

Postpartum haemorrhage in Zimbabwe: a risk factor analysis

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OBSTETRICS

Postpartum haemorrhage in Zimbabwe: a risk factor analysis

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ABSTRACT

Objectives To identify risk factors associated with postpartum haemorrhage (PPH) in order to improve the effectiveness of antenatal screening.

Design A population-based case control study.

Setting Harare, Zimbabwe.

Subjects Two groups of women, one group consisting of those with postpartum haemorrhage after a normal vaginal delivery and the other of women with normal unassisted vaginal delivery without PPH.

Method Data abstracted from the medical records; relative risks were estimated by multivariate logistic regression.

Results Low parity, advanced maternal age, and antenatal hospitalisation were among the strongest risk factors, with more modest associations for history of poor maternal or perinatal outcomes and borderline anaemia at the time of booking. No association with grand multiparity was found.

Conclusions These findings confirm the importance of previously recognised factors such as low parity, poor obstetric history, anaemia, and prolonged labour, but call into question the significance of grand multiparity. Previously undocumented factors such as maternal age greater than 35 years and occiput posterior head position emerged as predictors worthy of further investigation.

In the developing world, where more than 99% of the world's estimated annual half million maternal deaths occur (Royston & Armstrong 1989), the leading causes of maternal mortality are quite uniform and, in many cases, could be readily managed if appropriate treatment were available. The World Health Organization (WHO) has long advocated the screening of pregnant women to identify those at highest risk of complications during pregnancy or childbirth so that available services could be directed to those most in need of them (WHO 1981). Such screening could be carried out as part of antenatal care, where women seek such care, or by community health workers or traditional birth attendants.

Research into obstetric risk factors has not been a high priority in developed countries, where most women have ready access to competent medical care. Such research has been difficult to undertake in developing world settings, where hospital-based obstetric patients are usually unrepresentative of parturient women generally, and data from non-hospital-based deliveries are difficult to obtain. The problems are further compounded by the diversity of complications for which screening is employed and the interrelatedness of the potential risk factors.

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Postpartum haemorrhage (PPH) ranks high on the list of causes of maternal death because, even when the incidence is not greatly raised, the case fatality rate can be very high. While a mild haemorrhage of 500-800 ml may not be serious for a healthy well-nourished woman, even a mild haemorrhage can lead to disastrous consequences among women with chronic anaemia due to iron deficiency, malaria, or other parasites. The onset of PPH can be very rapid, allowing little opportunity for women delivering at home to get to a hospital. While PPH in industrialised countries is more often due to obstetric interventions such as induction of labour, epidural anaesthesia, and caesarean section (Gilbert *et al.* 1987), the leading causes of PPH in the developing world are retained placenta, failure of the uterus to contract (atony), and genital tract injury (WHO 1990). Risk factors thought to be associated with the incidence of PPH include primiparity, grand multiparity, anaemia, previous third stage complications, pregnancy induced hypertension, and multiple pregnancy, along with several less common medical conditions (WHO 1990). Only a few studies have tried to link these risk factors to the actual occurrence of PPH (Lennox 1984; Hall *et al.* 1985; Gilbert *et al.* 1987), but no population-based study within Africa using multivariate analysis to disentangle risk factors has been published so far.

Subjects and methods

For both cases and controls, only singleton, vertex births with spontaneous onset of labour without oxytocic or instrumental intervention during the delivery were included; all mothers were residents of Greater Harare. Most women (case and control) received one dose of Syntometrine (a mixture of oxytocin and ergometrine) or ergometrine alone after the delivery as standard treatment.

