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A Comparison of Excessive Postpartum Blood Loss Estimates Among Three Subgroups of Women Attending Births in Matlab, Bangladesh

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Abstract

Objective—Postpartum hemorrhage (PPH) is the leading cause of maternal death and disability worldwide. Recognition depends on subjective visual quantification. This study sought to assess and compare the thresholds for excessive postpartum blood loss reported by skilled birth attendants (SBA), traditional birth attendants (TBA), and laywomen in Matlab, Bangladesh.

Method—Data from six questions asking about excessive blood loss in the postpartum period were analyzed using analysis of variance (ANOVA), Hochberg test, Kruskal-Wallis and standard descriptive statistics.

Results—Thresholds for excessive blood loss estimated by laywomen and TBAs exceed biomedical standards for PPH. Skilled birth attendant reports are consistent with the definition of severe acute PPH.

Conclusion—Further research on locally validated blood collection devices, in birth kits, for diagnostic aid or referral indication is needed. Areas where coverage and uptake of skilled birth attendance are low should be targeted due to the number of home births attended by TBAs and laywomen in such settings.

Precis—A comparison of excessive postpartum blood loss estimates among skilled birth attendants, traditional birth attendants and laywomen in Matlab, Bangladesh.

Keywords

Bangladesh; Blood Loss; Maternal Mortality; Postpartum Hemorrhage; Childbirth

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Introduction

Worldwide, 536,000 women die each year from complications of pregnancy and childbirth.¹ Postpartum hemorrhage (PPH) is the most common cause of maternal mortality worldwide² and is an important cause of morbidity in the developing and developed world, occurring in up to 18% of births.³ PPH is a clinical diagnosis defined by the World Health Organization (WHO) as blood loss in excess of 500ml from the uterus, cervix, vagina and/or perineum after delivery of the baby.⁴ Uterine atony, retained placenta, lacerations, hematomas, uterine rupture and coagulopathies are the main causes of PPH.⁵

Recognition and response to PPH is critical because of the short interval between onset of bleeding and death, an average of two hours.⁶ Recognition depends on an assessment or estimation of blood loss. However, despite the long held and widely accepted definition, assessing postpartum blood loss with accuracy remains a problem. Estimates of postpartum blood loss, calculated by subjective visual quantification, are known to be fraught with error in clinical settings by professional health providers.⁷⁻⁹ Research has shown that blood loss is overestimated at low volumes (<150cc) and underestimated at high volumes and as blood volumes increase estimation error increases.¹⁰⁻¹³ Studies indicate an underestimation of 25-50% when visual assessment is compared to more objective measurement such as the “gold standard” of photospectrometry.¹¹ This is especially significant in areas where home births attended by unskilled attendants are common.

Little is known about the estimation of postpartum blood loss by unskilled attendants in developing countries where half of women continue to give birth at home assisted by unskilled providers. The aim of the study was to assess and compare the thresholds for excessive postpartum blood loss reported by two groups of unskilled birth attendants and one group of skilled birth attendants, in Matlab, Bangladesh. This is an area where laywomen experience and attend home births. These laywomen are considered unskilled birth attendants together with TBAs.

Study Location

In Bangladesh there are 570 (95% CI 380-760) maternal deaths per 100,000 live births¹; PPH remains a major cause of death. Nationally, approximately 90% of women deliver at home and 86% of women deliver with unskilled attendants.¹⁴ Matlab is located 55 kilometers southeast of the country's capital, Dhaka. Travel within Matlab is mostly by foot, rickshaw or country boat. The majority of the population is Muslim (90%) and the remainder is Hindu. Islam is the official religion of Bangladesh and all residents speak in *Bangla* the official national language. The principal economic activities are agriculture and fishing.

Matlab has a unique maternal health care infrastructure due to the internationally recognized efforts of the International Center for Diarrheal Disease Research (ICDDR,B) Maternal and Child Health and Family Planning Program (MCH-FP), serving one half of the Demographic and Surveillance System (DSS) area established in the early 1960's. The service area covers approximately 224,476 people of whom 60,777 are women age 15-49. This population is provided health care coverage through the ICDDR,B's four health sub-centers and town hospital.¹⁵ In 2005, approximately 2,700 births took place in this area, of which 52% occurred at home with unskilled attendants.¹¹

Methodology

A retrospective analysis was performed using existing data obtained from a larger study on the recognition of and response to postpartum hemorrhage in Matlab, Bangladesh in 2006.¹⁶ Structured interview records from 149 participants, including skilled birth attendants (SBAs)

traditional birth attendants (TBAs) and laywomen were analyzed. In the Matlab context, SBAs are comprised of accredited health professionals, such as a midwife, doctor or nurse, and paramedics who are educated and trained to proficiency in the skills needed to manage normal pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns.¹⁷ TBA refers to a person who assists the mother during childbirth and who initially acquired her skills by delivering babies herself or through an apprenticeship to other TBAs.¹⁸ Laywoman refers to women of reproductive age who recently delivered (within the previous year, 2005) and older influential women (50 years of age or greater).

