

**HUMAN IMMUNODEFICIENCY VIRUS PREVALENCE AMONG
SECONDARY SCHOOL STUDENT BLOOD DONORS IN NAIROBI COUNTY,
KENYA**

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DECLARATION

I declare that this thesis is my original work and not presented for a degree or other awards in any other university

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SUPERVISORS' APPROVAL

We confirm that the candidate under our supervision carried out the work reported in this thesis as University Supervisors

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DEDICATION

I dedicate this thesis to my dear mother the late Agness Ombaga, who perhaps would be alive today if she got a good pint of blood in time. I also dedicate this work to my lovely wife Rhoda and children Allan, Mark and Tamara for their encouragement and understanding during the course of my study.

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ABBREVIATIONS AND ACRONYMS

ANC	Antenatal Clinic
Ab	Antibody
Ag	Antigen
AIDS	Acquired Immunodeficiency Syndrome
ARCBS	American Red Cross Blood Services
CBS	Central Bureau Of Statistics
CDC	Centres For Disease Control and Prevention
CHIKV	Chikungunya virus
dL	Decilitre
ELISA	Enzyme Linked Immunosorbent Assay
ESARO	Eastern and Southern Africa Region Office
FDA	Food And Drug Administration
FHI	Family Health International
FFP	Fresh Frozen Plasma
FRD	Family replacement donors
GDBS	Global Database on Blood Safety
GP	Glycoprotein
Hb	Haemoglobin
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
HRP	Horse Radish Peroxidase
HTLV	Human T Lymphotropic Virus
ICASA	International Conference On Std/Aids In Africa
IEC	Information Education Communication
JICA	Japan International Cooperation Agency
KRCS	Kenya Red Cross Society
Ksh	Kenya Shillings
MOEST	Ministry Of Education Science And Technology

MOH	Ministry Of Health
NAC	National Aids Council
NACC	National Aids Control Council
NC	Absorbance of the negative control
NCPD	National Council For Population And Development
NASCOP	National Aids/Std Control Programme
NBTS	National Blood Transfusion Service
PLHIV	People living with HIV
POD	Peroxidase
QA	Quality Assurance
Rpm	Revolutions Per Minute
RBCs	Red Blood Cells
RD	Replacement donor
Rh	Rhesus
SOP	Standard Operating Procedure
STD	Sexually Transmitted Disease
TMB	Tetramethylbenzidine
TTI's	Transfusion Transmitted Infections
UNAIDS	United Nations Joint Programme On HIV/AIDS
UNDP	United Nations Development Programme
UNICEF	United Nations Childrens Education Fund
USD	United states Dollar
VCT	Voluntary Counselling and Testing
WHA	World Health Assembly
W H O	World Health Organization

DEFINITION AND OPERATIONAL TERMS

Antibody	Is a protein molecule formed by the immune system of a vertebrate, which reacts specifically with the antigen that induced its synthesis.
Antigen	Is any substance which if present in a vertebrate host, can elicit the formation of specific antibodies or the generation of a specific population of lymphocytes reactive with the substance.
Blood donor	Is a person who voluntarily has a specified amount of blood drawn from them and is used for transfusions or made into biopharmaceutical medications by a process called fractionation.
Endemic	Is a disease that is prevalent continuously to some degree in a community or region.
Enzyme	Is any protein catalyst that accelerates chemical reactions without being used up in the process.
Epidemic	Is an outbreak of disease such that for a limited period a significantly greater number of persons in a community or region suffer from it than is normally the case.
Hepatitis	Is a medical condition defined by the inflammation of the liver and characterized by the presence of inflammatory cells in the tissue of the organ.
The immune system	Is our body's natural defense system, involving antibodies and a class of white blood cells called lymphocytes.

Incidence	Is the number of cases of a disease, abnormality, accident, etc., arising in a defined population during a stated period, expressed as a proportion, such as a certain number cases per 1000 persons per year.
Prevalence	Is the number of instances of infections or of persons ill, or of any other event such as accidents, in a specified population, without any distinction between new and old cases.
Replacement donor	Is donation from family members or friends of the patient
Sero-conversion	Is the production in a host of specific antibodies because of infection or immunization. The antibodies are detectable in the host's blood serum following, but not preceding, infection or immunization.
Serum	Is the clear, slightly yellow fluid, which separates from blood when it clots
Transfusion	Is the transfer of whole blood or blood products from one individual to another usually for therapeutic purposes.
Voluntary donor	Is non-remunerated individual who donates blood out of his or her own free will

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ABSTRACT

The Human Immune deficiency Virus(HIV) and the Acquired Immune Deficiency Syndrome (AIDS) situation in Kenya has affected blood collection in the country leading to a decline from 150,000 units to about 70,000 units annually, yet the demand for blood in Kenya exceeds 300,000 units per year. Schools are major sources of blood in all counties of Kenya and more than 60% of blood in Kenya is collected from secondary school students but the data on HIV prevalence in this category of donors is scarce. The objective of this study was to determine the prevalence of HIV among secondary school student blood donors in Nairobi County and to determine their knowledge on blood donation and blood transfusion practices. Four hundred and thirty four (434) student blood donors were screened for anti-HIV antibodies. Two hundred and forty eight (248) of the students were male and 186 were females. The age of the students sampled ranged between 16–28 years with a mean age of 17.25 ± 1.057 years. Mean age for male students was 18 ± 1.433 years, while the mean age for the female students was 17 ± 1.057 years. Questionnaires to determine the students' knowledge on blood donation and blood transfusion practices were given to the students to fill before blood samples were collected from them by a qualified medical laboratory professional. All blood samples collected were tested for HIV using Vironostika Uni-FormII Ag/Ab ELISA method (Biomerieux, France) and confirmation done by Enzygnost HIV 1&2 4th generation ELISA test (Simens AG, Germany). Three (3) (0.7%) out of the 434 donors were positive for HIV and 431 (99.3%) were negative. Of these, two (0.46%) were boys and one (0.23%) was a girl. The data was analyzed using the SPSS version 22. Probability (p) value < 0.05 was considered statistically significant. The results showed a low prevalence of HIV among student blood donors in secondary schools compared to the general population. The study also shows there is low knowledge on blood donation and blood transfusion practices among secondary school student blood donors. Recommendation is made for strengthening the recruitment of secondary school students as voluntary unremunerated blood donors as a more effective strategy for reducing the risk of obtaining HIV infected blood from donors. Extensive and effective use of blood donor information and communication materials to sensitize the secondary school student donor population on blood donations and blood transfusion practices is also recommended.

CHAPTER 1: INTRODUCTION

1.1 Background information

Blood donation is important in many countries since donated blood alleviates danger in various critical conditions and can be lifesaving for individuals who need it. The safety of donated blood is an important public health concern in most developing countries where the consequences of not providing safe blood for transfusion may adversely affect the critical care for those requiring blood especially in emergencies. Many countries have adopted several measures in line with World Health Organization guidelines to improve the safety of donated blood (Zhao-Hua *et al.*, 2013). Some of the measures adopted include improved organization and management of blood donor recruitment, testing of donor blood, and encouraging appropriate use of blood by individual countries (Tagny *et al.*, 2010). Blood transfusion remains one of the major components of treatment and care for patients with conditions leading to loss of blood (Javadzadeh *et al.*, 2006). Shortage of blood is a constant problem in many developing countries of the world where getting to recruit voluntary non-remunerated donors remains a major challenge causing serious strain to transfusion services throughout the world.

Non-remunerated donors are the major blood source in Kenya and peoples' motivation is critical to keep the blood source sufficient. More effort is required to attract society members for blood donations (Kimani *et al.*, 2011). The rate of blood donation varies from various groups but there is no study conducted on the secondary school students who donate blood.

In Kenya, the safety and adequate supply of donated blood has remained a challenge despite efforts to improve the situation. A good portion of donated blood in Kenya is mainly from family replacement donors (FRDs). This situation is very similar to other countries in Sub-Saharan Africa where about 25% of donors are FRDs (Florent *et al.*, 2012). The family replacement donor is a group considered to be of a higher risk for transfusion-transmissible infections and a lot more effort is necessary to expand the base for voluntary donors (WHO, 2002).

In countries where resources are limited, recruiting young, voluntary and non-remunerated blood donors who are likely to be of lower risk for transfusion-transmitted infections, is the most prudent way to expand the blood donor base as observed by Field and Allain, (2007). Transfusion transmitted infections have generally contributed to a severe decrease in the blood donor pool in many developing countries especially in Sub-Saharan Africa. The most notable TTI'S are HIV, HBV, HCV and syphilis (Florent *et al.*, 2012). New and more sensitive screening tests for blood and better ways of using one's own blood are among steps that should make transfusions much safer. To minimize the chances of transmitting HIV through donated blood, stringent measures for selection of donors and deferral of donation are necessary, with proper channels that effectively communicate reasons for deferral. Continuous evaluation of new and more sensitive assays to detect HIV and other TTI'S is necessary to ensure early detection of pathogens in donated blood (Nwankwo *et al.*, 2012).

About 1.7 million Kenyans were living with HIV/ AIDS at the end of 2014 according to UNAIDS estimates. Women aged between 15-24 years are twice more likely to be infected by HIV compared to males in the same age group (UNAIDS, 2014). In 1986, the Ministry of health in Kenya issued a number of policy statements and guidelines in order to make the blood supply safer by reducing the risk of transmitting HIV through donated blood in line with the WHO's framework for increasing and expanding the pool of low-risk blood donors for the African region. In many countries where the WHO guidelines have been adopted the risk of TTI'S has been drastically reduced by introducing routine testing of donated blood particularly for HIV (Andre *et al.*, 2017).

Voluntary blood donation could be greatly increased by a national education campaign and increased accessibility to donation centers. This would ensure a safer and more reliable blood supply. Moreover, distinct promotion strategies should be adopted to increase repeated donations among young, experienced and first time donors. This sharing of experience from regular donor can motivate new donor and helps in reducing misconceptions as well. Special awareness and motivation programs on blood donation and transfusion practices should be launched by dissemination of information particularly on electronic media focusing 18-25 age groups which help in eliminating misconceptions about blood donation among them and in the society (Agbovi *et al.*, 2006)

1.2 Statement of the problem

The epidemic caused by HIV and AIDS has widespread effects on blood supply (CDC, 2012). The HIV and AIDS situation in Kenya has affected blood collection in the country

leading to a decline from 150,000 units to about 70,000 units annually (MOH, 2003). The demand for blood in Kenya exceeds 300,000 units annually and is projected to increase by 10% annually. There has also been an increase in HIV prevalence among blood donors from 1.5 % in 1987 to 6.5 % in 1996 (NCPD, 2003). Even though the HIV prevalence among adults aged 15 to 64 years decreased nationally from 7.2 %, as measured in KAIS 2007 to 5.6 % in 2012 (NASCO, 2012), there is a need to determine the prevalence of HIV in student blood donors, who constitute a large percentage of all blood donors.

1.3 Justification

In Kenya, more than 60% of blood is collected from secondary school students. They therefore form an important source of blood for the health sector in Kenya and it is necessary that this category of donors is safe (Blood link foundation, 2016). With HIV rates ranging from 0.2 % to 27.1 % among adults in different parts of the country (NASCO, 2012) and in different vulnerability groups, as well as significant levels of prevalence of other blood transmittable diseases, an effective blood-donor mobilization campaign needs to incorporate strategies to minimize the risk of transfusing unsafe blood (WHO, 2004). Epidemiological information of blood donors is important for coming up with strategies for recruiting and monitoring blood donors. The best way of doing this is to target the mobilization campaign at specific communities or profile groups where the prevalence of communicable diseases is low (MOH, 2003). Knowledge about the prevalence of HIV and AIDS in this category of donors will help providers of transfusion

services with valuable information to help them define better blood donor selection and deferral criteria (Melese *et al.*, 2012).

1.4 Conceptual framework

The conceptual framework shows the factors that could be contributing to an increased prevalence of HIV among student blood donors in Nairobi County as conceptualized by the researcher. There is a high demand for blood within Nairobi County due to several conditions resulting from the effects of illness, violence, injury due to accidents, pregnancy and childbirth among other reasons. Only the human body can manufacture blood, and transfusions are entirely dependent on voluntary donations. There is need to address the safety of blood donated by ensuring it is collected from persons or groups with low risk of transfusion transmittable infections especially HIV. The independent variables of the study are the factors affecting the prevalence of HIV among the student blood donors while the dependent variables are measurable variables in the study and include the HIV prevalence in the population and the sero-status of each donor. The intervening variables include the general educational levels in the society, access to information, knowledge on Blood donation issues, promotional, advocacy and educational activities, National blood policy and legal framework in the country as presented in Figure 1.1

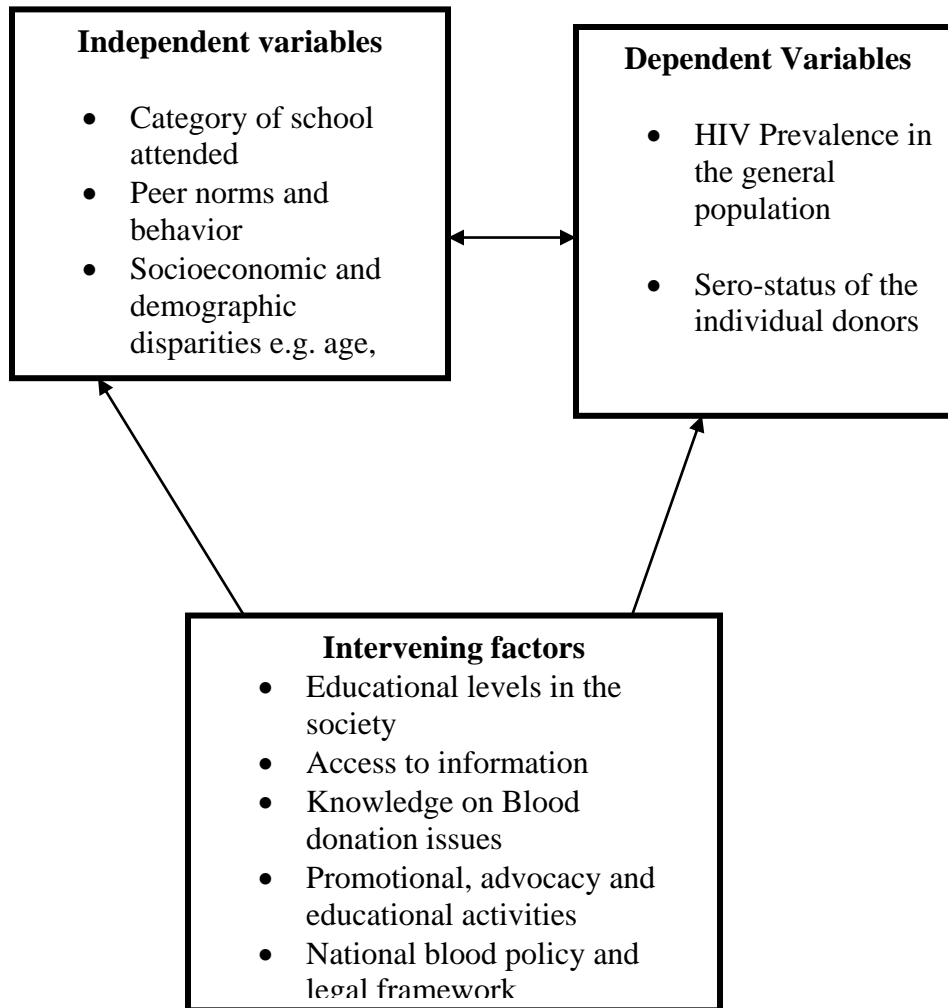


Figure 1.1 Conceptual framework adopted from Jabareen (2009) with modifications

1.5 Research questions

- (i) What is the prevalence of HIV among secondary school student blood donors in Nairobi?
- (ii) What is the HIV prevalence among student blood donors in the different categories of secondary schools in Nairobi?
- (iii) What is the level of knowledge on blood donation issues among secondary school student blood donors in Nairobi County?

1.6 Objectives of the study

1.6.1 General objective of the study

To determine the HIV prevalence among secondary school student blood donors in Nairobi.

1.6.2 Specific Objectives

- (i) To determine the prevalence of HIV among secondary school student blood donors from selected secondary schools within Nairobi County.
- (ii) To determine the difference in HIV prevalence among student blood donors in different categories of secondary schools in Nairobi County
- (iii) To determine the level of knowledge on blood donation and blood transfusion practices among secondary school student donors.

