

SCIENTIFIC ARTICLES



Partnership for safe blood in Mali: an implementation evaluation

Partenariat pour du sang sûr au Mali: évaluation d'un projet de mise en oeuvre

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Running Title

Partnership for safe blood in Mali

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ABSTRACT

Introduction

A readily available and a safe blood supply is a great need in Sub-Saharan Africa. The Ministry of Health Mali's Blood Supply Policy requires Blood Centres in remote areas beyond the capital Bamako. With limited resources for creating blood centres, the task requires solid, committed partnerships.

Aim

Physicians for Peace with the Safe Blood for Africa Foundation™, along with the American National Red Cross and *Hôpital Nianankoro Fomba* (HNF) in Ségou, united with the aim of developing a blood bank and testing centre.

Methods

The planning and implementation of this project occurred over five years and data collection began in 2012.

Results

Evaluation of this project revealed in 2012, 9% donors were volunteers vs. 23% in 2013. Safe blood is now available, however, supply does not match requests. In 2012, there was a shortfall of 644 units and 747 in 2013. Discarded blood accounted for 20% loss (2012) and 26% (2013). Transfusion-Transmissible Infections accounted for the majority of losses; e.g. HepB accounted for 50% in 2013.

Discussion and Conclusion

Many factors aid in on-going challenges related to sustaining the blood centre. The nature of working across multiple cultures and geographic areas, requiring clearly defined partner roles, and financial constraints cause strain on the timing and delivery of project goals. The partnership developed the Ségou region's first blood centre at HNF, with trained staff and an equipped facility, serving a community who previously had limited access to Safe Blood. Recommendations and next steps are made to promote sustainability of blood services in Mali.

RÉSUMÉ

Introduction

Le besoin en approvisionnement en sang disponible et sûr est grand en Afrique subsaharienne. La politique d'approvisionnement en sang du Ministère de la santé du Mali exige des centres de transfusion dans les zones reculées au-delà de la capitale Bamako. Compte tenu des ressources limitées à la création des centres de transfusion sanguine, la tâche exige des partenariats solides et engagés.

Objectif

Les Physicians for Peace, the Safe Blood for Africa Foundation™, the American National Red Cross et l'Hôpital *Nianankoro Fomba* (HNF) à Ségou, se sont unis pour développer une banque de sang et un centre de dépistage.

Méthodes

La planification et la mise en œuvre de ce projet ont eu lieu sur cinq ans et la collecte de données a débuté en 2012.

Résultats

L'évaluation de ce projet a révélé qu'en 2012, 9% des donneurs étaient des bénévoles contre 23% en 2013. Le sang sûr est maintenant disponible, mais l'offre ne correspond pas à la demande. En 2012, il y a eu un déficit de 644 unités et de 747 en 2013. Les pertes de sang ont représenté 20% (2012) et 26% (2013). Les infections transmissibles par la transfusion représentent la majorité des pertes; par exemple l'HepB représentait 50% en 2013.

Discussion et Conclusion

De nombreux facteurs contribuent aux défis continus liés au maintien du centre de transfusion sanguine. La nature du travail au sein de plusieurs cultures et zones géographiques, exigeant des rôles de partenaires clairement définis, et des contraintes financières mettent à rude épreuve le calendrier et la réalisation des objectifs du projet. Le partenariat a développé le premier centre de transfusion de la région de Ségou à HNF, avec un personnel formé et un établissement équipé, servant une communauté qui avait auparavant un accès limité au sang sûr. Des recommandations et les prochaines étapes sont faites pour promouvoir la pérennité des services de transfusion sanguine au Mali.

INTRODUCTION

Globally more than a billion people live in need of safe blood, which is a foundational resource for adequate healthcare as few Health System Strengthening (HSS) initiatives **DO NOT** make the assumption that adequate **SAFE** blood is available. McCullough and McCullough¹ report that about 80% of the world's population has access to only 20% of the world's blood supply. Fortunately, albeit inadequate, resources exist to combat the lack of safe blood in the developing world and an increasing number of international actors have dedicated themselves to such efforts. There is a growing action and collaboration among Ministries of Health (MOH), international blood safety organizations, international non-governmental organizations (NGOs), hospital leadership, and others to achieve shared goals due to limited funding. Additionally, such partnership allows for more efficient use of funding and resources, and greater specialization of each partner. It also requires a strong commitment to collaborate with clear definition of partner roles, while melding cultures and motivations unique to each country.