Participants were identified by a random sample from the DSS and from lists of local traditional and professional care providers maintained by ICDDR,B. In addition, we purposively sampled 20 laywomen who experienced excessive bleeding within 24 hours of homebirth and their self-identified female relatives, friends or neighbors who attended the homebirth.

An active household recruitment method resulted in full participation among all eligible participants. Three trained bilingual interviewers conducted and audio tape-recorded the face-to-face interviews in the local language, Bangla. Each interview, conducted at a time and place convenient for the participant, took approximately 45 minutes. Interviewers recorded verbatim responses directly on the questionnaire form and clarified ambiguities before concluding the interview. Afterwards, they listened to the entire tape-recorded interview, verifying responses against the completed form. Verified questionnaires were translated into English directly into an identical electronic version of the questionnaire.

Data were examined from six questions asking about knowledge of excessive blood loss at two time points, immediately after delivery (at birth) and within the first twenty-four hours after delivery, a time frame following the WHO's definition of early PPH.¹⁹ Questions asked about what blood volume and what number of saturated blood collection devices signified excessive blood loss. The questions are presented in Appendix A. Sheer, a local term for volume, roughly equivalent to a liter, was used to document responses about blood volume. Mats, jute made bags, nekra and pads were used to document responses about number of saturated blood collection devices. Mats are woven straw floor coverings; jute made bags are heavy-duty sacks popular for packaging agricultural commodities; nekra are rags usually torn from old saris, and pads refer to modern sanitary napkins.

Responses were either in the form of absolute or range values. Combined point estimates were calculated using the absolute values and the average of the low and high values of the range estimates. The objectives of the analyses were: 1) to describe estimates of excessive blood loss reported by two groups of unskilled and one group of skilled birth attendants, 2) to compare these estimates to actual biomedical standards and, 3) to determine differences between attendant subgroups: SBAs, TBAs and laywomen.

The biomedical standard of acute PPH is 500cc of blood loss after the vaginal birth of a single baby; severe PPH is defined as a blood loss of greater than 1000cc. Only reported blood volume estimates (i.e. sheer) could be compared to the biomedical standards due to the unknown variation in the soaking and saturation properties of the local blood collection devices. One sheer is approximately equivalent to 1000cc. Sheer were converted into cubic centimeters when comparing blood volume estimates to the biomedical standard of PPH.

Prior to analysis, data were examined for a fit between the distributions and analysis assumptions. To improve normality the distributions were logarithmically transformed. One-way independent analysis of variance (ANOVA) with a post hoc Hochberg test was performed in addition to standard descriptive statistics using SPSS software version 17.0.²⁰ Kruskal-Wallis, a nonparametric alternative to ANOVA, was performed on data not normally

distributed after transformation. A significance level of $\alpha=.05$ was selected for the analysis. Both Emory University Institutional Review Board and the ICDDR, B Ethical Review Committee, approved the parent study from which these data were acquired. The interviewers following standard disclosure procedures obtained verbal voluntary informed consent of all participants prior to the interview.

Results

Almost all participants were married women. The majority were Muslim (89%) and the remainder Hindu (11%), proportional to the general population in Bangladesh. There were 14 SBAs, 37 TBAs, and 98 laywomen participants. SBAs had the lowest average parity (mean (M) $\pm$ standard deviation (SD)= 2.1 ± 0.8) followed by laywomen (M $\pm$ SD= 4.4 ± 2.4) and TBAs (M $\pm$ SD= 5.7 ± 2.4). SBAs had the highest level of formal education and income level. TBAs and SBAs had attended on average 10 births and 65 births in the previous year, respectively. Eighty-one percent of participants indicated that either they have experienced or know of someone who has experienced excessive, life-threatening bleeding. Demographic characteristics of the sample are presented in Table 1.

Reports of blood volume (sheer) for excessive bleeding averaged among all participants exceeded current biomedical standards. Participants reported excessive bleeding at birth to be 2500cc (SD $\pm$ 2000cc), over twice the amount of severe PPH. Within 24 hours of birth, the threshold for excessive bleeding increased to 3600cc (SD $\pm$ 2500cc). Mean estimates of excessive blood loss reported by participant subgroups for both blood volume (sheer) and number of saturated blood collection devices (mats, jute made bags, nekra, pads) are presented in Table 2.