1.7 Significance of the study

Understanding the prevalence of HIV among student blood donors is essential for developing strategies for controlling the potential risk of transfusion-transmissible infections (TTIs) and thereby keeping the blood supply safer. The findings will be used to update intervention programs, which focus on the prevention and control of HIV/AIDS among blood donors. Besides, the study would reveal the different socio-demographic factors associated with sero-positivity in order to provide a baseline data for further studies and expand the blood donor base.

CHAPTER 2: LITERATURE REVIEW

2.1 Definition of blood

Blood refers to the fluid that circulates through the body's vascular system comprising of the heart, arteries, capillaries, and veins and is the chief means of transport within the body. It transports oxygen from the lungs to the body tissues, carbon dioxide from the tissues to the lungs, nutritive substances and metabolites to the tissues. It also removes waste products to the kidneys and other organs for excretion. Blood has an essential role in the maintenance of fluid balance. In cases of injuries, blood cells and antibodies in the blood move to the point of infection to fight the invading pathogens. To stop bleeding at injured sites, blood-clotting substances flow to the injured site with broken cells. Hormones also move from the endocrine glands to the organs they influence through the blood. Blood also plays a major role in regulating the body temperature and helps to carry excess heat to the surface layers of the skin where the heat escapes to the surrounding air (Barbara *et al.*, 2014).

2.2 Importance of blood

Blood is the most precious fluid in the human body and incomparable to anything else. In spite of the rapid and remarkable progress of medical science today, there has been little success in producing anything equivalent to blood and its various components. For those who require blood for any reason including emergencies resulting from accidents or other conditions leading to blood loss, blood donation remains the only mechanism to help them have access to blood to replenish their system (Gilreath *et al.*, 2014). Blood donation allows individuals to give or share some of their blood for use in medical

purposes to help another person (Aldebert *et al.*, 2012). Blood transfusion on the other hand, is a process of receiving blood or blood products into one's circulatory system intravenously, especially after an accident or during an operation or other medical purposes (Olaiya *et al.*, 2004). Blood donation remains the only way by which collected blood can be, accumulated for safe storage and used later to meet emergency requirements for saving lives. The decision to transfuse blood can only be made based on established guidelines, laboratory tests, and clinical observation or for surgery. Freshly donated blood is preferred than other forms of blood by transfusion programs depending on resource availability, with the aim of achieving self-sufficiency (WHO, 2010).

2.3 Global blood supply

More than half of all blood donations globally are collected in the high-income countries, which only carry 18 % of the world's population (Mulugeta *et al.*, 2016). There is a remarkable difference in blood use between high-income countries and low-income countries. More than 65 % of blood donated in low-income countries finds use for transfusing children under five years, yet more than 70% of donated blood in high-income countries is used in patients aged over 65 years. The rates of blood donations are much higher in high-income countries estimated at 36.8 donations per 1000 population but only 3.9 donations per 1000 population in low-income countries. There has been a remarkable increase in blood donations from voluntary unpaid donors from 2004 to 2012 in high-income countries (WHO, 2014).

2.4 Blood demand and supply in Kenya

The demand for blood in Kenya is at between 200,000 and 300, 000 units per year. However, with World Health Organizations' guidelines of 10-20 units per 1,000 people, then the need should range between 380,000 – 760,000 units annually. Currently, only 125,000 units of blood are collected through the National Blood Transfusion Service (NBTS). Family replacement donors cover the blood supply deficit (Michelle *et al.*, 2016). In Kenya, family replacement donors according to studies only account for 35 % of donors. Further complication for the blood supply situation in Kenya arises from the fact that over 70 % of blood donors are first time donors and more often than not, only donate once in their lifetime. Education for potential donors improves recruitment and every year the NBTS estimates that more than 500,000 Kenyans benefit through various channels to enlighten them on blood donation issues (MOH, 2014).

Many national blood transfusion services are finding it hard to cope with the blood supply demand due to host of factors, especially due to lack of adequate resources to build the necessary infrastructure to test all the donated blood for infectious agents easily transmitted through blood. The safety of donated blood remains a major challenge in many developing countries including Kenya. This is because in these countries there are hardly adequate financial and human resources to meet the needs of functionally sound national blood transfusion service (Florent *et al.*, 2012). Poor budgetary allocations to national blood transfusion services are just part of myriad problems facing the blood supply system in many of these countries. Lack of a sufficient pool of volunteer donors is another problem that needs urgent attention. Insufficient blood donor screening

information also poses a great challenge in many of these countries. Implementing quality systems in the selection of donors, blood donation procedures, testing and processing of donated blood should be a sure way of enhancing safety of donated blood. Continuous staff training, internal and external quality improvement programs and scheduled test validation procedures are critical in ensuring safety of blood. A proper balance between safety and availability of blood is required. Constant vigilance on the blood supply is also necessary to monitor continuously the magnitude of transfusion-transmissible infections in blood donors (Changning *et al.*, 2012).

2.5 Blood donation process

Blood donation occurs by drawing a specified amount of blood from a volunteer and later using the blood for transfusion or any other medical purposes. Depending on the specific patient needs, whole blood or a fractionated component of blood is directly transfused to the patients or they can be appropriately and safely stored for future use. Different blood donation centers develop their own blood collection guidelines and usually manage the donation process based on their specific guidelines and rules. In more developed countries most of the blood is collected from voluntary non-remunerated blood donors whereas in poorer countries most donations come from family members, relatives or friends of those in need of blood (Ehabor *et al.*, 2014).

Autologous donations, where donors have blood drawn from them for future use is also gaining prominence in the more developed countries (WHO, 2014). The blood donating

process is safe, but some donors may experience few problems here and there. Bruising may occur at the site of needle insertion, air embolism and general faint feeling may occur. Each blood donation center is required to have in place procedures for evaluating potential donors of any risks that may make the donation process unsafe or make the donated blood unsuitable for use. The evaluation process should include screening the collected blood for TTI'S and taking the donors through physical examination (CDC, 2013). The donor should also be required to answer questions about their medical history to make sure the donation is not hazardous to his or her health. The frequency of blood donation by a donor can vary from days to months based on component donated and the laws of the country where the donation takes place (ARCBS, 2012).

Most of the fractionated components of blood have very short shelf life and expire within a specified period. The short shelf life of these blood components leads to a persistent problem in maintaining a constant supply. The transfusion needs for Kenya are very high due to endemicity of diseases, which lead to blood loss and increase in emergencies resulting from road traffic accidents (FHI, 2004). There are a number of processes to undertake in order for a country to be able to sustain the provision of safe and efficacious blood and blood components. The processes include prudent selection of blood donors, proper collection and storage of donated blood, testing of donated blood for offensive pathogens transmissible through transfusion and compatibility testing and efficient administration of the blood to patients (Giovani *et al.*, 2016). Even though a pint of blood given to a patient in good time can be life-saving, blood-borne infections pose serious

risks to recipients of blood and all blood centers are required to ensure that a wide range of pathogens are screened for in donated blood to ensure maximum safety of the blood given to recipients.

Effective screening strategies are able to reduce the risk of transmitting pathogens through blood to very low levels. Whereas many countries have taken steps to minimize transmission of pathogens through blood, a significant proportion of donated blood remains unsafe especially in developing countries (Shimian *et al.*, 2012). In many developing countries especially in Sub-Saharan Africa, the blood remains unsafe because it is neither screened for all possible transfusion transmissible infections nor screened at all in emergencies (Evan *et al.*, 2012). The adoption of screening strategies should be appropriate to the needs, infrastructure and resources of each country. These steps if planned carefully and implemented can contribute significantly to improvements in blood safety. In countries where effective blood screening programmes exist, the risk of transmission of TTI's have declined drastically over the last 20 years (Erhabor *et al.*, 2014).

2.6 Blood Donor Categories in Kenya

In Kenya, there are several potential sources for blood donors. Relatives or friends to replace blood used on their patients and groups from academic institutions constitute an important source of donated blood in Kenya. Other sources include a small number of registered donors and auto-transfusion donors (MOH, 2003). The general characteristic of

these sources of blood is the non-predictability in their timely availability and suitability to donate required blood. There are important regional variations in the relative contribution of the different categories of donors. Schools, colleges, and volunteers are important sources of blood in all the provinces (MOH, 2014).

The Kenya government in its endeavor to strengthen the blood supply system set up the Kenya National Blood transfusion Service in 2001, followed by the formulation of guidelines to streamline the collection, testing and distribution of blood and blood components in the country. The Kenya National blood transfusion service works in conjunction with other non-governmental organizations like the Kenya Red Cross, Hope worldwide, Bloodlink foundation and Bloodlife initiative. The NBTS and partner organizations only collect blood from volunteers by appealing for blood donation in public in marketplaces, workplaces, worship houses, schools, colleges and Universities (Bloodlink Foundation, 2016). Individuals willing to donate join a process that starts with filling questionnaires designed to identify potential arrears of risk and have a brief understanding of the medical history of the potential donor. The reason for undertaking the risk assessment is to reduce chances of collecting blood infected by pathogens and reduce wastage (Owusu *et al.*, 2005).

In Kenya, all donated blood is screened for presence of HIV, HBV, HCV and syphilis. The NBTS thus targets donors with the least likelihood of having a TTI to improve safety and minimize discards. The NBTS has also adopted the use of quality assured methods of testing blood for HIV and other viral TTI'S. A major problem of sustaining the supply of

test kits exists due to the NBTS' heavy reliance on donor funding to purchase the kits. Another notable strategy adopted by NBTS to lay emphasis on collecting blood from young donors, particularly secondary school, college and university students who are presumed to have a lower prevalence of HIV and other TTI compared to the general population (MOH, 2014). This will contribute to the safety and sufficiency of blood and reducing discards from infected blood. In 2003, the MOH estimated the HIV prevalence within the general population at 7.8 % but only 1.5 % among voluntary blood donors (MOH, 2003).

2.7 Blood Transfusion risks and complications of blood donation

Blood transfusions carry several risks including possible transmission of the Human immune-deficiency Virus (Shimian *et al.*, 2012). Blood transfusion is the third most important mode of HIV transmission in Sub-Saharan Africa (Aleruchi *et al.*, 2014). The population most affected by transfusion-induced infection is children aged below five years mainly suffering from malaria. Blood transfusion in Sub-Saharan Africa apart from HIV transmission carries a high risk of other blood transmissible infections like HBV, HCV, Syphilis and malaria (WHO, 2014). A study by Kabiru and Kaviti (1987) in Nairobi between May 1985 and August 1986 found that out of 4470 blood units they screened 80 (1.75 %), had malaria parasites. Other recorded infectious risks of blood transfusion include bacterial contamination, HSV (1&2), HAV, and other diverse group of agents isolated from donors by Nucleic acid amplification technology (NAT), transmitted to recipient but without confirmed disease association (Shimian *et al.*, 2012).

The Human immunodeficiency virus (HIV) was isolated in blood as early as 1983. Information about the spread of HIV through blood reached blood banks and manufacturers of blood products in the early 1980's. This knowledge informed the decision by blood banks to have donated blood screened on a routine basis, in order to exclude the potential risk of HIV transmission through blood transfusion or blood derived products (Changqing *et al.*, 2012). Since 1984 when the first case of HIV appeared in Kenya, over 1.5 million people have succumbed to the disease (NACC, 2015). According to sentinel surveillance report, 2002 the HIV prevalence in adults aged between 15-49, ANC mothers was 10.2 % trends over time. A study done by Moore *et al* (2001) estimated that about 2 % of transfusions in Kenya transmit HIV. Blood transfusions save millions of lives, but only with guaranteed supply of safe blood. Without proper systems of blood screening, blood transfusions can easily increase the risk of an individual's infection by HIV (UNDP, 2004). Several past studies have shown that the best and safest type of blood donors is voluntary unpaid donors. They are more desirable and easier to retain than other blood donor groups (MOH and JICA, 2002).

A study by Nyamongo *et al* (2001), however, showed that sero-prevalence of HIV in Kenyan donors was significantly higher among persons making direct donations. Family replacement donors showed a prevalence of HIV of 9.7 % but a prevalence of only (1.7 %) among voluntary donors. According to Eder *et al* (2008), screening of donors for conditions that may put them at risk or lead to serious complications after donating is paramount. Those donating blood for the first time, women and teenagers require more attention as they are likely to be more at risk. It is also critical to understand that using

low –risk donor groups is the best way to reduce the possibility of infected individuals donating blood, especially during the window period when there are high chances of missing the HIV markers by the laboratory screening methods in use. Because of this inherent risk posed by individuals donating during the window period, excluding donors with perceived higher risk from the donation pool can be an effective tool to minimize the chances of collecting contaminated blood (UNAIDS, 2014). The World Health Organization exclusively advocates for VNRBD and a component of its 2012 objectives require that at least 80% of donors in any set up are VNRBD. The most commonly used alternative to VNRBD is collection of blood through replacement donation, which is more widespread in Sub-Saharan Africa (Bates *et al.*, 2010). An estimated 75-80% of blood donated in Africa comes from replacement donations. This is the major alternative to VNRBD and the primary source of blood collection in much of Africa (Melese *et al.*, 2012).

Studies show that about 2 % of blood donors show minor adverse reactions to blood donation. In the United States of America, blood banks are required to report all adverse effects of blood donations and analysis of all reports done periodically to evaluate the events associated with donations during any given period (Sube *et al.*, 2013). Bruises caused to the arm from the needle insertion are the most common problem. One study found that less than 1 % of donors had this problem (Mulugeta *et al.*, 2016). Available data indicate that the African donor pool comprises more of young donors, likely reflecting recruitment in secondary schools and universities, and is disproportionately

male. The latter may be, in part cultural where men in Africa are perceived as being healthier than women are. Women also disadvantaged due to physiological conditions where iron deficiency anemia, pregnancy, and breastfeeding preclude women from joining the donor pool (Tagny *et al.*, 2010). Broadening donor demographics represents a mechanism to bolster numbers; this should however, be tempered by prevalence data on TTIs.

Education and literacy are also notable obstacles to recruitment. The implication of HIV in voluntary blood donors is the risk of transmission of these infections to recipients of blood and blood products. It also implies that safe blood will be more difficult to get. An unsafe blood transfusion is very costly both in terms of human and economic costs. Morbidity and mortality resulting from the transfusion of infected blood have far-reaching consequences, for not only the recipients themselves, but also their families, their communities and the wider society (Gilliss *et al.*, 2011). Since a person can transmit HIV infection during the asymptomatic phase, it can contribute to an ever-widening pool of HIV infection in the wider population. In a study in Burkina Faso, 30.8% of blood donors were illiterate or of primary school level. Fourteen percent (14.4 %) of these donors only donated blood to access HIV testing, highlighting a need to communicate both the utility as well as the risks of blood transfusion (Nebie *et al.*, 2007).

2.8 HIV prevalence among blood donors in Kenya

Population based surveys undertaken in the last 10 years show that HIV prevalence among women and men aged 15-49 years ranged from 6.2% in 2003 to 5.6% in 2012. (Sirengo *et al.*, 2016). A study in Trans Nzoia District between 2001, 2002 and 2003 found prevalence of HIV among donors to be 3.8% and concluded that the prevalence of HIV among donors would be higher if a larger sample population was used (MOH, 2005). In Kenya, the most frequent source of blood is donations from relatives or friends to replace the blood. This is a policy adopted by many hospitals, whereby if the hospital gives a patient blood from its blood bank; their relatives or friends donate blood to replace the used units (MOH, 2001). A steady decline has been noted in the number of donors testing positive with transfusion-transmissible infections noted in almost all blood donor centers since the introduction of the national policy on blood transfusion services in 2001 (MOH, 2014).

Studies done on blood donor groups consistently show that HIV prevalence still ranks higher among family replacement donors compared to voluntary non-remunerated blood donors. The Ministry of Health reported that the HIV prevalence in blood donors fell from about 7 % to only 1.5 % between 1995 and 2003 (MOH, 2005). However, a study by Karuru *et al* (2005) found a very high prevalence of 9.3 % among HIV-VCT blood donor clients. The HIV prevalence among blood donors in any country depends on the prevalence in the general population and when determining the criteria for screening and exclusion of donors to protect the blood supply, the HIV prevalence patterns in the specific country need consideration (Aisha *et al.*, 2016).