An implementation evaluation of partnerships that were formed to realize a blood donation and collection service at Hôpital Nianankoro Fomba (HNF), in Ségou, Mali will be discussed. It is critical to understand the current status of blood safety in Mali and the need for implementing and strengthening blood programs in developing countries to ensure safe blood for all. The process of developing a blood bank has inherent challenges, yet through technical assistance and partnerships, successes were achieved. Improving blood availability leads to necessary next steps and an urgent call to action¹.

Centre National de Transfusion Sanguine (CNTS) is the entity in Mali within the Ministry of Health charged with the responsibility of overseeing all blood safety activities throughout the country. In addressing this role, CNTS has developed a National Blood Transfusion Policy² with the vision that each of the health regions will develop the capability to function autonomously. The policy promotes partners working synchronously as part of an integrated system — the goal of which is to have a readily available and safe blood supply. This vision, in accordance with the World Health Organization³ recommendations, has yet to be realized for a range of reasons, including insufficient expertise and resourcing.

Currently, the only fully functioning blood bank in Mali is located in the national capital, where there is easier access for a safe blood supply with the necessary safety and testing regimes that serves Bamako and its immediate surrounds. With few exceptions the rest of the country has inadequate access. In some of the larger communities, even as blood services are scarce, testing of donated blood is performed at a rudimentary level using rapid diagnostic tests. Blood donation practices are considered high risk due to a lack of application standards for screening donors and testing blood; this places recipients of donated blood at risk of infection for life-threatening diseases. Oftentimes, the lack of a dependable blood supply means that donations are “just in time” and transfusions are often performed from one person directly to another, known as ‘vein to vein’ or ‘family replacement’ transfusion. A safe and dependable blood supply would allow for avoiding many transfusion-related complications⁴, adverse reactions and infections. Much of the current blood donor system in Mali is an informal one, consisting of family replacement donors and those paid by the family (mostly clandestinely) to donate when family members cannot. While corroborated data are difficult to obtain, of the reported national pool of collections, only about 20% are from repeat voluntary non-remunerated blood donors (VNRBD) who are recognized as the safest donor pool⁵.

The majority of these donors are in the capital region, where CNTS regularly accepts blood donations². In 2006, Mali estimated it would need to collect 150,000 units of whole blood each year to meet the WHO's recommended figure of 1% of the population donating a unit of blood. In 2010, only about 48,500 units of whole blood were collected and of these, only 1,331 units were collected in Ségou². The majority (80%) of the units collected in Mali were from family replacement donors⁶.

In areas where there is no system for procuring, testing, storage and distribution of blood, its availability is unreliable. In these areas, a system for recruiting VNRBDs is lacking. Even in Bamako, the cold chain is not managed by the CNTS but rather by family members who collect the blood and carry it, often without any refrigeration, to the family member. When patients need blood, they often receive it through direct transfusion from a family member or person paid to pose as a family member. Lucky patients will be in a hospital that has a unit or two of blood, but those cases are rare. Sometimes in cases where family members are not present or are unsuitable donors, they will find and pay individuals to donate blood.

In outlying areas, non-family donors are typically procured through institutions located near hospitals. Military installations and factories are continuously bombarded with emergency requests for blood donations but these donors often demand large sums for their blood. As is the case elsewhere in Africa, the financial burden imposed on desperate relatives by paid donation is also frequently disproportionate to their means, placing highly vulnerable persons in an untenable situation. Unfortunately, these types of commercial donors also carry higher risks of transmitting infectious diseases, especially in populations with high rates of HIV, Hepatitis B and C.

Remunerated donors and blood donor recruiters, who may not have standardized stringent donor screening criteria that would exclude high risk blood donors, conspire to create a situation that is unfavourable for the safety of the blood collected^{3,7}.

