HIV SEROPREVALENCE IN ORTHOPAEDIC TRAUMA INPATIENTS AT A TERTIARY REFERRAL HOSPITAL IN KENYA

A dissertation submitted in part of fulfillment of the requirements of the University of Nairobi for award of the Degree of Master of Medicine in Orthopaedic Surgery (M.Med. Orthopaedic Surgery).

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H58/74589/2014

DECLARATION

I hereby declare that this study is my original work and has not been presented as a dissertation at any other university. Where other people's work has been used this has been acknowledged and referenced in accordance with the University of Nairobi requirements.

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DEDICATION

This is dedicated to my parents George Rigicha Thuo and Alice Muthoni Rigicha without whose support and encouragement I would not be where I am today.

ACKNOWLEDGEMENT

The completion of this study would not have been possible without the astute guidance and contribution of my supervisors; Dr. Edward Gakuya and Dr. George Museve. Thank you for the guidance and correction during the preparation of this document.

I would also like to acknowledge the contribution of my fellow Registrars and colleagues who offered assistance especially in recruiting patients to the study.

The members of staff in the orthopaedic wards of KNH for the assistance in obtaining the data without any obstacles.

The patients included in this study for giving consent and being patient enough to withstand the test.

LIST OF ABBREVIATIONS

- AIDS – Acquired immunodeficiency syndrome.
- CCC – Comprehensive Care Centre.
- CDC – Communicable Diseases Control.
- ELISA – Enzyme Linked Immunosorbent Assay.
- GCS – Glasgow Coma Scale.
- HBV – Hepatitis B Virus.
- HCV – Hepatitis c Virus.
- HCW – Health Care Worker.
- HIV – Human Immunodeficiency Virus.
- KNH – Kenyatta National Hospital.
- KNH ERC - Kenyatta National Hospital Ethics, Research and Standards Committee
- K-wires – Kirschner wires.
- NSIs - Needle Stick Injury.
- OR - operating Room.
- SPSS - Statistical Package for the Social Sciences
- STI – Soft Tissue Injury.
- UNAIDS – Joint United Nations Programme on HIV/AIDS
- WHO – World health organization

ABSTRACT

Background

Human immunodeficiency virus (HIV) is a major health problem in Kenya and worldwide. Trauma is a big public health problem in Kenya and the world at large. It is associated with high morbidity and mortality both in developed and developing countries. With the high prevalence of HIV in Kenya and sub-Saharan Africa at large, infected orthopaedic trauma patients pose significant danger of occupationally acquired infections to health care workers. The orthopaedic surgeon is at a higher risk due to the frequent exposure to blood and other body fluids and handling of sharp instruments and sharp bone fragments that increase chances of sustaining needle stick injuries (NSIs).

Objectives: To determine the prevalence of HIV infection amongst orthopaedic trauma patients in Kenyatta National Hospital.

Study design: cross sectional study.

Setting: Kenyatta National Hospital: A National Teaching and Referral Hospital in Nairobi, Kenya. The study was conducted in the orthopaedic surgery wards.

Methodology: This study was conducted in the orthopaedic wards (6A, 6C and 6D) at Kenyatta National Hospital (KNH).Patients 18 years and above who were fully conscious and being managed for orthopaedic trauma conditions were randomly recruited into the study. Demographic details (age, gender, marital status, occupation and level of education) and whether or not they were aware of their HIV status was recorded. Widows, widowers, divorced and the ones who were single were regarded as unmarried. The orthopaedic trauma condition and mechanism/circumstances of injury was also recorded after viewing their radiographs. Pre-counseling was done. Those who tested positive were counseled again and referred to the Comprehensive Care Centre (CCC) for follow up.

Results: A total of 277 orthopaedic trauma patients were randomly selected. The mean age was 36.0. The male to female ratio was 6.9:1. 27(9.7%) tested positive. 10(37%) of the patients who tested positive were 40-49yrs old, 9(33.3%) were 30-39years, 3(11.1%) were 50-59years, 2(7.4%) were above 59 years, 2(7.4%) 20-29 years and 1(3.7%) was below 20 years. 19(70.4%) of the seroreactive patients were males and 8(29.6%) were females. 17(63%) of the patients were married and 10(37%) were unmarried. 13(48.1%) had primary level of education, 11(40.7%) had secondary level of education and 3(11.1%) had Tertiary level of education.1(3.7%) of the patients who tested positive was in formal employment while 26(96.3%) were in the informal sector. Majority of the patients (59.3% had injuries on the lower limb, 18.5% had pelvic injuries, 14.8% had multiple fractures while 7.4% had upper limb injuries. 16(59.3%) were involved in a road traffic accident, 8(29.6%) had a history of a fall and 3(11.1%) were hit by an object. Of those involved in a road traffic accident 10(62.5%) were pedestrians, 3(18.8%) were motorbike riders and 3(18.8%) were vehicle passengers. Out of the 277 patients who were recruited, 247(89.2%) were aware of their HIV status prior to the test and 30(10.8%) were unaware of their HIV status.

Conclusion and recommendations: The HIV seroprevalence amongst orthopaedic trauma patients in our setup and sub-Saharan Africa at large is higher than that in the general population. Despite the awareness of the HIV status of majority of the orthopaedic trauma patients, they pose potential danger of exposure of the HIV virus to the health care workers attending to them due to the nature of risk of contact with the blood and other body fluids containing the virus.

It is recommended that all orthopaedic trauma patients be tested for HIV serostatus and that the HCWs should be provided with protective measures like orthopaedic gloves and protective eye wear while attending to this patients to help minimize the risk of seroconversion

CHAPTER 1: INTRODUCTION

The risk of HIV transmission has been reported to be high in health care workers who care for trauma patients due to frequent contact with blood and other body fluids during treatment of HIV infected patients. Risk of HIV exposure in management of trauma patients depends on the seroprevalence in the population. In trauma population, HIV seropositivity has been reported to be as high as 23% and hence pose an occupational health hazard to health care workers who care for these patients (1,2). Studies have shown prevalence of HIV among trauma patients to be generally higher than that in the general population (3–6).

World Health Organization (WHO) estimates that HIV has infected 36.7 million people globally (7), with Kenya having 1.6million Kenyans leaving with HIV in 2016 (8). Majority of carriers of this viral disease are asymptomatic.

Following universal precautions have resulted in reduced rates of HIV transmission that have been reported. However, there is poor compliance to the universal precautions in resource limited developing countries (9,10). This results in high risk of exposure to HIV transmission among trauma health care workers in our poor setting.

