

Risk factors for self-reported postpartum hemorrhage in Ga East, Ghana

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Abstract

Objective: To document the prevalence of self-reported postpartum hemorrhage (PPH) in Ga East, Accra, Ghana, and examine the demographic, biological, and social risk factors for PPH.

Methods: The present study was a cross-sectional secondary analysis of data collected during 2010–2012 from the Ghana Essential Health Interventions Program, a quasi-experimental interventional study surveying households in the urban Ga East Municipal District. The analysis included data from randomly selected parous women of childbearing age (15–49 years), excluding those with a history of abortion (spontaneous or induced) or stillbirth. The χ^2 test and logistic regression were used to identify significant risk factors for self-reported PPH.

Results: The current analysis included 2136 women. Self-reported PPH was recorded for 95 (4.4%) participants. The maternal age at delivery, the duration of labor, and the number of skilled delivery providers were significantly associated with self-reported PPH. Prolonged labor (odds ratio 3.70, 95% confidence interval 2.27–5.94; $P < 0.001$) and maternal age (odds ratio 0.96, 95% confidence interval 0.94–0.99; $P = 0.020$) were predictors of self-reported PPH.

Conclusion: Prolonged labor and younger maternal age were related to a higher burden of reported PPH. These findings were congruent with global and regional data on the prevalence and risk factors for objectively measured PPH and could help focus intervention strategies to high-risk groups, particularly in resource-limited settings.

KEYWORDS

Ga East Accra; Ghana; Maternal age; Maternal mortality; Postpartum hemorrhage; Prolonged labor; Risk factors; Skilled birth attendants

1 | INTRODUCTION

Maternal deaths have declined from an estimated 526 300 in 2008 to 292 982 in 2013.^{1,2} Despite global progress, the maternal mortality ratio (MMR) remains high, especially low- and middle-income countries. The burden of maternal mortality is highest in Sub-Saharan Africa, where the MMR is 50 times higher than in most high-income countries.³ The major factors accounting for differential progress in

the reduction of maternal mortality are weak health systems, high levels of fertility, and complications during the immediate postpartum period, with the latter including hemorrhage, the primary cause of maternal death related to childbirth.^{4–6} This reflects the situation in Ghana, where the MMR in 2015 was 319 per 100 000 live deliveries and hemorrhage accounted for 22.8% of maternal deaths, according to the WHO.⁴ In some Ghanaian regions, the contribution of hemorrhage is as high as 45.5%.^{7,8}

The risk factors for postpartum hemorrhage (PPH) are heterogeneous and may be categorized into biological, demographic, and social risk factors. The common biological risk factors, identified in past global research, may be categorized as either maternal or fetal causes and include overdistension of the uterus, first pregnancy, chorioamnionitis, prolonged membrane rupture, fibroids, previous delivery, coagulation disorders, induced/augmented labor, prolonged labor, high blood pressure, obesity, use of anesthetics, past PPH, a fetus large for gestational age, or a macrosomic fetus.^{9–12}

Whereas the risk factors for PPH have been extensively studied in high-income settings,^{9–11} there is limited evidence from African, particularly West African, settings. A 17-year review of 38 768 deliveries in Nigeria identified several demographic risk factors for maternal mortality specific to the African context.¹³ These were age, education level, ethnic group, marital status, and mode of delivery. Research in Ghana indicates that women who were married and older than 35 years were at a greater risk of dying from hemorrhage than their younger counterparts.⁷ The authors explain that reasons for this pattern are unknown.

The main social determinants associated with PPH are access to primary health facilities, number of skilled providers, and availability of medical resources, especially resuscitation fluids and blood products.^{14,15} Geographical access to care is also an important social determinant to having a safe delivery in general. In Ghana, 45% of the women live 2 hours or further away from facilities that could provide emergency obstetric services, and in remote regions this estimate is closer to 81%.¹⁶

Although the research reviewed provides some of the biological, demographic, and social determinants that could be implied in PPH, a large proportion of the work focused on maternal mortality rather than PPH as an outcome.^{7,8,13} Furthermore, these efforts are now more than a decade old and, for the most part, exclude West Africa.^{9–12} The current study aimed to address these gaps by investigating (1) the prevalence of self-reported PPH in the Ga East Municipal District, (2) the distribution of demographic factors, biological factors, and social factors in Ga East, (3) factors that contribute to a high likelihood of PPH and the interaction between them, and (4) the risk factors that contribute the most to PPH.