Despite this, because it has no substitute, safe blood is critical to a fully-functioning health system. Furthermore, most health systems strengthening initiatives, such as those addressing HIV, obstetric health, malaria-induced anaemia in children, any surgical procedures, etc., assume there are adequate reliable supplies of safe blood – this is a failed assumption in most of sub-Saharan Africa (SSA)⁸. All robust health care systems include a component of readily available, screened and processed blood. Yet the need for safe blood in Mali remains great, as it is an irreplaceable component of maternal care, treatment of blood disorders, and trauma care.

While Mali does not record specific statistics regarding complications of maternity care, we can extrapolate Mali's situation through external analyses. In Africa alone, 34% of maternal deaths can be attributed to obstetric haemorrhage, making it the leading cause of maternal death on the continent⁸. A study of maternal mortality rates in Mali from 1990–2008 estimated the maternal mortality rate for 2008 was at 669 per 100,000 live births, ranking 166 of 181 countries⁹. While the rate did decrease by 1.2% annually over that time, there remains tremendous room for improvement. Sadly, this rate is fairly consistent with the rest of SSA, which has an overall maternal mortality rate of 640 per 100,000 per live births, with an annual decline of 1.7%¹⁰. Indeed, a meta-analysis of 37 studies on haemorrhage and maternal mortality noted a direct link between maternal death and lack of blood services.

Of those, five provided quantitative information showing that overall, 26% (16-72%) of maternal haemorrhage deaths were due to lack of safe blood¹¹. In Ségou specifically, the young population (64% under the age of 25 in 2009) lends itself to a high birth rate. Over 5,000 births are expected annually in Ségou; the crude birth rate remains at 41.6 births for every 1,000 people. On average, a woman in Ségou can expect to give birth to 5.8 children over the course of her reproductive years¹².

In addition to meeting the needs for safe childbirth, we know that access to safe blood provides a host of other services to the population. Anaemia is common in Mali, and typically results from malnutrition (particularly iron-deficiency) or severe malaria affecting children under five mostly. According to Mali's Ministry of Health², 40% of women and children are diagnosed with anaemia each year. Sick cell anaemia is also more common among Sub-Saharan Africans, where the frequency of this genetic trait is estimated to be 15-30%^{5,13}. While scientists note the sickle-cell trait confers some resistance to malaria in early childhood, anaemia due to malaria accounts for approximately 70% of all blood transfusions given to children in SSA^{3,5,13}. Indeed, in Mali alone, malaria accounts for over 17% of childhood deaths¹⁴.

METHODS

In 2007, as the evidence for the need for a blood centre in Ségou mounted, various stakeholders began to discuss opportunities to meet the need. The relationship between key implementing partners Physicians for Peace (PFP) and the Millennium Villages Project/Millennium Cities Initiative (MVP/MCI) began with an introduction by Professor Jeffrey Sachs. The mission of MVP/MCI, the incubators at the Earth Institute of Columbia University, is to apply appropriate funding and resources to under-resourced areas of the world to demonstrate that the Millennium Development Goals are achievable. With 15 villages and 11 cities throughout Africa, the sites were, at that time, just a few years along in their development. PFP is a 27 year-old, non-profit medical education and training organization, dedicated to transforming lives through training, supporting, and empowering local health professionals working with the world's underserved populations.

With the new partnership, PFP conducted a fact finding visit in 2008 to Mali to determine its potential for a new project site. PFP representatives met with Ambassadors, Ministers of Health, and community health workers, visiting health facilities in Bamako and Ségou, both Millennium Cities, and Markala, a smaller city in the Ségou region. Markala, home to a referral hospital, has technical oversight of 15 community health centres in the district, including those in two Millennium Villages. In Ségou, the team visited Hôpital Nianankoro Fomba (HNF), the regional tertiary care facility supported by the Malian Ministry of Health. It housed approximately 200 beds, but physical, financial and staffing resources were severely limited.

PFP and MVP/MCI decided to initially collaborate on general maternal and child health training programs in Ségou. In 2009, they conducted two missions to train local surgeons on how to repair obstetric fistulae, a condition resulting from prolonged obstructed labour during childbirth resulting in urinary and/or faecal incontinence. During this time, they also further developed a partnership with the host health facility for these trainings, HNF in Ségou.