Orthopaedic surgery involves use of needles, blades and sharp implants like Kirschner wires (K-wires) hence the risk of accidental prick injury and contracting blood-borne infections (6). The blood-borne pathogens that are most commonly involved in occupational transmission are Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), and HIV (8,9). A general surgeon is estimated to sustain 0.8 injuries /100 h of operating time, resulting in a 0.15% lifetime risk of HIV infection (9).

Current HIV seroprevalence of the orthopaedic trauma population locally is not known and its establishment would be vital for policy formulation.

CHAPTER 2: LITERATURE REVIEW

There were approximately 36.9 million people worldwide living with HIV/Acquired Immunodeficiency Syndrome (AIDS) in 2017.There is a HIV seroprevalence of 0.8% among global adults. Approximately 25% of these people are not aware they are HIV positive. Most of the people with HIV live in low- and middle- income countries, with approximately 66% of them located in sub-Saharan Africa. Among this group 19.6 million are living in East and Southern Africa. Twenty one point seven (21.7) million People living with HIV (59%) were accessing antiretroviral therapy (ART) globally (11).

Kenya has the joint fourth largest HIV epidemic in the world (alongside Mozambique and Uganda) with up to 1.6 million (4.8%) people aged between 15-49 years leaving with HIV in 2016. The prevalence is higher in females at 6.2% compared to males at 3.5% as per Joint United Nations Programme on HIV/AIDS (UNAIDS) 2017 Data Book (8,12,13).

In a prospective study done in 1994 in Bulawayo, Zimbabwe by Cohen B et al, on seropositivity in patients undergoing orthopaedic procedures 12 out of the 76 (16%) patients tested positive (14).

Study done in lusaka Zambia in 1996 showed 32 HIV positive patients out of 100 (32%) trauma patients and 78 tested positive out of 320 (24.38%) patients admitted for cold orthopaedic cases.

Bowley et al in 2002 reported a 27% rate of HIV in major trauma patients admitted to the level 1 Trauma Unit at the Johannesburg Hospital (15).

Seroprevalence of HIV infection among Orthopaedic and Plastic surgery patients in Enugu Nigeria was found to be 8.26% (10/121) in 2002. This was higher than the national seroprevalence of 5.8% at that time (3).

Tatolo Ismael Sefeane in 2011 found a rate of 23% (57 out of 246) seropositive acute orthopaedic trauma patients at Johannesburg hospital. Again this was higher than the rate of the country at large that stood at 10.9% at that time (2).

Seroprevalence of HIV infection among patients attending various emergency departments in a tertiary care hospital in India was 5.75% (23 out of 400 patients). With a rate of 13.04% amongst orthopaedic and surgical patients (4).

Study in Greece in 2012 on seroprevalence of HIV, HBV and HCV in orthopaedic patients found 2 out of 1694 patients tested (0.1) to be HIV positive (16).

2.1: Trauma burden

Trauma contributes to an estimated 10% of the disease burden globally (17), causing about 5 million deaths every year worldwide (18), of this deaths,90% occur in middle and low income countries (19). Road accidents are found to be leading mortality cause in individuals 15–29 years of age (20,21) with the WHO Africa Region reporting highest rate of fatality worldwide (22). Other than mortality, injuries are associated with a high burden of morbidity and economic cost accounting for approximately 6% of global years lived with disability (23).

In Kenya, trauma has become one of the leading causes death and admission to hospital (24).The top on the list causes of injury in our country are assault at 42%, road traffic accidents at 28%, unspecified soft tissues injuries (STI) at 11%, dog-bites, cut-wounds, burns, poisoning, and falls each <10% (24).

Road traffic accidents are number nine among causes of death in our nation. In 2013 data released by Kenya police road traffic accidents caused a total of 3191 deaths countrywide. Pedestrians were mostly affected in the road traffic incidences comprising about 60% of all injury admissions to a national referral hospital (24).

A retrospective study done in Nairobi on demographic factors and pattern of fatal injuries, mortalities as a result injuries stood at 1,208. This was approximately 10.6% of the recorded Mortalities. Most of these deaths as a result of injuries happened to individuals 25 to 44 years of age (48.1%). Males stood at approximately 85% of all this injuries. Assault using a blunt force was leading cause at 30.5%, followed in frequency by road traffic accidents at 25.9% and injuries by firearms at 15% (25).

2.2: Needle stick injuries and HIV transmission

Needle stick injuries are one of the most commonly experienced occupational hazards health care workers are exposed to at their place of work. According to WHO data, approximately 35.7 million health workers worldwide are at risk of sustaining NSIs (26–30).

The orthopaedic surgeon may stand a higher chance of NSIs as a result of sharp bone spikes present in the operative field and the fact that they use sharp orthopaedic instruments like drills, saws and k-wires. It is estimated that an orthopaedic surgeon's risk of NSIs is as high as 80%-90% over a 10 year career period (31).

The potential effects of these injuries include risk of transmission of blood borne pathogens. In a study by WHO, the estimated annual global proportion of HCW exposed to the HIV was approximately 0.5%. Though the risk of HIV infection from any single NSI where HIV contaminated blood is involved is around 0.3% (32).

2.3: Risk of seroconversion for surgeons after single exposure

Seroconversion risk following a single sharp injury contaminated with blood of an HIV infected person is approximated to be about 0.3 - 0.4% (33,34).The risk of seroconversion, however, is probably not uniform being affected by factors relating to the exposure, the source of the HIV, and the recipient (32).First, the risk of HIV transmission may be affected by the volume of infected fluid, the type, and severity of exposure. Health care professionals exposed to large amounts of blood by deep injection, such as the entire contents of syringes, have a greater risk of seroconversion (32).

The type of exposure also affects the risk of transmission; sharp injuries have the greatest risk of disease transmission (32).Further, hollow needles, when compared to solid needles, may be more likely to result in seroconversion possibly because they transmit a larger inoculum of blood (34). Because surgeons are more likely to be exposed by non-hollow needle-sticks from suture needles

they may be at lower risk for seroconversion after a single exposure. Surgeons are also protected by gloves because the volume of blood transmitted by needle-sticks is reduced by around 50% when the needle passes through protective gloves (34).

Source factors affect the risk of disease transmission (32).Blood has been found to have much higher viral copies compared to other body fluids. In a case control study on seroconversion of HIV amongst health care providers following percutaneous exposure by Cardo D et al showed that one of the factors associated with increased risk of infection was injury with a needle that had been placed in a source patients artery or vein (35). Other factors are a deep injury and a source patient with terminal HIV-related illness not on therapy and with a high viral load (35). Recipient factors, such as the first-aid given, skin integrity, exposure duration, and status of the immunity of the exposed person may affect the risk of transmission (32,36).

