Published in final edited form as:

Transfusion. 2015 July ; 55(7): 1607–1612. doi:10.1111/trf.13019.

Transfusion practice and knowledge in Mozambique

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Abstract

BACKGROUND—In Mozambique, there is a limited supply of blood and elevated risks for transmission of infections. Prior studies have documented that many transfusions in Mozambique are potentially avoidable. Transfusion training workshops with a survey and exam were held for providers to understand their perceptions and to improve knowledge and clinical practice.

STUDY DESIGN AND METHODS—Health care providers completed a survey and a knowledge assessment. The Wilcoxon signed rank test was utilized to compare the relative importance of each factor in the survey, and pre- and posttraining exam scores were compared using Fisher's exact test.

RESULTS—A total of 216 health care providers participated; the majority worked in a referral hospital (74%) and reported transfusing blood at least once per week (56%). Most acknowledged the limited blood supply and transfusion risks. Providers rated low hemoglobin (Hb) levels and pallor as significantly important indications for transfusion ($p < 0.001$). They were more likely to transfuse with age under 5 years when compared to other ages ($p < 0.01$). The three most potentially influential factors for transfusion practice were increased reliability of the blood supply, education about transfusion indications, and assessment of perfusion. Before training, the majority of participants identified an incorrect Hb threshold for preoperative or critically ill patients. Overall exam scores improved from a mean of 58% to 74% ($p < 0.001$).

CONCLUSIONS—Mozambican providers were knowledgeable about the risks of blood transfusions. Preoperative patients, the critically ill, and children appear to be at highest risk for

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CONFLICT OF INTEREST

The authors have disclosed no conflicts of interest.

receiving an avoidable blood transfusion. These results will help guide planning for future provider training.

In sub-Saharan Africa, there are ongoing needs to improve the reliability and safety of the blood supply.^{1,2} Despite challenges with blood supply, overutilization of blood products has also been observed in some centers.^{3–5} While blood transfusions have the potential to save lives, they also have many risks including transmission of communicable diseases, transfusion reactions, and immunosuppression.^{6–8} In areas with a high human immunodeficiency virus (HIV) prevalence and lack of viral confirmation in screening, the risk of HIV transmission from blood transfusions is particularly concerning and represents another reason to promote their judicious use. In developed countries, blood transfusions have been associated with an increased rate of wound infections, longer length of stay, and higher mortality rates.^{9–11} Restrictive blood transfusions practices using lower hemoglobin (Hb) thresholds have proven to be safe and may result in improved outcomes.^{8,12}

In Mozambique, there have been recent accomplishments in improving the blood program infrastructure, laboratory infectious disease screening, and the blood donation process; however, it is clear that education and training of health care workers is a crucial next step to improving the national blood program and promoting optimal transfusion practice.¹³ To improve knowledge about blood transfusions and promote evidence-based restrictive blood transfusion practices that abide by World Health Organization (WHO) recommendations, the Mozambican Ministry of Health planned a national blood transfusion training program with support from the President's Action Plan for AIDS Relief (PEPFAR) and the US Centers for Disease Control and Prevention (CDC) in Mozambique and in collaboration with the AABB (formerly known as the American Association of Blood Banks). Expert consultants in transfusion medicine who were also native Portuguese speakers developed a full-day training program for Mozambican providers as an introduction and overview of transfusion medicine. In addition, an existing partnership between the David Geffen School of Medicine at UCLA and the University of Eduardo Mondlane Medical School at Hospital Central in Maputo was expanded to include training in transfusion medicine. A fellowship program for Mozambican physicians was established at UCLA to increase Mozambican specialty expertise in transfusion medicine and to help guide the establishment of a National Reference Blood Bank Laboratory. UCLA faculty in pediatrics, surgery, and transfusion medicine provided technical expertise for the transfusion training objectives and curriculum.

To assess current attitudes and knowledge about blood transfusion practices as well as the barriers to changing practices, a survey of health care professionals participating in the workshop was developed and administered. In addition, pre- and posttraining examinations were conducted to evaluate knowledge before and after the workshops. The survey and examinations results were intended to better plan future training workshops, inform and guide blood bank medical directors, and identify strategies for the Ministry of Health to define and improve adoption of evidence-based practices in transfusion.