2.9 HIV prevalence among youth in Kenya

Adolescents and young people represent a sizeable share of people living with HIV globally. An estimated 35 million people were living with HIV by the end of 2012 and of these 2.1 million were adolescents. The majority of those living with HIV were located in Sub-Saharan Africa (UNAIDS, 2014). Data from the United Nations Children's Fund (UNICEF) show that in 2016 alone, 610,000 young people between the ages of 15-24 years were new infections with HIV. Of this number 260,000 were adolescents between the ages 15-19 (UNICEF, 2016). The total number of people living with HIV (PLHIV) in Kenya is estimated to be 1.5 million in 2015, this includes 98,169 children aged <15 years Kenya HIV Estimates Report, and 268,588 youth aged 15 to 24 years. Children less than 15 years of age account for 6% of all infections, whilst people aged 15+ years account for 94% of all infections. Youth aged 15-24 years account for 18% of all infections. Comparable to the adult prevalence, the national HIV prevalence trend among youth shows that the HIV prevalence peaked at a level of 12-13% among females and 6-7% among males in mid-1990s. The HIV prevalence declined to about 3% among females and 1.5% among males in 2006 and has stabilized since then (NACC, 2015)

2.10 HIV transmission through blood transfusion

The realization that HIV could be transmissible through blood in the early 1980's resulted in major overhaul of the transfusion services of many developed countries. In Sub-Saharan Africa where comprehensive testing of donated blood for HIV and other Transfusion Transmissible Infections are not fully developed, between 10-15% of HIV transmissions are blood transfusion related. There is also a very high prevalence of HIV

in Sub-Saharan Africa compared to other parts of the world (WHO, 2012). The discovery in the mid 1980's that the acquired immunodeficiency virus syndrome (AIDS) was transmissible by blood transfusion heightened public concern about blood safety (George *et al.*, 1996). In most industrialized countries, screening for HIV is mandatory for all donations and it is therefore rare for transmission of HIV through a blood transfusion (WHO, 2014). A study on HIV diagnosis and safe blood transfusion in Nigeria, found that 1.4 percent of donated blood were HIV positive and concluded that the transfusion of contaminated blood remains a major route for transmission of HIV in Nigeria (Nwankwo *et al.*, 2012). HIV Transmissions to recipients of blood have been reduced by strategies put in place for the safety of donated blood and blood products such as biological systematic qualification of any unit of blood. Despite these different mechanisms of blood safety (quality assurance, selection of blood donors), the risk of transmission of HIV through blood transfusion still exists (Kabinda *et al.*, 2014)

In Kenya, a study in Nyeri County between January and December 2014, found HIV prevalence among blood donors aged between 16-65 years to be 5.2 % (Kamande *et al.*, 2016). In Kenya the HIV prevalence rates between the ages of 15-49 years ranged from 5.23 – 6.84 % with a mean value of 5.91 (NASCOP, 2015). Improving the sensitivity and specificity of the test assays and by using the blood appropriately, has been shown to drastically reduce the chances of transmitting HIV through blood transfusion (Zhao-Hua *et al.*, 2013). Center for disease control estimates that about 2.5 % of HIV reported cases are transmitted through blood transfusions and recommend that blood should preferably only be obtained from voluntary unpaid donors, who donate purely as an act of altruism

and are under no pressure to donate. Voluntary donors are safer and are more likely to meet the selection criteria set by blood donation centers (CDC, 2012).

2.11 Blood donor screening

Screening of blood donors for various infections is a critical and an integral part of strategies to ensure safe supply of blood. Many patients needing blood rely on donations from individuals who must themselves be free of any TTI'S to guarantee safety to the recipients of blood (WHO, 2014). Studies show that more than 25 % of blood available for transfusion in Sub-Saharan Africa is not tested for HIV or other TTI's posing a great risk to potential recipients of blood (Giovani *et al.*, 2016). The WHO estimates that between 5-10 % of HIV transmission in Africa is possibly through blood transfusion (WHO, 2016).

Inconsistent supply of test kits in many African countries is responsible for their inability to screen all the blood donors for HIV and other TTI'S (Evan *et al.*, 2012). It is however, recommended that all blood donations should be screened for HIV, HBV, HCV and syphilis (Jayaraman *et al.*, 2010). From WHO reports, at least 25 countries may not be in a position to screen all donated blood for HIV or other TTI'S. Risk of infections being transmitted through donated blood cannot be guaranteed just by setting up screening programs since all screening programs have some limitations and absolute safety of donated blood is still difficult to achieve. Each country must therefore address specific issues affecting its blood supply (WHO, 2012).

Many countries including Kenya are making concerted efforts to make the blood supply much safer. According to Nada and Atwa (2013), more stringent donor selection, additional tests for TTI's and refinement of transfusion decisions need to be continuously evaluated so that the intended blood safety goals are met. Due to the risks associated with donors who give blood during the window period with the possibility of transmitting infectious agents, excluding blood donors perceived to have an increased risk of HIV at the screening stage should be an effective strategy to protect the blood supply from contamination with HIV (Hasan *et al.*, 2017). Pre-donation screening or donor self-exclusion, used in combination with serological or biological screening have been highly effective in reducing both the number of blood donations from people who are HIV-positive at the time of donation and the risk of infection by blood donated during the window period (Velati, *et al.*, 2008).

2.12 Effects of HIV/AIDS on the blood supply in Kenya

The AIDS epidemic in Kenya has affected blood collection in the country leading to a shortfall in supply from an annual demand of 400,000 units to about 125,000 units being currently collected annually (Michelle *et al.*, 2016). Although a great deal of effort has been made to ensure that most of the blood for transfusion is screened, problems revolving around quality assurance, recruitment and retention of voluntary blood donors still persist despite a government plan to have 100 % safe blood supplies for purposes of transfusion by the end of 2004 (MOH, 2014).

The demand for blood and blood products steadily increases due to various disease conditions, accidents and complications of childbirth. Concurrently, blood donor recruitment becomes more and more difficult. In this situation, eligible volunteer blood donations should be promoted, especially among the youngsters, as they can supply blood continuously (Raja *et al.*, 2014).

CHAPTER 3: MATERIALS AND METHODS

3.1 Study area

The selected area for this study was Nairobi City County (Figure 3.1). Nairobi is one of the 47 administrative counties in Kenya and also serves as the capital city of Kenya. It has a population of 3.1 million inhabitants consisting of 1.6 million males and 1.5 million females (CBS, 2009). All Secondary schools participating in blood donation programmes in the catchment area had an equal chance of being included in the study (Appendix 7).

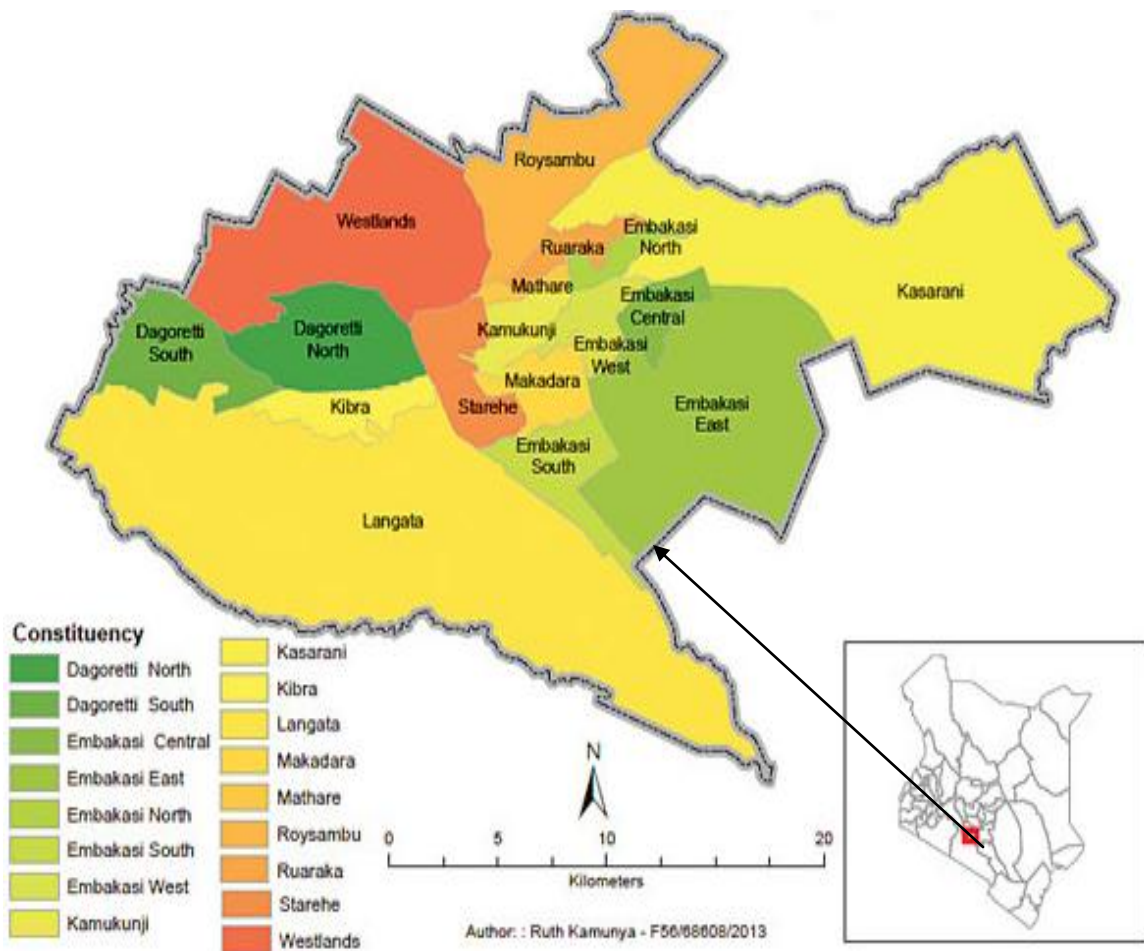


Figure 3.1: Map showing the study area (from Google Maps) Nairobi City County

3.2 Study design

This was a cross-sectional descriptive and analytical study involving student blood donors in selected secondary schools within Nairobi County (Figure 3.1). Nairobi County was chosen for the study due its dense population and high demand for blood. Nairobi County also houses the national referral hospital where the demand for blood is very high. Blood samples were collected consecutively from all students who filled the informed consent form (Appendix 1), assented to be included in the study and met the NBTS guidelines for blood donor selection (Appendix 2). The study was conducted for a period of two months beginning September 2015.

3.3 Study Population

The study population comprised student blood donors in secondary schools within Nairobi. All students aged 16 years and above as required by the NBTS guidelines (Appendix 2) in these schools were targeted.

3.4 Inclusion Criteria

- (i) Students aged 16 years and above (Appendix 2)
- (ii) Students weighing 50 Kgs and above
- (iii) Students with Heamoglobin levels of 12.5 g/dl and above
- (iv) Students who assented to be included in the study and filled the respondents questionnaire (Appendix 8)

3.5 Exclusion Criteria

- (i) All students aged below 16 years
- (ii) All students whose weight is below 50Kg
- (iii) All students reporting minor illnesses
- (iv) All students with Hb levels below 12.5 g/dl
- (v) All students who did not consent to be included in the study.

3.6 Sampling Methods

Stratification and simple random sampling were used to get the required samples. Secondary schools in Nairobi county (Appendix 7) were grouped into the following strata; Two (2) all girls only schools (1 boarding 1 day), Two (2) All boys only schools (1 boarding 1 day) and Two (2) Mixed gender schools (1 boarding 1 day). Simple random sampling was then used to pick proportionate number of donors from each school until the desired sample size was attained.

3.7 Sample Size determination

The sample size was determined by using the formula; $n = \frac{Z^2 pq^D}{d^2}$ as used by

Fisher *et al.* (1998)

Where: $z = 1.96$ at 95% confidence interval (C.I)

$P =$ Proportion of target population with a particular characteristic under study. (use 0.5 if unknown)

$q = 1 - P$

d = Degree of accuracy usually 0.05

D = Design effect – is equal to 1 where there are no replications or

Comaprison

Where $P = 0.5$, assume $D = 1$

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = \frac{3.8416 \times 0.25}{0.0025} = 384$$

The minimum sample size required (n) was therefore 384 donors from all the selected schools.

The stratum sample size was determined by proportionate stratification using the following equation: $n_h = \left(\frac{N_h}{N}\right) \times n$ (Cochran, 1977)

Where; n_h = is the sample size for stratum h , N_h = is the population size for stratum h , N = is total population size, and n = is the minimum total required sample size.

Table 3.1: Student population and proportionate stratum size for each category of school

School Category	Population	Proportionate Stratum Sample size
All Girls Boarding	550	56
All Girls Day	415	42
All Boys Boarding	900	92
All Boys Day	970	99
Mixed Gender Boarding	360	37
Mixed Gender Day	570	58
Total	3765	384

According to the proportionate stratum sample sizes, minimum required sample size (n) was 384.

3.8 Blood Sample Collection

Each donor in all the schools visited was interviewed and filled blood donor questionnaires (Appendix 3) in line with NBTS guidelines (Appendix 2). Vital signs were taken for each potential donor and they all underwent a physical examination before blood samples were collected. Hemoglobin levels were estimated for each donor using the copper sulphate gravity method for Hb estimation according to the NBTS' SOP003 of 2014 (Appendix 4). Blood drops with Hb greater than 12.5g/dL sank to the bottom of the solution but drops with Hb values less than 12.5 g/dL remained afloat. Only prospective donors with Hb levels of 12.5g/dL and above were allowed to donate blood. Those who passed the screening stage were bled into 500ml plastic bags containing the appropriate anticoagulant to prevent clotting. The blood samples were separated by centrifugation at 5000 revolutions per minute (rpm) for 30 minutes. The resulting serum aliquots were then transferred into marked cryo-tubes and stored at -20°C until the required number of samples to be tested was collected.

3.8.1 Testing blood samples for HIV

After obtaining the required number of samples for the study, all samples were tested for the presence of antibodies and antigens to HIV using Vironostika HIV Uniform II Ag/ab kit (Biomérieux, 2014). The manufacturer's instructions for use (Appendix 5) was strictly followed. All samples testing positive with Vironostika HIV Uniform II were subjected

to a confirmatory test using Enzygnost Anti-HIV 1 &2 plus kit for confirmation (Siemens, 2014).The instructions for use by the manufacturer (Appendix 6) was strictly adhered to.

3.8.2 Filling of questionnaires

Four hundred and thirty four (434) questionnaires were administered to the student blood donors in the sampled schools in Nairobi County. After filling the questionnaires, they were collected for statistical analysis. Each student was asked to fill the respondents' questionnaire (Appendix 8) which intended to get the respondents knowledge on blood donation and blood transfusion practices. Confidentiality of the process, objectives of the study and benefits to the community was

3.8.3 Ethical Clearance

The study involved human subjects and therefore ethical consideration was mandatory. Approval for the study was obtained from Kenyatta University's Graduate school (Appendix 13) and the ethical review committee (Appendix 14). Authorization and clearance was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) (Appendix 16) and the National Blood Transfusion Service in the Ministry of Health (Appendix15). Written assent was also obtained from each respondent (Appendix 1). The respondents were expected to willingly participate in the study and they were given all information about the study in order to make an informed decision about participating or not. All the information given by the respondents was

kept confidential and no questionnaires contained any of the respondents' names. The identity of the individuals was protected by coding the participants and not using their names. Assurance was also given that any information obtained was to be used only for the purpose indicated in the objectives and that their consent would be sought before revealing their information for any other purposes. The study did not cause any physical or psychological harm to the respondents.

3.9 Data Analysis

Data collected from the study was coded and entered into a computer excel sheet. Data verification and validation were performed by rechecking all data entries with the original data forms to achieve a clean data set that was then exported into SPSS version 22 for analysis. Pearson's Chi-square test was used to test the strength of association between variables. The threshold for statistical significance was set at $\alpha = 0.05$ and a two-sided p-value at 95 % confidence intervals (CI) reported for corresponding analysis.

CHAPTER 4: RESULTS

4.1 Demographic characteristics of students

Four hundred and thirty-four (434) student blood donors comprising 248 (57.14 %) males and 186 (42.86 %) females enrolled in this study. Their ages ranged between 16–28 years with a mean age of 17.25 ± 1.057 years. Mean ages were 18 ± 1.433 while the ages of the females were 17 ± 1.057 years. The majority (33.9 %, n = 434) of the donors were 16 years old, followed by those aged 17 years (28.6 %, n=434). Students aged 19 years and above were fewest at (14.3 %, n = 434).