Sharp injuries represent the most significant risk of HIV transmission, exposure to blood for operating room personnel may occur in at least four other forms; exposure to mucous membranes, to intact skin, to open wounds, and by aerosol droplets. Though the risk of disease transmission via these modes of exposure is much lower than after NSIs, they are more frequent to surgical personnel than the NSIs (37).

Surgical personnel may have a higher risk for blood-borne disease transmission after cutaneous exposure than other health care workers for two reasons. First, scrubbing frequently for surgeries may lead to small skin abrasions on their hands and fingers, a common site of cutaneous exposure. Secondly many accidental glove tears in the operation room (OR) are noted after the operation incidentally. The failure to immediately recognize a glove tear results in prolonged cutaneous exposure which also may increase the risk of disease transmission (36,38). Seroconversion following mucus membrane exposure has been estimated to be 0.09% (39,40). Sero-conversion following cutaneous contact with blood has not been recorded in any of the prospective studies of date (39,40).

2.4: Cumulative risk of seroconversion for surgeons

Although the 0.4% risk of seroconversion after a single needle-stick has been described as small (37), surgeons sustain multiple exposures every year and thus, surgeons risks are more appropriately expressed as a life-time risk (27–30).

Lifetime risk is defined as a surgeon's cumulative risk of HIV seroconversion over an entire surgical career. For any individual surgeon, the cumulative risk of seroconversion is dependent on the following factors: the seroconversion risk following a single exposure, the HIV seroprevalence in that population, the rate of exposure per surgical procedure, and the total number of operations the surgeon performs in his surgical career (36).

Higher patient seroprevalence obviously results in an increased cumulative risk. Rates vary significantly by geographic location with sub Saharan Africa having the highest rates. Consten et al 1995 reported that figures from a western setting will always differ significantly with those from an African setting ; (0.1% and 1.5%respectively) from a report in Zambia (41). This difference was described as being due to the higher population seroprevalence (22.3% in Zambia compared with 0.23 % in the Western setting). Within any geographic area certain patient subgroups, such as trauma patients, may have much higher infection rates than other patient populations (42).

The cumulative risk of HIV infection is also affected by the rate of exposure per surgical procedure, which varies between hospitals (37,43–45), and between surgical subspecialties.

The reported rates of sharp injuries ranges from 0.8 to 5.6 exposures per 100 procedure (44,46). The exposure rate to blood, including both cutaneous exposures and sharp injuries, has been reported to be as high as 30.1% of surgical procedure (37). Although comparison between hospitals and services is somewhat problematic because of possible under reporting (45), exposure rates for OR personnel are clearly substantial. Furthermore, orthopaedic and trauma surgery have a significantly higher rate of exposure to blood and other body fluids

than other types of surgery (37).The estimated cumulative risk of HIV seroconversion for surgeons may be as high as 1 to 4% (39).

2.5: Occupationally acquired HIV infection

Between1985 and 2013, there were 58 confirmed individuals and 150 suspected individuals with occupationally sustained HIV amongst HCW reported to the Communicable Diseases Control (CDC). Of the confirmed cases, those infected by percutaneous puncture or cut were 49, those by mucocutaneous exposure were 5, both percutaneous and mucocutaneous exposure were 2, and those by unknown exposure were 2. Those exposed to HIV-infected blood were 49, concentrated viruses in laboratories were 4, visibly bloody body fluid was 1, and unspecified body fluids were 4. From 1999, only one case has been confirmed (a laboratory technician who sustained a needle puncture while working with a live HIV culture in 2008) has been reported. Of course, underreporting is a possibility because reporting is voluntary (47).

2.6: Rapid HIV Test

Rapid assays have high sensitivity and specificity and, when used in parallel or serial testing algorithms, yield results similar to those of enzyme-linked immunosorbent assay (ELISA)-based testing strategies. Study done in Abidjan, Ivory coast showed rapid assays had a sensitivity of 100% and specificity ranged from 99.4% to 100% (48).Rapid tests can be performed by any health care worker who has been adequately trained, unlike ELISA that requires skilled laboratory technicians.

Rapid assays are easy to perform, affordable and readily available.

ELISA requires a minimum of 40 samples to be economically effective but rapid test can be easily done on as few as 1 patient.

2.7: Study Justification

HIV seroprevalence in Kenya and Sub Saharan Africa at large is higher than the rest of the world and the prevalence has been found to be higher amongst orthopaedic trauma patients or surgical patients in general than in the general population. Despite the sharp decrease in occupationally acquired HIV infection, this decline in documented incidents does not minimize the assumed risk to surgeons when treating HIV positive patients. Due to the use of sharp instruments and implants, bone spikes, prolonged operative time and extensive hemorrhage, the orthopaedic surgeon is inherently at a higher risk of exposure to HIV virus than most surgeons. Despite protocols to ultimately have both patient and surgeon undergo appropriate testing and treatment in case of a NSI, there may be an element of extra protection if the patient is known to be HIV positive but testing of trauma patients is not routinely done in our set up. No study has shown any relationship between the specific orthopaedic trauma conditions and HIV seropositivity in our set up. The aim of this study is to provide data that will enable orthopaedic surgeons improve efforts in protecting themselves against accidental viral transmissions during operations.

This data will also aid in policy formulation.

CHAPTER 3: OBJECTIVES

Main Objective:

-To determine HIV prevalence amongst musculoskeletal trauma patients at Kenyatta National Hospital.

Specific objectives:

1. To determine association between HIV and age, gender, marital status, occupation and level of education.
2. To determine association between HIV and orthopaedic trauma conditions.

3. To determine awareness of HIV serostatus amongst orthopedic trauma patients.

CHAPTER 4: MATERIALS AND METHODS

4.1: Study Design

This study was a cross sectional study.

4.2: Study Setting

This cross sectional study was conducted at Kenyatta National Hospital Orthopaedic Wards. KNH is a metropolitan, tertiary, teaching and referral hospital situated at Upper Hill area, along Hospital Road about 5km from Nairobi city Centre. KNH has a 2000 bed capacity with the orthopaedic wards having a capacity of approximately 300 patients. KNH is a major referral hospital serving East and Central Africa.

4.3: Methodology

Patients were recruited from the orthopaedic wards. Patient's cognitive function was assessed by the Glasgow coma scale (GCS) score and documented to be 15/15. Those below 15 were not recruited.

The aims and need for the study were explained to the patient and pre-counseling for HIV testing done.

Wish to know or be blinded to the results was discussed with the patient.

