

**BLOOD TRANSFUSION RESEARCH WORKSHOP  
Mombasa, Kenya. 23-25 September 2008**

**How can research contribute to improving safe blood supplies for emergency transfusions in sub-Saharan Africa?**

**WORKSHOP REPORT**

**Summary**

The aim of this workshop was for key stakeholders in blood transfusion services in sub-Saharan Africa to develop an agreed research agenda to fill gaps in the evidence needed to improve the supply and safety of blood for transfusion. The research agenda focuses primarily on obtaining high quality information about existing services and their effectiveness in order to be able to target areas where interventions will have maximum impact. Participants confirmed that there is almost no research expertise within the transfusion services in sub-Saharan Africa and this deficit will need to be addressed urgently as the research agenda is translated into action.

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**Background**

Improving the supply of safe blood is a key intervention in reducing mortality and morbidity in sub-Saharan Africa especially in young children and pregnant women. The purpose of this workshop was to bring together transfusion service providers, users and researchers to define and prioritise research to fill gaps in the evidence supporting improvements in the safety, adequacy and equity of the supply of blood for transfusion in sub-Saharan Africa, and to identify and disseminate examples of best practice (Appendix 1).

The 3 day workshop, which was funded by the Wellcome Trust, was lively, fun and very productive. It was held in Mombasa and co-hosted by the Kenya Chapter of the African Society of Blood Transfusion (AfSBT), the Regional Blood Transfusion Centre in Mombasa and the Kenya Medical Research Institute (Kilifi), with assistance from Oliver Hassall (OH; Kilifi, Kenya), Julie Makani (JM; Dar Es Salaam, Tanzania) and Imelda Bates (IB; Liverpool, UK). The 36 participants were from 13 countries and included transfusion researchers, transfusion service directors and funders, and representatives of transfusion users including senior obstetricians, anaesthetists and paediatricians (Appendix 2).

**Workshop outline**

The programme was structured around five themes which covered all aspects of transfusion practice (Appendix 3). A half-day session was devoted to each theme and each session consisted of four 10 minute thought-provoking presentations to highlight key areas of the theme. All participants were invited to make a presentation and final speakers were selected by the organisers to represent a range of topics, backgrounds and countries. For the rest of the session participants were split into groups of 6 and they discussed around the topic to identify key evidence gaps and devise research questions to address these gaps. At the end of each session the groups deliberations were discussed by all participants and a consensus reached

about the priority topics and research emphases. The consensus results were presented back to all participants in the sixth (final) session for refining and final agreement. All participants contributed to discussions about mechanisms for implementing, funding and disseminating the agreed blood transfusion research agenda.

## Outcomes of workshop

### i) Research agenda

The detailed research agenda was summarised into a more user-friendly format indicating key research topics identified by participants as priority areas to inform better transfusion practice in sub-Saharan Africa (Appendix 4).

### ii) Dissemination strategy

Who to?	Action by?
WHO	Summary to AFRO and HQ (IB, OH)
AfSBT	David Mvere – will put on website, e-mail members, journal Abstract for AfSBT meeting in June 2009 (Nairobi)
ISBT	Marcela Contreras (Transfusion Today journal) Abstract for ISBT meeting in March 2009 (Cairo)
CDC	Jane Mwangi
AABB	Jane Mwangi
MoH/policy makers	Via participants African Summit on Universal Access to Blood in October 2009: (Use research evidence as advocacy tool)
Associations	Oct 2008. Association of Pathologists. Others via participants (e.g. O&G)
PEPFAR	Larry Marum (LM)
GCBS	Meet in Geneva Nov 2009 (send next year after sensitised)
Wellcome Trust	IB, OH
Others	All workshop invitees including those who could not attend (Appendix 1)

### iii) Implementation strategy

The major challenge to implementing the research agenda is that there is almost no research capacity within the transfusion services in SSA. The implementation strategy therefore focuses on different approaches to building up capacity for research and rigorous monitoring and evaluation of transfusion services. Suggested approaches to build research capacity included:

- Establishing a network to exchange ideas about research (action David Mvere to put onto AfSBT agenda for next week)
- Establish link with local academic institutions for research mentoring and for BTS to host student projects
- PEPFAR Technical assistance links can be used as research resource persons
- Dedicated R&D officer could be appointed (e.g. Zimbabwe model) to manage data, policies and protocols
- NBS leaders need to promote and facilitate research and evidence-based practice
- Generic proposals for research need to be developed by academics and then implemented in different countries by BTS staff (action IB, OH?)

