

## REVIEW

## Transfusion in sub-Saharan Africa: does a Western model fit?

Stephen P Field, Jean-Pierre Allain

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This review examines the current state of transfusion services in sub-Saharan Africa and presents the argument for and against the Western model of a centralised blood service with 100% voluntary non-remunerated blood donors as advocated by the World Health Organization. The current practice of family replacement donors in hospital-based blood service is the most economical option, but in the face of high child and maternal mortality rates the blood supply has proved to be insufficient. With estimates of 5–10% of HIV transmission in Africa being the result of contaminated blood transfusions, there is a need to improve testing for transfusion transmissible diseases and the selection of blood donors. Of major concern, with respect to testing, is the quality of kits being used and the continuity of supply. The need to produce components is discussed in the context of the transfusion needs in sub-Saharan Africa. The running costs of establishing and maintaining centralised blood services need careful consideration as such projects need to be sustainable in the future. It is concluded that both options are viable while centralised programmes are being developed, and a pragmatic approach should be taken to ensure that the patients' needs are met and that resources are suitably utilised to ensure sustainability.

Southern African Countries (South Africa, Botswana, Zimbabwe and Namibia), none have developed the proposed centralised model (single or few dedicated blood centres) of blood collection and preparation without massive external technical and financial support.

This apparent failure of implementation suggests that most countries either have other health priorities or are severely limited by the lack of resources to implement the Western-based recommended strategy. A less expensive but effective strategy closer to local circumstances might be needed. Despite the diversity of geographical, socioeconomic and political situations present in African countries, each of them is ultimately responsible to choose an organisational model of ensuring an adequate supply of safe blood. A report from the WHO African region in 2004 suggests that progress is being made in some countries, with 15 countries reporting >95% of the blood supply coming from voluntary non-remunerated blood donation. It is notable that the information is self-reported and incomplete, and of the 46 member states, only 38 included data on blood donation.<sup>7</sup>

## ADEQUATE BLOOD SUPPLY AND MORTALITY

Blood supplies in Africa have never been able to meet the demand; this is reflected in the high maternal<sup>8–10</sup> and child mortality<sup>11</sup> rates in the continent. Haemorrhage and anaemia account for a large proportion of maternal deaths; many of these could be prevented by provision of good obstetric services and an adequate blood supply.<sup>2</sup> Malaria is the major contributor to deaths of children under 5 years and it has been shown that children with malarial anaemia (haemoglobin <5 g/dl) are at risk of dying if there is delay in getting blood for transfusion.<sup>11–13</sup> The number of cases presenting with HIV/AIDS on antiretroviral treatment in recent years has also placed an additional burden on the blood supplies.<sup>14</sup>

It is questionable whether hospital based family replacement blood banks are ever going to be able to maintain adequate blood supplies to meet these needs.<sup>15</sup> There is also clear evidence that a strictly volunteer donor system does not provide sufficient blood, estimated to range between 15 and 20 units/1000 inhabitants.<sup>16</sup> In sub-Saharan Africa, neither centralised national systems nor hospital-based systems even reach 10 units/1000,<sup>7</sup> suggesting that, at least for some years to come, both systems should coexist in order to provide patients with the blood they critically need.

An article by Lara *et al*, on page 1117 of this issue, highlights the dilemma of the cost of developing centralised blood services in Malawi.<sup>1</sup> Transfusion practices in most African countries are hospital based (decentralised) and rely on donors recruited from family members. Sometimes the provision of a replacement unit is either a condition of having the patient transfused<sup>2</sup> or provides a significant financial discount of the costs incurred in receiving blood. As is often the case when family members are unwilling to donate, commercial (paid) donors are contracted and these constitute a particularly high risk for transmission of diseases.<sup>3 4</sup>

The World Health Organization (WHO),<sup>5 6</sup> through its blood safety unit in Geneva, has long advocated that countries develop nationally coordinated blood services which are community based and are reliant on voluntary non-remunerated blood donors. The WHO has provided structured educational material to assist countries to develop a national blood policy and through this a national blood service. Although this policy was delineated in the 1980s, it seems to have had little effect, since less than 20% of sub-Saharan African countries have implemented such a policy. Except for a few

