ASSESSMENT OF BLOOD TRANSFUSION SERVICES IN SIX REMOTE REGIONS IN TANZANIA

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A mini-thesis submitted in partial fulfilment of the requirements for the Masters in Public Health

at the School of Public Health Sciences of the University of the Western Cape

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DECLARATION

I declare that **ASSESSMENT OF BLOOD TRANSFUSION SERVICES IN SIX REMOTE REGIONS IN TANZANIA** is my own work and that it has not been submitted before for any degree or examination in any other university. All information that I have used or quoted have been indicated and acknowledged as complete references.

Signed

Dr. Faustine Ndugulile

June 2010

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS   Acquired Immune Deficiency Syndrome

ELISA   Enzyme Linked Immuno-sorbent Assay

HIV   Human Immuno-deficiency virus

HBV   Hepatitis B virus

HCV   Hepatitis C virus

IEC   Information, Education and Communication

MOHSW   Ministry of Health and Social Welfare

NGO   Non Governmental Organisation

NBTS   National Blood Transfusion Service

PEPFAR   The U.S. President's Emergency Plan for AIDS Relief

PI   Principal Investigator

SD   Standard Deviation

TSH   Tanzanian Shillings

TTIs   Transfusion Transmissible Infections

USD   United States Dollars

WHO   World Health Organisation

ZBTCs   Zonal Blood Transfusion Centres
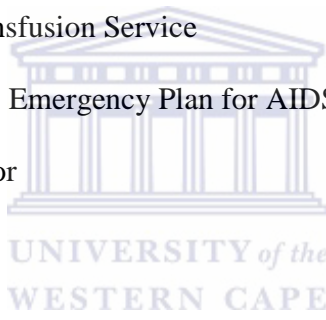
ABSTRACT

Assessment of blood transfusion services in six remote regions in Tanzania

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Background: The current blood transfusion system in Tanzania is hospital based and is often faced with frequent shortages of blood and un-standardized testing for Transfusion Transmissible Infections. The Government of Tanzania has recognised blood safety as one of the interventions for prevention of HIV infections and to reduce maternal deaths. After extensive consultation with stakeholders, the Government embarked in establishing a centrally organised blood transfusion system. This system is responsible for blood collection, processing and distribution of blood in the country. The six regions that are geographically inaccessible (hard-to-reach), are responsible to collect, process and issue blood for their own use. In order to effectively build the capacity of the hard-to-reach regions to provide adequate and safe blood to health facilities, there was a need to conduct an assessment of the current status of blood transfusion services in these regions.

The current study purposed to assess infrastructure development, equipment, staffing levels, blood requirement, testing capacity and training needs of the hard-to-reach regions to provide optimal blood transfusion services.

Study Design: A cross-sectional survey was conducted in seventeen health facilities that perform blood transfusion in the six selected remote regions.

Population and Sample: All the 17 public and private health facilities that offer blood transfusion services in the six regions were included in the study. The state of infrastructure development, equipments, staffing levels, blood requirement and the testing capacity were

assessed in all these facilities. In addition, a total of 90 medical practitioners (doctors or nurses) were randomly selected for interviews to assess their knowledge on blood transfusion practices.

Data Collection: A structured questionnaires were administered to assess the knowledge of health workers on issues related to blood transfusion. A checklist of essential blood bank personnel, infrastructure and equipment wa**s** used. Visual inspection was also conducted to verify the information given by informants.

Data Analysis: Basic, descriptive analysis was performed using Epi Info 2003.

Results: Seven of the seventeen (41.2%) of the facilities assessed had adequate space for blood transfusion activities. Seven (41.2%) and four (23.5%) facilities had phlebotomy and counselling rooms respectively. The laboratories were understaffed and mainly manned by lower cadre staff. Three facilities had ELISA capacity, the rest of the facilities were using rapid tests to test blood for TTIs. Only one laboratory was testing blood for HIV, HBV, HCV and Syphilis, the rest of the laboratories visited tested for HIV only. Nearly 95% of the 16,771 units of blood collected in the six regions came from replacement blood donors. The major recipients of the blood were children (31.1%) and maternal cases (26.8%). Only 32% of the health workers interviewed were able to correctly name the major Transfusion Transmissible Infections (TTIs). About 54.5% of those interviewed could identify at least two transfusion indications and about 37.2% of them were able to name at least two measures to be taken when a transfusion reaction occurs.

Conclusion: Most of the blood transfusion facilities had adequate space, but lacked some of the basic equipment. Blood collected in these facilities was not adequate to meet the blood needs of the regions. These facilities lacked specialised personnel and some of those practicing blood transfusion were not conversant with blood groups, transfusion reactions and the measures to be

taken if a reaction occurs. The findings of this study will be used to strengthen blood transfusion

services in these hard to reach regions.

KEY WORDS

Blood Transfusion

Remote regions

Transfusion Transmissible Infections

Tanzania

Replacement blood donors

Voluntary blood donors

Capacity

Strengthening

 HIV/AIDS

Safe

CHAPTER 1: INTRODUCTION

1.1. Background

Blood transfusion is an essential part of modern health care services. If blood transfusion is used correctly it can save lives and improve treatment outcomes. Improper use of blood and blood products may cause acute or delayed complications. Poorly screened blood also carries the risk of transmitting infectious blood-borne agents such as HIV, Hepatitis viruses, syphilis and malaria [1].

Improperly organised blood transfusion services not only may lead to increased prevalence of Transfusion Transmissible Infections, but also shortages of blood are also known to increase deaths due to bleeding during pregnancy [1, 2]. Availability of blood for transfusion has been shown to improve survival of anaemic children [3] and reduce maternal deaths up to 50% [1, 4].

The Twenty-eighth World Health Assembly resolution number WHA 28.72 of 1975 urged member countries to promote the development of national blood services based on voluntary non remunerated donation of blood; to enact effective legislation governing the operation of blood services and to take other actions necessary to protect and promote the health of blood donors and of recipients of blood and blood products. The blood transfusion services in Tanzania is hospital based, uncoordinated and faces frequent shortage of blood supply. Due to these problems and the need to prevent HIV infection through blood transfusion [1], the Government of Tanzania through the Ministry of Health decided to establish a national program that will coordinate blood transfusion services throughout the country. The Tanzania National Blood Transfusion Service (NBTS), using its zonal centres, will be responsible for collection of blood

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from voluntary donors, processing and distribution of the blood and its products to hospitals in their zones.

1.2.   Description of setting

Tanzania is a large country in East Africa occupying an area of 947,719 sq km. It is formed by the union of Tanzania mainland (945,087 sq km) and the islands of Unguja and Pemba which collectively are known as Zanzibar (2,632 sq km). The country is divided into 26 administrative regions (21 mainland and 5 Zanzibar), 130 administrative districts (120 mainland and 10 Zanzibar).   Tanzania Mainland is divided into seven zones that group together three to four regions to form the Eastern, Northern, Lake, Central, Western, Southern Highlands and Southern zones while Zanzibar has two zones based on the two main islands of Unguja and Pemba. The zonal system is demarcated for convenience of provision of sectoral services (e.g. health and training) and is not backed with a political or administrative system. According to the results of the 2002 Population and Housing Census, Tanzania has a population of 34,443,603. The majority of the population (77%) live in rural areas while 23% and 40% in Tanzania Mainland and Zanzibar live in urban areas respectively [5].

Tanzania has a well-established health care delivery system. It is in pyramidal shape and it ranges from the village health posts, dispensaries, health centres, district hospitals, regional hospitals, referral hospitals and finally to the national hospital. According to the Ministry of health, this network consists of about 4,990 dispensaries, 409 are health centres, 208 hospitals that include district and regional hospitals as well as 3 referral hospitals, 2 specialized hospitals and 1 National hospital. In addition there are other parastatal organizations, NGOs, voluntary

agencies and private sector health facilities that provide health services to the public. It is estimated that about 45% of the population lived within 1 km of health facility, 72 % lived within 5 km and 93% lived within 10 km.

The current blood transfusion systems in both Tanzania Mainland and Zanzibar are hospital-based. Health facilities from the district to the national hospital level have their own blood banks as part of the laboratory services. Most hospitals do not have dedicated space for blood transfusion. Blood transfusion activities within these laboratories are carried out alongside other laboratory functions.