While earlier fact finding teams recommended establishment of a blood bank in the district hospital in Markala, a later visit in 2011 recommended that HNF in Ségou was in need of a blood bank and a more appropriate site given that it is a regional tertiary care hospital.

HIV/AIDS is at general epidemic levels in Mali, although less so than in other parts of Africa, with an estimated prevalence rate of about 1.5%. Nevertheless, the infections remain concentrated in high risk populations: sex workers are at greatest risk and women are disproportionately infected. A study found that 5.1% of pregnant women in the Ségou region were infected⁶, nearly three and a half times the national prevalence rate. A centralized blood centre with high standards of safety and testing for communicable diseases, including HIV, would reduce the risk of infection from HIV during blood transfusion.

The unavoidable conclusion is that the need for more blood safety activities in areas outside Bamako is crucial. Clearly when blood is urgently required, it must already be collected, tested, stocked, available and accessible or the outcome is life-threatening. This is the impetus for evaluating the implementation of a blood bank in Ségou, Mali through committed partnerships.

Such a recommendation was in keeping with international standards for developing blood safety. Similar to other under-resourced health facilities, HNF had been performing blood transfusions using whole blood, with improper testing and an inadequate supply to meet the needs of its patients.

The regional hospital in Ségou was chosen as the site to develop a blood centre for several reasons. Ségou was designated a Millennium City by MCI, so it would be a perfect hub for the region. It was one of nine regional hospitals within the national health care system, so it would be a model for other regional blood centres. It also had strong support from the Director General of the hospital.

The HNF location is also in accordance with CNTS' plan for developing a blood service network throughout the country. Finally, HNF's human resources are capable of providing support to a blood centre at this location, including assisting with its development and implementation. These aligned criteria would likely enhance the probability of a sustainable, viable blood centre over the long term.

The objective of the project was established to develop a fully functioning blood centre to serve the Ségou region of Mali. The objective was based on the desire to contribute to the creation of a national system for Mali to provide a readily available and safe supply of blood. The system would be operationalized through a "hub and spoke," process whereby each region is home to a fully functioning blood centre (hub) that serves the surrounding district hospitals (spokes). This concept is consistent with WHO standards³ for the collection and processing of blood into components.

It was agreed that the partners would be PFP, MVP/MCI, the American National Red Cross (ARC), the Safe Blood for Africa Foundation (SBFA) and the Malian Ministry of Health. PFP would source all of the equipment and ensure training, along with two years of consumable supplies.

MVP/MCI would act as the in-country coordinator on behalf of PFP, ensuring local oversight for the project. The Malian Ministry of Health, acting on behalf of CNTS and HNF, would provide the building, on-going training and supplies to sustain the project after its initial implementation.

It took several months for the Ministry of Health and HNF to secure financing to construct an appropriate building where the blood centre could be located on the HNF campus. The Ministry of Health and HNF sought and received a donation of \$30,000 from the government of Japan to construct the blood centre building based on a design previously provided in accordance with WHO standards and recommendations. The building was completed at the end of February 2012.

During that time, PFP began preparations to gather and ship the necessary equipment and supplies for the blood centre. Even during the discussions of where the blood centre would be located, PFP had begun developing partnerships to secure the necessary equipment, supplies and training for the eventual blood centre. The ARC agreed to donate the equipment needed to outfit a fully autonomous blood centre. Because PFP was aware that it lacked the expertise to train health workers in blood safety practices, it partnered with the Safe Blood for Africa Foundation™ (SBFA) to execute this part of the project.

The SBFA was already operating in West Africa and providing training in the exact specialties this project required. It also had developed blood safety materials in French and had trainers in West Africa who could travel to Ségou more easily than sending trainers from the United States. The engagement of SBFA was part of the effort to include all significant actors in blood safety in Mali. The American Association of Blood Banks (AABB), Centers for Disease Control and Prevention (CDC) and Malian Red Crescent Society were all made aware of the project and asked to be involved at whatever level they chose, both during the project and for the follow-up that would be needed.

