Strategies for blood (and plasma) collection in infectious disease, endemic populations

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Introduction

- Various models exist for delivering services related to blood and blood products globally
  - Vast differences in infrastructure and sophistication of services provided between high, medium and low HDI countries
- National Services vs. very fragmented services
- Centralised functions of processing and testing vs. decentralised functions
    - Limitations related to introduction of economies of scale and automation

Key Focus Areas in Ensuring a Sustainable Operational Model

- Nationally co-ordinated blood transfusion service
  - Sustainable business/operating model (cost recovery)
  - Regulatory framework and policies
- Appropriate human resources

- Appropriate Quality Systems and Internal Processes
  - Quality manuals, SOP's, document management system
  - Infrastructure for Blood Collection, VNRBD
  - Infrastructure for processing, testing, storage and transport of blood in a quality assured manner
    - Centralised vs. decentralised operations
    - Algorithms
  - Appropriate access to blood products

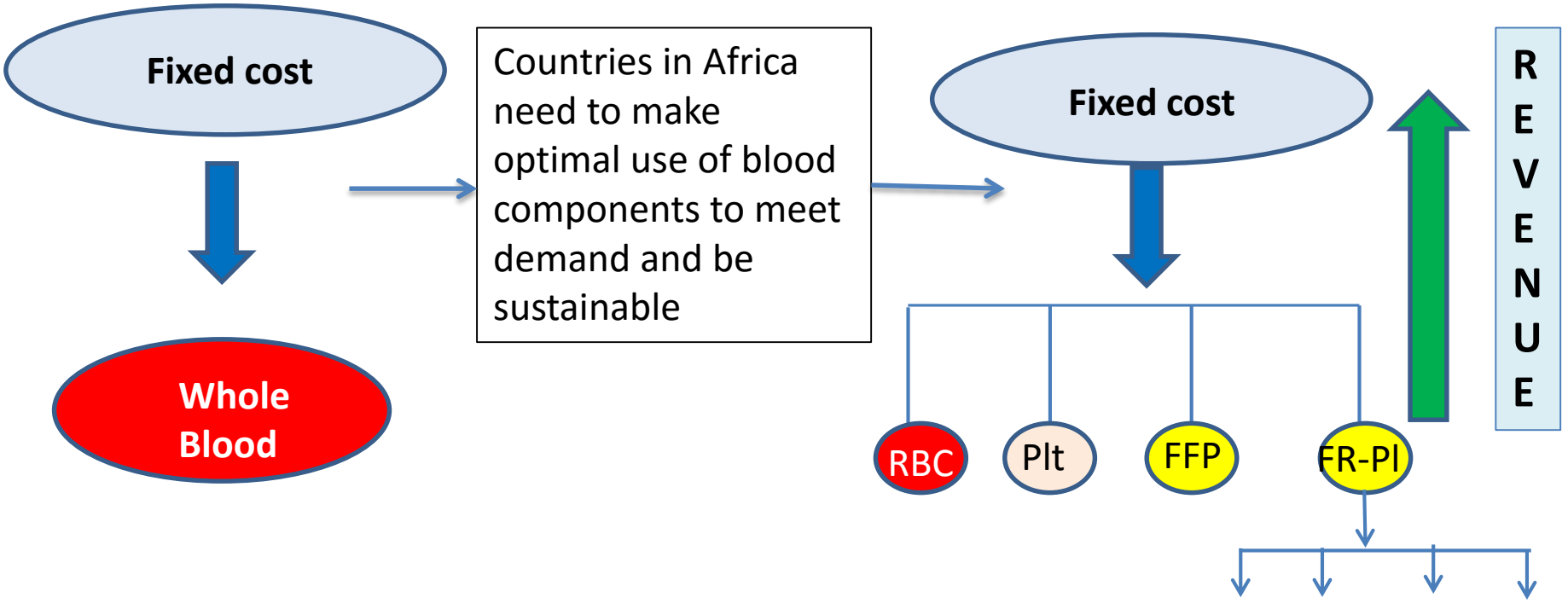
Financial Sustainability

- Critical to have an annual budget that ensures all costs are recovered
- Capital replacement on a fixed cycle
- Contracts for critical items, including maintenance contracts for equipment
- Optimal use of all products from a unit of whole blood
  - Recover costs by providing a wider range of products instead of one product.

