TRANSFUSION MEDICINE
Official Journal of the British Blood Transfusion Society
British Blood Transfusion Society
Transfusion Medicine | ORIGINAL ARTICLE

Clinical use of blood and blood components in post-abortion care in Botswana

B. M. Tsima,[1] T. Melese,[2] K. D. Mogobe,[3] K. Chabaesele,[1] G. Rankgoane,[1] M. Nassali[2] & D. Habte[4]

[1]*Department of Family Medicine and Public Health,* [2]*Department of Obstetrics and Gynaecology,* [3]*School of Nursing, University of Botswana, Gaborone, Botswana, and* [4]*Department of Public Health, Addis Ababa University, Addis Ababa, Ethiopia*

Received 14 March 2016; accepted for publication 29 April 2016

SUMMARY

Background: Understanding the pattern and gaps in blood product utilisation in post-abortion care is crucial for evidence-based planning and priority setting.

Objective: To describe the current use of blood and blood components in post-abortion care in Botswana.

Methods: We conducted a retrospective cross-sectional study across four hospitals in Botswana using routine patients' records. We included all patients admitted for an abortion between January and August 2014. Descriptive statistics are used to report the results.

Results: Whole blood and red cell concentrates were used in 59/619 (9·5%) of patients. Plasma and platelet use was 1·3 and 0·7%, respectively. The mean admission haemoglobin level was 10·07 g dL^{-1} (SD 2·69) and differed significantly between referral and district hospitals. The mean number of blood units transfused per patient was 2·23 (standard deviation (SD) 1·23), with 15/55 (27·3%) receiving a single unit. A total of 43/288 (14·9%) of the patients had haemoglobin levels below 7 g dL^{-1} but did not receive any transfusion. There was a moderate positive correlation between admission haemoglobin level and time to transfusion (Spearman's rho = 0·37, $P = 0·01$). The number of blood units given increased with decreasing admission haemoglobin level. The strength of this association was moderate (Spearman's rho = −0·48, $P < 0·001$).

Conclusion: There is a relatively low utilisation of blood and blood components in post-abortion care in Botswana despite an apparent clinical need in some instances. The reason for this shortfall, as well as its impact on morbidity and mortality, needs to be explored and be a focus of health systems research in Botswana.

Key words: abortion, blood, blood components, Botswana.

Correspondence: Billy M. Tsima, Faculty of Medicine, University of Botswana, 4775 Notwane Road, Private Bag UB 0022, Gaborone, Botswana.
Tel.: +267 3555564; fax: +267 310 5979; e-mail: billy.tsima@mopipi.ub.bw

Blood is in short supply in sub-Saharan Africa (SSA), and increased demands for blood and blood components have never been met in the African setting (Field & Allain, 2007). The reasons for such shortage may be due to cultural aversion towards blood donations and the impact of human immunodeficiency virus (HIV) and its treatment in SSA (Ahmed *et al.*, 2007; Appiah & Bates, 2015). Others have reported high levels of clinical misuse of blood in SSA (Arewa, 2009). There are a number of published reports on the safety of blood transfusion in SSA but little published on the clinical use of blood and blood components. The few studies addressing clinical use of blood are from paediatrics in relation to malaria (Arewa, 2009; Olupot-Olupot *et al.*, 2014).

Botswana, like many countries in SSA, has restrictive abortion laws. According to the Botswana penal code, abortion is illegal unless the pregnancy resulted from rape, incest, defilement or when the pregnancy is a threat to the life of the mother. Additionally, abortion is legal if it is evident that the would-be-born child is at risk of suffering serious physical and mental handicap. Emerging evidence suggests that countries with restrictive abortion laws tend to have high numbers of women presenting with incomplete abortion, often initiated outside regular health facilities (Sedgh *et al.*, 2012). Abortion-related complications, such as haemorrhage, severe anaemia and sepsis, contribute to the high maternal mortality and morbidity in Botswana. Their reduction was seen as a key strategy for the country's attainment of the Millennium Development Goal number five, which targeted a 75% reduction in maternal deaths by the year 2015, a target that has not been achieved. A review of maternal deaths in Botswana in the year 2010 reported that abortion accounted for 22% of direct maternal deaths that year (Ray *et al.*, 2013). It is, therefore, important to address abortion-related complications such as haemorrhage in order to reduce the maternal mortality ratio in Botswana. There is a paucity of literature on the clinical use of blood and blood components in post-abortion care in SSA. There are no published data from Botswana regarding the clinical use of blood and blood components in post-abortion care. Determining the current situation regarding the use of blood and its components in post-abortion care in Botswana will provide baseline data for assessing the impact of the relaxation of

Transfusion Medicine published by John Wiley & Sons Ltd on behalf of British Blood Transfusion Society doi: 10.1111/tme.12320

termination of pregnancy legislation, which is anticipated in the country. This assessment will also describe the current practice around the use of blood in the management of abortion, and this is likely to inform steps towards the cost-effective use of blood in clinical care as well as improving post-abortion care in Botswana.