The laboratory personnel that carry out blood transfusion activities are the same people who perform other laboratory functions. These laboratory personnel do not have specialised training in transfusion medicine and they lack continued professional development opportunities. The clinicians who work in this health system also lack formal training in transfusion medicine practices. Transfusion medicine practices constitute an insignificant proportion of the course content during their training.

The blood transfusion services in Tanzania and Zanzibar are based on family replacement system, which require the relatives of the patients to come to the health facility and donate blood when it is needed by their patients or to replace the hospital issued blood. Many of the hospital based blood banks have limited storage capacity; hence blood cannot be stored for more than 48 hours. This means that all the blood collected has to be used within 24 hours of collection. Constraints related to irregular blood supply and limited storage capacity have led to recurrent shortage of blood for transfusion. Given the fact that there is no central coordination, each region has been left to regulate its own blood transfusion activities and there is no standardised testing platform for Transfusion Transmissible Infections (TTIs), which are infections that can be

transmitted to a blood transfusion recipient due to a improperly screened blood. The TTIs of public health importance include HIV/AIDS, Hepatitis B virus, Hepatitis C virus, Syphilis and in some places Malaria.

1.3. Problem statement and study rationale

The high prevalence of HIV and other TTIs in Tanzania calls for immediate remedial measures through establishment of a nationally coordinated Blood Transfusion Service (NBTS). The current hospital based blood donor recruitment system does not meet the actual requirements of blood for the hospitals leading to frequent blood shortages. Testing process of donated blood to prevent transfusion transmissible infections is uncoordinated and un-standardised across the country. There is still irrational clinical use of blood due to lack of knowledge on safe and effective use of blood and blood product and use of the alternatives measures to transfusion.

The Ministry of Health has established a centrally coordinated national blood transfusion service that is divided in seven zones. There are seven Zonal Blood Transfusion Centres (ZBTCs) that are currently operational in Tanzania Mainland and these are located in the Eastern, Northern, Western Lake, Southern, Southern Highlands, Central and Zanzibar zones. However, these seven zonal centres do not cover the whole country and hence the six remote regions are currently not able to access services from these established zonal centres.

Due to remote location and logistical challenges, the government plans to give geographically inaccessible region which are often referred to as Hard-to-reach Regions limited capacity to collect and process blood for own use. These regions are Ruvuma, Rukwa, Kagera, Singida, Lindi and Manyara. There is little information about the infrastructure capacity, level of staffing,

gaps in basic knowledge about blood transfusion and the patterns of use of blood and blood products in hospitals in these regions, to effectively carry out blood transfusion services.

Therefore there is a need to conduct a situational analysis of the health facilities that are transfusing blood in the six regions to identify the gaps and to take appropriate measure to improve their capacity according to the requirements before they are accredited to offer such services.

CHAPTER 2: LITERATURE REVIEW

2.1.   Overview of blood transfusion services in the world

Globally, approximately 80 million units of blood are collected each year, Sub-Saharan Africa contribute only 2 million units in this global total[1]. The actual blood needs in the sub-Saharan Africa are not known, but given the high blood demand due to high maternal morbidity, malnutrition, and a heavy burden of infectious diseases, it is expected that the demands for blood in this region would exceed supply[1]. According to the World Health Organisation (WHO) report for 2001-2002, 60% of the blood collected worldwide was used for only 8% of the world population. Africa's blood needs account for the 60% of the world needs, but the continents contributed only 3 % [6]. Again, another WHO report of 1999 shows that Africa was only able to collect only 30% of the 12 million units required for the continent [7]. All these statistics point to the challenges that the health systems in sub-Saharan Africa are facing in terms of meeting the blood supply demands.

The WHO recommends that blood for transfusion should be based on voluntary, non-remunerated, repeating blood donors. Many developing countries including Tanzania have hospital based blood transfusion systems that rely on replacement blood donation system. According to the 2002 WHO report, only 40% of all blood donations in Africa came from voluntary blood donors [8]. Another study by Tagny *et al*. estimates that voluntary blood donors contribute between 20-25% of all blood for transfusion in Africa [9]. South Africa is probably the only country in sub-Saharan Africa with more than 80% of its blood donors being voluntary blood donors [10].

The family replacement blood system relies on family members donating blood for sick relatives and it often has a higher prevalence of Transfusion Transmissible Infections (TTIs) than the

voluntary blood donation system [1]. Family replacement blood donors due to urgency and external pressures to donate, they sometimes do not disclose their behavioural risks for HIV during donor selection.

Most of the blood collected from voluntary, non-remunerated blood donors come from schools youths and other training institutions. Training institutions blood donors are easily accessible and are usually willing to donate in large numbers. Due to reliance to this pool of blood donors, many blood transfusion programmes tend to experience severe shortages from when these training institutions close for holidays [11]. In Kenya, the mean age of blood donors is reported to be 28.9±8.5 years [12], whereas in Burkina Faso the mean age of blood donors is reported to be 28±7.9 years [13].

The transition from hospital based system to a centrally coordinated system is laborious, costly and time consuming. A few countries like Ghana which had transitioned from the hospital based blood transfusion to a centrally coordinated system still relies on family replacement blood donors [14, 15].

Despite the fact that blood collection in sub-Saharan Africa does not meet utilisation demands, there is still a lot of wastage of the little amount of blood that is collected in the region due to high levels of TTIs [9] and transfusion of whole blood [16]. Due to technological limitations of separating blood into components, whole blood is given when platelets, clotting factors, red cells or plasma could have been given to a patient depending on the need. Children are also being transfused whole adult pack instead of paediatric packs which result in the remaining blood being discarded.

Only about 20% of African countries produce platelet concentrates, less than 60% produced packed red cells concentrates, less than 50% produced fresh frozen plasma, and 75% of the

countries transfused whole blood [7]. However, there are no studies done in the developing countries that have looked into the wastage and discard rates in health facilities. Few studies have reported about quantities of blood that are being discarded due to TTIs. A study carried out in Gondar, Ethiopia reported a 16.3% blood discard rate due to viral markers [17].

According to the World Health Organisation, all the blood collected in the developed world is screened for Transfusion Transmissible Infections (TTIs), while over 50% of blood collected in developing countries are not screened for TTIs despite the high prevalence of these infections. [1]. Even in the countries that regularly screen blood for blood borne infections, the screening is inconsistent. In the early 1990s, unsafe transfusions were estimated to be responsible for up to 10% of all HIV infections, many of them in high income countries. HIV-contaminated blood now accounts for approximately 5% of HIV infections in Africa today [1, 18]. Globally, the major recipients of blood globally are the pregnant women and children under the age of five years [1].

2.2. Burden of transfusion transmissible infections

Provision of safe and adequate blood transfusion service in sub-Saharan Africa faces a number of challenges due to high endemicity of TTIs. The prevalence of HIV/AIDS, HBV, HCV, Syphilis and Malaria are high among blood donors in this region [19-21].

A number of studies have shown high prevalence on TTIs among blood donors in developing countries and more so in replacement than voluntary blood donors. A study conducted in India by Garg *et al.* revealed a higher prevalence of TTIs among replacement donors than in voluntary donors. The sero-prevalence for HIV, HBV, HCV and Syphilis among the replacement donors in

this study was 0.5%, 3.5%, 0.3% and 0.2% respectively compared to 0.3% 2.6%, 0% and 0.1% among the voluntary blood donors [22]. Another study that was carried out in neighbouring Uganda among voluntary blood donors reported the prevalence 2.2% for HIV, 3.0% for HBV, 0.2% for syphilis and 0.6% for HCV [23].

The prevalence of TTIs in Tanzania are also very high, a study conducted in 1999 by Matee *et al.* revealed the prevalence of Hepatitis C (anti-HCV), Hepatitis B core antigen (anti-HBc), Hepatitis B surface antigen (anti-HBsAg) and syphilis markers to be 8.8 %, 22%, 11% and 2.9% respectively. There was no evidence of antibodies against Human T-Lymphotrophic Virus type 1 (anti-HTLV-1) [24]. A follow up study conducted at the same facility by the same author showed prevalence of HIV and Syphilis among replacement blood donors to be 4.5% and 6.1% compared to 2.0% and 1.5% among voluntary blood donors respectively [25].

Blood transfusions systems in the developed countries are much more advanced and have stringent blood screening procedures than in the developing countries and employ more advanced and costly technologies for this purpose.