Table 4.1: Demographic characteristics of the study population

Demographic	Number of students (n = 434)	Percent
Gender		
Male	248	57.14
Female	186	42.86
Age (Years)		
16 years	147	33.87
17 years	124	28.57
18 years	101	23.27
19 + years	62	14.3

Table 4.1 above gives a summary of the age distribution of the study participants. Those aged 16 were 147 in number representing 33.9 % of all the study participants suggesting more donations come from the younger category of donors in secondary schools. Those

aged 19 and above only constituted 14 % (62), 17- year- olds were 124 (29 %) and those aged 18 years were 101(23 %)

Table 4.2: Study population and actual sample size

School category	Population	%Total population	Calculated Proportionate stratum sample size	Actual number of samples collected
All Girls Boarding	550	14.6	56	95
All Girls Day	415	11.0	42	44
All Boys Boarding	900	23.9	92	93
All Boys Day	970	25.8	99	101
Mixed Gender Day	360	9.6	37	41
Mixed Gender Boarding	570	15.1	58	60
Total	3765	100	384	434

Table 4.2 summarizes the composition of the study population. All girls boarding category had a population of 550 students representing 14.6 % of the total population. The all-girls day category of school had 415 students accounting for 11 % of the total study population. All-boys day category had the highest number of students with a population of 970 students representing 25.8 % of the total study population.

All-boys boarding category of school had a population of 900 students, representing 23.9 %. Mixed gender-boarding category had the lowest number of students at 360 students

accounting for only 9.6 % of the total study population. Mixed gender day category had 570 students or 15.1 % of the total study population. Table 4.2 also summarizes the actual number of samples collected from each category of school compared to the calculated stratum sample size. In all girls' boarding school, 95 samples were collected against a calculated stratum sample size of 56. In the category of all girls day school, 44 samples were collected against a calculated stratum size of 42 samples. Ninety three samples were collected from the all-boys boarding school category against a calculated stratum sample size of 92. One hundred and one samples were collected in all boys day school category. This was in comparison to 99 samples calculated for this category of school. In mixed gender boarding category, 41 samples were collected from a projected stratum sample of 37 whereas in mixed gender day school category, 60 samples were collected compared to 58 samples projected. The total sampled population was therefore 434 out of 3765, which is 11.5 %.

4.2 Age distribution by gender of the students

Considering the student's gender, the age distribution by gender was established in this study as shown in figure 4.1 below. In the ages of 17 years (66.1 % males), 18 (71.3 % males) and 19 years (69.4 %), male students dominated the female students in the number of respondents received. However, at the age of 16 years, female students (66.0 %) were more than the male students (34.0 %) were.

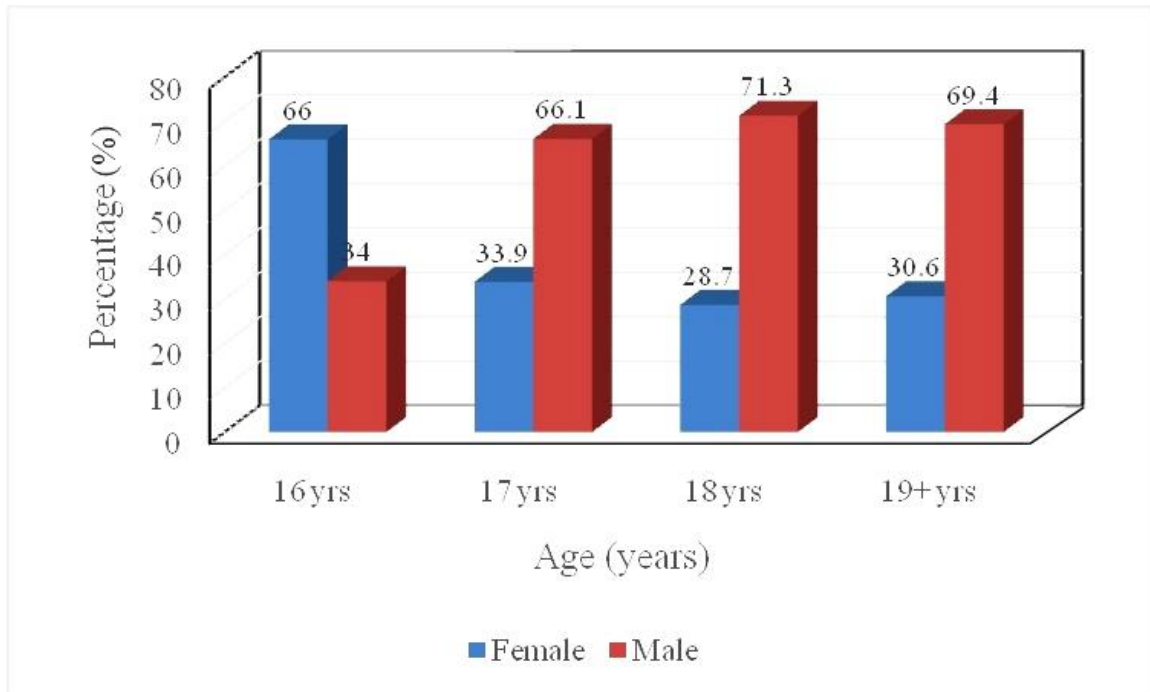


Figure 4.1: Age Distribution of students by gender among the sampled population

4.3 Age distribution of the students by the school categories

The category of schools in the study were; Girls boarding, Boys boarding, Boys day, Girls day, Mixed day and Mixed boarding (Appendix 7). The age distribution of the students in the schools was established. The age distribution of students in each category of school shows all-girls' boarding schools having the highest number of students aged 16 years (43.5 %) and the mixed gender day schools having the lowest number (8.2 %). There were more students aged 17 years in the all-boys day school category than in the other school categories (30.6 %), the lowest number were found in mixed gender day school category (3.2 %). The highest number of students aged 18 years was in the all-boys day school category (35.6 %) and the lowest numbers found in mixed gender boarding school category (4.0 %). The mixed gender day school category had more

students aged 19 years and above (45.2 %). Lowest numbers of students aged 19 and above were found in the all-girls day school category (1.6 %) (Table 4.3)

Table 4.3: Age distribution of the students by school categories

Distribution of students in the different school categories						
Ages (Years)	Girls boarding	Boys boarding	Girls day	Boys day	Mixed boarding	Mixed day
16 yrs	43.5	12.2	13.6	12.9	8.2	9.5
17 yrs	13.7	30.6	12.1	26.6	13.7	3.2
18 yrs	11.9	26.7	7.9	35.6	4.0	13.9
19+ yrs	3.2	16.1	1.6	21.0	12.9	45.2

4.4 HIV prevalence among the students

Three (3) donors tested positive for HIV antibodies representing the prevalence of 0.7 % (Figure 4.2). Of these, two (0.46 %) were boys and one (0.23 %) was a girl. The analysis of these numbers, with a 95% confidence limit, did not demonstrate a significant difference in prevalence between genders.

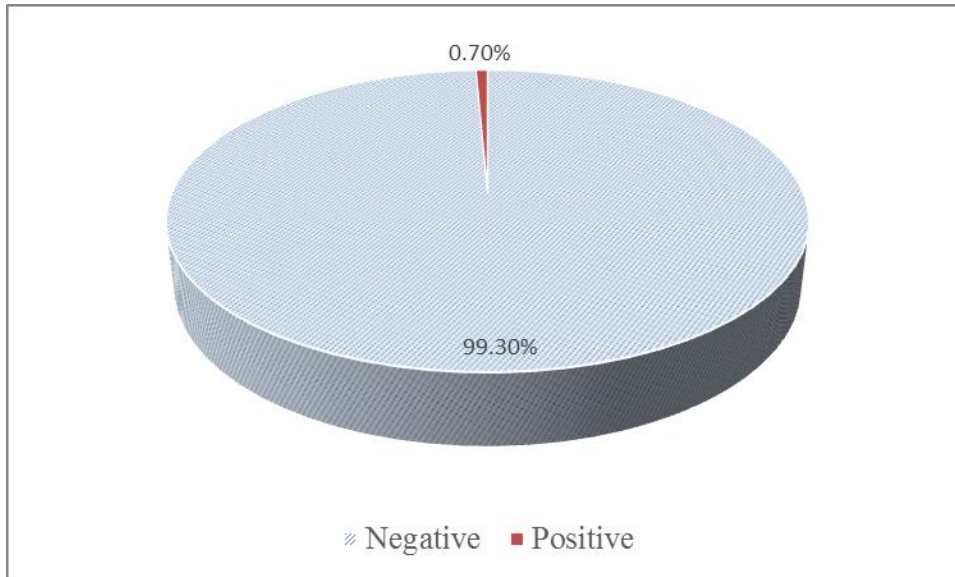


Figure 4.2: HIV Prevalence among the student blood donors

4.5 HIV prevalence among the students by gender

The HIV prevalence among the student blood donors in Nairobi County was found to be 0.7 %. Three (3) out the 434-student student blood donor were found to be HIV positive. Considering that the total number of females was 187 while the total number of males was 247 students, the HIV prevalence among the female students was 0.53 % whereas; HIV prevalence among the male students was 0.81 %.

4.6 HIV prevalence among the students by age

The three students found to be HIV-positive were aged 18, 19, and 21 years. HIV prevalence amongst students based on their age was therefore 1.0 %, 1.9 % and 33.0 % respectively. Students aged 16 years and those aged 17 years had no cases of HIV. In establishing relationship between the students' ages and the HIV status of the students, a

Pearson correlation was conducted ($r = 0.843$, $P = 0.073$) (Figure 4.3). This showed that there was no significant correlation established between age and HIV status of the students (Appendix 11).

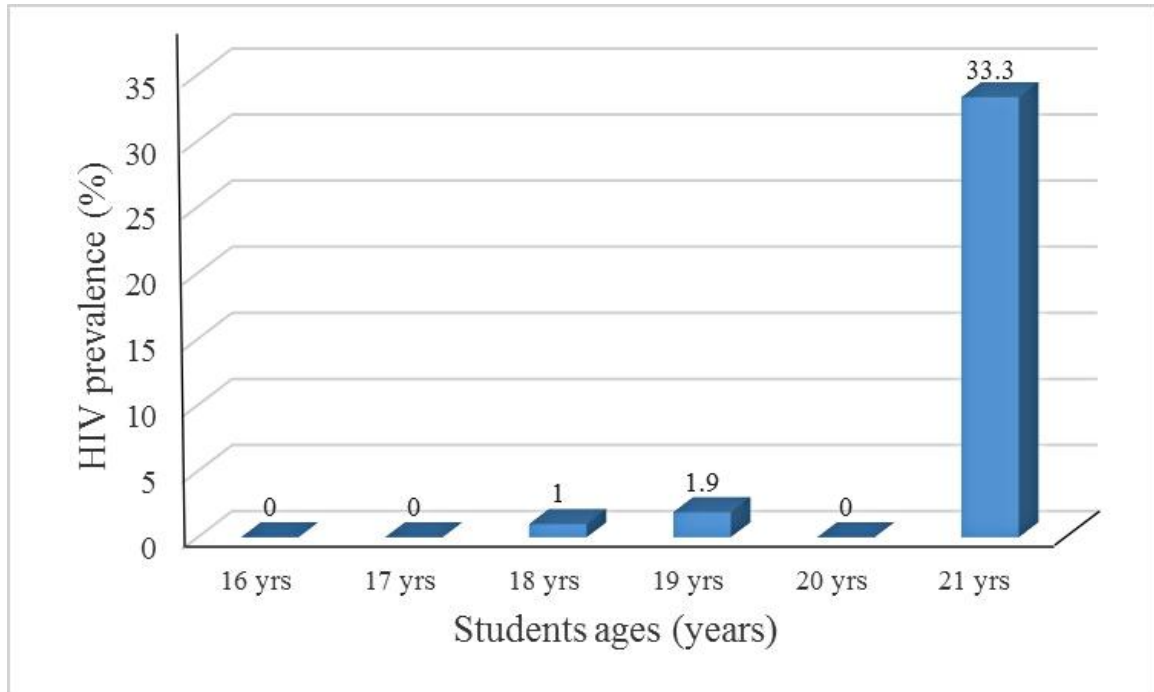


Figure 4.3: HIV Prevalence by age (years) in the sampled population

4.7 HIV prevalence by school category

Six school categories were sampled in this study. Ninety-five were from Girls boarding school, ninety-three (93) from Boys boarding schools, which had one (1) HIV positive case, one hundred and one (101) from Boys day school, which had one (1) HIV positive case, forty-three from girls' day school, sixty-two (62) from mixed boarding school, which had a positive case, and forty one (41) from mixed day school. Table 4.5 illustrates the prevalence HIV in relation to the category of the school. A higher prevalence (1.6%)

was recorded in mixed boarding school than that recorded in Boys boarding school (1.07%) and in Boys day school (0.99%). There were no student donors who tested positive for HIV in the other category of schools (Table 4.4)

Table 4.4: HIV prevalence by school category

	Girls boarding	Boys boarding	Boys day	Girls day	Mixed boarding	Mixed day
Total students	95	93	101	43	62	41
HIV Positive	0	1	1	0	1	0
%Prevalence	0.0%	1.07	0.99%	0.0%	1.6%	0.0%

4.8 Questionnaire return rate

Out of the 434 students who donated blood only, 388 of the students returned the questionnaires (Appendix 8) and these were analyzed. This gave a return rate of 88.5 %. The mean age of the respondents was 17.25 ± 1.057 this was in a range 16 to 28 years. Most of the participants were aged 16 years (33.87 %) and the least frequency belonged to those aged > 19 years (2.31 %). Most of the students, 341(86.5%) were aware of their blood groups whereas only a small number 6 (1.52%) were aware of any adverse effects of blood transfusion.

4.9 Students knowledge on blood donation and blood transfusion practices

In the six categories of schools, the students' knowledge on blood donation, the risk involved, and any other educational information required during blood transfusion was established. By coding all the correctly answered items on knowledge, a knowledge scale

was established to show the levels of knowledge. The mean response and the standard error (SE) in the school categories were therefore computed for each of the test items on the knowledge on HIV of the students in the school. The scale used was 0 – 1 (0 – 0.4 Not knowledgeable, 0.5-1 knowledgeable). The students knowledge therefore was merely 2.30% (Figure 4.4).

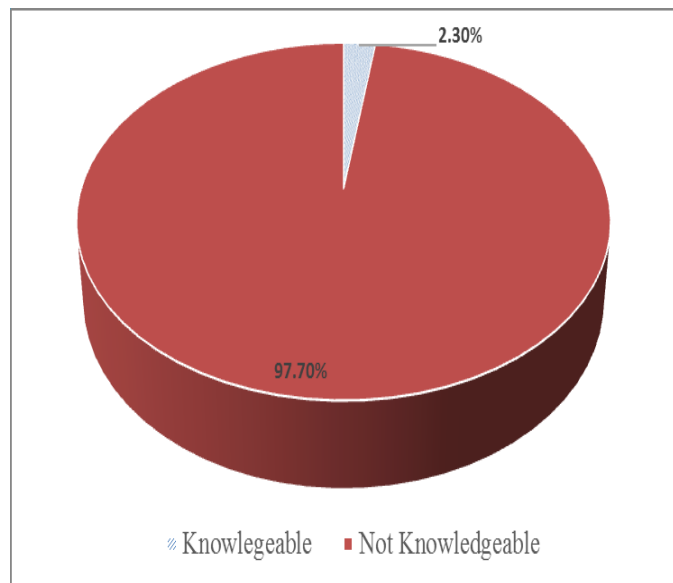


Figure 4.4: Students knowledge on blood donation and blood transfusion practices

The student's knowledge on blood donation practices was low with the mean score for those who knew the minimum, maximum age for donation being 0.11; the mean score for frequency of blood donation was 0.08, and that for knowledge on appropriateness of using blood donated by close relatives was 0.06. Only 0.09 of the students knew what prevents some people from donating blood and a very small number, 0.14 had read any educational materials on blood donation and knew how more people could be made to

donate blood. The results of this research also show that the students were knowledgeable on who a blood donor is (mean 0.78), the components of blood (mean 0.80) and who a blood recipient is (mean 0.60) (Table 4.5).