This study was part of a larger one involving two case groups: women with postpartum haemorrhage after a normal vaginal delivery, and women with cephalopelvic disproportion (CPD) requiring surgical or instrumental delivery. The CPD results are discussed elsewhere (Tsu 1992). The study used the current definition of primary PPH recommended by WHO (1990), i.e. excess bleeding in the 24 h after the birth of the baby, but with a minimum of 600 ml rather than 500 ml because this was the cut-off defining PPH in Harare. Women were also considered as PPH cases if heavy bleeding was noted in their charts in the first postpartum day and their haemoglobin was less than 8 g/dl or shock or transfusion was recorded. Women with operative deliveries, anesthesia (other than local) before the PPH, or oxytocin before the delivery were excluded in order to focus on PPH not associated with medical interventions. All eligible women giving birth between May 1 and December 31, 1989, in the ten municipal maternity clinics or the public referral hospital were included. It is estimated that 85% of all births in Harare take place in these facilities, with 8 to 10% of births occurring in two private hospitals and the rest occurring at home.

Women were identified at the referral hospital using the hospital delivery register, the surgical theatre register, the daily discharge summary book, and the daily treatment log for the intensive care section of the labour and postpartum ward. In addition, the nursing staff on the postpartum wards of the referral hospital were consulted 3 to 4 times each week, in order to identify any PPH cases referred into the hospital after delivery in a clinic. Since all women with a PPH occurring in clinics must be transferred to the hospital, all ultimately were cared for at Harare Maternity Hospital. Maternal deaths were also reviewed to ascertain whether they were eligible cases.

Postpartum blood loss in Harare was based on measurement from a basin, plus a visual estimate of blood on linens. The two amounts were noted separately on the maternity record at the time of delivery, with the estimate incorporating both measured and estimated amounts. This total was used to determine case and control status.

Women were included as controls only if they completed a normal, unassisted delivery without anaesthesia, other than local. They had a first stage of active labour of less than 18 h and had no more than one dose of Syntometrine postpartum. A control group was chosen for each case group using identical eligibility criteria, matched on a one-to-one basis for the facility where the case was originally booked to deliver and for the week of the delivery. Controls were chosen randomly from among those eligible according to the matching criteria. If a CPD

case and a PPH case both came from the same facility in the same week, one control was used to match both cases.

Data collection

Data were abstracted from the medical records by the author or the research midwife; approximately 20% of the charts abstracted by the midwife were also reviewed by the author, revealing a high degree of agreement of abstraction. The hospital and municipal clinics use a uniform maternity record for antenatal care, delivery and postpartum care. Information was collected on socio-demographic factors, medical and obstetric history, antenatal events, labour and delivery.

A substudy was carried out to validate the accuracy of the information in the medical records by interviewing 56 women about 16 items in the chart. The interview took 5 to 10 min and was carried out in the woman's preferred language. The medical record was abstracted after the interview was completed. Six of the 16 questions had no answers discordant with the chart, six had fewer than 10% discordant answers, and significant inconsistencies were found in three items: obstetric history (major complications not recorded on their charts), incidence of previous large babies, and the provision of ferrous sulphate supplements during pregnancy (usually the chart was lacking any notation of iron supplementation while the women reported receiving it).

Analysis

After a detailed comparison of the two control groups (PPH and CPD) revealed very little difference between them, the two groups were pooled, resulting in a combined control group of 299 normal deliveries. Unconditional multiple logistic regression using the EGRET software package was carried out to identify independent risk factors and control for matching variables and confounding variables. Relative risks approximated by the odds ratios were estimated by the method of maximum likelihood, and 95% confidence intervals (CI) were based on the standard error of the coefficient estimate and the normal approximation. Continuous variables such as age, interpregnancy interval, height, haemoglobin at first visit, and length of the stages of labour were categorised, in some cases to reflect screening factors established by the Ministry of Health in Zimbabwe. Obstetric history was considered both as individual elements and as combined summary measures; the most recent pregnancy was analysed separately from pregnancies prior to the last.

Results

Table 1 describes the delivery complications of cases and controls, and Table 2 gives the sources and amounts of haemorrhage experienced by the cases. Cases were much more likely than controls to have a traumatic delivery involving vaginal or cervical tears or episiotomy. While uterine atony was the most common cause of PPH, vaginal lacerations and cervical tears together account for

Table 1. Delivery complications.