Those who accept signed a consent form and blood sample of 1ml was taken.

Samples were analyzed by a rapid HIV test.

The patients who tested positive and had expressed the wish to know the results were counseled again then referred to CCC for follow up.

4.4: Inclusion criteria

-Orthopaedic trauma patients 18 years and above whom were fully conscious.

4.5: Exclusion criteria

-Patients below 18 years of age.

-Patients with a GCS below 15.

- Patients who declined to consent.

4.6: Sample size calculation

The adult orthopaedic wards have approximately 300 patients in total with new admissions of approximately 200 patients per month for all the 3 wards. About 90% of these patients have trauma conditions. The recruitment period was 3 months, giving us a population of approximately 900 orthopaedic trauma patients in 3 months.

Yamane formula was used to estimate the study population size.

$$\mathbf{n = N/1+N(e)^2}$$

Where: n is the sample size.

: N is the population size.

: e is the desired level of precision (i.e. the margin of error).

$n = 900/1+900(0.05)^2$

$= 900/1+900(0.0025)$

$= 900/1+2.25$

$= 900/3.25$

$= 276.9$

n = 277.

4.7: Data collection

Approval to carry out the study was sought from the Kenyatta National Hospital and University of Nairobi Ethics, Research and Standards Committee (KNH/UON ERC).

Once the relevant approval to carry out the study was obtained patients who met the eligibility criteria and provided written informed consent were enrolled into the study. This was terminated upon fulfilling the desired sample size.

Patients were recruited in to the study from the KNH orthopaedic wards.

Systematic random sampling technique was used to select patients who were in the ward and on every admission.

Patient's cognitive function was assessed using the GCS score and documented for those with 15/15. Aims and need for the study were explained to the patient. Pre-counseling was done. A wish to know or be blinded to the results was discussed with the patient and documented. The lead researcher collected demographic information of the patient and which orthopaedic trauma condition they were being treated for. Blood sample was taken and a rapid HIV test done and data recorded on questionnaire forms.

Names were not recorded; instead a study number was assigned.

4.8: Data management and analysis

Upon collection via questionnaires, data was verified to ensure accuracy then entered in to an excel work sheet. Final dataset was transferred to SPSS version 25.0 for analysis. Demographics and orthopaedic trauma diagnosis of the sample population was analyzed descriptively by presenting count and frequency data. Seroprevalence of HIV was calculated and presented as a proportion. Prevalence in the individual orthopaedic trauma conditions was presented. Study findings were presented in tables and charts.

4.9: Ethical considerations

Approval to carry out this study at KNH was sought from the University of Nairobi Department of Orthopedic Surgery and Kenyatta National Hospital, Ethics Research and Standards Committee (KNH/UoN-ERC). Patients recruited into the study gave a written informed consent after the details of the study had been explained to them. The aims and needs of the study plus its methods were explained to the patients in the language that they understood best.

For those who were not conversant with English or Kiswahili languages translation was sought.

All the data obtained was kept in the principal investigators possession at all times and subsequently entered into a password protected Microsoft Excel document after data coding.

Study limitations

-Low recruitment rate due to HIV stigma.

-HIV window period of 3 months.

-Language barrier.

Delimitations

-Pretest counselling

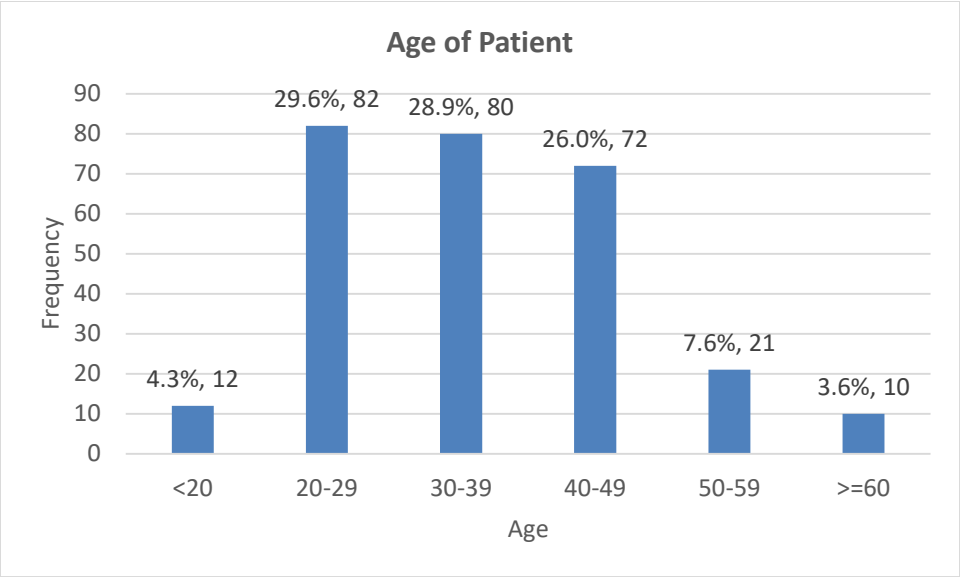
-Translation

CHAPTER 5: RESULTS

Table 1: Patient characteristics

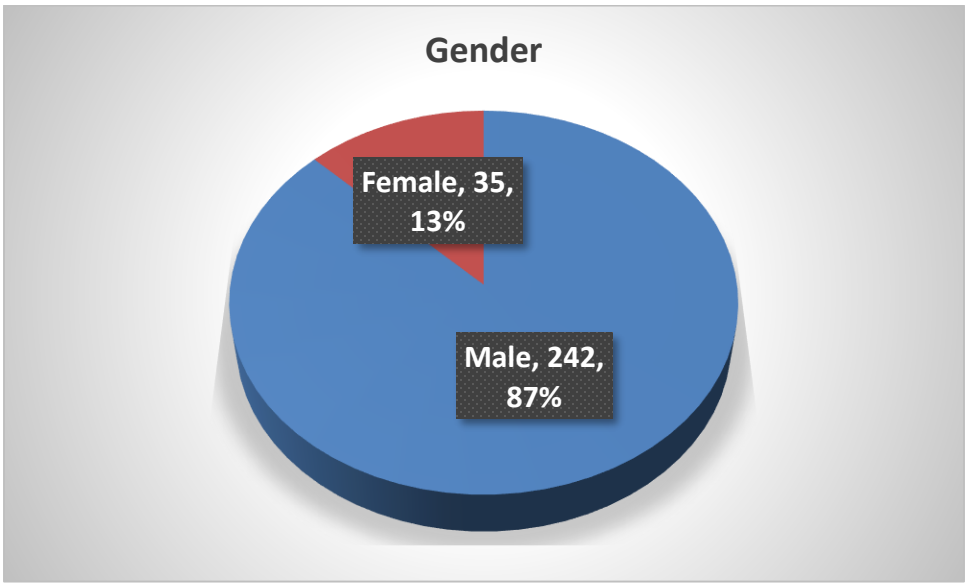
Age	**Frequency n (%)**
<20	12 (4.3)
20-29	82 (29.6)
30-39	80 (28.9)
40-49	72 (26.0)
50-59	21 (7.6)
>59	10 (3.6)
Gender	
Male	242 (87.4)
Female	35 (12.6)
Marital Status	
Married	173 (62.5)
Unmarried	104 (37.5)
Education	
None	5 (1.8)
Primary	116 (41.9)
Secondary	118 (42.6)
Tertiary	38 (13.7)