Table 4.5: Overall students' knowledge on blood donation and blood transfusion practices

Statements	Average score	Score implication
Knowledge on Who a blood donor is	0.78	Knowledgeable
Knowledge on who blood recipient is	0.60	Knowledgeable
Knowledge of what blood donation is	0.42	Not Knowledgeable
Knowledge of Blood donation programs	0.37	Not Knowledgeable
Knowledge on Benefits of blood donation	0.22	Not Knowledgeable
Knowledge on different blood components available in blood banks	0.21	Not Knowledgeable
Knowledge on major types of blood groups	0.24	Not Knowledgeable
Knowledge of whether diseases can be transmitted through blood	0.06	Not Knowledgeable
Knowledge on minimum/maximum age for donation	0.11	Not Knowledgeable
Knowledge on frequency of blood donations	0.08	Not Knowledgeable
Knowledge on appropriateness of blood donation from close relatives	0.06	Not Knowledgeable
Knowledge on what prevents some people from donating blood	0.09	Not Knowledgeable
Knowledge on how more people can be made to donate blood	0.14	Not Knowledgeable
Knowledge on how more people can be made aware of blood donations	0.18	Not Knowledgeable
If respondent had read any educational material on blood donation	0.14	Not Knowledgeable

Score scale; 0 – 0.5 (No Knowledge), 0.5 – 1.0 (Knowledgeable)

4.10 Knowledge of the students by Age

The result indicated that the mean age of students who were knowledgeable was 17.25 with a minimum age of 16.0 years and a maximum age of 19.0 years. The mean age of those who were not knowledgeable was 17.17 with a minimum age of 16.0 years and a maximum of 21.0 years. There was no significant relationship between the students' knowledge and the ages of the students ($r = 0.011$, $P = 0.834$). This indicated that older students were not necessarily more informed than the younger students were (Appendix 12).

4.12 Knowledge of the students by gender

The knowledge of the students on blood donation was evaluated by the students' gender. Based on the response received from the students on the test items an average response was computed for each of the 388 respondents. In a scale of 0 – 1 (not knowledgeable – Knowledgeable), a score of 0.0 – 0.4 was not knowledgeable while a score of 0.5 – 1.0 was knowledgeable. In this scale, 2.3% of the students were knowledgeable on issues of blood donation while the majority, 97.7% were not knowledgeable. To establish the association of the student gender with the students' knowledge on blood donation issues, a chi-square test of association was used. The result showed 55.9% males and 44.1% of the females were not knowledgeable ($\chi^2 = 1.706$, $P = 0.309$) (Fig 4.5).

Table 4.6: Students' knowledge on blood donation and blood transfusion practices by gender

Students' knowledge		
	Not knowledgeable	Knowledgeable
Male	212 (55.9%)	7 (77.8%)
Female	167 (44.1%)	2 (22.2%)
Total	379 (100%)	9 (100%)
χ^2 value	1.706	
P value	0.309	

Chi square tested at 95%

4.13 Knowledge of the students by school category

In the six school categories, there was no significant association between the students' knowledge on blood donation with the type/ category of school of the students ($\chi^2 = 5.300$, $P = 0.380$) (Table 4.8).

Table 4.7: Students' knowledge on blood donation and blood transfusion practices by school category

School category	Not knowledgeable	Knowledgeable	Total
Girls Boarding	84 (97.7%)	2 (2.3%)	86
Girls day	39 (100%)	0 (0.0%)	39
Boys Boarding	80 (96.4%)	3 (3.6%)	83
Boys day	88 (95.7%)	4 (4.3%)	92
Mixed Boarding	59 (100%)	0 (0.0%)	59
Mixed day	29 (100%)	0 (0.0%)	29
χ^2 value	5.300		
P value	0.380		

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

5.1.1 HIV prevalence among student blood donors in Nairobi County

The prevalence of HIV among student blood donors in this study was 0.7 %. Recruitment of safe blood donors is still a major challenge for many developing countries like Kenya, yet safe blood donors free from risks of transmitting diseases is the cornerstone of blood safety. In some countries taboos, socio-cultural beliefs and religion are still major obstacles towards altruistic donations and discourage people from engaging in benevolent donations. HIV/AIDS and associated stigma also tend to discourage a number of people from donating blood fearing to discover their status.

The general HIV prevalence in the population in the specific country, public awareness regarding HIV and blood donation, the selection of donors and steps taken to ensure thorough pre-screening of blood donors are all important factors requiring due attention (Aldebert *et al.*, 2012). In high-income countries, much emphasis has been put on proper donor selection and the HIV prevalence is as low as 0.001 % while in low-income countries the prevalence has remained high (WHO, 2009). Hassan *et al* (2008) reported an average incidence of 2.8 % of HIV among apparently healthy blood donors in Kaduna Northern central Nigeria, but Zachariah *et al* (2002) reported HIV incidence of 22 % among blood donors in Kampala Uganda in East Africa, which is significantly higher than the Nigerian studies. The prevalence of HIV infection among blood donors varies from one geographical location to another and can provide a reasonable ‘proxy’ for HIV

infection levels in a larger adult population (WHO, 2002). The majority of blood donors in Sub-Saharan Africa are family members and friends. This group of donors is considered particularly high risk since relatives and friends are likely to donate without considering their health conditions and only donate because they feel obligated to save a family member or friend (Nwankwo *et al.*, 2012). A comparative study on HIV prevalence between voluntary donors in Kenya found a great variation, with the HIV prevalence among voluntary donors at 1.7 % and 10 % among family replacement donors respectively (Kimani *et al.*, 2011).

The frequency of HIV found in this study (0.7 %) is much lower than that found by other studies like the one carried out by Nyamongo *et al* (2001) involving all donor groups in five provinces of Kenya, which reported prevalence rate of 9.7 %. Although relatively low HIV prevalence is seen among secondary school student blood donors, the figures contrast sharply to those observed by Glynn *et al.* (2000) when they analyzed the trends in viral infections among blood donors in the USA and only found a prevalence rate of 0.15 % for HIV. The American Red Cross Blood Services (ARCBS) in a study conducted between 1992 through 2001; found HIV sero-prevalence rates of 0.002 % amongst the general donor population, but only 0.00006 % amongst high school student donors (ARCBS, 2012). The figures in the ARCBS study are almost 10,000 times lower than those found in this study, suggesting that a lot still needs to be done in order to assure the safety of blood donated by secondary school students in Kenya. A study in a rural population India showed a HIV prevalence of 1.56 % among voluntary donors and

2.11% in replacement donors (Sonwane *et al.*, 2003), but another study by Kumar *et al.*, (1996), in Bangalore found a HIV prevalence among voluntary donors to be much lower at only 0.042 % (p=14266). In Uganda, the MOH surveillance reports showed a HIV prevalence of 0.7 % among school going blood donors (MOH, 2001). In the more developed countries, chances of transmitting HIV through donated blood is low due to stringent blood screening measures in place. The use of whole-virus lysate ELISAs and p24 antigen based assays has increased the sensitivity of the assays and thus viral products are detectable early during the window period. The average window period for the most sensitive ELISA for HIV is now to about 20 days (Shimian *et al.*, 2012)

Majority of cases of transfusion-associated HIV transmission may be the result of blood donated during the window period when the viral load of individuals is still low. Using whole-Virus lysate enzyme immuno assays (EIA'S) to screen blood may reduce the window period to about 45 days (95 % , CI 34-55 days). Studies show that the average window period for the most sensitive ELISA for HIV antibodies is now about 20 days giving an average infectious window period of 25 days (95 % , CI= 9-41 days) (Shimian *et al.*, 2012). For effective exclusion of blood donors perceived to bear risk and to protect the blood supply from viral contamination, the criteria used must take into account the specific epidemiological situation of any given country or region. The general observation in this study was that blood donated by secondary school students in Nairobi County has a significantly lower frequency of HIV antibodies (0.53-0.81 %) compared to the general population (6.1 %) (NAS COP, 2015).

5.2 Students knowledge on blood donation and blood transfusion practices

This study also aimed to establish the level of knowledge on blood donation and blood transfusion practices among student blood donors in Nairobi County, Kenya. The mean knowledge on blood donation and blood transfusion practices among student blood donors was not satisfactory at 33.2 % and SD 30.58± 394(86.2 %) of students who participated in the survey. Age range suitable for donation, and the acceptable interval between two donations were known to 44(11.16 %) and 98(24.87 %) student donors respectively. Complications of blood and component transfusion were areas that elicited a poor response with only 22.58 % of the student blood donors possessing good knowledge. On some of the basic parameters, namely, the age range of donors, minimum weight, the acceptable interval between two donations and diseases for which a donor is usually deferred (Misje *et al.*, 2009), the student blood donors in this study revealed major gaps in knowledge.

As non-remunerated donated blood is the only blood source in Kenya, peoples' motivation is imperative to keep blood source sufficient. Their level of knowledge on risks of blood transfusion and steps taken to prevent and treat such incidences was also not satisfactory (MOH, 2014). Knowledge about risks associated with donated blood was only 8.12 %, indicating an overall misconception about risks to the recipients of donated blood. Blood donors come from the local communities and thus awareness of the community members and their motivation to participate voluntary blood donations is essential (Devi *et al.*, 2012)

5.3 Conclusions

- (i) From the results of the study, it can be concluded that the prevalence of HIV among secondary school student blood donors is still low (0.7 %) compared to the general population (6.1 %). As such, this category of donors still constitutes a much safer population compared to other groups of donors.
- (ii) The results do not show any significant differences in the prevalence of HIV among students attending the different categories of schools suggesting that the category of school had no effect on the HIV prevalence among the students.
- (iii) The results did not show a significant positive correlation between age and HIV status suggesting that older students and younger students had an equal chance of being HIV- positive.
- (iv) From the results of the study, it can also be concluded that the student's knowledge on blood donation and blood transfusion practices is low. Male students appeared slightly more knowledgeable (55.7 %) on blood donation and blood transfusion practices compared to the female students (44.1 %) though there was no statistical correlation between knowledge and the students' gender.

5.4 Recommendations

- (i) Campaigns on recruitment of secondary school students as voluntary unremunerated blood donors requires strengthening as a more cost effective strategy. Strengthening efforts to recruit donors from only low risk populations such as secondary schools is also recommended

- (ii) Efforts for the development and extensive use of effective communication materials to sensitize the community on blood donations and blood transfusion practices should be implemented to improve secondary school student's knowledge on blood donation and transfusion practices. An interventional strategy in the form of repeated short blood donation awareness campaigns with respect to blood donation and blood transfusion practices have to be taken up because a significant number of students faltered in the basic aspects of blood donation and blood transfusion practices.
- (iii) Comprehensive screening of blood donors for HIV and other TTI'S using quality assured methods is highly recommended. Implementation of more sensitive tests (such as nucleic acid amplification testing) for HIV that detect early stages of HIV infections (i.e. reduce the window period) will further decrease risks of transfusion-transmitted HIV infections and improve safety of donated blood.

5.5 Recommendation for further studies

Due to the variability in the HIV prevalence in the different parts of the country, a larger study covering all the Counties of Kenya is recommended in order to determine the HIV prevalence among secondary school student blood donors in Kenya.

REFERENCES

- Adelbert, B. J., George, S., Christopher, D. H., and Beth, H. S. (2012).** Blood donations motivators and barriers: A descriptive study of African American and white donors. *Transfusion and Apheresis Science*, **48**: 87-93.
- Agbovi, K. K., Malewe, Kolou., and Akuete, Y. Segbena (2006).** Knowledge, attitudes and practices about blood donation. A Sociological Study among the Population of Lomé in Togo. *Transfusion Clinique et Biologique*, **13**: 260-5.
- Aleruchi, O., Peterside, N. F., and Ezekoye , C.C (2014).** Seroprevalence of HIV infection among blood donors at the University of Port Harcourt teaching hospital, Rivers state, Nigeria. *Global Journal of Biology ,Agriculture and Health Sciences*, **3**: 1-7.
- Aisha, A., Munira, B., Nida, A., Imran, N., Rehan, A., Samson, B., Naveena, F., Mustansir, Z., and Tahir, S. (2016).** Prevalence of transfusion transmissible infections in blood donors of Pakistan. *BioMed Central Hematology*, **10**: 16-68.
- American Red Cross Biomedical services (ARCBS) (2012).** FAQs about Donating Blood. Retrieved 2014-10-26 www.redcross.org/about-us/media/subject-matter/experts/blood-services.
- André, Loua., Janaki, Sonoo., Laurent, Musango., Jean, B. Nikiema., and Thomas Lapnet-Moustapha (2017).** Blood Safety Status in WHO African Region Countries: Lessons Learnt from Mauritius. *Journal of Blood Transfusion*, **10**: 1155-1163.
- Barbara J, Bain., Imelda Bale., Michael, A. Laffan., and S, Mitchell Lewis. (2014).** Dacie and Lewis Practical Haematology 11th edition Pg 118. ELSEVIER ISBN-13: 9780702034084. London, UK.
- Bates, I., and Hassall, O. (2010).** Should we neglect or nurture replacement blood donors in sub-Saharan Africa? *Biologicals*, **38**: 65–7.
- Blood link Foundation. (2016).** Quick facts on blood and blood donation. Retrieved on 25-1-2016. www.bloodlinkfoundation.org/quik_facts.html.
- Biomerieux. (2014).** Vironostica HIV Uni-form II ag/Ab 4th generation HIV sandwich ELISA product manual. The Netherlands.
- Centers for Disease Control and Prevention. (2012).** Progress Toward Strengthening National Blood Transfusion Services-14 Countries, 2008-2010. *Journal of American Medical Association*, **307**: 138-141.

Centers for Disease Control and Prevention. (2013). Blood Safety basics.

Central Bureau of Statistics, Republic of Kenya. (2009). Kenya population census report.

Changqing, L., Xiaopu, X., Huimin, Y., Miao, H., Jianping, L., Yudong, D., Yongshui, F., Jianmin, G., Yonglin, Y., Yan, L., Changzhou, L., Hongxiang, Z., and Wuping, L. (2012). Prevalence and prevalence trends of transfusion transmissible infections among blood donors at four Chinese regional blood centers between 2000 and 2010. *Journal of Translational Medicine*, **10**: 176.

Cochran, W. G. (1977). Sampling techniques (3rd Ed.) Pg 286. John Wiley and Sons. New York, USA.

Devi, H. S., Laishram, J., Shantibala., and Elangbam, V. (2012). Knowledge, attitude and practice of blood safety and donation. *Indian Medical Gazette*; Jan: 1 -5.

Eder, A. F., Hillyer, C. D., Dy, B. A., Notari, E. P., and Benjamin, R. J. (2008). "Adverse reactions to allogeneic whole blood donation by 16- and 17-year-olds". *Journal of American Medical Association*, **299**: 2279–86.

Erhabor, Osaro¹., Usman, Ismail¹., Wase, Abubakar., Buhari, Hauwa., Abdulrahman, Yakubu¹., Onuigwe, Festus., Okwesili, Augustine., Isaac, Zama¹., Yeldu, Muktar., Adias, Teddy., Charles, Marafa., Ahmed¹, Ibrahim., Kweifa¹, Uko., Emmanuel¹, Udomah., Frank, Yeldu., Mohammed, Haruna., Dallatu, Kabiru., Aghedo, Festus., Ikhuenbor, Dorcas., Gwarzo, Sani (2014). Prevalence of transfusion- transmissible HIV infection among blood donors in Sokoto, North Western Nigeria. *American Journal of Microbiology and Biotechnology*, **1**:36-42.

Evan, M. Bloch., Marion, Vermeulen., and Edward Murphy. (2012). Blood Transfusion Safety in Africa: A Literature Review of Infectious Disease and Organizational Challenges. *Transfusion Medical Reviews*, **26**: 164–180.

Family Health International. (2004). Guidelines for the appropriate use of blood and blood products in Kenya. Second Edition.

Fisher, A.A; Laing. J. E; Stoeckel, E. and Townsend J. W. (1998). Hand Book for family Operations Research Design. Second Edition. Population Council, New York, USA.

Field, S., and Allain, J. P. (2007). Transfusion in Sub Saharan Africa, does a Western model fit? *Journal of Clinical Pathology*, **60**: 1073-1075.