MATERIALS AND METHODS

Approval was obtained from the UCLA Institutional Review Board, the Mozambique National Bioethics Committee, and the CDC to conduct transfusion-related surveys and exams. The Ministry of Health requested that hospital departments send representatives to receive training at one of four day-long transfusion training workshops held between August 29 and September 4, 2013, at the three central hospitals (Maputo, two workshops; Beira, one workshop; Nampula, one workshop). The training program, survey, and knowledge assessment were provided in Portuguese. The training duration was 8 hours and included lectures on the following topics: introduction to transfusion medicine, blood groups, compatibility testing, blood donation processes, risk and benefits of blood transfusions, infectious risks specific to Mozambique, blood components and those available in Mozambique, safe administration of blood products, clinical indications for transfusion, massive transfusion protocols, adverse reactions to blood products, monitoring and evaluation in blood programs, and introduction to hospital transfusion oversight committees. Participants were asked to take a survey evaluating transfusion practices at the workshop prior to the educational component of the workshop. The survey was designed using a Likert scale to evaluate health care professionals' opinions about transfusions, the factors that increase their likelihood of transfusing, and factors that would influence their transfusion practices. The scale evaluating degree of agreement had the following options: -2 (strongly disagree), -1 (disagree), 0 (neutral), 1 (agree), and 2 (strongly agree). The scale evaluating level of importance ranged from 0 (not important) to 4 (very important).

Pre- and posttraining examinations were also performed. The examination was composed of five true/false and three multiple-choice questions. Exam questions were developed by the study team based on a review of the literature and important and relevant clinical transfusion issues observed in the Mozambican hospital setting. The exam was then piloted by a group of Mozambican providers to assess clarity and level of difficulty. Questions assessed understanding of Hb thresholds for patients including those who are critically ill, have a diagnosis of sepsis, have ongoing wound healing including a burn injury, or have undergone orthopedic surgery. Additional questions assessed understanding of the physiologic response to chronic and acute anemia, the risk of HIV transmission in Mozambique, and rates of transfusion reactions.

All surveys and examinations were voluntary and anonymous. Likert scale results were compared within each survey category using Wilcoxon signed rank test. Data were summarized using quantile box plots with a mean diamond. Pre- and postexamination questions and total scores were compared using Fisher's exact test.

RESULTS

Participant demographics

A total of 216 health care professionals participated in the four workshops (Maputo, 81 and 78; Nampula, 33; Beira, 24). The majority of participants were physicians (94%); 4% were technicians, and 2% were nurses. The largest group of physicians was postgraduate (resident) trainees (47%). Fifty-four percent of physicians reported a specialty: internal

medicine (36%), surgery (34%), pediatrics (19%), anesthesia (10%), and other (1%). The majority of participants worked at one of the major referral hospitals in Maputo, Beira, or Nampula (74%). The remainder worked at smaller community hospitals and clinics surrounding these three larger centers.

Survey

The majority of participants (56%) reported administering transfusions more than once per week. The remaining participants reported the following frequencies: more than one per month (18%), more than one per year (4%), never (< 1%), and no response (21%).

When participants were queried about their opinions regarding transfusion, most agreed that it was difficult to obtain blood transfusions due to interruptions in supply. The majority also acknowledged that transfusions are dangerous (Fig. 1). The majority indicated that their use of transfusions was appropriate by disagreeing that they transfused “too little” or “too much.” In regard to factors that increase the likelihood of transfusion, low Hb levels and pallor received a significantly higher level of importance when compared with tachycardia, planned surgery, slow capillary refill, low blood pressure, malaria, burns, and age ($p < 0.001$; Fig. 2A). Patient age of less than 5 years had a significantly higher level of importance influencing the decision to transfuse when compared with other age groups ($p < 0.01$); age 5 to 13 years had a significantly higher level of importance than age of more than 14 years ($p < 0.02$; Fig. 2B). The three factors identified as having the highest level of importance in influencing transfusion practice were education about transfusion indications, increased reliability of the blood supply, and training to assess perfusion. These were significantly more important when compared with increased availability of laboratory testing and changes in transfusion guidelines ($p < 0.01$; Fig. 3A). Ministry of Health guidelines were identified as more important in influencing transfusion practices when compared with hospital or departmental guidelines ($p < 0.001$; Fig. 3B).

Examination

Pretraining examinations were performed at three sites ($n = 135$), and posttraining examinations were completed at two sites ($n = 63$). Overall scores improved from a mean of 58% to 74% ($p < 0.001$). Results for the true/false questions are summarized in Table 1. The questions most frequently answered incorrectly assessed whether transfusion to obtain a Hb threshold of 10 g/dL was a requirement for surgery and improved survival in critically ill patients. The majority of participants correctly recognized that the estimated risk of HIV transmission was five or more for every 1000 blood transfusions (pre, 69%; post, 74%; $p < 0.01$). A minority of participants correctly recognized the estimated risk of blood transfusion reactions was at least 1% (pre, 42%; post, 49%; $p = 0.08$). The majority of participants correctly recognized that anemia can be compensated for by all the following: increase in vascular resistance, increase in venous return, increase in cardiac output, and increase in oxygen extraction (pre, 57%; post, 67%; $p = 0.22$).