Figure 1: Age distribution chart



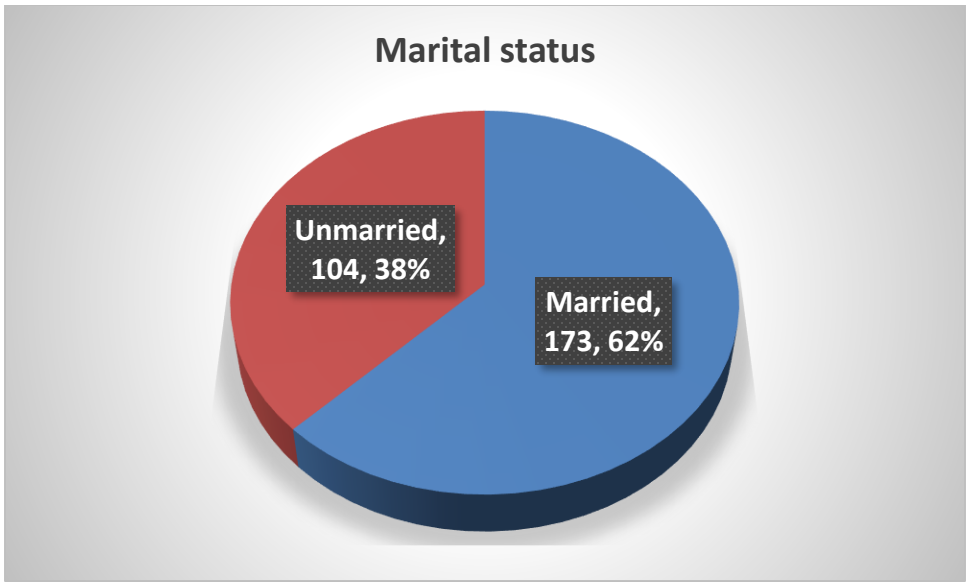
The mean age of the patients was 36.0 (SD=11.6) years (range 18-72years), while the median age was 34.0 (IQR=16) years. Majority were in the 20-29 age group (29.6%), followed by the 30-39 age group (28.9%) and the 40-49 age group (26.0%).

Figure 2: Sex distribution



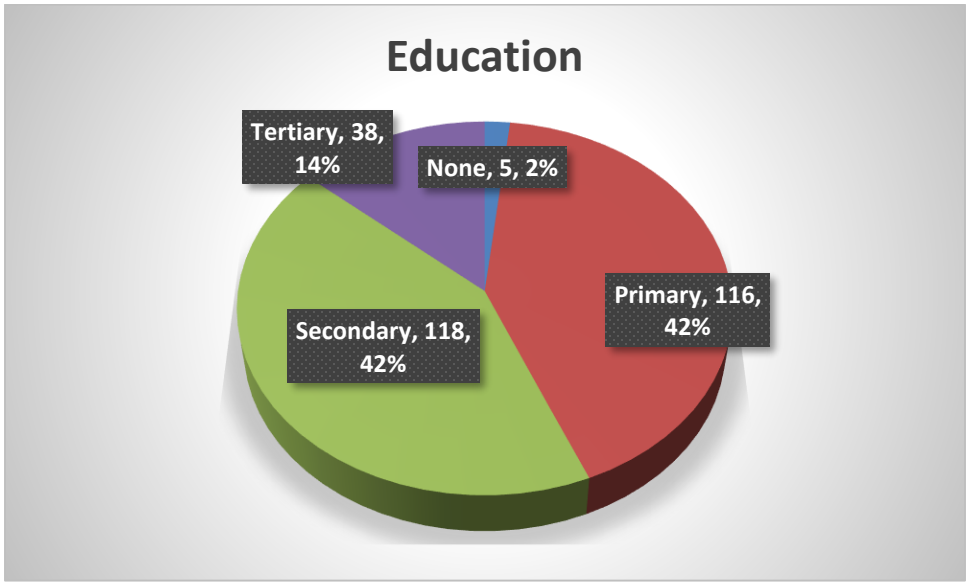
Majority of the participants were males (87.4%), with a male to female ratio of 6.9:1.

Figure 3: Marital status.



Of the 277 participants, 173 (62.5%) were married while 104 (37.5%) were unmarried.

Figure 4: Level of education



Majority of the participants had attained secondary school level of education (42.6%) followed closely by those who had attained only primary school level of education (41.9%).

Table 2: Diagnosis for all patients

Diagnosis	Frequency
Upper limb	20 (7.2)
Lower limb	160 (57.8)
Pelvic	36 (13.0)
Spine	2 (0.7)
Polytrauma	59 (21.3)

Most of the study participants were being managed for lower limb injuries (57.8%), followed by polytrauma (21.3%) and pelvic injuries (13.0%).

Table 3: Mechanism of Injury

Mechanism of Injury	Frequency	Percent
Assault	23	8.3
Cut by sharp object	3	1.1
Gunshot wound	5	1.8
History of fall	65	23.5
Hit by an object	10	3.6
Machine injury	4	1.4
Road traffic accident	167	60.3

60.3% of the participants sustained injury from road traffic accident followed by fall (23.5%) then assault (8.3%).

Table 4: Road Traffic Accident

	Frequency	Percent
Motorbike passenger	21	12.6
Motorbike rider	36	21.6
Pedestrian	75	44.9
Vehicle driver	10	6
Vehicle Passenger	25	15

Of the 167 that were involved in road traffic accidents, majority (n=75 (44.9%)) were pedestrians, Followed by motorbike riders (n=36 (21.6%)).

Association between Sociodemographic Characteristics and HIV

This section presents the results of the association between HIV and age, gender, marital status, occupation and level of education.