Sustainable Blood Transfusion Model

? Not sustainable

Government support - Sustainable



Effective Human Resource Infrastructure

- Management and Organization – appropriate governance, operations and support services infrastructure
  - Leadership
  - Marketing Staff , Collections staff
  - Medical and Laboratory personnel
- Support Services Personnel
  - Finance, IT, Logistics
- Effective education and training programmes

LIMS, Quality System and Traceability

- Quality policy and systems in place
- Validated, LIMS systems in place:
  - Traceability of all donors and donations
  - Quarantine and release of products
  - Labelling of products
- Appropriate Data management systems
- Monitoring and evaluation systems
    - Planning vs actual performance
    - Impact of strategies and actions

Blood Collection

- Most important is appropriate donor base
  - Low risk donors - repeat vs. first time donors
  - Systems to communicate with donors
  - Infrastructure for blood collection
  - Infrastructure for donor selection and deferral
  - Donor – donation traceability
- Appropriate logistics (vehicles, equipment, blood bags, scales, etc)
- Quality product collected – minimise wastage

Challenges in Donor Recruitment and Retention

- Poor infrastructure in BTS (IT systems)
- Staff shortages and lack of well trained staff
- Insufficient budgets for donor recruitment activity
  - BTS is part of Ministry of Health with budget constraints
- Widely spread population
  - in some countries over 60% of the population are “rural” making it difficult to access these individuals.
- High unemployment rates
- Many potential donors don’t have transport to reach donor clinics

Challenges in Donor Recruitment and Retention (cont'd)

- Myths and misconceptions on blood donation and poor public attitude
- Lack of suitable customer relations management systems to communicate with donors
- Poor communication system, particularly in rural areas
- High prevalence of HIV and HBV in the population

Managing Blood Collections

- Key elements
  - Business intelligence – what is the donor potential of the Country and where are they located
    - In developing countries many factors must be considered in establishing who the likely donors are
  - Systems to collect sufficient blood (database, infrastructure and logistics)
  - Processes (Recruitment of donors, retention programmes
- Important to know the target audience, have systems to reach them and processes to get them to donate

Strategies to Increase Repeat donations cost effectively

- Voluntary repeat donors are lower risk
  - ***>20 fold reduction in HIV prevalence in repeat donors vs. first time donors. <u>However only 3 fold reduction in recent infections</u>***
  - ***No significant difference in prevalence between 1st time and replacement donors is some studies***
- Adequate integrated IT and communication infrastructure is most important
- Good database and regular communication with donors
- Make it easy and accessible for donors to donate
  - **<u>Understand what motivates and deters them</u>**
- Loyalty programmes - incentives
- Strategy for replacement donors to become regular donors.

Cold Chain

- Transport in controlled manner to labs and blood banks
- Appropriate blood transport containers to maximise product yield
- Transport logistics to ensure timely arrival lab for further production into blood components (within 18 hours)
  - Compliance with transport regulations
  - Reliable infrastructure

Blood Processing

- Maximising component preparation and usage depends on the infrastructure of the BTS, and needs of the specific country
  - Significant collection, transport, production, testing and staffing infrastructure required to prepare quality blood components
  - Systems to ensure quality and safe products
  - Needs to be established demand for the various blood components in the Country
    - Collection and issue of whole blood may seem to be most cost effective option
    - However the country will then have limited or no access to platelets and plasma derived products

Donation Testing Strategy

- Critical to select appropriate systems/assays
  - Sensitivity of assay/s influenced by incidence data and risk
  - Specificity of assay – limit false positives and discard of blood
  - Automation vs semi-automated/manual (volumes)
- Quality assured testing of each donation is critical
  - EQAS and internal QC systems must be in place
- Use of sensitive serology assays leads to detection of most of the viral positive donations cost effectively
  - NAT (ID or pools) may be considered in countries with high incidence
- Confirmatory testing is required
  - Counsel donor (treatment and prevention of infection)
  - Assess residual risk of TTI transmission