Blood transfusions carry the risk of transmitting infections. The risk has been studied in detail in both the developed and developing countries. A study conducted in the United States by Lacritz *et al.* found the chances of a patient being transfused with HIV infected blood to be 1 case for every 450,000 to 660,000 donations of screened blood for transfusion [26].

Soldan *et al.* showed that the estimated frequency of infectious donations entering the blood supply in England, between 1993 and 2001 was 1 in 260,000 for HBV and 1 in 8 million for

HIV. For HCV, the frequency of infectious donations was 1 in 520,000 during 1993-98. This frequency fell even further with the introduction of molecular testing technology [27]. Jayaraman *et al.* used a mathematical model to estimates the risks of acquiring human immunodeficiency virus (HIV), hepatitis B virus (HBV) or hepatitis C virus (HCV) from a single unit of blood in sub-Saharan Africa. He based his model on the risk of a contaminated unit entering the blood supply, the risk that the unit will be given to a susceptible patient, and the risk that receipt of the unit will lead to infection in the recipient. Variables included in this model included the prevalence of infection in donors, extent of blood testing, test sensitivity, and susceptibility of recipients. This study projected that the median overall risks of becoming infected with HIV, HBV, and HCV from a blood transfusion in sub-Saharan Africa were 1, 4.3, and 2.5 infections per 1000 units, respectively. Jayamaran *et al.* estimate that if annual transfusion requirements projected by the WHO were met, transfusions alone would be responsible for 28,595 HBV infections, 16,625 HCV infections, and 6650 HIV infections every year [28].

2.3. Knowledge of blood prescribers

In order to reduce TTIs it is important to have well trained, skilled personnel who can test the blood and clinical practitioners who can advocate for rational blood use. Blood prescribers and the health workers who administer blood need to be conversant with the indications of blood transfusion. They also need to have an understanding of the different blood groups and which of these are universal blood donors and recipients. They need to know risks associated with blood transfusion, be able to symptoms of transfusion reaction and steps to be taken when a transfusion reaction occurs.

A study conducted by Moore *et al.* in six hospitals in Kenya, where he collected pre transfusion blood samples from blood already screened at the respective hospital laboratories, the pre-transfusion blood was tested at a reference laboratory and results compared to those from the hospital laboratories. He found that 26 HIV positive blood donations were given to 1290 HIV negative subjects. The risk of HIV transmission in this study was 2% [29].

It is essential that blood prescribers are well trained to ensure patients are not being given unnecessary blood transfusions [30, 31]. A study conducted in Kenya by Lackritz *et al.* found 47% and 90% of paediatric and adult transfusions respectively were unwarranted [32], hence putting the patients at a higher risk of contracting TTIs.

Tanzania does not have a robust national reporting system for blood collection and utilization. There is very scant data that shows the number of units collected and transfusions performed in hospitals throughout the country.

The only records available show that, in the year 2002 a total of 147,271 individuals donated blood in Tanzania Mainland while 15,000 individuals donated blood in Zanzibar [33]. Less than 20% of all blood donors in Tanzania were voluntary non-remunerated blood donors [33]. Data from the National Referral Hospital have shown that the main consumers of blood and blood products are children under five years of age mainly due to malaria-associated anaemia [50%], expectant mothers for treatment of pregnancy-associated anaemia or complications following delivery [30%], surgical and trauma patients (15%) and medical patients (5%) [34].

2.4.   Accessibility of the remote regions

Remote regions are those regions that are in the periphery of the country. These are located (distance in kilometres) Ruvuma (992), Rukwa (1186), Kagera (1425), Singida (709), Lindi (459) and Manyara (777) from the capital Dar es Salaam. The road infrastructure to these regions is underdeveloped and there are no reliable transport systems particularly during the rainy season. Being in the periphery of the country, these regions have relatively poor health services and serious shortage of skilled health workers [35].

2.5.   Blood transfusion capacity in the remote regions

The term blood transfusion capacity refers to the availability of adequate infrastructure, equipment, personnel and skills to meet the demand of blood transfusion service. The assessment of these key areas will provide information about the available blood transfusion capacity within the remote regions. There is no literature related to the assessment of blood transfusion services elsewhere. The few assessment reports on the capacity of blood transfusion services that are available have been done as part of health facility assessment or maternal and child health services [36, 37].

The blood requirements of these hard to reach regions are unknown. Assuming the fact 2% of the population will require blood in a year, the expected needs of blood units for each region is as follows: Ruvuma (22,343), Rukwa (22,835), Kagera (40,678), Singida (21,815), Lindi (15,826) and Manyara (20,809) [5].

Safe blood transfusion service require a national blood policy, centrally organised service that is relies on voluntary non remunerated blood donors [38]. The quality of service relies on well trained human resources, availability of equipment and blood screening supplies [18, 39, 40].

CHAPTER 3: AIM AND OBJECTIVES

3.1. Aim

The aim of the study is to conduct an assessment of the capacity of the six remote regions to provide adequate and safe Blood Transfusion Services in Tanzania Mainland.

3.2. Objectives

This study will attempt to address the following objectives:

1. To assess the available blood bank infrastructure, equipments and staffing levels in transfusing hospitals in the six regions.

2. To determine the type of blood donors (Voluntary/Replacement) in the six regions.

3. To determine the number of blood units collected and consumed at each transfusing hospital in the six regions per year.

4. To determine the range of tests performed in blood screening at each of the transfusing hospitals in the six regions.

5. To assess knowledge of prescribers in areas of blood safety and effective clinical use of blood in transfusing hospitals in the six regions.

CHAPTER 4: METHODOLOGY

4.1. Study design

This was a cross-sectional, descriptive survey of the blood transfusion services in the six hard to reach regions. Cross-sectional study was chosen because it provides the baseline information about the size and magnitude of the problem at a particular moment. Cross-sectional studies are relatively easy to perform and are usually inexpensive. There are no published studies that look at the assessment of blood transfusion services in the developing countries. This cross-sectional, descriptive survey is the best available study method to generate information that will be used to develop a strengthening plan for these facilities.

4.2. Definition of terms

Blood transfusion capacity- refers to infrastructure, equipment, personnel and skills required to meet the demand of adequate and safe blood transfusion service in these regions.

Remote/Hard to reach regions- These are regions that are in the periphery of the country and very far from the capital Dar es Salaam. The road infrastructure to these regions is underdeveloped and there are no reliable transport systems especially during the rainy season.

National Blood Transfusion Service- This is the nationally coordinated blood transfusion system that is being set up to replace the hospital blood transfusion system.

Transfusing health facilities/hospitals- These are public and private hospitals which are currently providing blood transfusion service.

Transfusion Transmissible infection- These are blood borne infections that can be transmitted to another person through transfusion of improperly screened blood. These include HIV, Hepatitis B, Hepatitis C, Syphilis and Malaria.

Blood prescribers- All those health workers with the mandate of ordering and transfusing blood to patients.

4.3. Study population

This study involved all the public and private transfusing health facilities within the six remote regions. These facilities visited to assess the space available for blood transfusion activities within the hospitals laboratories/ blood banks, equipment and available staff. A survey was also conducted among the clinical staff at the health facilities to assess their knowledge of blood transfusion practices.

4.4. Sample size and sampling procedure

In Tanzania, regional, district hospitals and some large private offer blood transfusion services. Since all the transfusing hospital facilities in the six regions in the remote regions were involved, random selection and sample size calculation was not be required. All hospitals that carry out blood transfusion in the six regions were included in the study.

At each health facility, a list of the doctors and nurses working in the medical and surgical wards was drawn. Random sampling was applied to identify three health workers that work in these wards and are involved in routine blood transfusion activities. These were interviewed to assess their knowledge on blood transfusion practices. A total of 90 health personnel were interviewed.

4.5. Data collection

4.5.1 Data collection tools

4.5.1.1. Assessment of the blood bank facilities, equipment and blood transfusion activities

A checklist with questions on essential blood bank personnel, infrastructure and equipment was used in the interview with either the Medical Officer in Charge or the Laboratory Technician in

Charge at the hospital (Appendix VIII). The checklist included questions on availability and the state of the blood bank infrastructure and equipments. Questions on staffing levels aimed at finding out the different blood transfusion health workers available at the facilities. The checklist also had questions on the type of blood donors, units of blood collected and used and screening tests performed at these facilities.

The interviewer administered the questions to the respondent and the responses were recorded in the checklist.