The aim of this paper is to describe the current use of blood and blood components in the management of abortion in hospitals in Botswana.

MATERIALS AND METHODS

Study design

We conducted a retrospective cross-sectional study at four selected public hospitals in Botswana. Medical records of patients admitted with the primary diagnosis of abortion between 1 January and 31 August 2014 were retrieved. Our inclusion criteria did not distinguish whether the abortion was induced or spontaneous in nature. We excluded files where the diagnosis was any of the following: threatened abortion; ectopic pregnancy; molar pregnancy or abnormal uterine bleeding. Trained data collectors extracted data onto data collection forms. Data included patient's demographics; clinical gynaecological and obstetric characteristics; admission haemoglobin level, type and number of blood products used; and HIV serostatus at admission. Data were entered into an EXCEL spreadsheet (Microsoft, Redmond, WA) for data management and exported to a statistical analysis software (Stata 13; Statacorp, College Station, TX, USA) for statistical analysis.

Study setting

The four hospitals included two referral hospitals [Princess Marina Hospital (PMH), Nyangabgwe Referral Hospital (NRH)] and two district hospitals [Mahalapye District Hospital (MDH), Letsholathebe II Memorial Hospital (LIIMH)]. The selection also closely reflects the referral pattern of the country's health care system such that PMH and MDH mostly cover the southern part, whereas NRH and LIIMH mostly cover the northern part of Botswana. The proportion of admissions for post-abortion care to all gynaecology clinics is estimated at 65 and 56% for PMH and MDH, respectively. For NRH and LIIMH, that proportion is 60 and 36%, respectively.

The Botswana National Blood Transfusion Services (NBTS) supplies all blood products to health facilities in the country. All blood products collected by the NBTS are from volunteer non-remunerated blood donors. The NBTS tests all donated blood for HIV, hepatitis B, hepatitis C and syphilis routinely. Potential blood donors in the NBTS must be aged between 16 and 65, with a weight not less than 50 kg (Ministry of Health, 2011).

Statistical analysis

Continuous variables were compared using the Wilcoxon rank-sum test, where variables were not normally distributed. Correlations between groups were assessed using Spearman's test. Multiple group comparisons were performed using Kruskal–Wallis test. Pearson's chi-squared test was used to assess the association between categorical variables. *P*-values less than 0·05 were considered statistically significant.

Ethical considerations

The study received ethical approval from the University of Botswana's Ethics Review Board, the Botswana Ministry of Health's Research Unit and from the Ethics Review Committees at each of the participating hospitals.

RESULTS

A total of 619 files out of the 620 targeted files for women admitted for post-abortion care among the four hospitals during the study period were retrieved and used for data extraction. Table 1 shows the demographic, clinical gynaecological and obstetric characteristics as well as the HIV serostatus of the patients at the time of admission. The mean maternal age was 27 years (range 13–46 years). The mean maternal age was not statistically different among the four hospitals, as shown in Table 1. A total of 326 (52%) of the patients had a negative HIV serostatus, and 142 (23%) had a positive HIV serostatus. A total of 132 (21%) of the patients had unknown HIV serostatus, and in 17 (2·8%) of the records, the HIV status of the patients was not documented. The proportion of patients with a negative HIV serostatus was statistically different among the four hospital such that it was 48·7, 45·9, 65·8 and 54·4% for PMH, NRH, MDH and LIIMH, respectively ($P = 0{\cdot}018$).

The number of patients who received one or more units of whole blood or red cell concentrates (RCC), plasma from fresh frozen plasma (FFP) and platelets was 59 (9·5%), 8 (1·3%) and 4 (0·7%), respectively. The number of patients who received one or more units of blood components was not statistically different across the four hospitals, although both plasma and platelet transfusions were not reported for LIIMH, and platelets transfusion was not reported for MDH (Table 2). The mean number (SD) of units given per patient across the four hospitals was 2·13 (1·23), with a minimum of 1 U and a maximum of 7 U transfused. Table 3 shows the average number of units of RCC transfused per patient among the four hospitals.