DISCUSSION

Interest in transfusion medicine education is increasing worldwide as patient blood management programs highlight the high rates of potentially avoidable blood transfusions and as awareness increases regarding the complications associated with transfusion of blood products. Additionally, a recent utilization project showed blood transfusions to be one of the most common procedures performed in the hospital setting, which, coupled with a limited amount of transfusion medicine education, has further prompted efforts to assess knowledge and improve evidence-based transfusion medicine practice (i.e., surveys, validated exams).^{14–18} PEPFAR has also recognized the need to improve the utilization and safety of blood in the recent release of the “PEPFAR Blueprint: Creating an AIDS-free Generation,” which includes improving blood safety and appropriate blood usage as one of its main tasks.¹⁹ Finally, in their conference report following the 2012 AABB Annual Meeting, Eichbaum and colleagues²⁰ highlight the challenges for transfusion medicine education in developing countries and provide examples of transfusion medicine training that is contextually relevant taking into account blood supply, technical knowledge, and resources, as well as the knowledge and available training for health care professionals.

In this article, we report the successful implementation of a Mozambican blood transfusion training workshop in the three major cities where blood transfusions are most likely to be available and administered. A large proportion of Mozambican physicians participated in the training as it is estimated that there are only 1000 national doctors (including approx. 250 postgraduate trainees) for the entire country.²¹ Nearly half of the physicians trained were postgraduates. The majority of providers reported transfusing blood at least once weekly. They reported difficulty in obtaining blood transfusions, acknowledging challenges with reliability of an adequate blood supply. However, they reported transfusing neither “too much” nor “too little” indicating a perception that provider use of red blood cell transfusions was appropriate. Participants in the workshop acknowledged that blood transfusions are dangerous, and the majority were aware of the relatively high risks of HIV transmission. However, a minority was aware of the incidence of noninfectious risks of blood transfusions (i.e., acute transfusion reactions).

Participants identified Hb level and pallor as the most important factors in determining the need for a blood transfusion when compared to signs of poor perfusion. However, the WHO advises that transfusions be based more on evidence of inadequate compensation for anemia and less on absolute Hb levels as reflected by laboratory tests or the presence of pallor.²² In most circumstances, clinical variables such as tachycardia and low blood pressure are better indicators of poor perfusion than pallor. In addition, participants were more inclined to administer blood transfusions to pediatric patients, particularly children under the age of 5, despite the fact that in most circumstances children have more cardiac reserve and ability to compensate for anemia than adult patients. The majority of participants also identified incorrect Hb thresholds (< 10 g/dL) as a requirement for surgery and to improve survival in critically ill patients despite current evidence in the medical literature that suggests that restrictive blood transfusion practices are advisable, especially in the context of a limited blood supply and high risks of HIV transmission.^{23,24} Based on these results, there will be a

benefit to focusing clinician training on adequate assessment of perfusion as well as providing targeted training for surgeons, anesthesiologists, intensivists, and pediatricians.

This information highlights the need for education on evidence-based clinical guidelines for transfusion and the potential impact national transfusion guidelines could have in improving blood utilization. In addition, although Hb testing is available in the majority of clinical inpatient settings, a delay in receiving results (up to 24 hr) may contribute to a higher rate of potentially avoidable transfusions. Access to point-of-care devices to measure Hb in high-volume patient areas such as intensive care units or operating rooms would further support adherence to a restrictive Hb threshold.

Participants identified training to assess adequate perfusion and education about transfusion indications as well as improved reliability of blood supply as the most important factors that could influence their blood transfusion practices. Interestingly, these first two factors are consistent with the gaps in education identified by the exam results and would reflect the participants' awareness of their limited knowledge in these areas. In contrast, availability of laboratory testing and changes in transfusion guidelines were viewed as being less important. Participants did appear to view guidelines from the Ministry of Health to be more important than those from the hospital and department suggesting that national guidelines would be the most impactful.

This study has several limitations. Representation from providers at primary and provincial hospitals was limited. However, these hospitals likely have extremely limited blood supply and transfusion capacity. A selection bias may also be present because attendance of the workshop may not have been random. By virtue of their attendance, participants may have been more likely to desire additional education or training, and this bias may have influenced the results. Another potential limitation of the study is that only half of the participants who took the pretraining examination completed the posttraining examination. However, the majority of the "missing" post-training examinations were due to organizational issues at the conclusion of the training workshop. Finally, the transfusion exam and survey we created were not validated as has been reported by large institutional collaboratives in high-income countries;^{18,25} however, the methods we report are novel, feasible, and reproducible in the context of a limited-resource setting.