Table 5: Association between Sociodemographic Characteristics and HIV

	Positive	Negative	Total	OR (95% CI)	p-value
Age					
<20	1 (3.7)	11 (4.4)	12 (4.3)	0.8 (0.1-6.8)	0.866
20-29	2 (7.4)	80 (32.0)	82 (29.6)	0.2 (0.04-0.7)	**0.008**
30-39	9 (33.3)	71 (28.4)	80 (28.9)	1.3 (0.5-2.9)	0.591
40-49	10 (37)	62 (24.8)	72 (26)	1.8 (0.8-4.1)	0.168
50-59	3 (11.1)	18 (7.2)	21 (7.6)	1.6 (0.4-5.8)	0.440
>59	2 (7.4)	8 (3.2)	10 (3.6)	2.4 (0.5-11.9)	0.248
Gender					
Male	19 (70.4)	223 (89.2)	242 (87.4)	0.3 (0.1-0.8)	**0.005**
Female	8 (29.6)	27 (10.8)	35 (12.6)		
Marital status					
Married	17 (63.0)	156 (62.4)	173 (62.5)	1.0 (0.4-2.3)	0.954
Unmarried	10 (37.0)	94 (37.6)	104 (37.5)		
Education					
Primary and below	13 (48.1)	108 (43.2)	121 (43.7)	1.2 (0.5-2.7)	0.622
Secondary and above	14 (51.9)	142 (56.8)	156 (56.3)		
Occupation					
Formal	1 (3.7)	27 (10.8)	28 (10.1)	0.3 (0.04-2.3)	0.245
Informal	26 (96.3)	223 (89.2)	249 (89.9)		

Out of the 277 study participants, 27 (9.7%) tested positive for HIV. 10 (37%) of the HIV positive participants were in the 40-49 age group, 9 (33.3%) were in the 30-39 age group, 3 (11.1%) from the 50-59 age group, 2 (7.4%) from the 20-29 age group, 2 (7.4%) were above 59 and 1 (3.7%) was below 20 years. Males who tested positive were 19(70.4%) while women were 8(29.6%). Majority of those who tested positive (13(48.1%)) had primary school level of education, followed

by 11(40.1%)) who had secondary level and 3(11.1%) who had tertiary level of education. Out of the 27 HIV positive participants, 26 were from the informal sector while only 1 was from the formal sector.

Association between HIV and specific Orthopaedic Trauma Conditions

This section presents the results of the association between HIV and specific orthopaedic trauma conditions.

Table 6: Association between HIV and Orthopaedic Trauma Conditions

	Positive	Negative	Total	OR (95% CI)	p-value
Diagnosis					
Upper limb	2 (7.4)	18 (7.2)	20 (7.2)	1.0 (0.2-4.6)	0.968
Lower limb	16 (59.3)	144 (57.6)	160 (57.8)	1.1 (0.5-2.5)	0.868
Spinal cord injury	5 (18.5)	31 (12.4)	36 (13.0)	1.6 (0.6 -4.5)	0.369
Pelvic	0 (0.0)	2 (0.8)	2 (0.7)	-	0.641
Polytrauma	4 (14.8)	55 (22.0)	59 (21.3)	0.6 (0.2-1.8)	0.346

Most HIV positive participants had injuries on the lower limbs 16 (59.3%). 5 (18.5%) had spinal cord injuries, 4 (14.8) had sustained polytrauma while 2 (7.4%) had upper limb injuries.

Awareness of HIV Serostatus amongst Orthopaedic Trauma Patients

This section presents the objective to determine awareness of HIV serostatus amongst orthopaedic trauma patients.

Table 7: awareness of HIV serostatus amongst orthopedic trauma patients.

	Frequency	Percent
Aware of HIV status		
Yes	247	89.2
No	30	10.8
If Yes,		
Positive	20	8.1
Negative	227	91.9
HIV status		
Positive	27	9.7
Negative	250	90.3

247(89.2%) of all participants were aware of their HIV status prior to the test while 30(10.8%) were not. 20(74.1%) of the HIV positive participants were aware of their HIV status prior to the study while 7(25.9%) were newly diagnosed. 227(90.8%) of the HIV negative participants knew of their HIV status prior to the study.

CHAPTER 6: DISCUSSION

The prevalence of HIV amongst orthopaedic trauma patients in KNH was found to be 9.7% which is approximately twice the prevalence of the general population which stands at 4.8% (8,12). This proportion is largely similar to other previous studies done by on seroprevalence of HIV amongst trauma and orthopaedic patients in general (2,3,14,15).

6.1: HIV and Demographics

Majority of the HIV positive patients were in the 40-49 years age group (37%) followed closely by the 30-39 Years age group (33.3%). Those below 20 years of age were only 3.7%. This is most likely due to the continued decline in the incidence of new HIV infections in Kenya which stood at 0.35% in 2010 and reduced to 0.19% in 2017 (12). A 48% decline in the number of AIDS related deaths between 2010 and 2017 could also contribute to the HIV positive patients being in the older age group. This decline is mainly attributed to the improved access of cART in the country since the roll out of free ARVs in 2003 hence an improved life expectancy of the HIV positive patients (12).

Most (87.4%) of our study participants were males. This proportion is largely similar to previous studies on HIV in trauma. We attribute this to males being involved in activities like construction and transport that puts them at a higher risk of undergoing trauma. Of all the patients who tested positive, 70.4% were males which reflects the higher number of males who participated in the study.

Incidence of HIV amongst the female patients recruited in to the study was 29.6% which was very high compared to the male patients which stood at 0.09. We attribute this to the higher incidence of HIV in the general population for females (6.2%) as compared to the males (3.5%). Women face discrimination in terms of access to education, employment and healthcare. As a result, men often dominate sexual relationships, with women not always able to practice safer sex even when they know the risks (8).

HIV was more common amongst married people (63%) than amongst the unmarried (37%).

HIV was more common among individuals in the informal sector than in those in the formal sector. This matches previous studies which have shown HIV to be more common among those of poor socio-economic status (11,12).

Individuals with primary school level of education had the highest prevalence (48.1%). It matches other studies that have identified education as a common social vaccine against contracting HIV, resulting in the more educated less likely to be infected (Baker, David Multiple Effects of Education on Disease: The Intriguing Case of HIV/AIDS in Sub-Saharan Africa). This could be explained by the level of understanding of the disease and prevention measures that should be taken to avoid contracting and spreading the disease.