A total of 15/55 (27·3%) of the patients who received blood transfusions received only 1 U of blood (Table 4). The table includes all transfusion received per patient per admission and does not differentiate between the interval of transfusions where more than one transfusion event occurred. Patients who were not transfused were managed with haemanitics over and above the usual post-abortion care, including the uterine evacuation of retained products of conception. The haemoglobin level on admission was recorded in 288/619 (46·5%) patients admitted for post-abortion care. The overall mean (SD) haemoglobin level on admission was 10·07 (2·69):8·7 (2·7), 10·3 (2·98), 10·7 (2·3), 10·6 (2·3) at PMH, NRH, MDH, and LIIMH, respectively.

Table 1. Characteristics of post-abortion cases managed in the hospitals

	Hospital				
	PMH	NRH	MDH	LIIMH	*P*-value
Age					
Mean (SD)	26·60 (5·6)	26·63 (5·9)	29·08 (6·2)	27·81 (6·5)	0·013[1]
Gravida					
Mean (SD)	2·48 (1·3)	2·50 (1·5)	3·08 (1·6)	2·92 (1·8)	0·003[1]
Parity					
Mean (SD)	1·22 (1·2)	1·32 (1·4)	1·81 (1·5)	1·74 (1·9)	0·004[1]
Gestational age by LNMP					
Mean (SD)	12·30 (4·5)	11·96 (4·9)	12·15 (4·4)	11·14 (4·0)	0·229[1]
HIV status					
Negative	130 (48·7%)	78 (45·9%)	52 (65·8%)	56 (54·4%)	0·018[2]
Positive	64 (24·0%)	36 (21·2%)	20 (25·3%)	22 (21·4%)	
Unknown	59 (22·1%)	44 (25·9%)	6 (7·6%)	23 (22·3%)	
Not documented	14 (5·2%)	12 (7·1%)	1 (1·3%)	2 (1·9%)	

[1]Kruskal–Wallis.
[2]Pearson's chi-squared.

Table 2. Number of patients who received one or more units of different types of blood products at each of the four hospitals

	PM hospital	NR hospital	MD hospital	LIIM hospital	*P*-value
Whole blood or RCC					
given	28 (10·5%)	13 (7·6%)	5 (6·3%)	13 (12·6%)	0·382
not given	239 (89·5%)	157 (92·4%)	74 (93·7%)	90 (87·4%)	
Platelets					
Given	2 (0·7%)	2 (1·2%)	0 (0·0%)	0 (0·0%)	0·578
Not given	265 (99·3%)	168 (98·8%)	79 (100·0%)	103 (100·0%)	
Plasma from FFP					
Given	2 (0·7%)	3 (1·8%)	3 (3·8%)	0 (0·0%)	0·105
Not given	265 (99·3%)	167 (98·2%)	76 (96·2%)	103 (100·0%)	

Table 3. Average red cell concentrates blood units given per patient among the four hospitals

Hospital	Number of observations	Mean blood units given[1]	Standard deviation	Minimum units	Maximum units
PMH	26	2·12	0·99	1	6
NRH	12	2·83	1·95	1	7
MDH	6	1·5	0·55	1	2
LIIMH	11	1·73	0·65	1	3

[1]Mean computed within the patients who were given blood transfusion.

The Kruskal–Wallis test was statistically significant when the admission haemoglobin between the hospitals was compared ($P < 0{\cdot}001$). When the hospitals were grouped as either referral or district, the mean admission haemoglobin was statistically lower in the referral than district hospitals ($P < 0{\cdot}001$). Of 288 patients admitted for post-abortion care at the four hospitals with haemoglobin records, the haemoglobin level on admission was less than 6 g dL^{-1} in 30 (10·3%), 6–8 g dL^{-1} in 37 (12·8%), 8–10 g dL^{-1} in 40 (13·8%) and greater than 10 g dL^{-1} in 181 (62·9%) patients. Blood transfusion rates were 28·6%, 35·7%, 14·3% and 21·4%, respectively, among these increasing haemoglobin level categories. When a haemoglobin level cut-off point of 7 g dL^{-1}, which is the transfusion threshold recommended by the national guidelines for transfusion, is considered, 43/288 (14·9%) of the patients were below this threshold. There was a statistically significant relationship between clinicians' reports on the presence of pallor and the admission haemoglobin level at a cut-off level of 7 g dL^{-1} ($P = 0{\cdot}024$). Among patients in whom haemoglobin was not measured ($N = 331$), nine received blood transfusions.