In addition, the investigators carried out observations as a verification process and performed physical check of the equipment to determine if there were in working condition. The infrastructures were checked for space adequacy, presence of a phlebotomy and counselling rooms. Laboratory documents and records available at the facility were used to verify the information given by the personnel at the site about the type of blood donors bled at the facilities, units of blood collected and transfused and screening tests performed.

4.5.1.2. Assessment of knowledge of blood prescribers

The knowledge of blood prescribers (doctors or nurses) on blood safety and practices were assessed using a questionnaire with open and closed ended questions (Appendix VII). The purpose of the study was explained to the participants and that the interviews for the knowledge of prescribers were anonymous. No interviewee names were used. Participants were allowed to decline taking part. The interviewer administered the questionnaire to the respondent and answers were recorded on the questionnaire.

4.5.1.3. Pilot study

The checklist and the questionnaires were piloted at three transfusing health facilities in Dar es Salaam. These data collection tools were tested to check if they are able to capture the required information; the questions are clear and can easily be understood by the interviewees in both English and Swahili. The tools were translated into Swahili and then translated back into English to check for accuracy. In addition, the time it takes to complete the questionnaires was assessed. Basing on the findings of the pilot study, modifications to the tools were made accordingly.

4.5.1.4. Data collection procedures

Prior to the interview visits, all facilities were sent a letter by the Ministry of Health informing about the study. The author was the principal investigator, he was assisted by two trained research assistant with a medical background. All interviews were either conducted in Swahili or English and in privacy.
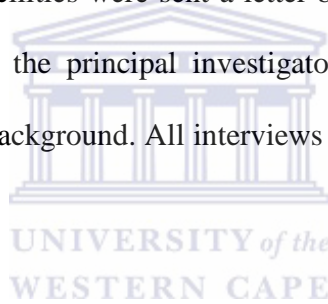
4.6. Data analysis

The data collected during the day was reviewed at the end of the day by the principal investigator. The incomplete information was sought from the facility the next day. In case the missing information could be retrieved, the particular field was excluded from the analysis. Complete questionnaires were coded. Data from the questionnaires was entered into a database by a research assistant. The data entered in the database was reviewed daily by the principal investigator for accuracy. The analysis of the data was performed using Epi info 2003. Frequencies and percentages were calculated. Continuous variables were defined as mean±standard deviation (SD) and discreet variables as percentages. Qualitative data collected were coded using predetermined template and analysed using codes, themes and categories.

4.7. Validity of study

Validity determines the strength of the conclusion or whether the research truly measures what it was intended to measure. All the questionnaires prior to use were piloted to ensure the questions provide the required information, consistency and easily understandable. Changes were made to the questionnaires before they were used. The findings of this study reflect the availability and the quality of blood transfusion service in these regions. All transfusing facilities in these regions were covered. Again, standardised questionnaires were administered by trained interviewers. Questions on blood transfusion knowledge were based on day to day practices. Therefore there are no concerns of recall or selection bias in this study.

4.8. Reliability of study

Reliability is the degree of the consistency of an instrument in providing the same results when used the same conditions and similar subjects. Reliability in this study was achieved by piloting the questionnaires, using the same interviewers for the interviews.

4.9. Generalisability of study

Generalisability of the study looks on whether the findings of the study can be inferred elsewhere or be applicable in the general population. In this study, all the transfusing hospitals in the remote regions were assessed and hence the findings of this assessment can be generalised to other remote regions, but not other regions which are close to the national capital or with improved transport infrastructure systems.

4.10. Ethical considerations

This protocol was submitted to both University of Western Cape and the local Ethics committee for approval prior to carrying out the study. Confidentiality and anonymity was maintained all times. The study did not involve taking samples from patients. Names or terms that identify the people interviewed were de-linked from the database during analysis.

The purpose of the study was explained to the participants and signed informed consent sought prior to the interviews about the knowledge of prescribers. Names were not used in the questionnaires; instead research identification codes were used. Participants were allowed to decline taking part. All the data was securely stored by the Principal investigator during the study period and will be for two years thereafter. Permission to access and use this data will only be given through the Principal investigator. No names or identifiers will be released to a third party.

4. 11. Risk to participants

The study did not involve taking samples from patients; therefore there were no harmful invasive procedure associated with the study.

4.12. Value of the study and population benefit

There were no direct individual benefit in participating in the study, but the feedback report from this study will useful to the facilities and health workers in the plans to strengthen the blood transfusion service. It is expected that this study will provide the following information:

1. State of the staff levels, infrastructure and equipments involved in blood transfusion in the six regions

2. Type of blood donors (Voluntary/Replacement) in the six regions

3. Number of blood units collected and consumed in the six regions

4. Range of tests performed in blood screening at each of the six regions

5. Knowledge of prescribers in areas of blood safety and effective clinical use of blood in the six regions

The findings of this study will provide useful information needed to develop a plan to improve the availability and safety of blood in the six remote regions of Tanzania.

A dissemination workshop will be held at the end of the study involving the stakeholders, officials for the National Blood Safety Programme and health management officials from the six regions. The feedback report will be general for each region. The feedback on blood prescribers will also be general without pointing the interviewees' names or facilities that they come from. This feedback will useful in developing tailor made training to address the transfusion practices knowledge gaps.
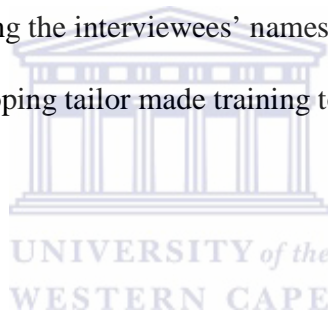
4.13. Logistics

The team used ground and air travel to these regions. The principal investigator developed the questionnaires, piloted it, carried out interviews, supervised data entry and carried out analysis and report writing. Two research assistants collected data and also entered the information in a database.

4.14. Time-frame

The data collection took four weeks to complete.

CHAPTER 5: RESULTS

5.1. Assessment of staffing levels, infrastructure and equipments involved in blood transfusion in the six regions

5.1.1. Staffing

A total of seventeen facilities were visited during the assessment in the six regions. Table 1 illustrates the occupational classifications of the health workers in the regions visited.

Table 1: Distribution of health workers according to cadres

Cadre	Number
Laboratory technologists	8
Laboratory technicians	8
Laboratory assistants	16
Laboratory attendants	14
Counsellors	5
Blood donor organiser	3
Phlebotomists	1
Drivers	0

Out of the 17 facilities, 8 had laboratory technologists, 8 had laboratory technicians, 16 had laboratory assistants, 14 had laboratory attendants, 5 had counsellors, 3 had blood donor organisers and only 1 had a phlebotomist. None of the facilities had a driver. The laboratory technologists were found mostly in regional blood transfusion centres, whereas the district and more remote facilities had laboratory technicians and assistants.

5.1.2. Infrastructure

Seven of the seventeen facilities visited had defined blood bank spaces. All of these seven facilities had adequate space for blood banking activities. All of the seven facilities had a phlebotomy room, but only 4 facilities had a counselling room. The other ten facilities had no dedicated blood bank space, blood transfusion activities were being carried out as part of routine laboratory activities.

5.1.3. Blood Bank equipments

Table 2: Distribution of blood transfusion related equipment found at the facilities

Item	Number
Blood bank refridgerators	10
Calorimeters	14
Microscopes	15
Body weighing scales	7
Centrifuge	16
Hot air oven	12
Blood bag weighing scale	1
ELISA washer	2
ELISA reader	3

Table 2 shows the blood transfusion related equipment that were available at the facilities. Blood bank refrigerators were available in 10, calorimeter 14, Microscopes 15, body weighing scales 7, centrifuge 16 and hot air oven 12 of the 17 facilities visited. Blood bag weighing spring scale, ELISA washer, ELISA reader were available in 1, 2 and 3 of the 17 sites visited respectively.

5.2. Type of blood donors (Voluntary/Replacement) at the facilities visited

Only four facilities out of 17 reported collecting blood from voluntary blood donors. The proportions of voluntary blood donors in these facilities were Litembo (19%), Sumbawanga (65.8%), Sokoine (4.3%) and Tabora (0.2%). Other facilities relied solely on replacement blood donors. A total of 16,771 units of blood was collected in the 17 facilities, of which 850 (5.1%) came from voluntary blood donors.