Complications	Cases (n ₁ = 151)			Controls (n ₂ = 299)		
	n	(SD)	%	n	(SD)	%
Episiotomy ¹	40	—	26.5	42	—	14
Perineal tears ¹	23	—	15	37	—	12.4
Vaginal lacerations ¹	35	—	23	16	—	5.4
Uterus not contracted ²	39	—	28.5	1	—	0.3
Estimated blood loss (ml) ³	888	(1±476.1)		139.5	(±66.8)	
Postpartum Hb <8 g/dl ⁴	14	—	10	0	—	—
Transfusion ⁵	15	—	10	0	—	—

¹ n₂ = 298; ² n₁ = 137; ³ n₁ = 133; ⁴ n₁ = 140; ⁵ n₁ = 150.

more than one-third of the haemorrhages. Nearly half the haemorrhage cases were relatively mild and required little medical intervention. There was one maternal death among the cases (case fatality rate of 6.6/1000). The perinatal mortality among the cases was 33.8/1000 live births (three stillbirths, two neonatal deaths) and none among controls.

Selected demographic and medical characteristics are shown in Table 3. While mean maternal age was nearly identical in the two groups (26.1 versus 26.2 years), the proportion of women 35 years or more in the case group was double that in controls. Education, marital status, height, weight and Quetelet index (weight/height²) were similar. Information on the number of women originally booked to deliver at Harare Maternity Hospital was not available, so it was difficult to describe the exact geographic distribution of all parturient women. If one uses the facility of those cases originally booked to deliver in the ten municipal clinics as an approximation of their residence in the city, the geographic distribution of cases booked for clinic rather than hospital delivery was similar to that of the general population of singleton deliveries. The proportion of deliveries occurring at the referral hos-

pital would, of course, be higher than the proportion originally booked for that facility.

Although cases and controls had similar mean gravidity (3.3) and parity (2.2), there were clear differences between the two groups in obstetric history and characteristics (Table 4). Compared with controls, cases were more likely to be of low parity, having either none or one previous delivery. Cases also had a higher proportion of grand multiparas (5 or more previous deliveries). For this study, parity was grouped as low (0 or 1 birth), medium (2–4 births), or high (5 or more births). Average interval since the last pregnancy was about 3.5 years in each group, but the proportion of women with an interpregnancy interval of 6 years or more (the cut-off used by the Ministry of Health for risk screening) was slightly higher among cases. The proportion of cases and controls with a prior caesarean section was similar (12.6% and 10.4%, respectively). Except for prior stillbirth, there is a consistent pattern of more cases than controls reporting prior poor outcomes such as PPH, miscarriage in the first or second trimester, or neonatal death. The differences between the two groups with regard to the outcome of the immediately preceding pregnancy is more marked than for pregnancies

Table 2. Source and amount of haemorrhage among cases.

Variables	%
Source of PPH (n = 151)	
Atonic uterus	18.5
Vaginal laceration	18.5
Cervical tear	17.9
Retained placenta	7.9
Ragged membranes	6.6
Retained products of conception	6.6
Precipitate labour	0.7
Uncertain/unspecified	23.2
TOTAL	100
Amount of haemorrhage (n = 133*)	
600–799 ml	48.1
800–999 ml	23.3
1000–1249 ml	16.5
1250–1499 ml	5.3
1500+ ml	6.8
TOTAL	100

* Exact amount not known for 18 cases, although >600 ml.

Table 3. Selected demographic and medical characteristics.

Variables	Cases (n ₁ = 151)		Controls (n ₂ = 299)	
	n	%	n	%
Socio-demographic factors				
Age (years) ¹				
15–19	18	12	33	11
20–29	88	59	185	63
30–34	20	13.4	54	18
35+	23	15.4	23	8
Education (primary or less) ²	82	56.6	172	60
Married ³	141	96	284	96
Physical/medical factors*				
Height (cm) ⁴	159.5±	7.6	159.2±	8.4
Weight at first antenatal visit (kg) ⁵	67.1±	11.4	66.7±	11.5
Quetelet (wt/ht ²) ⁶	16.9±	3.0	16.8±	3.3

*These values are shown as mean and standard deviation.