On March 21, 2012, a Malian military junta staged a coup, overthrowing President Amadou Touré. As the days continued, it became obvious that the transition from coup leader General Sanogo to a democratically-elected government would not be smooth, nor would it be fast and these caused delays while we were in the process of shipping the equipment,

deploying trainers and supplying consumables. In the wake of these events, the partners met and determined that the blood centre was needed more than ever. Rather than withdraw, the partnership that had been forged during the previous years remained strong, and the need for readily available safe blood continued. The partners advanced and in December 2012, shipped a container of equipment and supplies that would form the foundation of the blood centre at HNF in Ségou.

In January 2013, PFP and the Malian Ministry of Health signed an agreement formalizing their partnership. This formal agreement would help with the processing of the blood centre equipment shipping container, but also hold all partners accountable for their project responsibilities. Partly as a result of the political uncertainty, the containers took five months and multiple interventions from officials in both the U.S. and Mali to clear customs and arrive at its destination.

Sadly, due to the security situation in Mali, partners from the U.S. were unable to be in Mali to see the equipment delivered. When the container was finally released in May 2013 and delivered to HNF, the partners deployed a regional expert from SBFA to set up the blood bank equipment, assess the need for training and develop a plan to ensure the blood centre would be functional as soon as possible.

That visit was extremely successful, as SBFA was able to install the equipment donated by the ARC, purchase several items still needed for the blood centre and meet with HNF officials to determine the training the blood centre staff would need. In July 2013, SBFA trainers returned to conduct an intensive weeklong course on blood safety and processing practices. The partners then decided to suspend training visits for a few weeks during the presidential election, given the potential for unrest during this period. Once it was found to be safe, SBFA returned to continue its training and support to the actively functioning blood bank in Ségou. The training included both the technical aspects of testing blood for Transfusion Transmissible Infections (TTI) and strategies to recruit and manage VNRBDs.

RESULTS

HNF now houses a well-resourced blood service and twelve trained technicians. Training has been conducted on Monitoring and Evaluation techniques, Good Manufacturing Practices and Quality Systems in Blood Safety, Supply Chain and Equipment Management, Data Collection Practices and Record Keeping, Understanding the Blood Safety Value Chain¹⁵, Proper Utilization of Blood Test Kits, Donor Recruitment strategies and Donor Management. During training sessions, staff showed an average improvement of 17.7% between pre- and post-theoretical training tests.

Table 1: Annual HNF Blood Bank Outputs at Hôpital Nianankoro Fomba (HNF) in Ségou, Mali

Year	Population	Total Donors	Volunteer Donors	Family/Replacement Donors
2012	159,000	1,716	161	1,555
2013	159,000	2,288	533	1,755

Table 2: Units of Blood Requested vs those and available at Hôpital Nianankoro Fomba (HNF) in Ségou, Mali

Year	Units of Blood Requested	Units of Blood Available
2012	2,147	1,503
2013	2,582	1,835

PFP and SBFA also developed a tool to monitor and evaluate the project's success. Starting with a baseline of 2012, blood bank staff has been trained to utilize the customized tool to collect and report data annually (Table 1). The information will be used to assess changes in blood collection practices over time. In two years, there was an 18% increase in the number of blood donors. Further, in the first year 9% of donors were volunteers; in 2013, that number increased to 23%. The change was due to conducting limited training on voluntary donations and mobile collections in Ségou.

Hospital-based blood services are established to rapidly respond to local need and engage local communities. Requests for blood units were made to the new blood centre and the critical objective is to ensure their timely access and enough blood available whenever it is needed¹⁶ (Table 2).

Donor and recipient demographics include age and reason for transfusion. Donors of the ages of 25-44 years were the highest supporters (Figure 1). In 2012, males were 93% of the donors. Primary reasons for transfusion in 2013 include anaemia (55%), malaria (34%), surgery (7%), haemorrhage (2%), and trauma (2%).

Figure 1: Age demographics of donors and recipients at *Hôpital Nianankoro Fomba* (HNF) in Ségou, Mali.