6.2: HIV and Orthopaedic Trauma Conditions and Mechanism of Injury

There was proportional association between HIV and specific orthopaedic conditions. Majority (57.8%) of our study participants were being managed for lower limb injuries and this group had the highest number of seropositive participants at 16 (59.3%). This was followed by spinal cord injury participants who were 33 (11.9%) and 5 (18.5%) were seropositive. Orthopaedic conditions with higher incidence of participants had a higher HIV seroprevalence and vice versa. We did not come across another study for comparison that tried to determine the association between HIV and orthopaedic trauma conditions.

The main mechanism of injury in our study was road traffic accident at 60.3% followed by history of fall at 23.5%. This differs from other studies which found assault to be the leading cause of injury followed by road traffic accidents (22, 23). Amongst the road traffic accident group, majority were pedestrians. This is similar to a study done by ministry of health on stepwise survey for non-communicable diseases risk factors in Kenya in 2015 (22)

6.3: HIV Serostatus Awareness

Most of the study participants 89.2% were aware of their HIV status prior to the study. This reflects the increased awareness of HIV status in Kenya which was 73% of young females and 82% of young males in 2014. This was a rise from 48% of young females and 55% of young males in 2008. This can be explained by HIV education being introduced as part of the school learning program since 2003 (13,49).

CHAPTER 7: CONCLUSION

The HIV seroprevalence of 9.7% amongst orthopaedic trauma patients at a tertiary referral hospital in Kenya is relatively high and approximately double the HIV seroprevalence of the general population (4.8%). This carries an increased lifetime risk of seroconversion to the orthopaedic surgeons attending to this population.

The number of male orthopaedic trauma patients who are seropositive is higher than that of females but the incidence in female orthopaedic trauma patients is very high.

Informal sector had majority of the cases compared to the formal sector and marriage posed a bigger risk for HIV seropositivity.

The seroprevalence is higher in the older adults as compared to the younger adult orthopaedic trauma population.

HIV status awareness among the orthopaedic trauma patients is relatively high at 89% which is higher than in the general population.

CHAPTER 8: RECOMMENDATIONS

We recommended that all orthopaedic trauma patients be tested for HIV serostatus at admission and that the HCWs should be provided with protective measures like orthopaedic gloves and protective eye wear while attending to this patients to help minimize the cumulative lifetime risk of seroconversion.

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APPENDIX A: DATA COLLECTION SHEET

DEMOGRAPHIC DATA

Date…….

Study Number…….

Age……

Gender 1 Male 2 Female

Marital Status 1 Married 2 Unmarried

Diagnosis……

Mechanism of Injury…….

Occupation…….

Level of Education…….

Is patient Aware of HIV Status

- 1.yes
- 2.No

If yes above, what is the HIV status.

- Negative
- Positive

HIV test Results

- Negative
- Positive

If test above is positive, was the patient aware they were positive prior to the test.

- Yes
- No

APPENDIX B: PARTICIPANT INFORMATION CONSENT FORM

ENGLISH

HIV seroprevalence in orthopaedic trauma patients at a tertiary referral hospital in Kenya.

Principal Investigator: Dr. Rigicha Michael Thuo.

Introduction:

I would like to tell you about a study being conducted by the above listed researchers. The purpose of this consent form is to give you the information you will need to help you decide whether or not to be a participant in the study. Feel free to ask any questions about the purpose of the research, what happens if you participate in the study, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear. When we have answered all your questions to your satisfaction, you may decide to be in the study or not. This process is called 'informed consent'. Once you understand and agree to be in the study, I will request you to sign your name on this form. You should understand the general principles which apply to all participants in a medical research: i) Your decision to participate is entirely voluntary ii) You may withdraw from the study at any time without necessarily giving a reason for your withdrawal iii) Refusal to participate in the research will not affect the services you are entitled to in this health facility or other facilities. We will give you a copy of this form for your records.

May I continue? YES / NO

This study has approval by The Kenyatta National Hospital-University of Nairobi Ethics and Research Committee protocol No. _____

What is this study about?

The researcher listed above is interviewing individuals who are being managed for orthopaedic trauma conditions. The purpose of the interview is to find out the prevalence of HIV amongst the orthopaedic trauma patients. Participants in this research study will be asked questions about their bio data, occupation, level of education and HIV status. Participants will also have the choice to undergo a HIV test.

There will be approximately 277 participants in this study randomly chosen. We are asking for your consent to consider participating in this study.

What will happen if you decide to be in this research study?

If you agree to participate in this study, the following things will happen:

You will be interviewed by a trained interviewer in a private area where you feel comfortable answering questions. The interview will last approximately five (5) minutes. The interview will cover topics such as your age, marital status, how you sustained the injury and your HIV status.

After the interview has finished, a blood sample will be taken and a rapid HIV test conducted.

We will ask for a telephone number where we can contact you if necessary. If you agree to provide your contact information, it will be used only by people working for this study and will never be shared with others. The reasons why we may need to contact you include: Counseling you and referring you to the Comprehensive Care Centre (CCC) should the HIV test turn out positive and you had requested result to be disclosed to you.

Are there any risks, harms discomforts associated with this study?

Medical research has the potential to introduce psychological, social, emotional and physical risks. Effort should always be put in place to minimize the risks. One potential risk of being in the study is loss of privacy. We will keep everything you tell us as confidential as possible. We will use a code number to identify you in a password-protected computer database and will keep all of our paper records in a locked file cabinet. However, no system of protecting your confidentiality can be absolutely secure, so it is still possible that someone could find out you were in this study and could find out information about you.

Also, answering questions in the interview may be uncomfortable for you. If there are any questions you do not want to answer, you can skip them. You have the right to refuse the interview or any questions asked during the interview.

You may feel some discomfort when a blood sample is being taken and you may have a small bruise or swelling in your finger. In case of an injury, illness or complications related to this study, contact the study staff right away at the number provided at the end of this document. The study staff will treat you for minor conditions or refer you when necessary.

Are there any benefits being in this study?

You may benefit by receiving free counseling and free HIV testing. We will refer you to the Comprehensive Care Centre (CCC) for follow up and support where necessary. Also, the information you provide will help us better understand the relationship between HIV and orthopaedic trauma. This information is a contribution to science and health care workers

safety.

Will being in this study cost you anything?

Participating in this study will not cost you any finances.

What if you have questions in future?

If you have further questions or concerns about participating in this study, please call or send a text message to the study staff at the number provided at the bottom of this page.

For more information about your rights as a research participant you may contact the Secretary/Chairperson, Kenyatta National Hospital-University of Nairobi Ethics and Research Committee Telephone No. 2726300 Ext. 44102 email uonknh_erc@uonbi.ac.ke.

The study staff will pay you back for your charges to these numbers if the call is for study-related communication.

What are your other choices?