2 | MATERIALS AND METHODS

In the present study, we used data from the Ghana Essential Health Interventions Program (GEHIP) collected from January 1, 2010, to December 31, 2012.¹⁷ The GEHIP project was a quasi-experimental interventional study with the aim of reducing barriers to reproductive health by expanding referrals and increasing health knowledge. The program was based in Ga East, one of the 10 politically defined districts within the Greater Accra Region in Ghana.¹⁸ As of 2010, the population of Ga East was 147 742 with a fertility rate of 84.1 deliveries per 1000 women 15–49 years of age.¹⁸ The GEHIP project was reviewed and approved by the Navrongo Health Research Centre Institutional Review Board and the Ghana Health Service Ethics

Review Committee. Informed consent was obtained from both the heads of households and the individuals interviewed before participation in the study. Participation was voluntary and the participants were free to withdraw consent at any time.

The GEHIP study used the Ghana Statistical Service sampling strategy,¹⁷ which has established standardized enumeration areas or geographical boundaries within Ga East. Field workers then identified and numbered all households within the enumeration region and used a random sampling technique to select households. For the GEHIP study, from the households selected through random number generation, all women aged 15–49 years were selected to be interviewed. Only those who provided consent were included in the study.

The data collection instrument that was used for GEHIP was adapted from the Ghana Demographic and Health Survey instrument and the adapted survey was pretested and revised prior to administration at baseline to ensure its appropriateness, validity, and reliability.¹⁹ The data for GEHIP were collected by employees of the School of Public Health, University of Ghana, Accra, Ghana. The employees underwent 2 weeks of training to ensure their familiarity with local culture and the study instrument to facilitate answering any participant questions or concerns.¹⁷ Additionally, the GEHIP intervention evaluation study was able to link survey responses with the Community-based Health Planning and Services (CHPS) monitoring database, qualitative appraisals, and facility-based surveys to cross check responses for reliability.¹⁷ CHPS is a national health strategy intended to deliver essential health services to communities.

The current secondary analysis used de-identified and anonymous data. All women between the ages of 15 and 49 years who participated in the GEHIP project and had at least one past delivery were included. Women with a history of spontaneous abortion, induced abortion, or stillbirth were excluded. Stillbirths were excluded because hemorrhage associated with a stillbirth is commonly thought to be prepartum in etiology (for example, placental abruption), and it was not possible to distinguish prepartum hemorrhage from PPH in the GEHIP study.²⁰ Furthermore, the risk factors for stillbirth may independently contribute to the risk of PPH (for example, this is the case for uncontrolled maternal diabetes mellitus) and may complicate the association between the two.²¹ Original ethical approval was obtained by the GEHIP study from the institutional review boards of the Ghana Health Services, Accra, Ghana, University of Ghana, and Columbia University, New York, NY, USA.

The main outcome of interest in the present analysis was self-reported PPH during each participant's most recent delivery. In GEHIP, PPH was measured using questions that asked about adverse events during delivery on a nominal scale (Table S1). If a mother did not report excessive bleeding, she was categorized as having a low likelihood of having experienced PPH; if she reported excessive bleeding as a delivery adverse event, she was categorized as having a high likelihood of having experienced PPH. Consequently, the data were qualitative and subjective, and accurate measurements of the quantity and duration of blood loss were not recorded in GEHIP.

Participant demographic factors (age, education level, marital status, presence of polygamy), biological factors (prolonged labor), and

social factors (number of skilled providers, availability of resources such as fluid or blood supply, access to primary health facilities) were also recorded in GEHIP and were included in the current analysis (Fig. 1 and Table S1).