- Assist BTS staff to write and submit abstracts for the AfSBT meeting and the Africa summit on blood transfusion in 2009 (PEPFAR to support?)
- Research should be implemented as part of a research skills development course for BTS staff modelled on Pan African Thoracic Society research network initiative (Action IB, OH to discuss finding with Wellcome)

#### **iv) Funding strategies**

##### **Monitoring and evaluation aspects: PEPFAR**

PEPFAR already has networks with NBS across several SSA countries and data that will allow inter-country comparisons. They are able to fund monitoring and evaluation activities but not research and will build the aspects form the research agenda that fit into the M&E category into this strategy and budgets. (action LM)

##### **Primary research and research capacity building: Wellcome Trust**

Aspects of the research agenda that are primary research, and therefore not eligible for funding by PEPFAR, will be synthesized and submitted to the Wellcome Trust as well as a proposal for a formal research capacity building programme for transfusion services in SSA. (action IB, OH)

Oliver Hassall and Imelda Bates  
26<sup>th</sup> September 2008

## APPENDIX 1

### BLOOD TRANSFUSION RESEARCH WORKSHOP Mombasa, Kenya. September 2008

**How can research contribute to improving safe blood supplies for emergency transfusions?**

#### **WORKSHOP OUTLINE (12 July 2008) – excluding appendices**

##### **Purpose of workshop**

To bring together transfusion service providers, users and researchers to:

- a) define and prioritise research to fill gaps in the evidence supporting improvements in the safety, adequacy and equity of the supply of blood for transfusion in sub-Saharan Africa
- b) identify and disseminate examples of best practice

##### **Workshop hosts, organisers and planning**

The workshop will be hosted and organised by the Kenya Chapter of the African Society of Blood Transfusion (AfSBT) and the Regional Blood Transfusion Centre in Mombasa with assistance from Oliver Hassall (Kilifi, Kenya), Julie Makani (Dar Es Salaam, Tanzania) and Imelda Bates (Liverpool, UK). Many advisors have contributed to the planning of the workshop<sup>1</sup>.

##### **Workshop programme**

The workshop will be held in Mombasa and last 3 days. The programme will comprise half a day on best practice and research priorities under each of the five themes outlined below, and half a day to review key issues and plan the next steps.

##### **Workshop participants**

Participants will comprise transfusion service policy makers, planners, providers, users and researchers. They will be selected because they a) have first hand experience of transfusion services in Africa, b) can provide critical and thoughtful inputs that contribute to the purpose of the workshop and c) are committed to generating and/or using evidence that will improve transfusion services. Participants will be drawn from:

- International and national policy makers and planners – WHO (Geneva/AFRO), national transfusion service directors and managers, African Institute for Transfusion Medicine, Ministries of Health.
- Providers - regional transfusion centres, district health officers, blood donors
- Users from government, NGO and faith-based facilities – midwives, paediatricians, surgeons, anaesthetists, representatives of patient groups
- Researchers – health systems, economics, anaemia/transfusion researchers (e.g. Kilifi, Kenya; Blantyre, Malawi; Kumasi, Ghana)

In collaboration with local stakeholders and advisors, a core of 20 participants has been identified (Appendix 1). A further 20 individuals will be drawn from the list

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<sup>1</sup> Marcela Contreras, Bart Jacobs, Jean Emmanuel, Jean-Pierre Allain, Jane Mwangi, Jack Nyamongo, Rene van Hulst

suggested by the core participants to provide a balance of interests and countries (Appendix 2). The total number of places will be limited to 40 participants.