Your decision to participate in research is voluntary. You are free to decline participation in the study and you can withdraw from the study at any time without injustice or loss of any benefits.

CONSENT FORM (STATEMENT OF CONSENT)

Participant's statement

I have read this consent form or had the information read to me. I have had the chance to discuss this research study with a study counselor. I have had my questions answered in a language that I understand. The risks and benefits have been explained to me. I understand that my participation in this study is voluntary and that I may choose to withdraw any time. I freely agree to participate in this research study.

I understand that all efforts will be made to keep information regarding my personal identity confidential.

By signing this consent form, I have not given up any of the legal rights that I have as a participant in a research study.

I agree to participate in this research study: Yes No

I agree to have (define specimen) preserved for later study: Yes No

I agree to provide contact information for follow-up: Yes No

Participant printed name: _____

Participant signature / Thumb stamp _____ Date _____

Researcher's statement

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and haswillingly and freely given his/her consent.

Researcher's Name: _____ Date: _____

Signature _____

Role in the study: _____

For more information contact

Dr. Rigicha Michael Thuo at **0720752469**

From 8:00am to 5:00pm.

P.O.Box: 67916 (00200) Nairobi

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APPENDIX C: FOMU YA IDHINI

Kichwa: UTAFITI KUGUNDUA IDADI YA WAGONJWA WAMIFUPA AMBAO WAKO NA VIRUSI VYA UKIMWI KATITA HOSPITALI KUU YA KENYATTA.

Nambari ya utafiti:

Mtafiti Mkuu: Dk Rigicha Michael Thuo MBChB
Mwanafuzi wa Orthopedic, Chuo Kikuu cha Nairobi
Nambari ya simu: - 0720752469

1. Wasimamizi:
DR. E. M GAKUYA
CHUO KIKUU CHA NAIROBI

2. DR. G. K MUSEVE
CHUO KIKUU CHA NAIROBI

Utangulizi
Katika nchi za kipato cha chini na katikati , mzigo wa ugonjwa wa virusi vya ukimwi uko katika hali ya juu sana. Madaktari wako katika hatari ya kuambukizwa virusi vya ukimwi wanapohudumia wagonjwa ambao wako na maumivu ya mifupa na virusi vya ukimwi. Idadi ya wagonjwa waliona maumivu ya mifupa na wangali na virusi vya ukimwi, imegunduliwakuwa juu katika maeneo mengine. Idadi ya wagonjwa hawa hapa nchini mwetu haijulikani.

Kusudi la Utafiti

Utafiti huu utatumia data juu ya idadi ya wagonjwa wa mifupa ambao wako na virusi vya ukimwi kuwawezesha wafanyi kazi wa afya kujilinda zaidi wanapohudumia hawa wagonjwa.

Uchaguzi wa washiriki
Wagonjwa wenye majeraha ya mifupa; umri wa miaka 18 au zaidi wanaalikwa kushiriki katika utafiti huu.

Kushiriki kwa hiari na Haki ya Kukanusha
Ushiriki wako katika utafiti huu ni kwa hiari na hakuna malipo au fidia itatolewa kwa washiriki wa utafiti. Ni uchaguzi wako kushiriki au la. Ikiwa unachagua kushiriki au la,

huduma zote unazozipata zitaendelea na hakuna chochote kitabadilika. Ikiwa unachagua kushiriki katika mradi huu wa utafiti, bado utatolewa matibabu ambayo hutolewa mara kwa mara katika hospitali hii.

Muda
Utafiti unafanyika kwa kipindi cha miezi mitatu. Wakati huo tunahitaji dakika 15 tu ya muda wako kukusanya habari kutoka kwako.

Taratibu
Utafiti huu utafanyika kwa kutumia dodoso la awali la washiriki.

Kuhifadhi faragha na siri
Msaidizi ataweka habari zote kuhusu wewe salama. Jina lako litatolewa kwenye kumbukumbu zote zinazohusika katika utafiti. Nambari itatumiwa kwenye dodoso la utafiti badala yake. Wafanyakazi wa mradi tu watapata upatikanaji wa data ya utafiti. Hutatumia jina lako tunaporipoti matokeo ya utafiti.

Matatizo au maswali
Ikiwa una maswali yoyote kuhusu utafiti huu au kuhusu matumizi ya matokeo, unaweza kuwasiliana na mchunguzi mkuu, Dr. Rigicha Michael Thuo kwa wito 254720752469.
Ikiwa una maswali yoyote juu ya haki zako kama mshiriki wa utafiti unaweza kuwasiliana na Profesa Chindia M.L, katibu, KNH / UoN- ERC kwa kupiga simu Tel. 2726300, ext. 44102, Nairobi.

HATI YA RUHUSA
Nimesoma taarifa iliyotangulia, au imesomewa. Nimekuwa na fursa ya kuuliza maswali kuhusu hilo na maswali yoyote niliyokuwa nayo yamejibiwa kwa kuridhika kwangu. Mimi _____najitolea kwa hiari kushiriki kama katika utafiti huu.

Jina la Mshiriki _____ Jina la Mtafiti: Dr. Rigicha Michael Thuo
Saini ya Mshiriki _____ Watafiti Saini _____

Tarehe _____ Tarehe _____

Nani wa Kuwasiliana
Ikiwa una maswali yoyote unaweza kuwauliza sasa au baadaye, hata baada ya utafiti kuanza. Ikiwa unataka kuuliza maswali baadaye, unaweza kuwasiliana na yoyote yafuatayo: Ninaelewa kwamba ikiwa nina maswali kuhusu utafiti huu au haki zangu katika kuitumia, nitawasiliana na Dr Rigicha Michael Thuo kwenye 0720752469 au Profesa Chindia ML, Katibu, KNH / UoN- ERC, Simu. 2726300, ext. 44102, Nairobi.

APPENDIX D: Time line of study

	Proposal Writing	Proposal Presentation	Submission for Ethical Approval	Data Collection	Data Analysis	Dissertation Writing
FEB 2019						
MAR 2019						
APR 2019						
MAY 2019						
JUN 2019						
JUL 2019						
AUG 2019						
SEP 2019						
OCT 2019						
NOV 2019						
DEC 2019						
JAN 2020						
FEB 2020						

APPENDIX E: BUDGET

ITEM	QUANTITY	UNIT COST	TOTAL			
Printing			3,000			
KNH/UON research fee			2,500			
HIV Tests	277	100	27,700			
Research Assistant	12 weeks	2,000	24,000			
Statistician	1	30,000	30,000			
Stationary			3,000			
Miscellaneous			10,000			
TOTAL			**100,200**			