The statistical analysis was carried out using Stata version 14 (StataCorp, College Station, TX, USA). Missing data and non-responses were handled through dummy coding and mean imputation. Descriptive statistics were used to describe the study population and identify the prevalence of mothers with a high likelihood of having experienced PPH. The Pearson χ^2 test was used to examine whether there were differences in distribution between groups for all the variables measured. For the purposes of the χ^2 analysis, age was grouped into 5-year intervals according to the Ghana Statistical Service standards. These analyses were conducted to examine the relationship between variables that could be contributing to PPH. Bivariate analyses were also conducted to explore the association between PPH and various biological, demographic, and social factors. An all factor multiple logistic regression model was used to identify predictors for PPH when adjusting for all variables. $P < 0.05$ was considered statistically significant. Additional multiple regression models were conducted by pre-established categories to identify potential mediators or downstream variables. For the purposes of the logistic regression models, age was treated as a continuous variable.

3 | RESULTS

In total, 4537 women provided informed consent to be a part of the GEHIP study. Of these, 2327 parous women were considered for eligibility in the current analysis; women with a spontaneous or induced abortion ($n=166$), or a stillbirth ($n=25$) were excluded. The

final number of participants included in the present analysis was 2136. Their biological, demographic, and social characteristics are presented in Table 1.

In total, 95 (4.4%) women had experienced excessive bleeding or hemorrhaging up to 6 weeks after delivery (high likelihood of PPH), whereas 2041 (95.55%) had not (low likelihood of PPH).

Age, frequency of prolonged labor, and number of skilled delivery attendants were significantly different between women with and without self-reported PPH. The highest burden of PPH occurred among women aged 25–29 years (8/74 [10.8%]), followed by the group aged 15–19 years (5/73 [6.8%]) and those aged 20–24 years (35/689 [5.1%]) ($\chi^2=13.88$; $P=0.031$). The prevalence of PPH was also higher among women who experienced prolonged labor (29/220 [13.2%]) than among those who did not (66/1916 [3.4%]) ($\chi^2=44.03$; $P<0.001$). The prevalence of hemorrhage was highest among mothers with one (55/768 [7.2%]) or two skilled delivery attendants (17/231 [7.4%]), followed by those with three attendants (2/39 [5.1%]); those with no skilled delivery attendants had the lowest prevalence of PPH (21/1095 [1.9%]) ($\chi^2=34.40$; $P<0.001$).

Whereas there were no significant group differences between maternal education and PPH, there were significant group differences between maternal education and (1) marital status ($\chi^2=31$, $P=0.002$), (2) prolonged labor ($\chi^2=11.8$, $P=0.019$), (3) number of skilled providers ($\chi^2=64.5$, $P<0.001$), (4) availability of resources ($\chi^2=10.1$, $P=0.039$), and (5) access to health facilities ($\chi^2=17.6$, $P=0.001$). Marital status also had significant group differences with (1) age ($\chi^2=203.4$, $P<0.001$), (2) education level ($\chi^2=31$, $P=0.002$), and (3) number of skilled providers ($\chi^2=82.1$, $P<0.001$). The presence of polygamy had significant group differences with number of skilled providers ($\chi^2=17.7$, $P<0.001$). The availability of resources differed significantly with patients stratified by access to primary health services ($\chi^2=288.9$, $P<0.001$).