5.3. Number of blood units collected and consumed
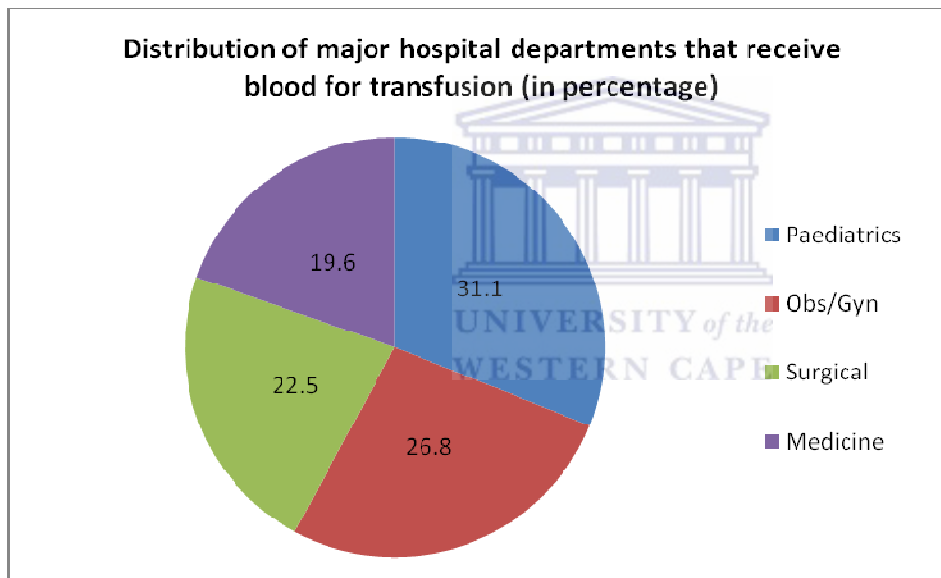
A total of 16,771 units of blood were collected in all the seventeen facilities in one year. Out of these, only 15,880 (94.7%) units of blood were used in transfusion. Indications for transfusion were as outlined in figure 1. Paediatric cases received the most blood (31.1%) followed by Obstetrics/ Gynaecology (26.8%), Surgical (22.5%) and Medical cases (19.6%).

5.4.   Screening of blood for TTIs performed at these facilities

According to the national guidelines, all of the blood for transfusion should be screened for HIV, HBC, HCV and Syphilis. All the seventeen facilities visited screened for HIV. Hepatitis B, Hepatitis C and Syphilis infections were screened in one facility each. Out of all the 16,771 units of blood collected, 863 (5.15%), 5 (0.03%), 3 (0.02%) and 20(0.12%) units were reactive to HIV, Hepatitis B, Hepatitis C and Syphilis respectively.

5.5.   Knowledge of the blood prescribers about blood transfusion practices

A total of 94 health workers in the regions visited were interviewed about basic knowledge of blood transfusion practices (Table 3). They consisted of 61 nurses (64.9%) and 33 (35.1%) doctors. Of these 38 (40.4%) were female and 56 (59.6%) were male.

Eighty-one interviewees (86.2%) were involved in blood transfusion on weekly basis. Eighty-nine (94.7%) interviewees were able to correctly mention the four major blood groups (A, B, AB and O). A total of 87 (92.6%) and 81 (86.2%) of the interviewees were able to correctly identify Blood Group O and AB as universal blood donor and universal blood recipient, respectively. Only 30 (31.9%) were able to correctly name the four major Transfusion Transmissible infections: HIV, HBV, HCV and Syphilis.

A total of 51 (54.3%) interviewees were able to mention more than two indications for blood transfusion, 39 (41.5%) mentioned one and 4 (4.3%) did not know any indication for blood transfusion.

A total of 35 (37.2%) were able to mentioned at least two transfusion reactions, 57 (60.6%) were able to mention one and 2 (2.1%) did not know any transfusion reaction.

A total of 32 (34.0%) were able to mention at least two steps to be taken in case of a transfusion

reaction, 49 (52.1%) mentioned one step and 13 (13.8%) did not know any.

Table 3: Knowledge of the blood prescribers on blood transfusion practices

Item	No.	%
Cadres interviewed (n=94)		
Nurses	61	64.9
Doctors	33	35.1
Gender		
Male	56	59.6
Female	38	40.4
Involvement in blood transfusion		
Weekly	81	86.2
Identification of blood groups		
All four blood groups	89	94.7
Identification of universal blood donors and recipients		
Group O as universal donor	87	92.6
Group AB as universal donor	81	86.2
Identification of TTIs		
Correctly identifying all four TTIs	30	31.9
Indications for blood transfusion		
Mentioned more than two indications	51	54.3
Mentioned one indication	39	41.5
Did not know any	4	4.3
Transfusion reactions		
At least two	35	37.2
One	57	60.6
Did not know any	2	2.1

CHAPTER 6: DISCUSSION

While the developed countries have managed to make all units of blood for transfusion safe, this is not the case in the developing countries. The developing countries are still struggling with the basic screening of HIV. The World Health Organization (WHO) has set targets of having safe blood being available in Sub-Sahara Africa by the year 2012 [7]. The due date is not very far off, although there has been an overall improvement in the quality of blood transfusion services in this region, still many of Sub-Saharan African countries are far from meeting the target. As mentioned earlier, most of the blood in use in the developing Countries is not safe and there is still high reliance on replacement donations. In addition, the developing countries still face many challenges related to the development and implementation of national policies for transfusion, the recruitment of voluntary blood donors, proper screening of collected blood and rational use of blood [7, 41]. Setting up a centralized blood transfusion system requires huge investments, which are not always available in Africa where are other competing health priorities such as Malaria, Tuberculosis and high maternal and infant deaths [42].

However, a recent report by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) which provides technical and financial support to strengthen national blood transfusion services in 14 countries in Africa and the Caribbean shows that some progress has been made in strengthening blood transfusion services in these countries. This report showed that 12 of the 14 countries had a national blood transfusion policies; all 14 countries showed marked increase in the collection of whole blood; it was also reported that the percentage of collections from voluntary, non-remunerated donors had increased in all 14 countries and finally there was a

decrease in the percentage of collected blood units reactive for HIV in 13 of the 14 countries [41].

The Government of Tanzania has taken a bold step towards meeting the WHO goal of having safe and adequate blood available throughout the country, strengthening blood transfusion services in remote regions is one of the step in that direction.

In order to strengthen blood transfusion service in these remote regions, there was a need to address the issue of infrastructure, personnel and equipments so as to have a functional blood transfusion services.

Very little efforts have been made to assess the quality of blood transfusion services elsewhere in the developing countries.

Blood transfusion infrastructures in remote and inaccessible areas of the country are consistent with finding elsewhere; they are usually underfunded, underdeveloped and ill equipped. A study conducted in small hospital in Nigeria revealed that this health facility had limited blood handling capacity and shortage of well trained staff [43].

The blood transfusion infrastructures were available in seven of the seventeen facilities visited. The rest of the facilities did not have a dedicated blood bank and they were using laboratory space for blood transfusion activities. The seven facilities that reported to have blood banking infrastructure also reported to have adequate space for blood transfusion activities.

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Blood transfusion practices in Tanzania and in other countries have been traditionally part of laboratory services. With initiatives to prevent HIV infection through blood, there are now calls to strengthen the blood transfusion services and make them more independent or prominent in the laboratory setting.

Most facilities lacked phlebotomy and counselling rooms to ensure comfort and confidentiality during pre and post counselling of blood donors. Counselling is an essential component of blood transfusion. Blood donors need to undergo pre-counselling prior to donating blood. Likewise, once the testing results become available, they are required to undergo post-counselling.

Some of the facilities lacked some of the basic blood bank equipments such as weighing scales, ELISA Reader and washer. This is evidence enough to show that most of these laboratories are still using rapid tests to test for Transfusion Transmissible Infections. Given the large number of blood units to be screened, this creates an additional work burden to the already understaffed laboratories. The use of rapid tests usually is labour intensive and it is often very easy to make mistakes. A study conducted at district hospitals in Tanzania found the laboratories lacked ELISA equipment and only screened blood using rapid tests [44]. A study conducted by the WHO in six African countries found the performance of rapid tests were inferior to ELISA in testing for HIV, HCV and HBV [45].

Traditionally, the laboratory personnel are also responsible for blood collection, testing and blood issuance. The facilities that were assessed were understaffed. There was no dedicated blood transfusion staff, the available staffs carried out other laboratory diagnostic work in addition to blood bank activities.