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## BLOOD SAFETY AND TESTING

It has been estimated that 5–10% of HIV transmission in Africa is by contaminated blood transfusions.<sup>17</sup> Testing for transfusion transmissible diseases would be more effective in a centralised regional laboratory, where economies of scale would make testing cheaper, with less wastage of reagents once the equipment has been acquired or donated (ie, larger runs of tests with one set of controls used for a large number of donations). It would also enable standardisation of techniques and better quality management. It may even allow more specialised techniques such as PCR to be employed with greater effect. These potential benefits, however, need to be confronted with the timeliness of blood availability required by emergencies such as massive delivery-related haemorrhages. Testing in hospital-based transfusion services needs to be adapted to small numbers of samples being processed (<10 000/year, often <1000/year); it is therefore often done by rapid tests, which vary in quality and need to be carefully selected. While some rapid tests are able to detect viral markers with almost equivalent sensitivity to ELISA tests, this is not always the case. One of the major problems in developing countries is to obtain a consistent supply of suitable reagents; if services were centralised, this would be easier to achieve and control.

In terms of screening, the quality and efficacy of tests used is paramount, but the type of tests should be adapted to the number of samples, quality of staff, availability of equipment and its maintenance and, most importantly, resources. Pragmatism rather than dogmatism should be applied in order to provide safe blood in all circumstances.

In addition, the article by Lara *et al* clearly shows the importance of testing blood for malaria parasites, an issue often neglected but of critical importance in paediatric transfusion.<sup>1</sup> The often-used strategy of short-term prophylactic treatment of transfused young children with anti-malarial drugs is only partially satisfactory.

## WHOLE BLOOD OR COMPONENTS?

Production of components has been difficult in many developing countries because of unavailability of suitable centrifuges or, in some instances, due to the poor state of repair of such equipment. Centralised blood services would be able to process blood from voluntary non-remunerated donors and, because of the economy of scale, would have adequate backup equipment in the case of breakdown. Some may argue that in sub-Saharan Africa, the vast majority of transfusions are given in emergency circumstances for massive bleeding and that whole blood is the product of choice. However, in children and many of the non-acute adult cases, red cell concentrates are the preferred products. A limited demand for platelets and fresh frozen plasma may be present for use in acquired bleeding disorders such as disseminated intravascular coagulopathy, but rarely is there a demand for use in chemotherapy patients, since this expensive treatment is needed but cannot be afforded. A regional or centralised blood service would be able to distribute such products to many hospitals as they are required, or to replace small stocks as they are used. The logistical difficulties of such distribution should not be underestimated in vast countries with a poor road network, often unusable during the rainy season.<sup>18</sup> Locally produced blood may then be the only option.

## FUNDING OF BLOOD TRANSFUSION AND SUSTAINABILITY

Except for some Southern African countries, most centralised blood transfusion services in sub-Saharan Africa have been put in place with massive financial and technical support from European or North American countries. The question is often

## Take-home messages

- The current systems of collecting blood for transfusion in sub-Saharan Africa are not coping with the demands for transfusion in countries with high maternal and child mortality.
- This review looks at the arguments for and against implementing centralised Western model blood centres as compared to hospital based systems.
- Hospital systems that use family replacement and commercial donors have been shown to be high risk for transfusion transmissible diseases.
- Centralised systems are not yet able to deliver adequate quantities of blood from voluntary non-remunerated donors, and recruiting and infrastructure is expensive.
- A pragmatic approach is required, with both systems operating until resources are suitably utilised, to ensure sustainability of centrally organised blood services.

raised as to how such blood services are sustained after external funding sources are no longer available. Hospitals are often cash strapped and have to charge fees to the patients for services and medications. This results in health care becoming inaccessible to the majority of people. Government allocated hospital laboratory budgets have to cover a wider range of investigations and thus the proportion provided to transfusion tends to be relatively small. Centralisation of the collection and testing of blood allows more flexibility in hospital laboratory budgets. Centralised funding for community blood centres, although more costly, does allow money to be dedicated to providing the appropriate equipment and reagents and for recruiting activities to ensure a consistent adequate safe blood supply. It has been suggested that partial cost recovery from patients may play a role in sustaining such facilities in the future.<sup>19</sup>

However, as illustrated by Lara *et al*, there is a 2–4-fold difference between the cost of centrally produced and locally produced blood, which reflects affordability.<sup>1</sup> There would be clear benefits in utilising a single model of economic analysis applied to the two main systems discussed here in order to allow fair comparisons within the context of global public health. A strategy aiming at improving the second until such time as the first can be put in place might permit a smooth transition between the two options, which should not be mutually exclusive but complementary in an ordered continuity. Such pragmatism may serve better the patients' needs and resources, and ensure sustainability.

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