## **Research themes to address challenges facing blood transfusion services in sub-Saharan Africa**

### **1. Biological safety**

- The focus of research into blood transfusion safety is almost always on transfusion-transmitted infections especially HIV. The effectiveness of screening for other infections such as HBV, HCV, syphilis and malaria, and the consequences for recipients who may have a high prevalence of some of these infections, is poorly researched
- Almost nothing is known about the extent, risks and consequences of bacteriological infections or of blood group incompatibilities particularly those occurring in patients who have received multiple transfusions
- Most district hospitals struggle to maintain a cold chain for their supplies of blood both within and between facilities. Local solutions to these problems need to be documented and evaluated and lessons learnt. The cost-benefit balance of using domestic refrigerators to store blood compared to specialised but expensive blood transfusion fridges is unknown
- Examples of feasible and sustainable techniques for assuring the quality of screening tests in hospital-based and national transfusion services have been published but transferability has not been assessed. Wealthy country models are unlikely to work in resource-poor settings so pragmatic systems for assuring test quality that are affordable and workable need to be developed, piloted and evaluated in different contexts.

### **2. Blood donors**

- Most blood in East and Southern Africa is donated by family/replacement donors yet voluntary donors, especially those who donate repeatedly, are considered to be less likely to transmit infections through blood transfusion. More evidence about what motivates volunteer donors, disincentives to blood donation and culturally appropriate educational messages is needed in order to promote voluntary donation.
- Successful models for improving the number of blood donations are available from individual hospitals and national systems but they need to be adapted and evaluated in a range of different contexts before they can be recommended for scaling up

### **3. Hospital management of blood and blood transfusions**

- Guidelines for the clinical use of blood can significantly reduce inappropriate transfusions but they are rarely implemented routinely. Guidelines need to be developed in the context of local health systems and resources and ways found to promote and monitor their use
- Appropriate use of blood and blood products and monitoring of transfusions are poorly taught and only superficially covered in the curricula of all cadres of health provider and will vary with the level of sophistication of the health facility. Better methods of training and increasing knowledge about blood transfusion are needed to ensure that blood and blood products are used safely and effectively

- Use of ancillary treatments, such as fluid replacement, and optimising the amounts and rates of fluid and blood infused may enable less blood to be used but the most effective therapeutic packages for those in need of emergency transfusions have not been determined in resource-poor settings
- Even if blood is available in the hospital there are often significant delays in ensuring that it reaches the patient quickly. The barriers responsible for delays in the management of blood stocks and issuing and transportation of blood to the wards need to be identified and solutions found.
- Blood transfusion reactions are almost never documented in clinical practice in Africa yet they are likely to be more common than in wealthy countries. In wealthy countries fever is a cardinal sign of a transfusion reaction but in Africa many transfusion recipients are already febrile so other indicators are needed to enable clinicians to differentiate between adverse effects of blood transfusion and those due to the underlying condition.

#### **4. Adequate supplies and equitable distribution**

- Sub-Saharan Africa has the lowest quantity of blood per capita in the world and most patients who need a blood transfusion die before they can be transfused. Blood transfusion is an essential, but often missing, component of comprehensive emergency obstetric care. The evidence underpinning recommendations about the number of units of blood/capita is very weak and has been based on the needs of wealthy countries. There is no evidence on which to calculate blood requirements for sub-Saharan Africa and this information cannot be extrapolated from wealthy countries where the majority of transfusions are planned and for malignant conditions. This lack of targets for blood collection in Africa makes it difficult to plan and budget accurately for transfusion services.
- Access to emergency blood for transfusion is inequitable with those living nearest to transfusion centres and major hospitals having better access than those in rural areas. How close does the provision of blood for transfusion have to be to the community for it to have a significant impact on mortality and how can this be achieved in resource-poor settings?
- The number of units of blood collected is a key target for transfusion services but there is a risk that such a target will mitigate against the rigorous selection of low-risk or non-anaemic donors. More evidence is needed to design targets that are easily measurable and which focus on clinical outcomes as well as protection of donors.

