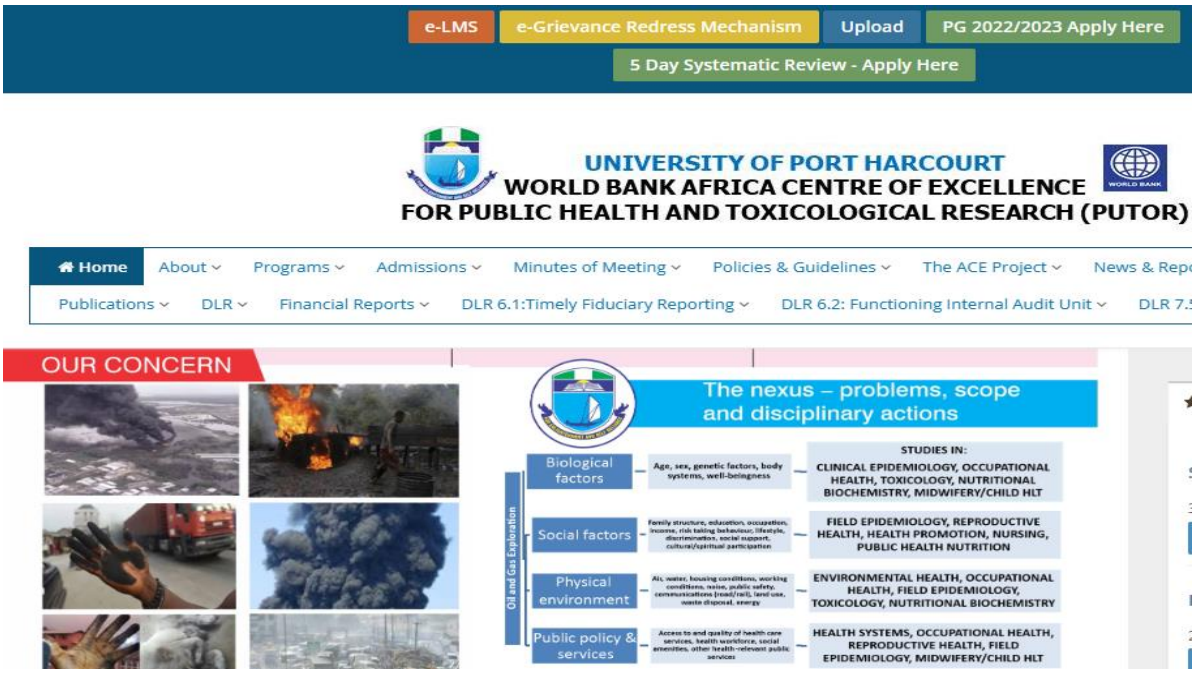
Ononge,S., Mirembe,F., Wandabwa,J., Campbell. (2016) Incidence and risk factors for postpartum hemorrhage in Uganda. *Reproductive Health 13*(38). https://doi.org/10.1186/s12978-016-0154-8.

Nigu Nigussie, J., Girma, B., Molla, A., Tamir, T., & Tilahun, R. (2022). Magnitude of postpartum hemorrhage and its associated factors in Ethiopia: a systematic review and meta-analysis. *Reproductive Health*, *19*(1). https://doi.org/10.1186/s12978-022-01360-7

Tolossa, T., Fetensa, G., Zewde, E. A., Besho, M., & Jidha, T. D. (2022). Magnitude of postpartum hemorrhage and associated factors among women who gave birth in Ethiopia: A systematic review and meta-analysis. *Reproductive Health*. *BioMed Central Limited*,*19*(1) https://doi.org/10.1186/s12978-022-01498-4

WHO, UNICEF,UNFPA,World Bank Group & the United Nations Population Division. (2019)*WHO recommendations for the prevention and treatment of postpartum h emorrhage*. (n.d.). www.who.int/maternal_child_adolescent

Zenebe, G. A., Zenebe, W. A., Ewunie, T. M., & Dires, S. (2023). Primary postpartum hemorrhage and associated factors among delivering women in Gedeo Zone, Southern Ethiopia. *Frontiers in Medicine*, *10*. https://doi.org/10.3389/fmed.2023.1096501.



PUTOR-UNIPORT (aceputoruniport.edu.ng)

Manuscript submission: Journal of Public Health and Toxicological Research (jphtr.com)