Results of the ANOVA test indicate significant group differences between laywomen, TBAs and SBAs for blood volume (sheer). The groups differed in the estimated threshold for excessive bleeding *at time of birth* ($P < .001$) and *within 24 hours of birth* ($P < .001$). Laywomen's reports of excessive bleeding were significantly higher than SBA ($P < .001$) and TBA ($P < .001$) reports at time of birth. Laywomen's reports were higher than SBA ($P < 0.001$) and TBA ($P < .033$) reports within 24 hours after birth.

Reports from TBAs were also higher than SBA reports, whose knowledge of excessive bleeding corresponded with the biomedical definition of severe acute PPH (>1000 cc) at both time points. While mean differences were significant among all groups, a Hochberg post hoc analysis indicated the most pronounced differences were between laywomen and SBA reports *at time of birth* (M difference $\pm$ standard error (SE) = 2.5 ± 0.55 sheer) and *within 24 hours of birth* (M difference $\pm$ SE = 3.2 ± 0.78 sheer).

The blood volume thresholds for excessive bleeding by participant subgroup at birth and after birth are presented in Figure 1. While, exact volume equivalents for mats, nekra, jute made bags, and pads are unknown, laywomen and TBAs reported a similar upward bias for each of these blood collection devices compared to SBA reports. However, differences between groups were only significant for jute made bags at time of birth ($P < .001$) and mats after birth ($P < .049$).

Discussion

The observed differences between SBAs and TBAs and laywomen are critical from the perspective of maternal survival in a setting such as Matlab, where homebirth with unskilled attendants is practiced and postpartum hemorrhage remains a leading cause of maternal mortality. The apparent inability of TBAs and laywomen to quantify life threatening blood loss

in home settings is consistent with findings that show estimates by health care professionals in clinical settings are error prone. While participation in trainings using simulations has resulted in improved visual quantification among health care providers practicing in developed country hospital settings^{7, 12, 21}, alternatives are needed for unskilled birth attendants in rural developing country-situations.

Alternatives include, a blood collection drape with a conical bottom and markings in milliliters, such as the one tested in India. The drape allows for more accurate estimates compared to visual assessment and may have particular utility in settings where laywomen and TBAs continue to attend childbirth in home settings.²² However, introducing non-biodegradable plastic disposables into widespread use is not a sustainable environmental option. Additional data on the breakdown, decontamination and possible reuse of such products are needed.

Locally produced, standard size, cotton cloth *kanga* in Tanzania, used by TBAs as blood collection towels, is another possible option. Two blood soaked *kangas* represent slightly more than 500cc, allowing for immediate diagnosis and response to PPH.²³ This adaptation of the *kanga* is promising and consistent with findings from a study in Gambia that showed TBAs distinguish between “normal” and “alarming” amounts of blood loss by using the number of *lappas* (pieces of cloths) soaked with blood in addition to assessing blood flow²⁴. A third alternative, developed by the ICDDR,B and now included in the Matlab setting, is a special pad or diagnostic aid calibrated to help women and lay caregivers identify 500 ml. blood loss.¹⁶ These pads are similar to those used by hospitals in the United States to absorb fluids.

Several limitations of our study need consideration. First, the retrospective method does not provide for measures of actual blood loss to compare with reported estimates. Second, the subgroup sample of SBAs is small, compared with the TBA and laywomen subgroups. Third, the data were obtained in an area of Bangladesh with sustained maternal and child programmatic inputs, including SBA and TBA training, which limits the generalizability of findings. However, such program inputs likely biased reports in the direction of biomedical definitions, that is, the differences would be underestimated.

Conclusions

The ability to recognize and respond to excessive postpartum blood loss can decrease PPH associated morbidity and mortality. Laywomen's and TBA's knowledge of what constitutes excessive blood greatly exceed the biomedical standard of acute PPH. Erroneous quantification of blood loss could lead to underestimation of actual postpartum blood loss, delaying recognition of PPH. This is especially significant in low resource settings where laywomen and TBAs attend home births and blood loss estimates using local collection devices are unreliable. In such settings, blood may be dispersed on mats, jute made bags, and absorbed into earthen floors.

Blood is often mixed with amniotic fluid and sometimes with urine, further complicating visual assessment by unskilled attendants. Simple, low cost alternatives to visual estimation and high cost laboratory measurements of postpartum blood loss are needed.²⁵ Further research on sustainable, locally validated blood collection devices that can be used for diagnostic aid or referral in home settings is needed especially in areas where coverage and uptake of skilled birth attendance are low.