- Florent, F. Y., Basile, K., Jeanne, H. F., Nadege, K., Sandrine, M. and Jacqueline, D. M. (2012).** High Rates of Hepatitis B and C and HIV Infections among Blood Donors in Cameroon: A Proposed Blood Screening Algorithm for Blood Donors in Resource-Limited Settings. *Journal of Blood Transfusion*, **10**: 1155-1162.
- George, B. S., Michael, P. B., Steven, H. K., and James, J. K. (1996).** The risk of transfusion-transmitted viral infections. *New England Journal of Medicine*, **334**: 1685-90.
- Gilliss, M. Brian., Looney, R. Mark., and Gropper, A. Michael. (2011).** Reducing Non-Infectious Risks of Blood Transfusion. *Anesthesiology*, **115**: 635–649.
- Gilreath, J. A., Stenejem, D. D., & Rodgers, G. M. (2014).** Diagnosis and treatment of cancer-related anemia. *American Journal of Hematology*, **89**: 203-212.
- Giovanni, Di Minno., Carlo, FedericoPerno., Andreas, Tiede., David, Navarro., Mariana, Canaro., LutzGüertler., James, W. Ironside. (2016).** Current concepts in the prevention of pathogen transmission via blood/plasma-derived products for bleeding disorders. *Blood Reviews*, **30**: 35-48.
- Glynn, S., Steven, A., Kleinman, H., George, B. S., Michael, P. B., David, J. W., James, W. S., Catharie, C. N., and Alan E. W. (2000).** For the Retrovirus Epidemiology Donor Study (REDS). *Journal of American Medical Association*, **284**: 229-235.
- Hassan, A., Muktar, H. M., Mamman, A.I., Ahmed, A. J., Isa. A.H., and Babadoko, A. A. (2008).** The incidence of HIV among blood donors in Kaduna, Nigeria. *African Journal of Health Science*, **8**: 60.
- Hasan, B., Enayat, A., Sedighe, S. S., Mehdi, O., Esmaeil, R., and Zahra, M. (2017).** Prevalence of HIV, hepatitis B and C infections among volunteer blood donors at the blood transfusion center of Ilam city, Iran. *Journal of Basic Research in Medical Sciences*, **4**: 4-8.
- Jabareen, Y. (2009).** Building Conceptual framework: Philosophy, Definitions and procedure. *International journal of quantitative methods*, **8**: 4.
- Javadzadeh, Shahshahani H., Yavari, M .T., Attar, M., & Ahmadiyeh, M.H. (2006).** Knowledge, attitude and practice study about donation in the urban population of Yazd, Iran, 2004. *Transfusion Medicine*, **16**: 403-9.
- Jayaraman, S., Chalabi, Z; Perel, P., Guerriero, C., and Roberts, I. (2010).** The risk of transfusion-transmitted infections in sub-Saharan Africa. *Transfusion*, **50**: 433-42.

Kabinda, Jeff Maotela., André Nyandwe, Bulabula., Philippe, Donnen., René, Fiase., Jeff, Van den Ende., Daniel, Sondag-Thull., Dramaix-Wilmet, Michèle. (2014). Residual Risk of Transmission of HIV and Hepatitis B and C by Blood Transfusion in Bukavu in the Democratic Republic of Congo. *Open Journal of Epidemiology*, **4**: 157-163.

Kabiru, E. W., and Kaviti, J. N. (1987). Risk of transfusion malaria In Nairobi. *East African Medical Journal*, **64**: 825-27.

Kamande, M. W., Kibebe, H., and Mokua, J. (2016). Prevalence of Transfusion Transmissible Infections Among Blood Donated At Nyeri Satellite Transfusion Centre In Kenya. *Journal of Pharmacy*, **6**: 20-30.

Karuru, J. W., Lule, G. N., Joshi, M., and Anzala, O. (2005). Prevalence of HCV and HIV/HCV co-infection among volunteer blood donors and VCT clients. *East African Medical Journal*, **82**: 166-9.

Kimani, D., Mwangi, J., Mwangi, M., Bunnell, R., Kellogg, T. A., Oluoch T., Gichangi, A., Kaiser, R., Mugo, N., Odongo, T., Oduor, M., and Marum, L. (2011). Blood donors in Kenya: a comparison of voluntary and family replacement donors based on a population-based survey. *VoxSanguinis (The International journal of blood transfusion)*, **100**: 212–218.

Kumar, R. R., Jayshree, R. S., and Sridhar, H. (1996). Prevalence of HIV infection in voluntary blood donors and cancer patients. *Indian Journal of Pathology and Microbiology*, **39**: 187-9.

Melese, G., Kifle, W., and Ameyu, G. (2012). HIV Sero-Prevalence Trend among Blood Donors in Jimma University Specialized Hospital, Southwest Ethiopia. *Ethiopian Journal of Health Sciences*, **22**: 37–43

Michelle, S., Chevalier, M.D., Matthew, Kuehnert, M. D., Sridhar, V. B, MD., Adam, Bjork, PhD., and John P. Pitman, PhD. (2016). Progress Toward Strengthening National Blood Transfusion Services-14 Countries, 2011–2014. Morbidity and Mortality weekly report (MMWR) Centers for Disease Control. *Weekly*, **65**: 115–119.

Ministry Of Health, Republic of Kenya. (2001). AIDS in Kenya Background, Projections, Impact, Interventions and Policy, 6th Edition NASCOP.

Ministry Of Health, Uganda. (2001). HIV/AIDS surveillance report.

Ministry Of Health, Republic of Kenya, and JICA. (2002). The study of Blood Transfusion System in Kenya.

Ministry Of Health, Republic of Kenya. (2003). Kenya demographic and health survey report.

Ministry Of Health, Republic Of Kenya. (2005). Aids in Kenya. Trends and impact 7th Edition.

Ministry Of Health, Republic of Kenya. (2005). NBTS, National Strategy on Blood donor Mobilisation.

Ministry of Health, Republic of Kenya. (2014). National Blood Transfusion Service report.

Misje, A. H., Bosnes, V., and Heier H.E. (2009). Gender differences in presentation rates, deferrals and return behavior among Norwegian blood donors. *VoxSanguinis (The international journal Of Transfusion Medicine)*, **97**: 93-182.

Moore, Anne., Guillermo, H., Nyamongo, J., Lactritz, E., Tim, R., Nahlen, B., Oloo, A., Opondo, G., Muga, R and Janssen, R. (2001). Estimation of risk of HIV transmission by blood transfusion in Kenya. *Lancet*, **358**: 2097.

Mulugeta, M., Betelihem, T., Fikir, A., Bamlaku, E., Tadele, M., Yakob, G. T., Mohamedamin. Areba and Elias, S. (2016). Knowledge, Attitude, and Practice of Adult Population towards Blood Donation in Gondar Town, Northwest Ethiopia: A Community Based Cross-Sectional Study. *Journal of Blood Transfusion*, **10**: 1155.

Nada, H. A., and Atwa, M. (2013). Seroprevalence of HBV, HCV, HIV and Syphilis Markers among Blood Donors at Suez Canal University Hospital Blood Bank. *Journal of Blood Disorders and Transfusion*, **5**: 177.

National Aids Control Council. (2015). Kenya HIV estimates report, 2015, Nairobi, Kenya.

National Council For Population And Development (NCPD) (2003). Kenya Country Report on reproductive health and Reproductive rights, Nairobi, Kenya.

National AIDS and STI Control Programme (2012). Ministry of Health, Kenya. September 2013. Kenya AIDS Indicator Survey 2012: Preliminary Report. Nairobi, Kenya.

National AIDS and STI Control Programme. (2015). Ministry of Health, Kenya HIV estimates 2014.

Nebie, K. Y., Olinger, C., and M. Kafando, E. (2007). Lack of knowledge of blood donor in Burkina Faso (West Africa); Potential obstacle to transfusion security. *Transfusion Medicine*, **14**: 446-452.

Nwankwo, E., Imoru, M., Ismaila, U., Babashani, M., and Adeleke, S. (2012). Seroprevalence of major blood-borne infections among blood donors in Kano, Nigeria. *Turkish Journal of Medical Sciences*, **42**: 337-341.

Nyamongo, J., Lactritz, E., Moore, A., Herrera, G., Granade, T., Phillips, S., Nahlen, B. and Janssen R. (2001). Evaluation of HIV testing of the blood supply in Kenya. *Lancet*, **358**: 657–60.

Olaiya, M. A., Alakija, W., Ajala, A., and Olatunji, R. O (2004). Knowledge, attitudes, beliefs and motivations towards blood donations among blood donors in Lagos, Nigeria. *Transfusion Medicine*, **14**: 13-17.

Owusu-Ofori S., Temple, J., and Francis, S. (2005). Pre donation screening of blood donors with rapid tests: implementation and efficacy of a novel approach to blood safety in resource poor settings. *Transfusion*, **45**: 133–140.

Raja, Danasekaran., Geetha, Mani., Kalaivani, Annadurai (2014). A Cross-sectional study on Awareness and Practices about Blood donation among Medical students. *International Journal of Multidisciplinary Research and Development*, **1**: 131-134.

Shimian, Z., Susan, L. S., and Roger, Y. D (2012). Donor Testing and Risk: Current Prevalence, Incidence, and Residual Risk of Transfusion-Transmissible Agents in US Allogeneic Donations. American Red Cross Biomedical Services, Gaithersburg, MD. © 2012 Elsevier Inc. New York, USA.

Siemens Healthcare. (2014). Enzygnost[®] HIV Integral 4 HIV combo assay user instructions for use. Germany.

Sirengo, M., Rutherford, W. G., Otieno-Nyunya, B., Kellogg, A. T., Kimanga, D., Muraguri, N., Umuro, M., Mirjahangir, J., Stein, E., Ndisha, M., and Kim, A. A. (2016). Evaluation of Kenya's readiness to transition from sentinel surveillance to routine HIV testing for antenatal clinic-based HIV surveillance. *Infectious Diseases*, **16**: 113.

Sonwane B. R., Birare S.D. and Kulkarni P, V. (2003). Prevalence of Sero-reactivity among blood donors in a rural population. *Indian Journal of Medical Sciences*, **57**: 405–407.

Sube L L Kenetha, Oromo, F. Serianoa., Rose, P. Gorea., Salvador, Jaja., Richard, L. Lorob., Emmanuel, Oryem., Linob, Opiaka., A. Serianoc., Samuel, N. Wania., Loboro, J. Alexa., Kwoji, R. Jacka., and Isaac, Abraham (2013). Prevalence of HIV among blood donors at Juba Teaching Hospital Blood Bank, South Sudan. *South Sudan Medical Journal*, 7: 4.

Tagny, C.T., Owusu-Ofori S. and Mbanya, D. (2010). The blood donor in sub-Saharan Africa: A review. *Transfusion Medicine*, 20: 1–10.

United Nations Development Programme (2004). Human development Report, New York, USA.

United Nations Childrens Education Fund (2016). Global information and education on HIV.

United Nations Joint Programme On HIV/AIDS (UNAIDS) (2014). The gap report.

Velati, C., Romano, L., Fomiatti, L., Baruffi., L., & Zanetti, A.R. (2008). Impact of nucleic acid testing for hepatitis B virus, hepatitis C virus, and human immunodeficiency virus on the safety of blood supply in Italy: a 6-year survey. *Transfusion*, 48: 2205-2213.

World Health Organization (2002). Aide-memoire for blood safety, Geneva, Switzerland: World Health Organization; 2002. Available at:http://www.who.int/bloodsafety/transfusion_services/en/Blood_Safety_Eng.pdf (Accessed 6 November 2015).

World Health Organisation (2004). Blood Transfusion Safety. Facts and Figures from the WHO Global data Base on Blood Safety 1997-2001, Geneva, Switzerland.

World Health Organization (2009). Blood safety indicators.

World Health Organization (2010). Availability, Safety and Quality of Blood products. WHA63.12.

World Health Organization (2012). WHO Global Database on Blood Safety (GDBS) for the year 2012 reported by 100 countries.

World Health Organization (2014). Blood safety and availability. Fact sheet N°279 Updated June 2014: Trends in Incidence and Prevalence of Major Transfusion-Transmissible Viral Infections in US Blood Donors, 1991 to 1996.

World Health Organization (2016). Global status report on blood safety and availability. ISBN 978-92-4-156543-1.

Zachariah, R., Harries, A. D., Nkhoma, W., Arendt, V., Spielmann, M. P., Buhendwa, L., Chingi, C., and Mossong, J. (2002). HIV prevalence and demographic risk factors in blood donors. *East African Medical Journal*, **79**: 88-91.

Zhao-Hua, J., Cui-Ying, L., Yong-Gang, L., Wei, C., Yao-Zhen, C., Xiao-Peng, C., Min, T; Jing-Hua, L., and Qun-Xing, A. (2013). The prevalence and trends of transfusion-transmissible infectious pathogens among first time, voluntary blood donors in Xi'an, China between 1999 and 2009. *International Journal of Infectious Diseases*, **17**: e259–e262.

PLATES

PLATE 1: STUDENTS FILLING QUESTIONNAIRES



PLATE 2: BLOOD DONATION IN PROGRESS



APPENDICES

APPENDIX 1: INFORMED CONSENT FORM

a) Introduction

My name is **Moses C O Lorre**; I am a master's student from Kenyatta University. I am conducting a study on "**HIV Prevalence among secondary school student blood donors in Nairobi county**". The Ministry of Health is working to improve access and quality for screening of donated blood in Nairobi County.

b) Procedures to be followed

Participation in this study will require that I ask you some questions and examine you in order to screen you for HIV. I will take some specimens from you for further tests. I will record the information from you in a questionnaire. You have the right to refuse participation in this study. You will get the same care and Medical treatment whether you agree to join the study or not and your decision will not change the care you will receive from us today or that you will get from any other center at any other time.

Please remember that participation in the study is voluntary. You may ask questions related to the study at any time.

You may refuse to respond to any question(s) and you may stop an interview at any time. You may also stop being in the study at any time without any consequences to the services you receive from us or any other organization now or in the future.

If are included in the study these things will happen;

- i) You will be asked to donate blood only once during our blood donation drive.
- ii) I will ask you a few questions regarding your general health status only once at the beginning of the study.
- iii) I will check your temperature, breathing rhythm, heartbeat and your weight.
- iv) I will use a needle to take a small amount of your blood from your arm.

c) Benefits

If you participate in this study, you will help us to learn how to provide effective and quality HIV screening services among blood donors. This can help to improve the health of blood donors and reduce the risk of HIV transmission through donated blood. You will also benefit from being screened for HIV and if you are found to have a problem, you will be advised and referred for treatment and comprehensive care at MOH approved HIV treatment and comprehensive care centers free.

d) Discomforts

The blood donation procedure is safe however; a few inconveniences may be experienced. The stick from the needle will hurt a little but the hurt will go away after awhile. There may be some other effects that will make you feel strange, different, or even dizzy. You must tell your teacher or the study investigator if you feel unwell. Maximum care will however be taken to ensure minimal discomfort. We shall adhere to strict safety precautions and a comfortable environment will be provided for all the procedures. Some of the questions you will be asked are on intimate subject(s) and may be embarrassing or make you uncomfortable. If this happens, you may refuse to answer these questions if you so choose. You may also stop the interview at any time.

e) Risks

The blood donation process is safe. New, sterile disposable equipment is used for each donor, so there is no risk of contracting a blood borne infection by donating blood. Those who draw blood are also well-trained professionals and will monitor every step of the donation process to ensure maximum safety of the donor.

f) Care and protection of participants

Several screening measures will be used to ensure that the blood donation process is safe for the donor and is unlikely to have any negative health effects. Medical history and physical examination is carried out for all donors to determine whether they can safely

donate blood without experiencing any negative health effects. In addition to a medical history, donors undergo a brief physical examination before donation to check for any obvious signs of illness or conditions that would disqualify them from donation. Qualified medical laboratory technologists or technicians to ensure maximum safety to the donor will only carry out the blood donation process, including bleeding of the donor. The process will be conducted in a comfortable environment with good ventilation and adequate lighting. There will also be on standby a qualified nurse to monitor any changes on the part of the donor.

g) Confidentiality

The interviews and examinations will be conducted in a private setting identified within the school setting. Your name or identity will not be recorded in the questionnaire. The questionnaires will be kept in a locked cabinet for safekeeping at Kenyatta University. Everything will be kept private.

h) Contact information

If you have any questions, you may contact Prof. Michael M. Gicheru on 0722609765 or Prof. E W Kabiru on 0733805863 or the Kenyatta University Ethical Review Committee Secretariat on chairman.kuerc@ku.ac.ke, secretary.kuerc@ku.ac.ke, ercku20082gmail.com

i) Participant's statements

The above information regarding my participation in the study is clear to me. I have been given a chance to ask questions and my questions have been answered to my satisfaction. My participation in this study is voluntary. I understand that my records will be kept private and that I can leave the study at any time. I understand that I will still get the same care and medical treatment whether I decide to leave my decision or not and my decision will not change the care I will receive today or that I will get from any other center at any other time.

Name of participant.....

.....
Signature or thumbprint **Date**

j) Investigator statement

I, the undersigned, have explained to the volunteer in a language s/he understands the procedures to be followed in the study and the risks and benefits involved.

Name of interviewer.....

.....
Interviewer signature **Date**

APPENDIX 2: NATIONAL BLOOD TRANSFUSION SERVICE BLOOD DONOR GUIDELINES

Guidelines On Requirements For Blood Donation (Extract from National Blood Transfusion Service, Kenya).