¹ n₁ = 149, n₂ = 295; ² n₁ = 146, n₂ = 286, adjusted for age (<25, 25+); ³ n₁ = 147, n₂ = 295; ⁴ n₁ = 98, n₂ = 201; ⁵ n₁ = 123, n₂ = 239; ⁶ n₁ = 86, n₂ = 161.

Table 4. Obstetric history.

Variables	Cases (n ₁ = 151)		Controls (n ₂ = 299)	
	n	%	n	%
Parity				
0	29	19	44	15
1	42	28	70	23.4
2-4	58	38.4	154	51.5
5+	22	14.6	31	10.4
Interpregnancy interval 6+ years ¹	22	19	33	13
Single events				
Prior PPH ²	3	2.5	0	—
Prior fetal death 1st trimester ²	18	15	24	9.4
Prior fetal death 2nd trimester ²	7	6	4	1.6
Prior stillbirth ²	5	4	15	6
Prior neonatal death ²	8	7	13	5
Combined events				
Poor OB outcome* last preg. ²	20	17	22	9
Poor OB outcome* pregs. prior to last ³	22	27	32	17
Poor OB outcome* in any prior pregnancy ²	35	29	50	20

*PPH, fetal death first or second trimester, stillbirth, neonatal death.

¹ n₁ = 117, n₂ = 252; ² n₁ = 120, n₂ = 254; ³ n₁ = 81, n₂ = 188.

prior to the most recent one preceding the index pregnancy.

Table 5 shows selected antenatal and intrapartum factors for the current pregnancy. Cases and controls both initiate antenatal care relatively late, have a similar number of antenatal visits and have similar proportions of unbooked women (i.e. women with no antenatal care). Haemoglobin assessment was carried out for only about 30% of women and slightly more often for cases (34%) than for controls (28%). Although the local definition of anaemia is less than 10 g/dl and the definition recommended by the Centers for Disease Control (1989) for women at 28 weeks of pregnancy (the average time of the first visit in this population) and at the altitude of Harare (nearly 1500 m) is less than 11 g/dl, the numbers of women with haemoglobin less than 11 g/dl were too small for meaningful analysis (7 cases, 4 controls). When borderline anaemia (up to 12 g/dl) is considered, cases were nearly twice as likely as controls to have low haemoglobin at first antenatal visit.

Cases were more likely than controls to have been hospitalised during the pregnancy for anaemia or antepartum bleeding, but the numbers were small. When hospitalisation for all pregnancy-related causes is considered, nearly three times more cases than controls reported such hospitalisation during the current pregnancy.

During the course of labour, a higher proportion of cases than controls experienced prolonged first or second stages and an occiput transverse or posterior fetal head position. Artificial rupture of membranes is standard practice in Harare once labour is established, and the proportions in the two groups were similar. The size of the babies and proportions of large babies (4000 g or more) were also similar among cases and controls.

The results of the logistic regression analysis are given in Table 6. Among factors detectable before the onset of labour, advanced maternal age, antenatal hospitalisation and borderline anaemia show independent associations with an increased risk of PPH. Women 35 years or more at delivery were at two and a half times greater risk of PPH than were younger women. After adjustment, high parity was no longer associated with an increased risk of PPH, but women bearing their first or second child had about a 70% greater incidence of PPH than did other women. Women whose last pregnancy resulted in a PPH, first or second trimester fetal death, stillbirth or neonatal death, were about twice as likely to have a PPH as women with no such history or no prior pregnancy. After adjustment for other risk factors, women who were hospitalised antenatally for a pregnancy-related problem were at three or four times greater risk of PPH than were women without hospitalisation. When antepartum factors were taken into account, occiput transverse or posterior fetal head position was associated with a nearly-tenfold greater relative risk for PPH. A prolonged first or second stage of labour is associated with relative risks of 2.9 and 2.6, respectively, even when controlled for each other and the other factors in the model.