There was a moderate positive correlation between admission haemoglobin level and time to transfusion (Spearman's rho = 0·37), which was statistically significant ($P = 0{\cdot}01$) (Fig. 1). The number of blood units given increased with decreasing admission haemoglobin level. The strength of this association was moderate (Spearman's rho = −0·48) and was statistically significance ($P < 0{\cdot}001$) (Fig. 2).

Table 4. Frequency of units of blood products given per patient when blood was transfused

Number of blood units given per patient	Number of patients	Percentage (%)
1	15	27·3
2	31	56·4
3	2	3·5
4	4	7·3
5	1	1·8
6	1	1·8
7	1	1·8
Total	55	100

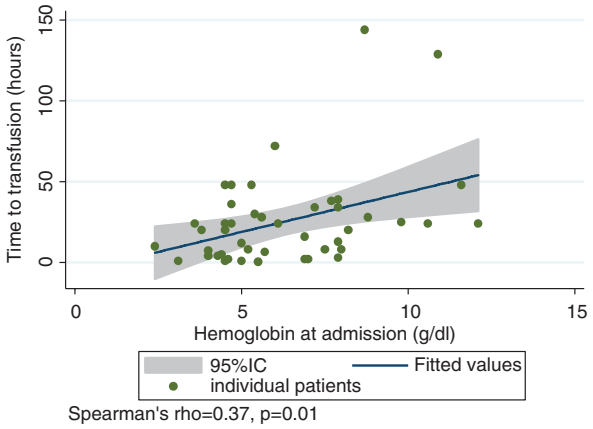

Fig. 1. Admission haemoglobin level ($g\,dL^{-1}$) versus time (hours) to transfusion of blood.

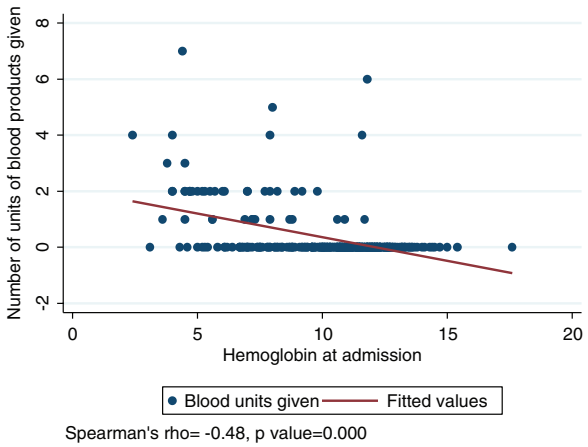

Fig. 2. Admission haemoglobin level ($g\,dL^{-1}$) versus number of units of blood products given.

DISCUSSION

Our data indicate that blood and blood components were used infrequently in the management of post-abortion complications. Blood in the form of whole blood or RCC was used in 9·5% of cases during the study. Plasma and platelet use was even more uncommon, accounting for 1·3 and 0·7%, respectively. Overall, only 11% of the patients in the study received blood transfusions as part of their in-patient care. This is much lower than reports from the neighbouring country, Namibia, where a large 4-year study assessing the use of blood and blood components in that country revealed that abortion/miscarriage represented 21·6% of all RCC units issued for pregnancy-related indications (Pitman *et al.*, 2015). Where plasma and platelets were issued, pregnancy-related indications accounted for 11·6 and 8·7%, respectively. However, abortion was not specifically accounted for in the pregnancy-related indications category when the data were analysed for plasma and platelet use (Pitman *et al.*, 2015). The need for blood and blood components in the management of abortion may indicate a high number of severe complications of abortion (Adler *et al.*, 2012). Our results show a relatively low usage of blood and blood components in post-abortion care in hospitals in Botswana. This may be a reflection of the shortage of blood supply in this setting. Conversely, this may suggest good stewardship of blood, indicating that clinicians in this setting follow a restrictive transfusion regimen. A restrictive strategy has been shown to be advantageous compared to a liberal strategy in recent studies. The authors of a large 2012 Cochrane collaboration review reported higher in-patient mortality among patients managed with a liberal strategy compared to patients managed with a restrictive transfusion strategy (Carson *et al.*, 2012). A meta-analysis published in 2014 compared transfusion thresholds of 7 and 8 $g\,dL^{-1}$ and concluded that the lower transfusion threshold was superior to the higher threshold in critically ill and bleeding patients (Salpeter *et al.*, 2014). The restrictive regimen highlighted in our study will need to be assessed to see if it results in good clinical outcomes in patients admitted for post-abortion care in Botswana.