The Blood Donor

1. Any healthy person between 16-65 years of age (inclusive), may become a blood donor. However, blood can be collected from fit regular blood donors who are above the age of 65 years. Where it is necessary to request blood donation from someone below the age of 18 years, prior consent shall be obtained from parents or guardians. Donors above the age of 65 years. Where it is necessary to request blood donation from someone below the age of 18 years, prior consent shall be obtained from parents or guardians. Donors above the age of 65years must thoroughly examined by competent physicians with good knowledge of blood transfusion procedures.
2. Fifty Kilograms (50kg) body weight shall be the minimum acceptable weight for a blood donor; blood donors weighing between 45-50kg may, in exceptional circumstances, be allowed to donate blood at the discretion of the medical officer
3. The volume of blood collected from a donor shall not exceed 500ml per visit.
4. The blood haemoglobin level accepted for blood donation shall be a minimum of 12.5g/dl for both female and male donors. For autologous donation a minimum of 10 g/dl will be accepted
5. Prior to the donation, the donor shall complete a questionnaire that declares his/her identity as well as present and past health status. A donor with an identified risk factor will be temporarily or permanently excluded from donating blood.
6. The donor must acknowledge that he/she has been made aware of socio-behavioural risk factors associated with an increased risk of transmitting an infection through transfusion. Pre-donation individual counselling shall be used to defer donors who are at risk of transmitting an infection if they do not elect to defer themselves.

7. Only donors who agree to be informed of their sero-status of notifiable diseases through appropriate counselling facilities shall be accepted as regular donors.
 - a) Before blood is collected, the donor must pass a medical examination. Blood pressure will be recorded, and haemoglobin or haematocrit values must be determined by a reliable technique. The standard operating procedures for donor assessment must be followed precisely. However, donations may be acceptable from certain donors, subject to approval of medical person incharge of the centre.
 - b) The interval of blood donations shall not be less than 3 months. In special circumstances, blood may be donated at 2 month intervals. The standard operating procedures must be followed precisely.
 - c) Potential donors who are either temporarily or permanently deferred shall be referred to appropriate medical and/or counselling facilities of their choice.
 - d) Sterile, disposable blood collection, sets must be used for blood collection. Strict aseptic conditions must be ensured during blood collection – steps must be taken ensure that blood and blood products for transfusion are as safe as possible.
 - e) All blood for transfusion must pass the infectious diseases screening tests agreed upon by the MOH, before being made available to the recipient.
 - f) Confidentiality in blood donor records shall be maintained.

**APPENDIX 3: NATIONAL BLOOD TRANSFUSION SERVICE BLOOD DONOR
QUESTIONNAIRE**

Thank you for accepting to donate blood today. Without volunteer donors like you blood would NOT be available for thousands of patients across Kenya who needs it daily. However, before you donate, we would like you to reflect on the following questions. If any of the questions is not clear kindly, ask any of the staff to you for an explanation. These questions are part of our continuing efforts to ensure the safety of both you as a donor and the recipients of blood. It is, therefore necessary that you answer the questions as truthfully as possible.

Delete that which does not apply

1. Have you received a blood transfusion in the last six months?				Yes	No
2. Have you had a major operation?				Yes	No
3. Are you currently under any medication?				Yes	No
4. Do you suffer from any medication?				Yes	No
Anemia	Yes	No	Heart Disease	Yes	No
Diabetes	Yes	No	High Blood Pressure	Yes	No
Epilepsy	Yes	No	Jaundice	Yes	No
Any chronic illness	Yes	No	Any other illness NOT listed Above?	Yes	No
Specify			Specify		
5. Have you ever been asked before NOT to donate blood?				Yes	No
6. Have you ever paid or received payment/services for sex?				Yes	No
7. To your knowledge, has your partner ever engaged in sex with a commercial sex worker?				Yes	No
8. Have you suffered or been treated for sexually transmitted diseases?				Yes	No
9. Have you ever injected yourself with a needle?				Yes	No
10. Have you ever tested positive for HIV?				Yes	No
11. Have you ever tested positive for hepatitis?				Yes	No
12. Have you ever had herpes zoster (shingles)?				Yes	No
13. Have you suffered recently from unexplained weight loss?					
14. MALES ONLY			FEMALES ONLY		
Have you ever had sex with Another male?	Yes	No	Are you pregnant?	Yes	No
Have you been pregnant in the last three months?					
				Yes	No
Are you breastfeeding now?				Yes	No

If you have answered YES to any of the questions above kindly, ask to talk to one of the Blood Transfusion Services staff members present

APPENDIX 4: KENYA NATIONAL BLOOD TRANSFUSION SERVICE

NAIROBI CENTER,

STANDARD OPERATING PROCEDURE FOR COPPER SULPHATE HB ESTIMATION

SP003 2

LOCATION

Donor Room

SUBJECT

Qualifying Test for Blood Donation

FUNCTION

Method of estimation of donor's

haemoglobin by copper sulphate method

DISTRIBUTION

-Medical Officer

-In-Charge of Donor Area for use by all technicians in the area

-Master File

1. SCOPE AND APPLICATION

To find a fit and healthy donor, assuring his or her safety. This also helps in assuring the quality of the product.

2. RESPONSIBILITY

It is the responsibility of the technician working in the donor area.

3. REFERENCE

Technical Manual of American Association of Blood Banks, 13th edition, 1999 Pg. 711-712

4. MATERIALS REQUIRED

- a. Copper sulphate working solution with a specific gravity 1.053.
- b. Sterile gauze/cotton, spirit and sterile disposable lancets.
- c. Heparinized capillaries (dimensions: 75mmx1mm)
- d. Containers with 1% sodium hypochlorite solution for disposing sharp lancets, capillaries and bio hazardous materials.
- e. Coplin jar with lid.

For preparation of copper sulphate working solution, refer SOP: SP 004.

5. PROCEDURE Principle:

This is a qualitative test based on specific gravity. The drop of donor's blood dropped into copper sulphate solution becomes encased in a sac of copper proteinate, which prevents any change in the specific gravity for about 15 seconds. If the haemoglobin is equal to or more than 12.5 gm/dL the drop will sink within 15 seconds and the donor is accepted.

N.B:

- Do not depend on colour of tongue or conjunctiva.
- Accept a donor only if haemoglobin is >12.5g/dL.

Method:

- a. 30 ml copper sulphate working solution (Sp.gr.1.053) in a clean, dry coplin jar is used for determining hemoglobin. The jar is kept covered with a lid when not in use. The working solution is changed after every 25 tests.
- b. The fingertip is cleaned thoroughly with a spirit swab and allowed to dry.

- c. The finger is punctured firmly near the tip with a sterile disposable lancet. A good free flow of blood is ensured. The finger is not to be squeezed repeatedly since it may dilute the drop of blood with excess tissue fluid and give false low results.
- d. The first drop of blood is wiped and % of the micro capillary is allowed to fill with blood sample by capillary force, without any air bubbles.
- e. Allow one drop of blood to fall gently from the capillary from a height of about 1 cm above the surface of the copper sulphate solution, into the coplin jar.
- f. The drop of blood is observed for 15 seconds.
- g. The lancet and capillaries are disposed off in a container with 1% sodium hypochlorite solution.

Interpretation:

- a. If the drop of blood sinks within 15 seconds (i.e. donor's haemoglobin is more than 12.5gm/dL), the donor is accepted for blood donation.
- b. However, if the blood drop sinks midway (i.e. haemoglobin level is less than 12.5gms/dL), and then comes up, the donation or donor is deferred.
- c. If the drop sinks slowly, hesitates and then goes to the bottom of the jar, confirm the haemoglobin of this donor.
- d. If the donor fails the CuSO_4 test, repeat haemoglobin by Sahli's /Drabkin's / Automated Cell Counter.
- e. In case if the haemoglobin is lower than 12.5g/dL, prescribe haematinics and ask the donor to come for a recheck after one month

6. DOCUMENTATION

Enter the result on donor card

N.B.: WHO has developed a simple device for estimating haemoglobin (Haemoglobin Colour Scale)

NAIROBI BLOOD TRANSFUSION CENTER

Number	Effective Date	Pages	Author	Authorised by
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SP 004	1			
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Version	Review Period	No. of Copies	Approved by	Date
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1	Biennial			
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LOCATION

Donor Room

SUBJECT

Haemoglobin Estimation

FUNCTION

Preparation of CuSO₄ solution

DISTRIBUTION

-Donor Area

-Medical Officer in Charge of Donor Area

-Masterfile

1. SCOPE AND APPLICATION

The specific gravity of 1.053 is equivalent to 12.5 g/dl haemoglobin. Hence, CuSO₄ solution of specific gravity 1.053 is used for predonation haemoglobin test.

2. RESPONSIBILITY

The technician/laboratory assistant in the donor area

3. REFERENCE

Introduction to Transfusion Medicine: Z.S. Bharucha, D.M. Chouhan, 1st Edition, 1990, page 99.

4. PROCEDURE

Stock solution is made as follows and kept in a jar or bottle

- a. Dissolve 170 gm crystalline CuSO 5H, O in 1000 ml distilled water(Working solution)
- b. Every morning prepare fresh solution.
- c. Add 51 ml stock solution to 49 ml distilled water.
- d. Check Specific Gravity which should be 1.053. if not, adjust it using either stock solution or distilled water.

5. DOCUMENTATION

Record the volume of stock and working solution prepared on the register (Table 1 of SOP 005)

NAIROBI BLOOD TRANSFUSION CENTER

Number	Effective Date	Pages	Author	Authorised by
SP 005	4			
Version	Review Period	No. of Copies Approved by Date 2014		
1	1 Year			

LOCATION

Quality Control Laboratory

SUBJECT

Copper Sulphate Solution

FUNCTION

Quality control-Quality Control Laboratory

DISTRIBUTION

-Supervisor

-Quality Manager

-Master File

1. SCOPE AND APPLICATION

Copper sulphate solution is used for screening blood donors by testing the haemoglobin concentration before blood donation.

Copper sulphate solution is checked to ensure that a drop of blood sample of predetermined haemoglobin value reacts as expected (sinks/floats).

2. RESPONSIBILITY

It is the responsibility of the Quality Control personnel to ensure testing of the reagent before use.

3. REFERENCES

Technical Manual of American Association of Blood Banks, 13 Edition, 1999, pg 56

4. MATERIALS REQUIRED**Equipment:**

Urinometer

Reagents:

Copper sulphate working solution Distilled water

EDTA blood samples of known haemoglobin concentration

Glassware:

Coplin jar

Heparinised capillaries Miscellaneous:

Tissue paper

Copper sulphate record book Tube racks

5. PROCEDURE

- a. Check the copper sulphate solution against a light source for the presence of precipitate/cloudiness.
- b. Check the specific gravity of the solution using a urinometer . Copper sulphate being a colored solution, the marking of the urinometer corresponding to the upper meniscus of the solution should be 1.053=12.5g% of haemoglobin
- c. Arrange the blood samples according to haemoglobin concentration in a rack
- d. Obtain samples of known Hb values
- e. Transfer 30ml copper sulphate working solution in a Coplin jar
- f. Mix the blood sample of known haemoglobin concentration by inversion
- g. Fill heparinised capillary upto % capacity with the blood sample
- h. Allow the drop of blood to fall gently into the copper sulphate solution
- i. Repeat the procedure for all the blood samples
- j. Note the result
- k. Record the results in the copper sulphate record book.

6. RESULTS

If the solution appears cloudy or precipitate is present, the solution is discarded.

The result of testing the solution is interpreted as follows:

RESULT	Hb CONCENTRATION	INTERPRETATION
---------------	-------------------------	-----------------------

(a)	Blood drops floats	Hb<12.5g% Fail (F)
-----	--------------------	--------------------

(b)	Blood drops sinks	Hb<12.5g% Pass (P)
-----	-------------------	--------------------

(c)	Blood drops sinks slowly or	
-----	-----------------------------	--

	Blood drop hesitates midway and sinks slowly	Hb<12.5g% Pass fail reaction (P/F)
--	--	------------------------------------

7. DOCUMENTATION

The results are noted in the copper sulphate record book

SP 006

APPENDIX 5: VIRONOSTIKA UNIFORM II AG/AB HIV TEST KIT
INSRCTIONS FOR USE

Vironostika Kit Contents

Microelisa Strip Plates

12 strips per plate each with 8 wells coated with a mixture of HIV-1 gp 160, HIV-1 ANT 70, hiv-2 ENV(aa 592-603) and anti-HIV-1 P24. Each well contains a pearl shaped sphere, containing lyophilised HRP-Labeled HIV-1 gp 160, HIV-1 ANT 70 and HIV-2 env(aa 592-603) conjugate and anti-HIV-1 p24 (murine monoclonal).

Negative Control

Human serum nonreactive for anti-HIV and HIV antigen.

Ready to use as supplied.

Anti-Hiv-1 Positive Control

Human serum containing human monoclonal anti-HIV-1, ready to use as supplied.

Anti-Hiv-2 Positive Control

Human serum conmtaining murine monoclonal anti-HIV-2, ready to use as supplied.

HIV-1 Antigen Positive Control

HIV-1 p24 (inactivated)

Specimen Diluent

Contains stabilizing protein and detergent. Ready to use as supplied.

Phosphate Buffer Concentrate

To be diluted 25fold with distilled water for use in the test procedure.

TMB Solution

Tetramethylbenzidine in citric acid

Urea Peroxidase Solution

Combine with equal parts of TMB solution for use in the test procedure.

Plate Sealers

Perforated, adhesive.

Sheets Of Labels

Protocol, reagent and working solution identification.

Additional Equipment And Materials Required but not provided.

Distilled or de-ionised water

Vortex mixer

Timer

Suitable disinfectant, Disposable gloves

Disposable V-shaped troughs

1N Sulfuric acid

Pipettes 50ul, and 100ul, 1ml and 5ml

Incubator or water bath at $37 \pm 2^{\circ}\text{C}$

Microwell reader, single wavelength 450nm

Microwell aspiration wash/ system

Reagent Preperation

The following reagents were prepared before starting the assay procedure. Reagents and samples were equilibrated to room temperature (15-30°C) before beginning the assay.

Phosphate Buffer

The phosphate buffer concentrate was checked for the presence of salt crystals and where present, the crystals were redissolved by warming at 37°C.

The phosphate buffer was then diluted 1: 25 with distilled water for use in the testing procedure.

TMB Substrate

The required amount of TMB solution was combined with equal parts of urea peroxidase solution according to number of wells being run(see chart below) and mixed well for use.

Table Distribution of reagents to ELISA plate wells

NO OF WELLS	TMB SOLUTION	UREA PEROXIDASE SOLUTION
1-16	1ML	1ML
17-32	2ML	2ML
33-48	3ML	3ML
49-64	4ML	4ML
65-80	5ML	5ML
81-96	6ML	6ML

Assay Procedure Vironostika Uni-Form II Ag/Ab

100ul of specimen diluent was pipetted into all wells of the microplates including the control wells. 50ul of samples and controls were added to assigned wells.

The plates were then mixed thoroughly using a microshaker and incubated at 37°C for 60 minutes. The microplate wells were then washed and soaked with phosphate buffer six

times. At the end of the sixth wash, the well contents were completely aspirated into a waste flask. 100ul of TMB was then pipetted into each well and incubated at room temperature for 30minutes. The reactions in the wells was then stopped by adding into each well 100ul of 1N Sulfuric acid. The microplates were then read for the absorbance of the solutions in each well using a single wavelength reader at 450nm.

Calculation Of Test Results

Test results were calculated separately for each strip holder for each microplate as required by the manufacturer of Vironostika test kit. The following guidelines were followed.

NC= Absorbance of the negative control

PC1= Absorbance of the Anti-HIV-1 positive control

PC2= Absorbance of the Anti-HIV-2 positive control

PC3= Absorbance of the HIV-1 antigen positive control

Qualification Of NC Values

NC Value had to be < 0.250 . Any NC with a value greater than 0.250 was eliminated and not used to calculate the test results.

The mean NC_x value of the remaining controls was then determined.

$NC \leq 1.4NC_x$. Any $NC > 1.4 NC_x$ eliminated

NC had to be $\geq 0.6 NC_x$. Any $NC < 0.6 NC_x$ eliminated. These steps were taken to remove any outliers as required by Vironostika test methodology.