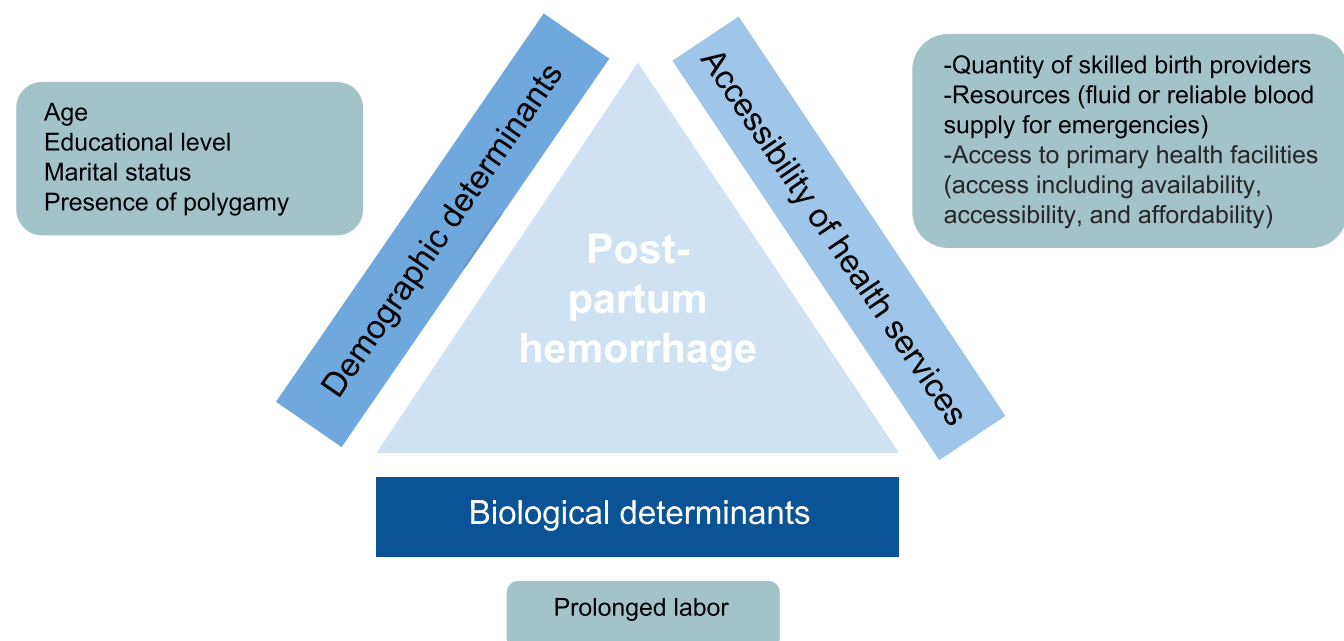


FIGURE 1 Demographic, biological, and social factors examined in the current study.

TABLE 1 Participant characteristics (n=2136).

Variable	Value ^a
Postpartum hemorrhage	
Low risk	2041/2136 (95.6)
High risk	95/2136 (4.4)
Age, y	32.05 ± 7.33
Education level	
No formal education	454/2136 (21.3)
Primary	255/2136 (11.9)
Junior secondary school and middle school	923/2136 (43.2)
Senior secondary school (technical and O level/A level)	383/2136 (17.9)
Higher education	121/2136 (5.7)
Marital status	
Single	558/2136 (26.1)
Cohabiting or married	1458/2136 (68.3)
Separated or divorced	69/2136 (3.2)
Widowed	51/2136 (2.4)
Presence of polygamy	
Single wife	1535/1578 (97.3)
Multiple wives	43/1578 (2.7)
Missing data	558
Prolonged labor	
No	1916/2136 (89.7)
Yes	220/2136 (10.3)
Number of skilled delivery providers who attended delivery	
0	1095/2133 (51.3)
1	768/2133 (36.0)
2	231/2133 (10.8)
3	39/2133 (1.8)
Missing data	3
Availability of resources (fluid or blood supply)	
Resources not available	274/1152 (23.8)
Resources available	878/1152 (76.2)
Missing data	984
Access to primary health facilities	
Not accessible	72/1112 (6.5)
Accessible	1040/1112 (93.5)
Missing	1024

^aValues are given as number/number available (percentage) or mean ± SD.

The complete logistic regression (n=2133, pseudo $R^2=0.096$) indicated that many of the variables did not significantly affect the odds of PPH (Table S2). The presence of prolonged labor was the only variable associated with increased odds of experiencing PPH in the all-factor model (odds ratio 3.67, 95% confidence interval 2.27–5.94; $P<0.001$). Age, level of education, marital status, presence of polygamy, quantity of providers, availability of resources, and access to healthcare

facilities were not predictive of PPH in the all factor model. Logistic regressions were also performed by category (demographic, biological, and social variables) to identify downstream variables (Table S3). This analysis revealed age to be an additional significant predictor of PPH (odds ratio 0.96, 95% confidence interval 0.94–0.99; $P=0.020$).