Given the retrospective design of our study, we did not distinguish whether an abortion was induced or spontaneous. However, our results revealed that in 24/619 (3·9%) of patients, the abortion was recorded to have been induced. However, it was not possible to distinguish if this was performed by the patient herself or by someone else outside the health care settings. These two types of abortion share similar clinical signs and symptoms, and therefore, it is often difficult to differentiate between the two (Dragoman *et al.*, 2014). Eliciting the history of the presenting problem from the patient is important in determining the probability of one over the other. However, in the setting of restrictive abortion laws, women seeking treatment at health facilities may report an abortion as spontaneous when in fact it had been induced for fear of criminal charges (Dragoman *et al.*, 2014). It is therefore likely that the figure of self-induced abortion is an underestimation as it is well recognised that women are often reluctant to report induced abortions, especially where it is illegal, and underreporting occurs even where abortion is legal (Shellenberg *et al.*, 2011). Furthermore, eliciting information regarding abortion is unreliable (Jagannathan, 2001). The

presence of a clandestine abortion might affect the demand for blood products and its consumption by complicating the patient's clinical condition like sepsis with ongoing haemolysis, end organ damage and damage to visceral organs, requiring laparotomy and advanced clinical care. We excluded patients with diagnoses of threatened abortion, ectopic pregnancy, molar pregnancy or abnormal uterine bleeding as we were focusing on post-abortion care. Given that the determination of the cause of vaginal bleeding in a pregnant woman is often subjective and difficult in low-resource settings, there is a risk for misclassification bias in studies such as ours.

A total of 23% of the patients were HIV infected, and 52% were not. Nearly a quarter of the patients (24%) had an unknown or undocumented HIV status. The HIV prevalence in this population of women admitted for post-abortion care is slightly lower than the 30% HIV prevalence among pregnant women in Botswana (Voetsch *et al.*, 2012). The high proportion of patients with unknown or undocumented HIV status in our study may explain the discrepant figures. It is, however, concerning that the HIV status of a quarter of the patients could not be determined. It may be that this population represents a proportion of abortions that were in fact induced as HIV testing is offered and encouraged when pregnancy is diagnosed and antenatal care begins. In Botswana, this is conducted after 8 weeks' gestation. The median gestational age in our study was 11 weeks (range 5–24 weeks), thus suggesting that these women had missed antenatal care registration. Therefore, it is likely that pregnant women with unknown HIV status had not had contact with antenatal care services as they had not planned to stay pregnant. It would be difficult to confirm suspicion of induced abortions in our setting where abortion is illegal and restricted by law.

Haemoglobin level on admission was reported in less than half of the patients. Given that this group of patients included patients with incomplete abortions, a diagnosis in which heavy bleeding is an inevitable feature, the rational use of blood products should be guided by objective measures like haemoglobin and not just subjective clinical impression. The generally lower admission haemoglobin levels seen at the referral hospitals (PMH, NRH) compared to district hospitals (MDH, LIIMH) may be due to the fact that more sick patients are likely to be referred to PMH and NRH. These patients may have lower haemoglobin levels to start with. Additionally, transfer from far places may not be timely due to transportation challenges, and therefore, patients sustain continued blood loss in transit to the next level of care.

Our data indicate that 10, 12, 13 and 63% had haemoglobin levels on admission of less than 6, 6–8, 8–10 g dL^{-1} and greater than 10 g dL^{-1}, respectively. This differs with observations from Ghana, where the pre-transfusion haemoglobin level was less than 6 g dL^{-1} in 36·7%, 6–8 g dL^{-1} in 29·1% and greater than 8 g dL^{-1} in 33·2% (Osei *et al.*, 2013). The comparatively lower proportion of patients with a haemoglobin level less than 6 g dL^{-1} and haemoglobin level of 6–8 g dL^{-1} in our study limited to those admitted with the diagnosis of abortion compared to the Ghanaian study may be due to several differences in the populations. Firstly, this may be due to the higher prevalence of sickle cell anaemia in tropical regions such as equatorial Africa compared to its relatively low prevalence in places like South Africa and Botswana (Alli *et al.*, 2014). Furthermore, our study population did not include all causes of abortions, whereas these authors included all patients admitted to the Obstetrics and Gynaecology department.