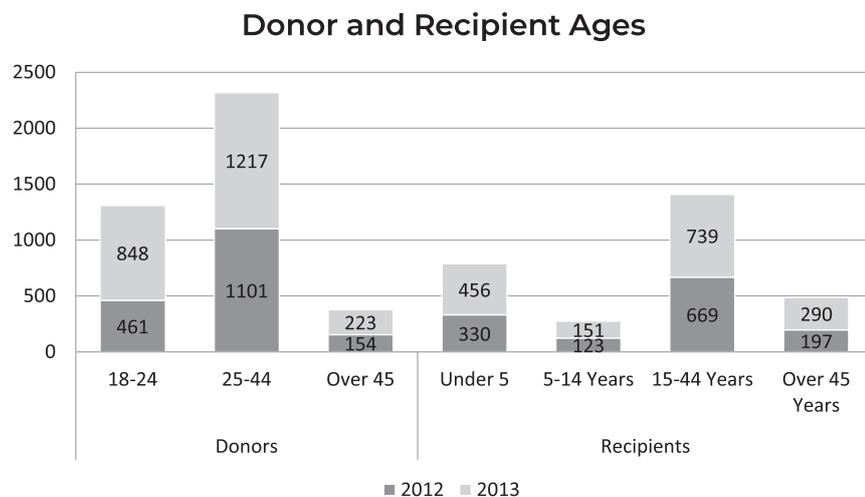


Figure 2: Reasons for discarded blood at *Hôpital Nianankoro Fomba* (HNF) in Ségou, Mali

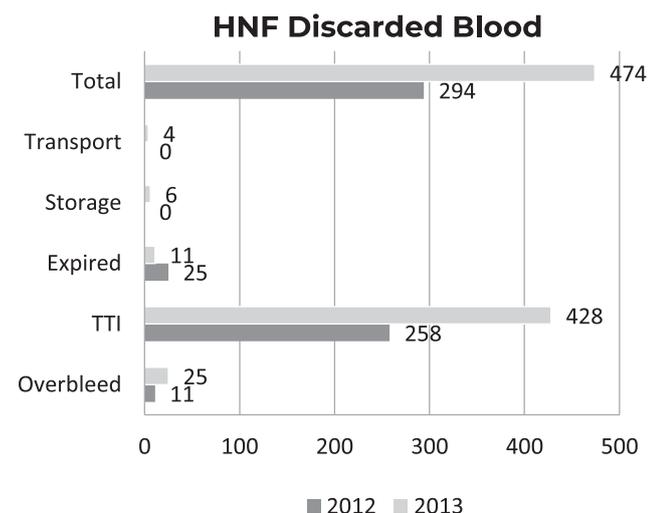
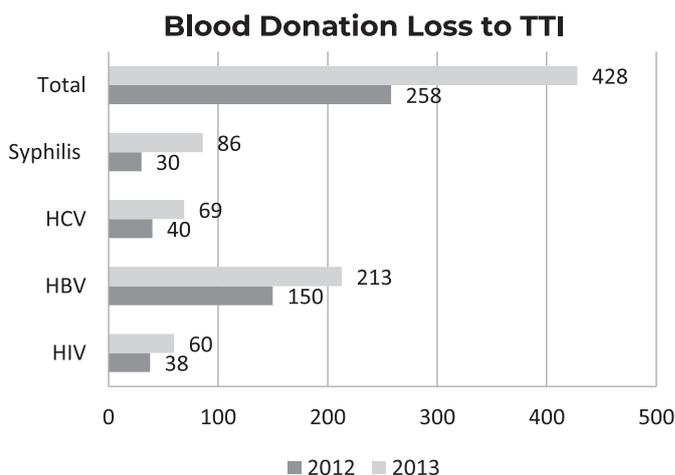


Figure 3: Blood donation loss to Transfusion Transmissible Infections (TTI) at *Hôpital Nianankoro Fomba* (HNF) in Ségou, Mali.



Cost-wise, hospital-based blood banking is lower, thus providing a vital advantage when there is a limited budget for health care¹⁷. While determining the cost of collecting and processing blood is complex¹⁸, Schantz-Dunn & Nour¹⁹ suggest one unit of blood can be procured, screened and tested for approximately US\$ 40, dramatically less than the cost of addressing HIV transmission or morbidity associated with having no safe blood available. While safe blood is available, the requested units were often not able to be matched to the patient. In 2012, there was a lack of 644 units and 747 units in 2013. Discarded blood was a notable reason for loss of blood units (Figure 2), with 20% loss in 2012 and 26% loss in 2013. Transfusion-transmissible infections (TTI) accounted for the majority of the discards (Figure 3).