#### **5. Transfusion systems and sustainable financing**

- Health economics and decision analysis are crucial to inform decision makers of the costs and consequences of the interventions described in the preceding sections. The focus of evidence for blood transfusion safety and cost has been on transfusion transmitted viral infections. However, investments in improving quality systems for other aspects such as blood group screening and averting bacterial and malaria transmission may provide greater health benefits than investing in more sensitive screening techniques for HIV, HBV or HCV.
- The western model of centralised collection and screening of blood from voluntary donors and distribution to peripheral facilities has not been adopted by the majority of African countries. Innovative alternative ways have been developed to improve availability of blood and these need to be disseminated, and evaluated

economically and clinically. The transferability of the various service delivery models to different contexts needs to be assessed

- A unit of blood from a national transfusion service is more expensive than one from a hospital based service. Poor families in Africa already bear the cost of finding a 'replacement' donor in the hospital based system and cannot afford the true cost of a unit of blood. Mechanisms need to be developed and evaluated which ensure that poor families are buffered against unplanned costs of emergency blood transfusion.
- In the majority of African countries with a national transfusion system, finance has been provided by external donors. There are concerns that this strategy is not sustainable and more information is needed about barriers to sustainability and alternative macro-and micro financing methods.
- Private health providers play an increasingly important role in many African countries but how they can access blood products and how they should contribute to the development of transfusion services has received almost no attention

## APPENDIX 3

### BLOOD TRANSFUSION RESEARCH WORKSHOP Nyali Beach Hotel, Mombasa

#### PROGRAMME

Tuesday, 23<sup>rd</sup> Sept

Introduction		
Time	Presenters:	
8.30	Kishor Mandaliya	Welcome address
8.40	Imelda Bates	Introduction – purpose of workshop
8.50	Oliver Hassall	Organisation of sessions

#### Session 1: Biological Safety

Time	Presenters:	
9.00	Jane Carter	Validation of screening procedures on donor units
9.10	Tonderai Mapako	An overview of seroprevalence of non-HIV infections in Zimbabwe: highlights of key challenges
9.20	Marcela Contreras	Errors as a cause of serious ABO incompatible haemolytic transfusion reactions.
9.30	Rene Van Hulst	Transmission risk assessment in developing countries.
9.40		<i>Clarifications and contributions</i>
	<b>Contributors:</b>	
	Bridon M'Baya	Syphilis screening: a necessity for blood safety or a waste of resources?
	Joseph Mulenga	
10.00		Group discussions
10.30		COFFEE BREAK
10.50		Group discussions
11.20		Feedback from groups
11.40		General discussion
12.10		LUNCH (12.30 – 2.00)

#### Session 2: Blood Donors

Time	Presenters:	
2.00	Timothy Odongo	How to increase the number of blood donors. Best practice examples
2.10	Shirley Owusu-Ofori	Generating repeat donors: The Kumasi experience.
2.20	Rashid Seif	Motivating blood donors in Africa.
2.30		<i>Clarifications and contributions</i>
	<b>Contributors:</b>	
	Marcela Contreras	The advantages of altruistic, regular blood donors versus replacement donors.

	Ahmadi Makuwani	The challenge facing NBTS Tanzania in recruitment of voluntary, non remunerated blood donors.
	Tonderai Mapako	Strategies for enhancing donor retention rates in Zimbabwe: An overview of progress made with special emphasis on Pledge 25 club.
	Larry Marum	Notification and counselling of blood donors.
	Efesper Nkya	The challenge facing NBTS Tanzania in recruitment of voluntary, non-remunerated blood donors.
2.50		Group discussions
3.20		COFFEE BREAK
3.40		Group discussions
4.10		Feedback from groups
4.30		General discussion
5.00		CLOSE