Our findings further indicate that 14·8% of the patients would qualify for blood transfusion under the 7 g dL^{-1} threshold recommended by national guidelines. Overall, only 11% of the patients in the study received blood component transfusions. This discrepancy is likely due to a shortage of blood and blood components. It may also be due to the fact that clinicians are not prescribing blood transfusion in the management of the anaemia based on haemoglobin level in the setting of abortion, but rather, decisions to transfuse may have been determined by the presence of symptoms. Conversely, some patients received blood transfusion without a documented level of haemoglobin. We were not able to describe the circumstances surrounding these patients given the retrospective nature of our study. It is possible that these few patients were treated as emergencies, as cases of haemorrhagic shock requiring uncrossmatched group O negative blood.

Blood units were transfused at a rate of 2·13 (SD 1·23) units per patient across the four hospitals. This rate is comparable to findings from Osei *et al.* (2013) where their Ghanaian study reported the average blood products used per patient not undergoing emergency nor elective treatment to be 2·4 U per patient. Similarly, researchers in Uganda reported that patients in the Obstetrics and Gynaecology ward received an average of 2·7 units of blood (Natukunda *et al.*, 2010). However, our study was restricted to patients with a diagnosis of abortion that excluded other causes of vaginal bleeding that may have been included by these authors. It may be that our finding underestimates the true transfusion rate prevailing in Botswana. Close to a third (27·3%) of the patients received a single unit of blood. This may suggest that there was a shortage of blood to transfuse during the period, and priority clinical conditions such as states of acute haemorrhage were preferentially managed with the available blood. This finding is slightly better than results reported by Natukunda *et al.* (2010) which showed that 38·6% of their patients were recipients of single-unit transfusions.

There was a moderate positive correlation between admission haemoglobin level and time to transfusion (Spearman's rho = 0·37, $P = 0·01$) (Fig. 1). Thus, it appears that the efficiency of transfusion was correlated with the admission haemoglobin level. The number of blood units given increased with decreasing admission haemoglobin level (Spearman's rho = −0·48, $P < 0·001$) (Fig. 2). This finding suggests an appropriate practice as the number of units prescribed per patient is expected to be determined by the severity of the anaemia. However, we found a high proportion (27%) of patients whose anaemia was managed with a single unit of blood. This may have been due to a shortage of blood for transfusion. Others have reported proportions higher than ours elsewhere (Natukunda *et al.*,

2010). This analysis may also reflect the changing demands for blood and blood components in SSA whereby there is increased demand due to cancer therapies as recently observed in Namibia and Uganda (Pitman *et al.*, 2015).

Our study has notable limitations. Firstly, there were missing data for the analysis due to incomplete records. We were not able to fully assess the clinical appropriateness of the blood use due to limited information from the records. Furthermore, we limited our data collection to admission records and did not access laboratory records on blood transfusion. A prospective study including laboratory records could address this limitation that is inherent in retrospective studies such as ours. Additionally, responses from patients may be biased for fear of the legal implication associated with unsafe abortion.

CONCLUSIONS

There is a relatively low utilisation of blood and blood components in post-abortion care in Botswana despite the clinical need. It appears that, when abortion is considered, the use of blood and blood components is lower than what would be expected. The reason for this shortfall, as well as its impact on morbidity and mortality, needs to be a focus of health systems research in Botswana. Given that the majority of patients in the current study were managed with whole blood and RCC, blood components use should be explored as a possible solution to address the shortage. The advantage of using blood components is that a donated unit of blood can be used by more than one patient. Component blood therapy may be a possible solution to the blood shortage in the management of post-abortion complications in Botswana.

ACKNOWLEDGMENTS

T.M. designed the study. B.M.T. analysed the data and wrote the manuscript. T.M., K.D.M, G.R., M.N. and D.H. revised the manuscript. B.M.T., K.C., K.D.M., T.M., G.R. and M.N. collected the data. We are grateful for the support received from staff members at the four hospitals involved in the study. We also thank the Botswana Medical Education Partnerships Initiative (BoMEPI) for the financial support granted to carry out this study under the President's Emergency Plan for AIDS Relief (PEPFAR) through Health Resources and Services Administration (HRSA) under the terms of grant T84HA21125.

CONFLICT OF INTEREST

The authors have no competing interests.

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