Managing Risk with Testing Strategies

- Quality assured serology tests is most powerful factor in reducing risk of TTI with clear benefits vs. costs (mandatory requirement)
- In high prevalence countries, implementation of NAT can further increase safety
  - Increased safety and saving on litigation
  - Confidence in blood supply and increased usage
  - Donor confidence and increased supply
  - Additional revenue from components (buffy coat platelets, plasma for fractionation, FFP)
  - May be required by the Fractionator
- In South Africa, ID-NAT continues to contribute significantly to the safety of the blood supply.

SANBS HIV Data – 3 Years

	Concordant Anti-HIV & NAT pos		NAT only pos		p24 negative NAT pos		Anti-HIV only pos		Total HIV pos	
2012	1553	0.195%	**60**	**0.008%**	**37**	**61.67%**	18	0.002%	1631	0.205%
2013	1864	0.229%	**82**	**0.010%**	**46**	**56.10%**	36	0.004%	1982	0.244%
2014	1805	0.220%	**58**	**0.007%**	**37**	**63.79%**	40	0.005%	1903	0.232%
Total	5222	0.215%	**200**	**0.008%**	**120**	**60.00%**	94	0.004%	5516	0.227%

Significant number of ID-NAT positive, anti-HIV negative, p24 antigen negative donations being detected

SANBS HBV Data – 3 Years

	Concordant HBsAg & NAT pos		**NAT only pos**		HBsAg only pos		Total HBV pos	
2012	740	0.093%	**198**	**0.025%**	19	0.002%	957	0.120%
2013	800	0.098%	**193**	**0.024%**	11	0.001%	1004	0.124%
2014	706	0.086%	**198**	**0.024%**	24	0.003%	928	0.113%
Total	2246	0.092%	**589**	**0.024%**	54	0.002%	2889	0.119%

Close to 4 HBV ID-NAT positive samples only, per week – higher residual risk of transmitting early window period samples

Limitations in Resource Limited Countries

- Lack of data on inter donation intervals for repeat donors
  - cannot use established models to calculate residual risk in repeat donors
- Large percentage of 1st/family replacement time donors
  - Not able to estimate number of window period donations and residual risk in this group.
- Guidelines developed by WHO to assist these countries
  - Average lengths of window period with different assays
  - Average viral load in the plasma donation of a window period donation with different assays

	WHO Guidelines (Draft) - Diagnostic Window: lengths of viraemic phase for test categories in days (average)							
	NAT ID	NAT MP (16)	antigen ELISA	combo ELISA	antibody ELISA	antigen RDT	combo RDT	antibody RDT
HIV	8	11	14	16	21	---	20	28
HBV	27	37	42	---	---	55	---	---
HCV	5	7	9	38	60	---	---	80

HIV Risk in Plasma to be used as an Active Pharmaceutical Ingredient for Fractionation

- Only anti-HIV testing - average 2 700 000 copies of HIV RNA per 225 ml donation.
- HIV p24 antigen anti-HIV test - average 900 000 copies of HIV RNA per 225 ml donation.
- ID-NAT testing - average 7 500 copies of HIV RNA per 225 ml donation.
  - Total HIV viral loads introduced into the plasma pools prior to the fractionation and inactivation process will depend on the actual number of window period donations and the total viral load will be many fold lower than in a) and b) above
  - 360 fold reduction compared to anti-HIV testing alone

Discussion

- Countries need a comprehensive plan to ensure quality assured processes and products across the value chain
- Committed/Low risk donors is the key to ensure a sustainable blood supply
- In Countries with a relatively high incidence HIV
  - Significant risk of non-detection of high viral load window period donations with serology testing alone
  - Strategies such as additional testing (NAT) may be useful
- Monitoring and Evaluation is critical
  - Requirement for good data collection and management systems

Thank You