Several studies have shown that improvement in the quality of blood transfusion services lead to improved obstetric care which in turn can lead to the reduction of maternal mortality rate. Between 30 to 42 percent of women in the developing countries have anaemia and about 25 percent of maternal deaths after delivery are due to bleeding [46-48]. Therefore the availability of adequate and safe blood can significantly reduce maternal and infant deaths due to anaemia in these hard to reach regions.

The blood transfusion practices in these facilities is still replacement blood donation, there is very little collection from voluntary blood donors. The blood collected from these facilities was mainly screened for HIV meaning that there was a danger of exposing patients to other TTIs. This finding is consistent with other finding from elsewhere in Africa which show between 75 - 80% of the available blood for transfusion come from replacement blood donors. This model is preferred because it is easy to operate, less time consuming and cheap [49]. The disadvantages of this system include high risk of transfusion transmissible infections and irregular supply of blood [50, 51]. A study conducted in Malawi showed that a unit of blood from the centralised system was three times more expensive than a unit from the hospital-based "replacement" system. Additional costs of the centralized system are due to expenses related to donor recruitment, testing, storage and transportation of blood. A number of countries have managed to cost a unit of blood. In Benin, the cost of a unit of blood in 2004 was USD 52 whereas in Namibia, the cost was USD 87 in 2006 [7].
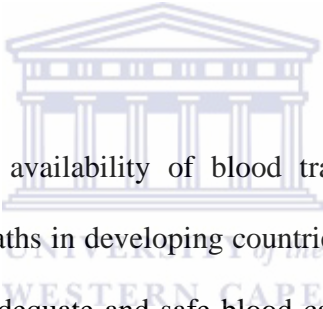
In the replacement system the cost of donor recruitment is borne by the family. In this model, the family is responsible for finding a matching blood donor, bring that person to the hospital to be bled [52].

Nearly all blood transfusion services in the world face frequent shortage of blood for transfusion. It is reported that in South East Asia the blood supply requirement is around 15 million units, but only 7 millions are collected [53]. There is very little data about blood needs and consumption in Africa. One study conducted in Nigeria found the rate of blood collection did not match the increase in the number of patients who are in need of blood transfusion [51].

It is very difficult to quantify the regional blood needs, but a formula that is commonly used to estimate blood needs assume that 2% of the population will require blood in a year. Therefore, using the census populations for these regions, the expected needs of blood units for each region is as follows: Ruvuma (22,343), Rukwa (22,835), Kagera (40,678), Singida (21,815), Lindi (15,826) and Manyara (20,809) [5].

The problem with this formula is that it tends to overestimate the blood supply needs. Currently there are no other available reliable and accurate methods of quantifying blood needs. The total blood collected in the six regions during this assessment was 16,771 units; this blood supply is about adequate for the Lindi region alone. This finding highlights the problem of frequent shortages of blood facing these regions.

The blood collected was mainly used in children, obstetrics/gynaecological and surgical cases. These blood use pattern is consistent with the data from the national hospital that shows that the major consumers of blood and blood products are children less than five years of age. This is due to malaria-associated anaemia [54, 55], followed by pregnancy-associated anaemia or complications following delivery and finally surgical and trauma patients [34]. These results are consistent with results obtained elsewhere. In a study conducted in Mozambique showed that most of the orders for blood came from the Paediatrics department (47.2 %); Surgery (16.9 %), followed by Obstetrics and Gynaecology (16%) and the Intensive Care Unit (15.7%). Children under five years old were the major recipients (43.3 %) of the blood and Malaria was the commonest diagnosis (59.3%) [56].

Several studies have shown that availability of blood transfusion services have an added advantage of reducing maternal deaths in developing countries. Most of maternal deaths are due to bleeding. Timely provision of adequate and safe blood can limit the number of unnecessary maternal deaths [57, 58].

The prevalence of the TTIs was low in these regions. These regions are in the remote of Tanzania and are known to have low prevalence of HIV. Out of all the 16,771 units of blood collected in these regions, 863 (5.15%), 5 (0.03%), 3 (0.02%) and 20(0.12%) units were reactive to HIV, Hepatitis B, Hepatitis C and Syphilis respectively. The national prevalence of HIV/AIDS is about 6 %.
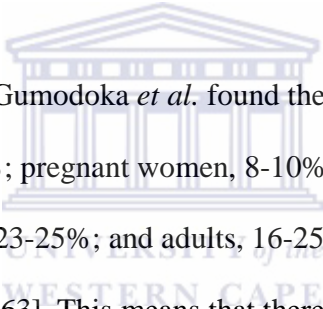
These regions are still using predominantly the family/replacement method, a practice that is being discouraged. Blood from voluntary blood donors is considered to be much safer than blood from replacement donors. This fact is being supported from studies from other parts of the world which also show that the family replacement donation to be the predominant method [22, 59-61]. With initiative such as PEPFAR, there has been a slight shift towards voluntary blood donation.

Over 80% of the health workers interviewed were involved in blood transfusion activities weekly. They were knowledgeable about the various blood groups, universal blood donors and universal blood recipients groups. They however had limited knowledge of the TTIs, only 31.9% of the respondents could name the major four TTIs correctly. This could be attributed to the fact that the focus in the past has been to screen the blood for HIV only. The guidelines to screen blood for the four TTIs were only introduced in 2004. These finding could mean that this knowledge has not filtered through to these remote areas.

The knowledge about indications for blood transfusion was also very limited among the respondents; similarly, the knowledge of transfusion reactions and the measures to take in case of a transfusion reaction was limited. This could be attributed to the fact the health workers in these remote are often not exposed to continued medical education. Again, the type of skill set that is found in these remote areas are not usually exposed to knowledge of how to identify transfusion reaction and manage them during their training.

A study conducted in Iran among medical doctors found out that only 22%, 37%, and 40% of them answered correctly questions referring to basic knowledge, clinical aspects of blood use

and transfusion reactions respectively. This study also showed that the knowledge scores tended to significantly decrease with the increasing years in practice. This shows that in order to maintain high level of transfusion knowledge, regular training is essential. Ninety nine percent of physicians this study believed that they needed special education to raise their transfusion medicine knowledge[62] . Another study conducted in Tunisia among paramedical personnel showed that only 15% of the respondents had appropriate knowledge and practice with no negative consequences for the patient safety. About 13.8% of the study population provided right answers related to the biologic exams required before red cells transfusion and 34% for the abnormal reaction circumstances.

In Tanzania, a study conducted by Gumodoka *et al.* found the following blood transfusions to be avoidable: operated patients, 8-24%; pregnant women, 8-10%; children aged less than 5 years, 31-52%; children aged 5-14 years, 23-25%; and adults, 16-25%. Overall, between 23-39% of blood transfusions were avoidable [63]. This means that there are number of patients who are being given blood without proper indication and hence exposing them to possible TTIs. These results and many others underscore the importance of continuous medical education, implementing a blood transfusion information system and the use of transfusion practice guidelines [64]. These results are echoed by other studies that have been conducted elsewhere showing that repeated transfusion practices and training are critical for safe transfusion practices [31, 65, 66].

Limitation of the study

This study has the following limitations:

1. The study used a cross-sectional design, it was chosen because it is the preferred method of conducting an assessment of health services such as this. The questions formulated to ask about the infrastructure and equipment required to set up a functional blood transfusion services may not be exhaustive. Questions about the set up and the work flow within the laboratory were not asked, these questions are important to ensure safety within the laboratory. Similarly, the checklist did not include reagents and other consumables which also essential for smooth operations and testing within the laboratory.

2. The study sites were chosen based on convenient sample due to time and logistics constraints. The findings of this study are relevant for the six regions, but might not be the true reflection of blood transfusion services elsewhere.

3. Assessment of the infrastructure required to set up a functional blood transfusion was done using a questionnaire and visual inspection. The knowledge and transfusion practice of blood prescribers was assessed by the questions that were administers to them, accuracy and reliability of this information could not be verified.

4. The entire work had to be done in four weeks due to delays in obtaining ethical clearance for data collection.

CHAPTER 7: CONCLUSION AND RECOMMENDATIONS

7.1. Conclusion and recommendations

This study has provided useful information that will help to strengthen blood transfusion services in the hard to reach region. The findings of this study have highlighted the key areas of the laboratories and blood banks in these regions that need to be strengthened in order to provide effective blood transfusion services.