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Appendix A. Interview Questions

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1. If a woman has excessive, life-threatening bleeding at the time of birth, how many sheer of blood is lost?
 2. If a woman is lying on a mat and has excessive, life-threatening bleeding at the time of birth, how many mats will be soaked with blood?
 3. If a woman is lying on a jute-made bag and has excessive, life-threatening bleeding at the time of birth, how many jute made bags will be soaked with blood?
 4. If a woman has excessive, life-threatening bleeding during the first day of birth (0 - 24 hours), how many sheer of blood is lost?
 5. If a woman has excessive, life-threatening bleeding during the first day of birth (0-24 hours), how many nekra will be soaked with blood?
 6. If a woman has excessive life-threatening bleeding in the first day of birth (0 - 24 hours), how many sanitary pads (modex) will be soaked with blood?
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References

1. World Health Organization. Maternal Mortality in 2005: Estimates developed by WHO, UNICEF, UNFPA and the World Bank. WHO Press, World Health Organization; Geneva, Switzerland: 2007.
2. Khan KS, Wojdyla D, Say L, Gulmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: a systematic review. *Lancet* Apr 1;2006 367(9516):1066–74. 2006. [PubMed: 16581405]
3. Elbourne DR, Prendiville WJ, Carroli G, Wood J. Prophylactic use of oxytocin in the third stage of labour. *Cochrane Database Systematic Review* 2001;4 S. M. CD001808.
4. World Health Organization. Managing Complications in Pregnancy and Childbirth. World Health Organization; Geneva: 2000.
5. Anderson JM, Etches D. Prevention and Management of Postpartum Hemorrhage. *American Family Physician* 2007;75(6):877–81.
6. Maine, D. Safe Motherhood Programs: Options and Issues. Columbia University, Center for Population and Health; 1991.
7. Bose P, Regan F, Paterson-Brown S. Improving the accuracy of estimated blood loss at obstetric haemorrhage using clinical reconstructions. *BJOG* 2006;113(8):919–24. [PubMed: 16907938]
8. Larsson C, Saltvedt S, Wilkund I, Pahlen S, Andolf E. Estimation of blood loss after cesarean section and vaginal delivery has low validity with a tendency to exaggerations. *Acta Obstet Gynecol Scand* 2006;85:1448–52. [PubMed: 17260220]
9. Stafford I, Dildy GA, Clark SL, Belfort MA. Visually estimated and calculated blood loss in vaginal and cesarean delivery. *Am J Obstet Gynecol* Nov;2008 199(5):519 e1–7. [PubMed: 18639209]
10. Razvi K, Chua S, Arulkumaran S, Ratnam SS. A comparison between visual estimation and laboratory determination of blood loss during the third stage of labour. *Aust N Z J Obstet Gynaecol* May;1996 36(2):152–4. [PubMed: 8798302]
11. Duthie SJ, Ven D, Yung GL, Guang DZ, Chan SY, Ma HK. Discrepancy between laboratory determination and visual estimation of blood loss during normal delivery. *Eur J Obstet Gynecol Reprod Biol* Jan 30;1991 38(2):119–24. 1991. [PubMed: 1995380]
12. Dildy GA 3rd, Paine AR, George NC, Velasco C. Estimating blood loss: can teaching significantly improve visual estimation? *Obstet Gynecol* Sep;2004 104(3):601–6. [PubMed: 15339775]
13. Kavle JA, Khalfan SS, Stoltzfus RJ, Witter F, Tielsch JM, Caulfield LE. Measurement of blood loss at childbirth and postpartum. *Int J Gynaecol Obstet* Oct;2006 95(1):24–8. [PubMed: 16919628]