## EVENING COCKTAIL PARTY

**Wednesday, 24<sup>th</sup> Sept**

### Session 3: Hospital Management of Blood and Blood Transfusions

<b>Presenters:</b>		
9.00	Bridon M'Baya	The handling of blood at QECH: time from blood bank to patient
9.10	Kathryn Maitland	Emergency practice – who to transfuse and pre-transfusion management.
9.20	Nancy Mwaura	Nursing perspective: detecting confirming and managing transfusion reactions.
9.30	Dora Mbanya	Monitoring transfusion outcome in a hospital setting in Cameroon: Lessons learnt.
9.40	Jack Nyamongo	The importance of Hospital Transfusion Committees in encouraging good practices.
9.50		<i>Clarifications and contributions</i>
<b>Contributors:</b>		
	Marcela Contreras	Haemovigilance as a tool for decision making in research for services and transfusion medicine.
	Jean Emmanuel	Roles of Hospital Transfusion Committees.
	Sam Gulube	Blood transfusion practices in South African Hospitals.
	Anthon Heyns	Improving the optimal utilization of blood products in hospitals.
	William Macharia	Day care blood and blood product transfusions for patients with cancers and blood disorders.
	Tonderai Mapako	Current efforts to promote rationale use of blood and monitoring of transfusion reactions in Zimbabwe.
	Benjamin Tsofa	District perspective.
	Jessie Githanga	

	Joseph Mulenga	
10.10		Group discussions
10.40		COFFEE BREAK
11.00		Group discussions
11.30		Feedback from groups
11.50		General discussion
12.20		LUNCH (12.30 – 2.00)

#### Session 4: Adequate Supplies and Equitable Distribution

	<b>Presenters:</b>	
2.00	Oliver Hassall	Spatial and temporal distribution of blood donation and supply in Coast Province, Kenya.
2.10	Anthon Heyns	Challenge to make blood products equitably available to patients.
2.20	Larry Marum	Progress in adequacy of supply of blood in 14 PEPFAR-supported countries, 2003 – 2007.
2.30		<i>Clarifications and contributions</i>
	<b>Contributors:</b>	
	Marcela Contreras	Blood stock management
	Tonderai Mapako	Challenges in the provision of adequate blood supplies and equitable distribution in Zimbabwe.
	Peter Kataaha	
	Nancy Mwaura	
2.50		Group discussions
3.20		COFFEE BREAK
3.40		Group discussions
4.10		Feedback from groups
4.30		General discussion
5.00		CLOSE

Thursday, 25<sup>th</sup> Sept

#### Session 5: Transfusion Systems and Sustainable Financing

	<b>Presenters:</b>	
9.00	Imelda Bates	Cost of district hospital transfusion service in Malawi.
9.10	Natasha Nasamala	Workable transfusion system models.
9.20	Jean Emmanuel	Model for sustainable blood services.
9.30	Rene Van Hulst	Health economics of blood transfusion safety in developing countries.
9.40		<i>Clarifications and contributions</i>
	<b>Contributors:</b>	
	Tonderai Mapako	Does cost recovery work in a hyperinflationary environment? A case of survival strategy for NBTS Zimbabwe.

	Peter Kataaha	
10.00		Group discussions
10.30		COFFEE BREAK
10.50		Group discussions
11.20		Feedback from groups
11.40		General discussion
12.10		LUNCH (12.30 – 2.00)

## Session 6: Review, Planning and Dissemination

### APPENDIX 3

## BLOOD TRANSFUSION WORKSHOP

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## APPENDIX 4

### BLOOD TRANSFUSION RESEARCH WORKSHOP Research Agenda Synthesis

#### Reducing transfusion-transmitted infections

##### Problems

The variable prevalence rates, infection risk and screening methods for HBV and to a lesser extent, HCV and syphilis, mean that it is difficult for hospitals and transfusion services to make rational decisions about the risks, benefits and costs of different strategies for screening blood based on evidence from outside Africa. The morbidity/mortality due to transfusion-transmitted malaria and the benefits and feasibility of screening for malaria are unknown. In sub-Saharan Africa (SSA) children are major users of blood. Because paediatric packs are expensive adult units are split into smaller aliquots with the risk of bacterial contamination. Evidence is needed to ensure transfusion services cater adequately for children as well as adults.