Most of the facilities had adequate space but lacked blood collection and counselling rooms. They also lacked most of the basic equipments.

The infrastructure will either be developed or renovate to create adequate space for blood collection, counselling, testing and storage. Equipments associated with blood collection, transportation, testing and storage will be purchased and installed.

Fully fledged blood transfusion services will significantly increase work in already understaffed facilities. In anticipation to the possible increase volume in the workload, additional staff who will totally be dedicated to blood transfusion services will have to be hired. The hiring will be based on the gaps identified in this assessment.

The new hired staff will be trained in proper procedures for collection, testing and storage of blood. In this survey, the clinical staffs were found to be familiar with the different types of blood groups. They also knew the blood groups that are universal blood donor and recipient. They however fell short when it came to identifying major that can be transmitted through blood transfusion. Again, most of them had limited knowledge of indications for transfusion and what measures to be taken in event of a transfusion reaction.

These health workers will be trained on how to correctly identify the major Transfusion Transmissible infections which are HIV, HBV, HCV and Syphilis. These health workers will

need to be exposed to rational blood use practices. They will need to be trained on how to correctly identify indications for blood transfusion. They will also need to be educated on appropriate measures to taken when transfusion reactions occur.

The country has embarked on a new policy shift from replacement to voluntary blood transfusion practices. Health workers in these regions will need to be sensitized on this policy shift. The support of the health workers in these regions will be critical for this new system to succeed. Measures will need to be put in place to promote voluntary blood donations. For those few that have been voluntarily donating blood, they will be encouraged to become voluntary, repeating blood donors.

In order to increase blood donors' pool, mobilization and blood donation teams will be set up in each of the regions. The mobilization team will have the primary function of mobilizing the communities within each region to become blood donors. The blood donation teams will carry out the function of blood collection from all those who volunteer to do so. In addition, information, Education and Communication (IEC) strategies will be put in place to target the members of the community to become regular blood donors.

The laboratories and the blood banks will be made to adhere to the national testing strategy for Transfusion Transmissible Infection. A standardized testing strategy across the country makes it easy to monitor the quality of testing services being provided at each blood bank.

Record keeping was weak in all the health facilities visited. A documentation system will be introduced so that there is proper record keeping in all transfusion centres. This system will keep

in track the number of blood units collected, number of those tested, number units that are reactive to the different infectious diseases agents and the various categories of blood recipients.

In addition, there will be a need to have a database of all the first time voluntary blood donors. The creation of the database will make it easy to follow up the first time blood donors and encourage them to become regular, repeating blood donors.

Finally, these blood transfusion centres will be linked to the national blood transfusion system for policy and technical guidance.

With all these measures being put in place, the vision of having a centrally coordinated blood transfusion system that is responsible for collection, transporting, testing and distribution of blood from voluntary, non remunerated, repeating blood donors from low risk population will be realized.

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APPENDICES

Appendix I: Work Plan showing weekly activities

Activity	Duration (weeks)	May 1	2	3	4	June 1	2	3	4	July 1	2	3	4	August 1	2	3	4	September 1	2	3	4
Protocol development	3	■	■	■																	
Pre-testing of tool	2				■	■															
Ethical clearance	3						■	■	■												
Data collection	2									■	■										
Analysis	2											■	■								
Write up	2													■	■						
Corrections	2														■	■					
Final submission	1																■				
Dissemination meeting	1																		■		

Appendix II: Budget

S/N	ITEM	QUANTITY	RATE	FREQUENCY	TOTAL
1	**Personnel**				
	Principal investigator (PI)-**Days**	1	30,000.00	85	2,550,000.00
	Research Assistants (RAs)-**Days**	2	20,000.00	85	3,400,000.00
2	**Pretesting**				
	Research Assistants - **Days**	2	20,000.00	1	40,000.00
3	**Transport**				
	Local transport (Six trips)	3	3,000.00	6	54,000.00
	Air travel (two trips)	3	300,000.00	2	1,800,000.00
	Fuel	2000	1,200.00	1	2,400,000.00
4	**Secretarial service**				
	Printing and photocopying of questionnaires	1000	200.00	1	200,000.00
	Report writing	1	150,000.00	1	150,000.00
	TOTAL				10,594,000.00
5	**10% contingency**				1,059,400.00
	Grand Total (In Tsh)				**11,653,400.00**

Appendix III: Budget Justification

1. Three personnel were involved in this study: Principal investigator and two research assistants. The Principal investigator was paid Tsh 30,000 and the Research Assistants were paid Tsh 20,000 each from the proposal development phase until the submission of the final report, a total of 85 working days.

2. Two research assistants were given Tsh 20,000 each for meal and fare to and from the pilot site.

3. A total of Tsh 4,254,000 was used as air travel, fuel and local transportation costs for the three investigators.

4. A total of Tsh 350,000 was used for secretarial services and report writing.

Appendix IV: Problem analysis chart
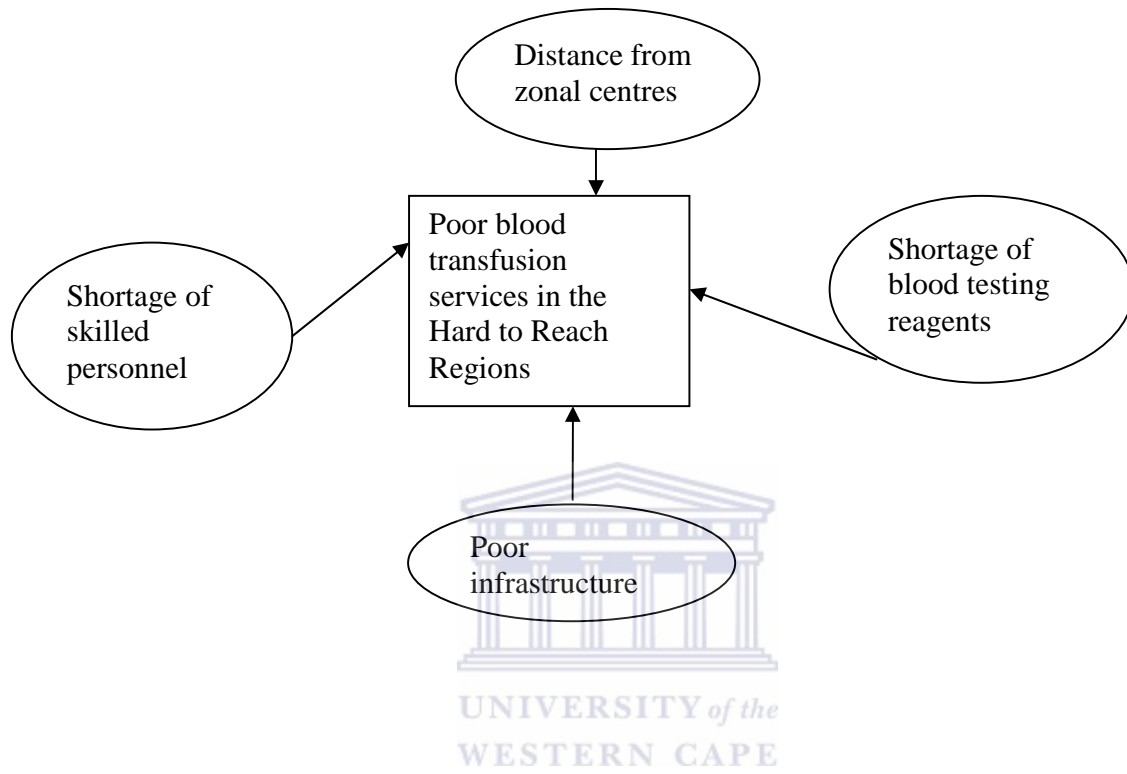
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PARTICIPANT INFORMATION SHEET

Dear Participant,

Consent to participate in study of **: ASSESSMENT OF THE CAPACITY OF THE SIX REMOTE REGIONS TO PROVIDE ADEQUATE AND SAFE BLOOD TRANSFUSION SERVICES IN TANZANIA MAINLAND**

My name is Faustine Ndugulile. I am a researcher working in a team that will be doing an assessment of the capacity of the six geographically inaccessible region hospitals to provide adequate and safe blood transfusion services in Tanzania mainland.
The purpose of the study: This study is being done to meet one of the fulfilments for the Master of Public Health (MPH).