4 | DISCUSSION

In the current study, 4.4% of the women interviewed in Ga East reported excessive bleeding, a subjective indicator of PPH. The maternal age at childbirth, prolonged labor, and the number of skilled delivery providers had significant effects on self-reported PPH, with prolonged labor and maternal age emerging as strong predictors of self-reported PPH. Specifically, lower age ranges (15–29 years) had the highest burden of PPH whereas older ages (30–49 years) had the lowest burden and prevalence of self-reported PPH. These results are in agreement with the risk factors for PPH reported in studies employing more objective measurements of PPH.²⁰

The 4.4% prevalence estimate of PPH is in line with regional estimates. A 2012 meta-analysis²² indicates that the prevalence of severe PPH is 5.1% in Africa and 1.9% in Asia. Although the present findings indicate a high burden of PPH in the Ga East region, the prevalence is slightly below continent-level estimates.

The present study revealed that maternal age, duration of labor, and number of skilled providers were significantly associated with PPH, with age and prolonged labor emerging as predictors of PPH. Younger ages (15–29 years) were associated with a higher burden of PPH than older ages (30–45 years). Although education and access to health facilities were not directly associated with PPH, they were associated with prolonged labor and the number of skilled providers. The association between the number of skilled providers and PPH may appear counterintuitive; however, past research has indicated that this association is mediated by obstetric interventions, which are more likely to take place in the presence of skilled providers and are an independent risk factor for PPH.²³ Similarly, it is possible that individuals who experience complications during labor are more likely to seek out skilled providers for care than those who do not experience complications.

The regression model indicated that women with prolonged labor had a 3.67 times higher odds of experiencing PPH than those without prolonged labor. This model accounts for 9.60% of the variance in the outcome of PPH per the pseudo R^2 value. These findings are in line with a large-scale study on PPH in Egypt²⁴ and a nation-wide sample in the USA,²⁰ which report similar R^2 values ranging from 5.6% to 10%, respectively. When the logistic model was run by type of variable (demographics, biological factors, and access to health services) to identify downstream variables, age was found to be significant with each year increase in age being associated with a 4% lowered odds of PPH. The effect is likely small because the prevalence of PPH peaked at 25–29 years followed by a decline at 30–44 years and an even steeper decline later in life at 45–49 years.

Given the well-established association between prolonged labor and PPH, interventions should target women who are at increased risk

for prolonged labor such as those with slow effacement of the cervix, a large fetal head circumference, a small maternal pelvic size, or age 25–29 years. Estimating the fetal head circumference and pelvic size without access to prenatal screening and ultrasonography may be difficult in low-resource areas, and efforts should be made to continue to improve access to equipped health facilities prenatally and to skilled delivery providers during and after labor.

There were some limitations to consider. First, the GEHIP study used self-reports from women of childbearing age in Ga East to gather the data presented here. As a result, the current study may not represent risk factors for the most severe cases of PPH that were fatal. Furthermore, the assessment of whether PPH had occurred was retrospective and subjective, and therefore liable to both recall and reporter bias. Second, the present study did not examine other factors explored in past literature such as the use of augmented labor, anesthesia during labor, and other obstetric interventions both before and after labor. This was because they were not included in the GEHIP data set. Third, the effects of PPH on maternal and newborn morbidity and mortality were not explored in the present study; an understanding of these effects is necessary to provide a contextual basis for investment into interventions and strategies aimed at reducing PPH.

Nevertheless, the present study represents the first effort to understand the demographic and biological factors associated with an increased risk for PPH in Ga East. Of note, the study used surveillance data from Ga East and therefore the sample size was large ($n=2136$). The data were collected by trained research assistants employed by the School of Public Health, University of Ghana, who underwent 2 weeks of training and consequently were familiar with the population and well versed in the local culture and language.¹⁸

It is important to note that although the findings of the present study may apply to other districts serviced by the CHPS model, they may have limited generalizability to other areas of Ghana that lack access to a community health system. Despite this, the results of the present study provide insights into the risk factors for PPH in Ga East, and may be informative to the development of other CHPS models as they are rolled out in rural regions outside of urban centers like Accra.

AUTHOR CONTRIBUTIONS

VV and MF contributed to the planning of the paper, data analysis, and writing the manuscript. PBA contributed to data collection and revising the manuscript. AUN and PTNT contributed to data handling and revising the manuscript.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. Postpartum hemorrhage questionnaire used in the Ghana Essential Health Interventions Program study.

Table S2. Logistic regression analyses (all variables).

Table S3. Logistic regression by demographic, biological, and social (access to health services) variables.