The study is unique in its use of a survey to assess provider attitudes about transfusion practices and how their practices might be influenced and improved. A prior study that described implementation of transfusion training workshops in the Mwanza region of Tanzania failed to demonstrate a significant reduction in overall avoidable transfusions except in the pediatric patient population.⁵ These authors commented that the workshops were most successful in areas where there was a local leader that championed changes in transfusion practices. The establishment of hospital transfusion committees has also been recommended to engage department chiefs to improve adherence to restrictive blood transfusions guidelines and optimize allocation of a limited blood supply.

Given the limited blood supply and higher risk of HIV transmission in Mozambique, the Ministry of Health would benefit from improvements in allocation of blood through a

centralized collection and distribution process and attempts at improving transfusion practice thereby decreasing transfusions that are not indicated and associated with significant risk. Adoption and adherence to more restrictive blood transfusion practices will require ongoing education and clinical training. The improvements in examination scores observed in this study suggest that knowledge transfer can be successful following training workshops. Monitoring and evaluation through the establishment of hospital transfusion committees to engage department chiefs to improve adherence to restrictive blood transfusions guidelines and optimize allocation of a limited blood supply will also be required to ensure that knowledge transfer persists and is associated with improved practices and a reduction in avoidable blood transfusions.

Acknowledgments

This research has been supported in part by the AABB, President's Emergency Plan for AIDS Relief (PEPFAR) through the Health Resources and Services Administration under the terms of Cooperative Agreement U97HA04128, the UCLA Center for World Health, Mending Kids International, Sunwest Mortgage, the UCLA AIDS Institute, the NIH/NCRR/NCATS UCLA CTSI Grant UL1TR000124, the UCLA Department of Pathology and Laboratory Medicine and the Division of Transfusion Medicine, and the UCLA Department of Surgery and Division of Pediatric Surgery. The findings and conclusions presented are those of the authors and do not necessarily represent the official position of the funding agencies.

We acknowledge Dr Lee Miller, Dr Atanasio Taela, Dr Carmen Nogueira, Dr Jose Duran, Dr Linda Baum, Dr Paula Santos, Zachary Burke, James Chen, Dr Celson Conceicao, Debbie Martins, Brittni Johnson, Amy Boore, and Leonardo da Sousa for their contributions.

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ABBREVIATION

PEPFAR President's Emergency Plan for AIDS Relief.

Difficult to obtain blood transfusions.*

Guidelines influence transfusions.

Transfusions are dangerous.

Transfusions are safe.

I transfuse too little.

I transfuse too much.

Fig. 1.

Opinions about transfusions. Box plots illustrate degree of agreement with statements about blood transfusions using Likert scale from survey. * $p < 0.01$ when compared with other statements.

Fig. 2.

(A) Factors increasing likelihood of transfusion. Box plots illustrate the level of importance each factor has on the likelihood of ordering a transfusion using Likert scale from survey. * $p < 0.001$ when compared with all other factors. (B) Factors increasing likelihood of transfusion—age. Box plots illustrate the level of importance each age group has on the likelihood of ordering a transfusion using Likert scale from survey. * $p < 0.001$ when compared with other groups. † $p < 0.02$ when compared with age > 13 years.

Fig. 3.

(A) Factors influencing transfusions. Box plots illustrate the degree of influence each factor has on transfusions using Likert scale from survey. *The three factors all achieved significance of $p < 0.01$ when compared with increased availability of lab testing and change in guidelines. (B) Factors influencing transfusions—guidelines. Box plots illustrate the degree of influence changes in guidelines would have by each organization on transfusions using Likert scale from survey. * $p < 0.001$ when compared with other factors. † $p < 0.001$ when compared with departmental guidelines.

TABLE 1

Examination results *

Result	Percent correct		p value
	Before training (n = 135)	After training (n = 63)	
Blood transfusions to maintain the Hb > 10 g/dL are necessary before surgery. (FALSE)	24	67	<0.001
Blood transfusions to maintain the Hb > 10 g/dL are required to improve survival in critically ill patients (without cardiac ischemia or cardiovascular accident). (FALSE)	47	65	0.02
Blood transfusions to keep the Hb > 10 g/dL reduce the risk of sepsis. (FALSE)	74	89	0.02
Blood transfusions to keep the Hb > 10 g/dL improve survival in healthy patients. (FALSE)	87	98	<0.01
Lower Hb levels are better tolerated in chronic anemia. (TRUE)	95	100	0.10

* True/false statements from examination are listed with correct answer in parentheses. p values represent comparisons between before and after training using Fisher's exact test.