Because of the partnerships HNF is now home to the Ségou region's first blood service centre, with a trained and equipped staff and facility, serving a population that did not previously have access to an available and safe blood supply.

DISCUSSION

The challenges associated with this project are great, yet many were mitigated through careful planning, and sometimes trial and error. First, the nature of working across multiple cultures and geographic areas causes strain on the timing and sometimes the delivery of project goals. Second, collaborations require clearly defined roles from each party. Finally, financial constraints created challenges in planning, execution and partner engagement. Each of these challenges is further explored.

Communicating across cultures was the first significant challenge faced. The partners had to overcome a language barrier and six- and eight-hour time differences. This was easily navigated through careful planning, the use of translators and Francophone trainers, however, translation added time and parties to communications. The difference between translation and interpretation also became apparent as there

are few professional translators well versed in blood Safety. Physical separation proved to be a challenge as well. Once the project was near completion, the hospital hosted a ribbon-cutting ceremony, yet U.S.-based partners were unable to attend the ceremony due to security constraints.

Another challenge was all partners' access to and use of technology. In Mali, for example, the partners in Bamako and Ségou had regular access to email and Internet, so they had the ability to correspond with those in the U.S. and elsewhere. Despite that, the physical distance sometimes contributes to a lack of relationship building, causing delays in correspondence. At times, it took multiple attempts to obtain responses that meant that issues went unanswered and opportunities potentially lost.

Similarly, combatting the culture of aid is always a challenge. Within the NGO world, there are organizations that ‘go and do’, sometimes even causing more harm than help. This occurs when organizations determine the beneficiaries’ needs and attempt to meet them without consulting the beneficiary or accounting for the local capacity or culture. Because the Malian partners have been subjected to such treatment in the past, it took several years to establish a true working relationship based on trust. Progress moves at the speed of trust.

Solid partnerships require not only time but also clearly defined roles and expectations for all parties. Responsibilities for health care in Mali were complicated. Prior to the construction of the blood bank in Ségou, the CNTS funded the country’s only blood centre in Bamako and any blood safety activities outside that centre (whole blood collections and transfusions) were funded from the local hospital’s budget, which was sourced directly from the Ministry of Health. Thus a significant concern was who would take ownership over the new blood centre, both financially and in management. It was agreed that once the Ségou blood bank was fully functional, CNTS, which gets its funds from the Ministry of Health, would be allocating a portion of its budget for the maintenance of the facility. Strategic oversight of the blood bank would come from CNTS, while the hospital provides daily management and would in part be responsible for budgeting for the routine operational aspects.

Partners engaged in the project understood the need to define roles and responsibilities. Some were clear – e.g. the ARC would donate equipment – but other actors had different interests. PFP is typically an organization that provides medical training, but blood safety was outside of the organization’s core expertise. MVP/MCI are research and advocacy organizations but not logistical experts.

The hospital partners are aware of their needs but, not having previously processed blood, did not know specifically how to set up a blood bank. The SBFA, while the most experienced in blood safety, was engaged as a consultant, not lead, on the project. This structure was due to their existing relations in Mali, working on behalf of the CDC to improve blood safety in the country. They were required to keep their CDC and PFP work separate. Challenges of defining responsibility were overcome through long-term planning informed by detailed discussions between all the concerned parties. Signing of an agreement between PFP and the Ministry of Health created an overarching construct; PFP would serve as project manager and coordinate all parties, while the Ministry of Health would plan for and provide input into the planning and long-term funding and oversight for the blood centre.

Finally, funding for this specific project was, and continues to be a significant challenge. The project was cached as part of PFP’s “maternal and child health” program to attract donors and ‘fit’ with PFP’s organizational mission. Unfortunately, PFP was unable to secure a lead donation, and had to redirect other internally sourced funds to finance the project. Ultimately, in-kind donations of equipment and time from the ARC and SBFA, and careful budgeting meant that all of the project’s original objectives were able to be met with the funding available.

There is still much to be done before the blood centre in Ségou can be sustained locally. The critical component of all future activities is the engagement of both a technical assistance partner, such as SBFA, and the Ministry of Health, who will be working together over the longer term to improve blood safety throughout Mali supported by the U.S. President’s Emergency Plan for AIDS Relief (PEPFAR) as long as this lasts.