Discussion

Although it has been generally accepted that grand multiparity is an important risk factor for PPH (O'Connor & Cavanagh 1982; Reed 1988; Royston & Armstrong 1989; WHO 1990), several studies have not supported this view; further, it was not borne out by this study. The significantly elevated crude relative risk for high parity seen in these data virtually disappeared once it was adjusted for maternal age. Even without adjustment for maternal age, Lennox (1984) found little relationship between high parity and third-stage complications (including PPH) among women in Papua New Guinea. Similarly, in a large study of singleton deliveries in Aberdeen, Hall *et al.* (1985) found no increased rate of PPH among women with high parity (five or more). In their Nigerian study of more than 22 000 deliveries, Harrison *et al.* (1985) reported a twofold risk of PPH for women para five or greater, but it was not adjusted for age or other delivery complications. In a study of 50 057 deliveries in Israel (Fuchs *et al.* 1985), grand multiparity (there defined as seven or more deliveries) was associated with a fourfold increase in risk for PPH due to uterine atony, but this was not controlled for high maternal age or for operative delivery. A recent study in California using multivariate analysis (Combs *et al.* 1991) also found no association with high parity.

The elevated risk associated with low parity found in this study is compatible with the findings of other studies (Lennox 1984; Hall *et al.* 1985; Gilbert *et al.* 1987; Zanini *et al.* 1988) and general reviews (WHO 1990).

High maternal age previously has been considered a factor that affects the sequelae of haemorrhage rather than the incidence (WHO 1990). This study, however, suggests a threefold elevation of risk for PPH associated with high maternal age. A possible mechanism for this effect might be age-related changes in connective tissue

Table 5. Antenatal history and intrapartum events.

Variables	Cases (n ₁ = 151)			Controls (n ₂ = 299)		
	n	(SD)	%	n	(SD)	%
Antenatal (AN) factors						
Gestation at first visit (weeks)	27.3	(±6.2)		28.2	(±6.0)	
Number of AN visits	5.9	(±3.3)		5.7	(±2.9)	
Unbooked (no AN visits)	10		6.6	14		5
Hb at first visit (g/dl) ¹	12.3	(±1.7)		13.0	(±1.4)	
Hb < 12.0 g/dl ¹	19		39.6	15		19
Pregnancy-related AN hospitalisation	13		8.6	9		3
AN hospitalisation for anaemia or APH	4		2.6	1		0.3
Intrapartum events						
Spontaneous rupture of membranes ²	60		40	102		34
Occiput transverse or posterior position ³	7		25	2		0.7
Stage 1 > 10 h ⁴	42		28	37		12.4
Stage 2 > 20 min ⁵	25		17	22		7.4
Stage 3 (min)	15.8	(±66.3)		5.9	(±2.5)	
Mean birth weight (g)	3166	(±476.1)		3207.1	(±355.2)	
Birth weight > 4000 g	3		2	6		2

¹ n₁ = 48, n₂ = 79; ² n₁ = 150, n₂ = 298; ³ n₁ = 141, n₂ = 283; ⁴ n₁ = 150; ⁵ n₁ = 149.

that diminish the ability of cervical, vaginal and perineal muscles to stretch as needed during delivery (Turnbull & Anderson 1978), resulting in greater trauma to tissues, prolonged labours, and diminished uterine contractility after delivery.