Benefits: We expect that the results of this research will provide us with information that can be used to strengthen the blood transfusion service in these regions.

What does it involve to participate in the study? We will be asking you questions related to blood safety, effective clinical use of blood and alternatives to transfusion. All participants will be provided with this information sheet to read and will be asked to sign an informed consent form. Participation in the study is completely voluntary, you can choose to decline taking part in this study or withdraw at any stage during the interview and there will no adverse action taken against you in any way.
.
Risks: We do not anticipate any dangers if you decide to take part in this study.

Confidentiality: All the information we collect will be entered into a computer with only the study identification number, not the name. Only the investigators of the study and dedicated support staff will handle the data and information obtained.

Persons to contact for questions or problems: If you have any questions about the study or if you should experience any problem as a result of participating, you may contact the principal investigator Dr Faustine Ndugulile, telephone 02151040, email: fndugulile@yahoo.com.

Annex VI: Informed consent form

RECORD OF INFORMED CONSENT TO CONDUCT AN INTERVIEW

Interviewee's ID number: _____   **Place of interview:** _____

Institution: _____

Tel: _____ **Fax:** _____   **E-mail:** _____

Date: _____   **Interviewer:** _____

_____

Thank you for agreeing to allow me to interview you. What follows is an explanation of the purpose and process of this interview. You are being asked to give your consent to me to interview you.

1. Information about the interviewer
I am Dr Faustine Ndugulile, a student at the SOPH, University of the Western Cape. As part of my Masters in Public Health, I am required to submit a Mini thesis. My research will be focusing on "**ASSESSMENT OF THE CAPACITY OF THE SIX REMOTE REGIONS TO PROVIDE ADEQUATE AND SAFE BLOOD TRANSFUSION SERVICES IN TANZANIA MAINLAND".** I am accountable to Dr Brian van Wyk who can be contacted at +27219380454 or email bvanwyk@uwc.ac.za.

2. Purpose and contents of interview
The purpose of the study: This study is being done to meet one of the fulfilments for the Master of Public Health (MPH). We also expect that the results of this research will provide us with information that can be used to strengthen the blood transfusion service in these regions.
We will therefore be asking you questions related to blood safety, effective clinical use of blood and alternatives to transfusion.

3. The interview process
Participation in the study is completely voluntary, you can choose to decline taking part in this study or withdraw at any stage during the interview and there will no adverse action taken against you in any way.

4. Anonymity of contributors
At all times, I will keep the source of the information confidential and refer to you or your words by a research ID. At no point your real name will be used. I shall keep any other records of your participation locked away at all times, and access will be limited to research staff only.

5. Things that may affect your willingness to participate
The interview will touch on issues related blood safety, effective clinical use of blood and alternatives to transfusion. If there is anything that you would prefer not to discuss, please feel free to say so. I will not be offended and there will be no negative consequences if you would prefer not

to answer a question. I would appreciate your guidance should I ask anything which you see as intrusive.

6. Agreement
6.1 Interviewee's agreement
I have **read/ been told** the contents of this form and understand its meaning. My questions have been answered. I agree/ disagree to take part in this study.

6.2 Interviewer's agreement
I shall keep the contents of this research interview confidential in the sense that the ID noted above will be used in all documents which refer to this interview. The contents will be used for the purposes referred to above, but may be used for published or unpublished research at a later stage without further consent. Any change from this agreement will be renegotiated with you.

Signed by interviewer   Signed by participant:
Date: Date:
Place: Place:

UNIVERSITY *of the*
WESTERN CAPE

APPENDIX VII: QUESTIONNAIRE TO ASSESS THE KNOWLEDGE OF PRESCRIBERS ON BLOOD SAFETY AND CLINICAL USE.

QUESTIONNAIRE NUMBER   **REGION**   **DATE**

The Ministry of Health intends to strengthen blood transfusion services in the hard to reach regions. This questionnaire is aimed at assessing the knowledge of prescribers on blood safety and clinical use of blood and blood products. The information from this questionnaire will be treated with confidentiality and you are free to decline taking part.

	Question	**Response**	**Response code**
1	**Area of specialisation**	a. Surgeon/ Gynaecologist	1
		b. Physician/ Paeditrician	2
		c. General doctor	3
		d. Intern	4
		e. Others	5
2	**Gender**	a. Male	1
		b. Female	2
3	**Involvement with blood transfusion (Reference is weekly)**	a. Weekly	1
		b. At least once a month	2
		c. Less than once a month	3
		d. Never or once in a year	4
4	**How ABO Blood groups do you know?**	a. None	0
		b. One	1
		c. Two	2
		d. Three	3
		e. Four	4
5	**Mention major infections that can be transmitted through blood transfusion?**	a. None	0
		b. One	1
		c. Two	2

		d. Three	3
		e. Four	4
6	**Mention blood group that can serve as universal blood donor?**	a. Blood group O	1
		b. Blood groups other than O	2
7	**Mention blood group that can serve as universal blood recipient?**	a. Blood group AB	1
		b. Blood groups other than AB	2
8	**Mention indications for blood transfusion**	a. Does not know any	0
		b. Know at least two	1
		c. Know more than two	2
9	**Mention risks of blood transfusion**	a. Does not know any	0
		b. Know at least two	1
		c. Know more than two	2
10	**Mention measures to be taken before and during blood transfusion.** i. Correct identification of the patient and the blood unit. ii. Correct aseptic technique used. iii. Careful observation of the patient during transfusion.	a. Mentions none of these conditions	1
		b. Mentions one of these conditions	2
		c. Mentions at least two.	3
11	**Mention at least three transfusion reaction signs**	a. Does not know any	1
		b. Mentions one sign	2
		c. Mentions three or more signs	3
12	**Mention steps to be taken in an event a transfusion reaction** i. Stop transfusion ii. Notify blood bank iii. Maintain intravascular volume iv. Monitor vital signs	a. Does not mention any	1
		b. mention one step	2
		c. Mention more than two steps	3

APPENDIX VIII: QESTIONNAIRE TO ASSESS STAFF, INFRASTRUCTURE, EQUIPMENT AND BLOOD TRANSFUSION PRACTICES AT THE FACILITIES

QUESTIONNAIRE

NAME OF THE HEALTH FACILITY: _____

REGION: _____

ADDRESS: _____

TELEPHONE: _____

FAX: _____

NAME OF OFFICER IN-CHARGE: _____

NAME OF LABORATORY IN-CHARGE: _____

NAME OF INTERVIEWER:_____

DATE OF INTERVIEW:_____

	A. GENERAL BLOOD TRANSFUSION INFORMATION			
			Total	**Remarks**
1	Total number of units of blood collected in a year	No. of units collected from voluntary blood donors		
		No. of units collected from replacement blood donors		
		Total		
		Percent of voluntary blood donations as part of total collection		
		Percent of replacement blood donations as part of total collection		
2	Total number of units of blood transfused in a year	Surgery		
		Obs/Gyn		
		Medicine		
		Paediatrics		
		Others		
		TOTAL		
3	Total number of voluntary blood units with the following infections	HIV		
		HBV		
		HCV		
		Syphilis		
4	Total number of replacement blood units with the following infections	HIV		
		HBV		
		HCV		
		Syphilis		
5	Total number of blood units discarded due to TTIs			
	B. HUMAN RESOURCES	**AVAILABLE**	**REQUIRED**	**GAPS**
6	Laboratory Technologists			

#	Item	Available/Yes-No		Working/Not Working	
7	Laboratory Technicians				
8	Laboratory Assistants				
9	Laboratory Attendants				
10	Blood Donor Counsellors				
11	Blood Donor Organisers				
12	Phlebotomists				
13	Blood donation Clerks				
14	Driver				
	C. INFRASTRUCTURE				
15	There is a defined blood bank unit	Yes			
		No			
16	If yes, Is the space adequate?	Yes			
		No			
17	Is there a phlebotomy room?	Yes			
		No			
18	Is there a counselling room?	Yes			
		No			
	D. EQUIPMENT	**AVAILABLE**		**WORKING/ NOT WORKING**	
19	Blood bank fridge				
20	Presence of Colorimeter				
21	Body weighing scale				
22	Blood Bag weighing spring scales				
23	BP machine				
24	Stethoscope				
25	Microscope				
26	Centrifuge machine				
27	ELISA Washer				
28	ELISA Reader				
29	Microscope				
30	Hot air oven				

GENERAL COMMENTS

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