Assay Validity

An assay run was considered valid if,

More than half the number of negative controls are not eliminated

PC1- $NCx \geq 0.600$

PC2 – $NCx \geq 0.600$

PC3 – $NCx \geq 0.400$

Cutoff Value

Cutoff value for valid test runs was calculated as $NCx + 0.100$

A test sample was considered reactive(positive) if the sample absorbance was \geq cutoff value.

A test sample was considered non reactive(negative) if samlpe absorbance was $<$ cutoff value.

APPENDIX 6: ENZYGNOST HIV 1/2 PLUS KIT INSTRUCTIONS FOR USE**Enzygnost anti-HIV 1/2 plus kit contents****Microtitration Plate**

Coated with a mixture of recombinant HIV(env) proteins(E. Coli) representing the viral proteins gp41 (HIV 1), gp41 (HIV 1 Subtype O), gp36 (HIV 2).

HIV Ag/POD Conjugate

Recombinant HIV protein and synthetic HIV peptides, peroxidase(POD)-Conjugate, ready for use.

Sample Buffer**Control Serum, Positive(Anti-HIV 1)**

Heat treated human serum containing antibodies to HIV 1 antigens

Control Serum, Negative(Anti-HIV)

Human serum without antibodies to HIV 1/2 and HIV 1(Subtype O) antigens.

Washing Solution POD (Concentrate)

Phosphate buffer solution 90mmol/l

Buffer/ Substrate TMB

Hydrogen peroxide in acetate buffer solution.

Chromogen TMB

Tetramethylbenzidine dihydrochloride.

Stopping Solution POD

0.5 N Sulfuric Acid

Empty Bottle- for working chromogen

Polyethylene Bag- for storing unused test strips

Preparation Of Reagents

Washing solution

20ml of washing solution POD was diluted to 400ml with distilled water for use in the test procedure.

Working Chromogen Solution

For each test plate, 1ml chromogen TMB was diluted with 10ml of Buffer/substrate TMB in the plastic bottle supplied with the kit.

Assay procedure Enzygnost Anti-HIV 1/2 plus

25ul of sample buffer was pipetted into all wells of the microplates including the control wells. 100ul of samples and controls were added to assigned wells. The plates were then mixed thoroughly using a microshaker and incubated at 37°C for 30 minutes. The microplate wells were then washed and soaked with washing solution four times. At the end of the fourth wash, the well contents were completely aspirated into a waste flask. 100ul of conjugated was then pipetted into each well and covered with a fresh foil then incubated at 37 °C for 30minutes. After this incubation all wells were washed five times. 100ul of working chromogen was then added to all the wells then incubated at 37 °C . The reactions in the wells was then stopped by adding into each well 100ul Of 0.5N Sulfuric acid. The microplates were then read for the absorbance of the solutions in each well using a single wavelegth reader at 450nm.

Test Validation

The individual values of the absorbances for the control sera had to comply with the following specification:

$$-0.01 \leq A_{\text{neg}} \leq 0.150$$

$$A_{\text{pos}} \geq 0.700$$

Where A_{neg} = Absorbances of the negative controls.

A_{pos} = Absorbances of the positive controls.

If this conditions were not fulfilled the tests were repeated.

Evaluation/Calculation of results

The mean absorbance of the valid negative controls was obtained and the cut-off calculated by adding 0.400

$$A_{\text{neg}} + 0.400 = \text{Cut-off}$$

The retest range was defined as: Cut-off to Cut-off- 10%

Based on the criteria of the test, the samples were classified as follows:

1. $A_{\text{sample}} < \text{Cut-off} - 10\% \wedge$ “negative”

2. $A_{\text{sample}} > \text{Cut-off} \wedge$ “reactive”

$$\text{Cut-off} - 10\% \leq A_{\text{sample}} \leq \text{Cut-off} \wedge \text{“equivocal”}$$

APPENDIX: 7 SECONDARY SCHOOLS IN NAIROBI COUNTY

SN	SCHOOL
1.	AQUINAS HIGH SCHOOL – BOYS BOARDING
2.	HIGHWAY SECONDARY SCHOOL – BOYS DAY
3.	HURUMA GIRLS’ HIGH SCHOOL – GIRLS DAY & BOARDING
4.	OUR LADY OF MERCY SEC SCH SOUTH B – GIRLS DAY
5.	OFAFA JERICHO HIGH SCHOOL – BOYS BOARDING
6.	NILEROAD SECONDARY – GIRLS DAY
7.	ST. TERESA’S BOYS SECONDARY SCHOOL – BOYS DAY
8.	MAKONGENI SECONDARY SCHOOL – MIXED DAY
9.	RUARAKA HIGH SCHOOL – MIXED DAY
10.	BURUBURU GIRLS SEC SCH – GIRLS BOARDING
11.	OUR LADY OF FATIMA SEC SCH – MIXED DAY
12.	BABA DOGO SECONDARY SCHOOL – MIXED DAY
13.	C.G.H.U SECONDARY SCHOOL – MIXED DAY
14.	EASTLEIGH HIGH SCHOOL – BOYS DAY
15.	MAINA WANJIGI SECONDARY SCHOOL – MIXED DAY
16.	UHURU SECONDARY SCHOOL – BOYS DAY
17.	KAMUKUNJI SECONDARY SCHOOL – MIXED DAY
18.	O.L.M SHAURI MOYO GIRLS SEC. SCH – GIRLS BOARDING
19.	JAMHURI HIGH SCHOOL – BOYS DAY
20.	PARKLANDS SECONDARY SCHOOL – BOYS DAY
21.	PUMWANI SECONDARY SCHOOL – BOYS BOARDING
22.	NGARA GIRLS’ HIGH SCHOOL – GIRLS BOARDING
23.	ST TERESA’S GIRLS SECONDARY SCHOOL – GIRLS DAY
24.	NDURURUNO SECONDARY SCHOOL – MIXED DAY
25.	MURANG’A ROAD MIXED DAY SEC SCH – MIXED DAY
26.	PUMWANI GIRLS SECONDARY SCHOOL – GIRLS DAY
27.	LANG’ATA HIGH SCHOOL – MIXED DAY
28.	KAREN ‘ C ‘ SECONDARY SCHOOL. – MIXED DAY
29.	OLYMPIC HIGH SCHOOL – MIXED DAY
30.	RAILA EDUCATIONAL CENTRE – MIXED DAY
31.	DAGORETTI HIGH SCHOOL – BOYS BOARDING
32.	UPPER HILL SCHOOL – BOYS BOARDING
33.	MOI GIRLS’ SCHOOL NAIROBI – GIRLS BOARDING
34.	PRECIOUS BLOOD RIRUTA – GIRLS BOARDING
35.	MUTUINI HIGH SCHOOL – BOYS DAY
36.	RUTHIMITU SECONDARY SCHOOL – MIXED DAY
37.	NEMBU GIRLS HIGH SCHOOL – GIRLS BOARDING
38.	RUTHIMITU GIRLS SEC SCHOOL – GIRLS DAY
39.	DAGORETTI MIXED SEC SCHOOL – MIXED DAY
40.	PARKLANDS ARYA GIRLS HIGH SCH – GIRLS BOARDING

41. STATEHOUSE GIRLS H. SCH – GIRLS BOARDING
42. KANGEMI HIGH SCHOOL – BOYS BOARDING
43. HOSPITAL HILL HIGH SCHOOL – MIXED BOARDING
44. ST. GEORGE'S GIRLS' SEC SCH – GIRLS BOARDING
45. NAIROBI MILIMANI SEC SCH – BOYS DAY
46. LAVINGTON MIXED SEC SCH – MIXED BOARDING
47. HIGHRIDGE MIXED SECONDARY SCH – MIXED BOARDING
48. KAHAWA GARRISON SECONDARY SCH – MIXED DAY
49. KAMITI SECONDARY SCHOOL – MIXED DAY
50. KAYOLE SECONDARY SCHOOL – MIXED DAY
51. EMBAKASI GIRLS SECONDARY SCH – GIRLS BOARDING
52. PETER KIBUKOSYA SECONDARY SCHOOL – MIXED DAY
53. KAYOLE SOUTH SECONDARY SCHOOL – MIXED DAY
54. DANDORA SECONDARY SCHOOL – MIXED DAY
55. MUHURI MUCHIRI BOYS HIGH SCH – BOYS BOARDING
56. HON. DR. MWENJE SECONDARY SCH – MIXED DAY
57. USHIRIKA SECONDARY SCHOOL – MIXED DAY
58. JEHOVA JIRE SECONDARY SCH – MIXED BOARDING
59. DRUMVALE SECONDARY SCH – MIXED BOARDING
60. ST. GEORGE ATHI SEC SCH – MIXED BOARDING
61. LENANA SCHOOL-BOYS BOARDING

APPENDIX 8: RESPONDENTS' QUESTIONNAIRE

PART 1: PERSONAL INFORMATION

1. School ----- Code: -----Student Number -----
2. Contact Details: Postal Address (where you would like to receive your correspondence)-----
3. Home phone number: -----Cell phone number: -----
4. Age-----
5. Sex/Gender-----

PART 2: KNOWLEDGE ON BLOOD DONATION

6. Do you know who a blood donor is? Yes/No
7. Do you know who is a recipient? Yes/No
8. Have you ever heard of blood donation? Yes/No
9. Are you aware of any blood donation programs? Yes/No
10. Do you know any benefits of blood donation? Yes/No
11. Do you know any risks associated with blood donation/transfusion? Yes/No
12. Have you ever donated blood? Yes/No
If yes specify when-----

13. Do you know the components of blood? Yes/No
14. Do you know whether diseases can be transmitted through blood transfusion?

PART 3: KNOWLEDGE ON BLOOD TRANSFUSION PRACTICES

15. Do you know the major types of blood groups? Yes/No
16. Do you know your blood group? Yes/No
17. Do you know what should be the minimum and maximum age limit for blood donation? Yes/No
18. Do you know the different blood components available in our blood banks? Yes/No
19. Do you know how frequently can a donor donate blood? Yes/No

If yes, specify

Days/months/years-----

20. Blood should be preferably transfused by blood donated from a close blood related relative.

True/False

Specify reasons for your answer.

21. Do you know what prevents people from donating blood? Yes/No

If you answered yes to no.21 above, kindly give example.

22. Do you know how we can make more people donate blood? Yes/No

23. Do you know how we can make people aware of blood donations? Yes/No Specify

24. Have you read any educational materials on blood donation or blood transfusion?

Yes/No

25. Are you aware of any adverse effects of blood transfusion? Yes/No

THANK YOU FOR YOUR COOPERATION

**APPENDIX 9: CORRELATION BETWEEN STUDENTS' HIV STATUS AND
GENDER**

		HIV status	Student gender
HIV status	Pearson Correlation	1	-.016
	Sig. (2-tailed)		.733
	N	434	434
Student gender	Pearson Correlation	-.016	1
	Sig. (2-tailed)	.733	
	N	434	434

**APPENDIX 10: CORRELATION BETWEEN STUDENTS' HIV STATUS AND
AGE**

		Ages	HIV prevalence
Ages	Pearson Correlation	1	.843
	Sig. (2-tailed)		.073
	N	5	5
HIV prevalence	Pearson Correlation	.843	1
	Sig. (2-tailed)	.073	
	N	5	5

**APPENDIX 11: CORRELATION BETWEEN THE STUDENT'S KNOWLEDGE
AND AGE**

		Age	Knowledge
Age	Pearson	1	.011
	Correlation		
	Sig. (2-tailed)	.	.834
	N	388	377
Knowledge	Pearson	.011	1
	Correlation		
	Sig. (2-tailed)	.834	.
	N	377	377

APPENDIX 12: GRADUATE SCHOOL PROPOSAL APPROVAL



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke

Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 19th June, 2015

TO: Moses G.O Lorre
C/o Zoological Sciences Dept.

REF: 157/0253/2003

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that your Research proposal for M.Sc Degree Entitled, "HIV Prevalence among Secondary School Student Blood Donors in Nairobi County, Kenya" was approved on 11th June, 2015.

You may now proceed with your Data Collection, subject to clearance with the permanent Secretary, Ministry of Higher Education, Science and Technology.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking Forms per semester. The form has been developed to replace the Progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

Thank you.


JOHN ODONGI
FOR: DEAN, GRADUATE SCHOOL

c.c. Chairman, Department of Zoological Sciences

Supervisors:

1. Dr. Michael Gicheru
C/o Department of Zoological Sciences
Kenyatta University
2. Prof. Ephantus W. Kabiru
School of Public Health
Kenyatta University

JMO/rwm

APPENDIX 13: KENYATTA UNIVERSITY ETHICAL APPROVAL



KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE

Email: chairman.kuerc@ku.ac.ke
secretary.kuerc@ku.ac.ke
erc@ku.ac.ke
 Website: www.ku.ac.ke

P. O. Box 43844 - 00100 Nairobi
 Tel: 8710901/12
 Fax: 8711242/8711575

Our Ref: KU/R/COMM/51/560

Date: 16th October, 2015

Moses C.O. Lorre,
 Kenyatta University,
 P.O Box 43844, Nairobi.

Dear Lorre,

RE APPLICATION NUMBER PKU/378/1 350- "HIV PREVALENCE AMONG SECONDARY SCHOOL STUDENT BLOOD DONORS IN NAIROBI COUNTY, KENYA" - VERSION 2

1. IDENTIFICATION OF PROTOCOL

The application before the committee is with a research topic, "HIV prevalence among secondary school student blood donors in Nairobi County, Kenya" - Version 2 dated 2nd October, 2015.

2. APPLICANT

Moses C.O. Lorre

3. STUDY SITE

Selected secondary schools in Nairobi County, Kenya

4. DECISION

The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (section 7.2.1.3) and the Kenyatta University Ethics Review Committee Guidelines AND APPROVED that the research may proceed for a period of ONE year from 16th October, 2015.

5. ADVICE/CONDITIONS

- i. Progress reports are submitted to the KU-ERC every six months and a full report is submitted at the end of the study.
- ii. Serious and unexpected adverse events related to the conduct of the study are reported to this board immediately they occur.
- iii. Notify the Kenyatta University Ethics Committee of any amendments to the protocol.
- iv. Submit an electronic copy of the protocol to KUERC.

If you accept the decision reached and advice and conditions given please sign in the space provided below and return to KU-ERC a copy of the letter.

PROF. NICHOLAS K. GIKONYO
 CHAIRMAN ETHICS REVIEW COMMITTEE



I, Moses C.O. Lorre accept the advice given and will fulfill the conditions therein.

Signature: [Signature] Dated this day of 22/10/15 2015.
 cc. Vice-Chancellor

APPENDIX 14: MINISTRY OF HEALTH (NBTS) AUTHORIZATION



MINISTRY OF HEALTH

Telephone: 020-2012867
Hotline: +254 716775245
Email: info@nbtskenya.or.ke
Website: www.nbtskenya.or.ke
When replying please quote:

Ref. No.: ST/000001

NATIONAL BLOOD TRANSFUSION
SERVICE - HQS
LOCATION: KENYATTA NATIONAL
HOSPITAL, NPJLS GROUNDS
P.O.BOX 29804-00202
NAIROBI

Date: 14/08/2015

Mr. Moses C. O. Lorre
P. Box 20924-00202, KNH

RE: RESEARCH AUTHORIZATION

This is to confirm that this office grants you permission to carry the above study.
You will work with Nairobi RBTC.

Thank you


DR. MARGARET ODUOR
Head, KNBTS

Cc: Mr. Abdi - Head RBTC - Nairobi region

APPENDIX 15: NACOSTI RESEARCH AUTHORIZATION



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No. NACOSTI/P/15/3094/8504

Date:

11th November, 2015

Moses C. Onono Lorre
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*HIV prevalence among secondary school student blood donors in Nairobi County, Kenya*," I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for a period ending **11th November, 2016**.

You are advised to report to **the County Commissioner, the County Director of Education and the County Coordinator of Health, Nairobi County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


SAID HUSSEIN
FOR: DIRECTOR GENERAL/CEO

Copy to:

The County Commissioner
Nairobi County.


The County Director of Education
Nairobi County.




APPENDIX: 16 RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MR. MOSES C. ONONO LORRE
of KENYATTA UNIVERSITY, 0-202
NAIROBI, has been permitted to conduct
research in Nairobi County
on the topic: HIV PREVALENCE AMONG
SECONDARY SCHOOL STUDENT BLOOD
DONORS IN NAIROBI COUNTY, KENYA
for the period ending:
11th November, 2016

Permit No : NACOSTI/P/15/3094/8504
Date Of Issue : 11th November, 2015
Fee Recleved : Ksh 1,000



Applicant's Signature



Director General
National Commission for Science, Technology & Innovation