14. National Institute of Population Research and Training. Bangladesh Maternal Health Services and Maternal Mortality Survey, 2001. Center for Health and Population, John Hopkins University & ORC Macro; Dhaka, Bangladesh and Calverton, Maryland USA: 2003.
15. ICDDR B. Registration of health and demographic events, 2006. ICDDR,B; Dhaka: 2008. Health and Demographic Surveillance System-Matlab. Scientific Report No. 103
16. Sibley L, Hruschka D, Kalim N, Khan J, Paul M, Edmonds J, et al. Cultural theories of postpartum bleeding: implications community health programming. *Journal of Health, Population and Nutrition*. November;2009 2009(forth coming URL: icddr.org).
17. Thomson A. The joint WHO/ICM/FIGO statement on skilled attendants at birth. *Midwifery* 2005;21 (1)
18. World Health Organization. Traditional birth attendants: a joint WHO/UNICEF/UNFPA statement. World Health Organization; Geneva: 1992.
19. World Health Organization. The Prevention and Management of Postpartum Haemorrhage: Report of Technical Working Group. World Health Organization; Geneva: 1990. Report No.: WHO/MCH/90.7
20. SPSS for Windows. 17.0 ed.. SPSS Inc; Chicago: 2008.
21. Sukprasert M, Choktanasiri W, Ayudhya NI, Promsonthi P, P OP. Increase accuracy of visual estimation of blood loss from education programme. *J Med Assoc Thai* Oct;2006 89(Suppl 4):S54–9. 2006. [PubMed: 17726810]
22. Patel A, Goudar SS, Geller SE, Kodkany BS, Edlavitch SA, Wagh K, et al. Drape estimation vs. visual assessment for estimating postpartum hemorrhage. *International Journal of Gynaecology and Obstetrics* 2006;93(3):220–4. [PubMed: 16626718]
23. Prata N, Mbaruku G, Campbell M. Using the kanga to measure postpartum blood loss. *International Journal of Gynaecology and Obstetrics* Apr;2005 89(1):49–50. [PubMed: 15777900]
24. Bij de Vaate A, Coleman R, Manneh H, Walraven G. Knowledge, attitudes and practices of traditional birth attendants in Gambia in the prevention, recognition and management of postpartum haemorrhage. *Midwifery* 2002;18(3-11)
25. Geller SE, Adams MG, Kelly PJ, Kodkany BS, Derman RJ. Postpartum hemorrhage in resource-poor settings. *International Journal of Gynecology and Obstetrics* 2006;92:202–11. [PubMed: 16427056]

Figure 1.

Threshold for Excessive Blood Loss by Participant Subgroup and Time Frame Matlab, Bangladesh 2006.

Thresholds for excessive blood loss estimates were reported by laywomen, traditional birth attendants (TBAs) and skilled birth attendants (SBAs) at both the time of birth (*open bars*) and day of birth (*gray bars*). The quantity of blood loss was reported in *sheer* where 1 sheer is approximately equivalent to 1 liter. Error Bars represent 95% confidence intervals.

Table 1

Demographic Characteristics of 149 Birth Attendants in Bangladesh by Subgroup

Characteristic	SBA ^a s (n=14)	TBA ^a s (n=37)	Laywomen (n=98)
Age, mean (SD), y	42.0 (8.0)	52.6 (11.5)	41.5 (16.2) ^a
Parity, mean (SD)	2.07 (.83)	5.7 (2.4)	4.4 (2.4) ^b
Educational level, %			
No school	-	59.5	40.6
1-5 y	-	37.8	30.2
6-10 y	35.7	2.7	24.0
11-12 y	3.7	-	4.2
Graduate school	28.6	-	1.0
Income in Taka ^c , %			
< 2500	-	43.2	32.3
2500-5000	-	46.0	33.3
> 5000	100	10.8	34.4
Religion, %			
Hindu	92.9	10.8	12.5 ^a
Muslim	7.1	89.2	87.5

SBA=skilled birth attendant; TBA=traditional birth attendant

^a 2 missing,^b 3 missing,^c 1 Bangladesh Taka=0.015 United States Dollars

Table 2

Perceived Thresholds for Excessive Postpartum Blood Loss by Skilled Birth Attendants, Traditional Birth Attendants, and Laywomen (N=149)

Threshold Blood Volume or Number of Saturated Blood Collection Devices that signifies Excessive Postpartum Blood Loss	Mean (SD)		
	SBA (n=17)	TBA (n=37)	Laywomen (n=98)
<i>Time of Birth</i>			
Sheer ^{a,b}	.77 (.35)	1.9 (1.5)	3.3 (2.1)
Number of Mats ^c	2.5 (1.3)	3.4 (2.1)	4.0 (3.0)
Number of Jute Made Bags ^c	1.8 (.74)	2.8 (1.7)	3.6 (2.0)
<i>Day of Birth (within 24 hours)</i>			
Sheer ^{a,b}	.86 (.35)	2.9 (2.8)	4.2 (2.9)
Number of Nekra	8.9 (5.5)	8.3 (6.6)	9.5 (7.6)
Number of Pads	9.5 (6.3)	7.6 (4.8)	9.4 (6.3)

^a Blood volume was reported in *sheer* where 1 *sheer* is approximately equivalent to 1 liter or 1000cc.

^b ANOVA test results indicate significant between group differences- *at time of birth* ($P < .001$) and *within 24 hours of birth* ($P < .001$).

^c Kruskal-Wallis test results indicate significant between group differences- *number of mats* ($P < .001$) and *number of jute made bags* ($P < 0.05$).