Despite challenges in developing the project, the partners do have a robust plan to monitor the outcomes and outputs of the new blood centre. Developed according to WHO guidelines for blood safety, the project collects information on a variety of parameters including numbers of donors, numbers of recipients, and blood centre practices. Data collection is on-going and reported annually, which allows for continuing tracking of change over time. Partners also have regular check-ins to provide a real time update on blood centre operations.

Additionally, the model of partnership also lends itself to long term stability for the blood centre. Because there are stakeholders physically situated near the blood centre, they will be able to maintain a relationship even after the project is complete. This allows for continuity and long term support for the centre.

This project also had a fit-for-purpose design. After careful analysis of the existing blood safety infrastructure in the country and conversations with global experts in blood safety, the partners determined together that this blood centre would not simply replace the blood services that the hospital was already providing, but augment care through improved processing of blood components. Further, locally purchased equipment, such as a generator and freezer, would ensure that the blood centre would have in-country technicians able to service the equipment and keep it functioning for years to come.

Perhaps the greatest strength of the blood centre project is the engagement of all significant actors in the Mali blood safety sector. Partnering with organizations already engaged in regional blood projects, rather than attempting to recruit new experts, means that the blood centre staff become part of the regional blood safety network. Specifically, the CDC, through PEPFAR, is a significant funder of capacity building programs for blood safety in Mali, so the blood centre in Ségou should now be incorporated into CDC planning for the country.

There remain numerous areas for future development of the new blood centre in Ségou. First, a blood centre is useless without individuals who donate their blood optimally as volunteer non-remunerated blood donors. Second, an infrastructure to distribute blood in remote areas of the Ségou region is needed. Finally, Mali’s other eight administrative regions deserve the same access to high quality safe blood as those in Bamako and Ségou have.

During the development of the blood centre, all partners were aware that the most critical factor to its success would be the cultivation of VNRBDs. They are the lifeline for any blood safety system, providing a constant and arguably safer supply of blood that is readily available for transfusion when needed. While this project was focused on developing the actual blood centre, those who would take ownership over the centre and incorporate it into the National Blood Safety System were engaged, so that the transition would occur more easily. The development of VNRBDs is a priority for both the Ministry of Health and the CDC, so that once the blood centre is fully functional, those parties will assume responsibility for donor outreach and development. During the political conflicts, the country experienced an increase in VNRBDs, who were showing solidarity with their fellow citizens affected by the conflict. The Ministry of Health and CNTS hope to capitalize on such momentum to educate citizens on the importance of donating blood and mobilize them to do so. At the same time, the CDC is funding work that analyses barriers to donating blood and develops a plan to increase blood donations in Mali over the next several years. Once the blood centre at HNF in Ségou is fully operational as a regional hub, the Ministry of Health must develop a ‘spoke’ system, to push blood out to the referral hospital centres as well as extend its donor network.

While blood will only be processed in Ségou, its components should be stocked in the regional health centres, so that patients who need transfusions but cannot come to the tertiary care hospital can receive them. Further, a fully developed hub and spoke system would include the collection of blood donations in satellite facilities, which would then be transported to the blood centre in Ségou for processing, then distributed out where needed. Some mobile collection and distribution has already begun on an inconsistent basis, but such practices need to be more strategic. This will be achieved through more directed training in mobile collection practices, although the blood bank has already begun mobile collections on an infrequent basis, displaying their enthusiasm and commitment to long term sustainability.

Sadly, while this initiative to develop a blood centre in Ségou was a huge effort on the part of all stakeholders, it is only a small advancement toward improving Mali's health care system. Now, only Bamako and Ségou have blood centres known to conform to WHO guidelines³, but even more aspiring is that the country's eight other districts would have blood services integrated into a nationally coordinated competency under the CNTS. Once the Ségou region has a well-developed blood safety system, the government and international investors must replicate this throughout Mali. They will have the experience and resources from this project to assist in a smoother development process.

As this implementation evaluation emphasizes, safe blood is one of the foundations of a fully-functioning health system, yet Mali's blood safety system is woefully under-resourced and underdeveloped.

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