##### Research questions/topics

1. Can a model be developed that enables variables such as prevalence, test cost etc to be inputted to provide information about cost effectiveness of screening/not screening for TTIs (e.g. HBV, HCV, syphilis). The model should incorporate the variable effectiveness different screening strategies (e.g. pre- or post-donation testing, NAT testing) with differing prevalence rates<sup>2</sup>.
2. What are the factors that contribute to the prevalence and epidemiology of TTIs. Simple IT systems are needed to enable rigorous inter-country comparative studies of TTIs using 'look back', and recipient tracing
3. Can a centralised service be established to advise on validated test kits for TTIs? What robust, practical systems can be used to ensure test quality particularly in hospital based systems? Does HIV infection interfere with grouping/cross-matching?
4. Should malaria screening be carried out? Are there appropriate tools and what alternative strategies (e.g. treating recipients with anti-malarials) more appropriate/ cost-effective? Would giving ITNs to donors reduce transfusion-malaria risk?
5. Is there clinically significant bacterial contamination of blood packs? Is it restricted to packs split for paediatric use and how can contamination be reduced? How could the cost of paediatric bags be reduced?

#### Increasing recruitment and retention of safe donors

##### Problems

About 80% of the blood in SSA comes from replacement donors. A large proportion of voluntary donors are secondary schoolchildren. There is very little published information about what motivates and deters blood donors/non-donors in SSA.

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<sup>2</sup> For example: <http://www.bloodsafety.info/>

Without this information, meaningful recruitment and retention strategies cannot be implemented and tested. There are no mechanisms to measure the impact and cost-effectiveness of locally appropriate donor strategies. Donor care (post-test counselling, referral and treatment) is an important transfusion service responsibility with implications for donor recruitment and retention and wider public health, but practice is not standardised or evidence-based.

### **Research questions/topics**

1. What evidence exists about donor motivation and retention in SSA? How can this be disseminated and used to develop appropriate and cost-effective education and marketing strategies? Does the private sector have a role in donor recruitment and/or screening? What incentives are acceptable? How can the safety and supply of replacement donations be improved? Are SMS and other technologies useful?
2. What are existing practices for referring donors for management of TTIs and anaemia? Evidence is needed to inform an effective but practical donor care strategy. What is the impact of regular donation on haematinic balance in donors in SSA? Should donors be offered HBV vaccination and could donors who clear HBV and syphilis infections be re-recruited instead of deferred for life?
3. What are the lessons and costs of different donor recruitment models, including databases, lookback systems, testing algorithms and donor counselling? Could donor screening be integrated with VCT/HIV services?

## **Promoting appropriate use of blood transfusion**

### **Problems**

There is significant inappropriate use of blood and blood products in SSA coexisting with lack of supply. The problem is compounded by lack of knowledge about use of blood/component transfusions and poor/unknown quality of haemoglobin measurements which are critical to guide decisions to transfuse and for monitoring transfusion effectiveness. There is little evidence available to guide hospital management of children with uncomplicated severe anaemia (Hb 4-6g/dl) and the evidence underpinning transfusion guidelines for adults and children is weak. There is almost no information about the prevalence and patterns of transfusion reactions in SSA and no system for detecting and reporting these reactions; patterns are likely to be different from those in other regions. There is mistrust between hospital staff and transfusion services which hampers effective use of blood. Blood transfusion committees may be one mechanism to bridge this gap in larger hospitals but they are difficult to establish and maintain.

### **Research questions/topics**

1. What is the evidence to guide emergency pre-transfusion management of adults and children with severe anaemia and for prescribing transfusions including those to stable children with Hb 4-6 g/dl. How can accurate, rapid haemoglobin measurements always be available to inform transfusion practice?
2. How can clinicians ensure that guidelines for appropriate use of blood/products are adhered to at all health service tiers in SSA, and how can the impact of adherence be evaluated? What are the alternatives to transfusion in SSA (e.g. iron, autologous transfusion, anti-fibrinolytics) and how should they be used? In

what circumstances would outpatient rather than inpatient transfusions be cost-effective?

3. What are the patterns and prevalence of transfusion reactions in different settings in SSA including alloimmunisation in multiply-transfused patients, and incidence of detect delayed reactions and infections. How can severe reactions be effectively confirmed, communicated and lessons learnt and disseminated?
4. What factors hinder good collaborations between hospital and transfusion service staff? Would a haemovigilance officer and/or blood transfusion committee peer review of blood utilisation practices facilitate better blood use?