The moderate association between poor obstetric history and PPH seen in this study is consistent with findings elsewhere. Lennox (1984) found higher risks for third-stage complications associated with prior PPH, prior long labour and prior neonatal death. Hall *et al.* (1985) found a threefold increased risk of PPH among women with a prior PPH compared with those who had no such history. Although prior PPH seems to be a good predictor of subsequent PPH, the ascertainment of that

history is problematic. The number of women reporting a history of PPH is well below what would be expected based on the occurrence of PPH in the population. This could be explained in part if PPH reduces women's likelihood of becoming pregnant again, for example through maternal mortality, hysterectomy associated with the haemorrhage, or a higher level of contraceptive use to avoid future dangerous pregnancies. More likely, it would appear that women do not recall PPH as well as they do other complications (Lennox 1984) or are never even aware that a PPH occurred. Estimation of blood loss is difficult even for experienced clinicians; traditional birth attendants and mothers themselves are unlikely to have a clear idea of how much blood constitutes a haemorrhage.

Table 6. Relative risk of PPH associated with selected demographic, medical, and obstetric characteristics: multivariate analysis.

Characteristics	Crude RR		Adjusted RR ¹ without intrapartum factors		Adjusted RR ² with intrapartum factors	
	RR	(95% CI)		(95% CI)		(95% CI)
Demographic						
Age 35+	2.2	(1.2, 4.0)*	2.6	(1.2, 5.8)*	3.0	(1.3, 7.3)*
Obstetric						
Parity						
Low	1.6	(1.1, 2.5)*	1.7	(1.1, 2.7)*	1.5	(0.95, 2.5)
Medium ³	1.0		1.0		1.0	
High	1.9	(1.0, 3.5)*	1.1	(0.49, 2.4)	1.3	(0.57, 3.2)
Prior FD 2nd trimester	3.9	(1.1, 13.5)*				
Poor OB history last pregnancy ⁴	1.9	(1.0, 3.6)*	1.8	(0.94, 3.7)	2.0	(0.99, 4.1)
Interpregnancy interval (6+ years)	1.5	(0.85, 2.8)				
Antenatal (AN)						
AN hospitalisation	5.5	(1.9, 15.8)**	4.3	(1.4, 12.8)**	3.2	(0.96, 10.5)
Hb < 12 g/dl ⁵	2.7	(1.3, 5.5)**	2.2	(0.99, 5.0)	2.8	(1.1, 6.7)*
Intrapartum						
OT or OP head	7.3	(1.5, 35.8)*	—		9.9	(1.9, 52.8)**
Stg1 > 10 h	2.8	(1.7, 4.5)***	—		2.9	(1.6, 5.0)***
Stg2 > 20 min	2.5	(1.4, 4.7)**	—		2.6	(1.2, 5.2)*

*P < 0.05; **P < 0.01; ***P < 0.001.

¹ Adjusted for age, parity, obstetric history, antenatal hospitalisation, anaemia, and facility booked (not shown).

² Adjusted for factors as above plus fetal head position (OT or OP) and duration of stages one and two of labour.

³ Reference category.

⁴ History includes PPH, fetal death first or second trimester, stillbirth, or neonatal death; compared to no such history or no known history.

⁵ Hb at first visit; compared to higher Hb or not known.

Unless a haemorrhage is severe enough to result in visible medical interventions such as transfusion, referral to another facility, or surgery, many women will be unaware of the problem. Even women delivering in health facilities are seldom apprised of events during the delivery. Maternal record cards that span several pregnancies are being introduced in several countries (Royston & Armstrong 1989), including Zimbabwe, and may improve the reporting of this important piece of obstetric history.

The significance of pre-existing anaemia relative to the consequences of haemorrhage has been clearly recognised, but its role as a risk factor for PPH has been suggested only tentatively (O'Connor & Cavanagh 1982; WHO 1990) and has not been evaluated in any published studies so far. The finding here that borderline anaemia at the time of the first antenatal visit is associated with a relative risk of 2.8 for PPH warrants further investigation, although the conclusions regarding anaemia in this study are limited by the fact that less than half the women had their haemoglobin checked. The association seen here is unlikely to result from confounding by malaria or sickle-cell disease in this particular population, since they are uncommon in Harare.