## **Managing supply, stocks and equitable distribution**

### **Problems**

In contrast to wealthy countries, the majority of transfusions in SSA are emergencies. Most deaths from lack of blood occur in the community and/or primary health facilities so efforts should focus on improving blood supply in the periphery. The need for blood in SSA is unknown. Tools are needed to provide reliable estimates of units needed/capita so that adequacy of supply at all health services tiers can be assessed. Transfusion services have no mechanisms for predicting changes in trends in blood/component usage (e.g. due to impact of ACTs, ITNs and ARVs). There is inequitable distribution with those living close to a central BTS having better access but the degree of inequity needs to be quantified and mapped. Inequity is exacerbated by poor distribution and management of existing blood stocks and lack of evidence to guide discard policies (e.g. 30 minute 'out of fridge' rule). There is no system in the region for utilising excess plasma produced by centres which prepare blood components.

### **Research questions/topics**

1. How much blood do the countries of SSA need? What tools and what models can be developed to estimate this need, to document unmet need and to prioritise facilities with the greatest gap in supply? What factors contribute to unmet need, what is the impact of unmet need on morbidity and mortality and how can this be measured, addressed and monitored?
2. How much does mismanagement of stocks within facilities contribute to inadequate supply (e.g. ordering, stock management, inappropriate transfusions)? What is the evidence to guide discard policies in SSA including the effect of using domestic refrigerators for storage and the '30 minute rule'? Could Maximum Blood Ordering Schedules work in SSA? How can changing trends in transfusion needs for HIV and malaria patients be predicted and catered for in different transfusion systems?
3. What is the distribution policy in centralised systems? What is the degree of inequity in access to blood supply in all systems? What factors contribute to this inequity and what mechanisms can be used to improve existing hospital-based systems? What is the true cost of blood to families in different countries/systems (including hidden costs such as donor recruitment)? How do hospitals make rational choices about transfusion recipients when supplies are inadequate? What interventions can improve equitable access to blood?
4. What are the options in SSA for contract fractionation that would be ethical and acceptable to donors and what evidence-based recommendations can be made?

## **Transfusion service models – cost, effectiveness and sustainability**

### **Problems**

The hospital-based system provides 80% of blood in SSA. It is sustainable and based predominantly on replacement donors but it cannot meet all demand and it is difficult to ensure quality. Centralised systems are more controllable, predictable and produce safer blood from voluntary donors but there is no evidence that they reliably reach the most peripheral communities. Hybrids of these two models exist in several countries. Rigorous evidence is lacking regarding the effectiveness and sustainability of different transfusion systems in SSA (ie. centralised/zonal, hospital-based, hybrids) and there is virtually no public information about the economics of these systems including the proportion spent on donor recruitment and care. There is a lack of skilled and knowledgeable staff in all disciplines within the transfusion service and difficulty in attracting and retaining high calibre staff.

### **Research questions/topics**

1. What structures within each type of system are effective/ineffective in meeting supply and safety needs, and impacting on clinical outcomes in SSA, and what are the reasons for success/failure? What indicators can be used to compare equitability, effectiveness and sustainability of different systems?
2. What is the full economic cost of 'donor vein' to 'recipient vein' blood, and associated pre-and post-vein activities, from different perspectives (e.g. health provider, recipients) in different systems? What is the cost-effectiveness of different models of transfusion services taking account of societal costs, willingness to pay, level of automation, morbidity and mortality (e.g. at 2 years). What are the DALYS for various conditions (especially those relating to maternal and child health), and how do they vary with context in SSA? Can this information be used to derive societal costs of the lack of blood?
3. How will cost-effectiveness of each type of system change if, for example, the appropriateness of blood usage improves, workload increases or local quality reagents are available? What is the gap between government funding and the full cost of producing a safe unit of blood in different systems and are there models for how this gap can be filled (e.g. cost-recovery)? Can comparative inter-country case studies of models that are successful/unsuccessful be synthesized, particularly from countries that no longer have donor funding?
4. What attracts, motivates and retains professional transfusion staff? What career development structures are needed? What human resource skills are needed in the different systems? What educational methods should be used and how can they be evaluated?