Hospitalisation during pregnancy for a pregnancy-related complaint is probably, like obstetric history, more of an aggregate indicator of problems than a marker for a specific factor related to PPH. The association between antenatal hospitalisation and PPH was not due solely to acknowledged risk factors such as anaemia, antepartum haemorrhage (APH), or pregnancy-induced hypertension (PIH), although cases were twice as likely as controls to have APH or PIH. The usefulness of hospitalisation as a risk indicator is limited, though, by its dependence on local circumstances governing antenatal admission to hospital, such as facility availability and patient access.

Prolonged labour or traumatic delivery, even when it ends with a noninstrumental vaginal delivery, has been previously recognised as a precursor to PPH. Occiput transverse or posterior fetal head position has not been described as a risk factor before but in this study was associated with increased risk of PPH, regardless of whether the source of the haemorrhage was uterine atony, retained placenta or cervical tears. An active first stage of labour longer than 10 h was associated with a high risk for PPH due to cervical tears (RR = 5.2), to ragged placental membranes (RR = 4.2), and to vaginal lacerations (RR = 2.8). A second stage longer than 20 min was associated more strongly with PPH due to retained placenta (RR = 4.2) and uterine atony (RR = 2.7). Gilbert *et al.* (1987), in one of the few studies to control for mode of delivery when looking at prolonged labour, also found a fourfold risk associated with a first stage greater than 12 h and a nearly threefold increased risk of PPH if the second stage was greater than 1 h in spontaneous deliveries. They did not, however, control for induction of labour or other potential confounders. Birth weight greater than 4000 g, found to be associated with a nearly twofold increase in risk of PPH in normal vaginal deliveries in a study in Australia (Allen *et al.* 1988), was not found to be important in the Harare study, perhaps in part because such weights were relatively uncommon.

Study limitations and strengths

This study has several limitations that affect the interpretation of its findings. Since it dealt only with spontaneous, singleton, vertex labours without oxytocic augmentation, analgesia/anaesthesia, or instrumental delivery and it excluded those with a placental abruption, it does not address many of the factors cited in other studies and is difficult to compare with research from developed countries where obstetric intervention is much more common. On the other hand, it is more representative of the natural course of labour prevalent in the developing world where the vast majority of women deliver without sophisticated medical care. The universal prophylactic administration of Syntometrine or ergometrine after delivery in Harare may have affected the composition of the case group by differentially suppressing certain types of PPH (such as atony); if different types of PPH have different predictive factors, the overall mix of predisposing factors in this study might not be representative of women in general with PPH. The numbers of women with each type of PPH available in this study are not sufficient to analyse this possibility, although it does appear there are some differences in the importance of the various risk factors by type of haemorrhage (for example, women with retained placenta tend to be older).

The urban context in which this study was done may limit its generalisability to rural populations in Africa or other developing world areas. In particular, the fact that these women all had trained medical personnel attending their deliveries distinguishes them from the vast majority of rural women. However, except for the prophylactic dose of Syntometrine, these deliveries involved a very low level of medical intervention, quite similar to the care rural women might receive. In addition, the occurrence of PPH is not likely to differ among urban and rural women (although its consequences differ dramatically), and there is no obvious reason to believe that the risk factors identified in this study would differ for urban and rural residents. There is a great deal of movement in Zimbabwe between urban and rural areas as well, which makes it less likely that Harare women differ substantially from their rural counterparts.

Conclusions

This study represents one of the largest series of PPH cases collected in a developing world setting and is one of a very few to employ multivariate analysis to disentangle related factors. The results confirm several of the risk factors previously suggested in the literature, such as low parity, an obstetric history that includes adverse outcomes (especially prior PPH), anaemia, and prolonged labour. The study also identifies several previously undocumented factors, such as maternal age 35 years and older and fetal head position other than occiput anterior, and calls into question the importance of grand multiparity. Replication of these investigations in other African groups and operational research into the value of the findings for better prevention or management of postpartum haemorrhage are now needed.

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