ASSESSMENT OF THE TUBERCULIN SKIN TEST POSITIVITY RATE AMONG STUDENTS OF INTERNATIONAL HEALTH SCIENCES UNIVERSITY

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DECLARATION

I Kabera Michael do declare that this research dissertation submitted to the institute of Allied Health sciences is my original work and has never been submitted by another scholar to any other University or institution of higher learning for any award. The information from other sources, authors have been acknowledged.

Signature……..……. Date…….

APPROVAL

This research report done by KABERA MICHAEL Reg. No. 2014-BMLS-FT-009, pursuing a bachelor's degree of Medical laboratory Sciences has been compiled and submitted for examination under my supervision.

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Date.....

DEDICATION

This work was dedicated to my family especially my wife Matovu Majorine, Daughter Kayitesi Myrah as well as my brothers Stephen Nizeyimana, Didas Niyigaba, Innocent Tugume, Mathias Munyantwari and Sisters Rose Niyonshuti and Nirere Gloria.

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I am very grateful to the Almighty God for giving me life, wisdom and the strength to carry on even at times I felt like I could not do it anymore up to this level.

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DEFINITION OF TERMS

Indulations: Palpable, raised and hardened area across the fore arm perpendicular to the long axis of the fore arm.

Latent tuberculosis infection: An individual has been exposed to *Mycobacterium tuberculosis* bacilli but does not have active tuberculosis.

Nosocomial infections: these are hospital acquired infections like TB, Pneumonia and salmonellosis.

Anergy: Refers to tolerance mechanism in which the lymphocyte is intrinsically functionally inactivated following an antigen encounter, but remains alive for an extended period of time in a hypo responsive state.

Booster phenomenon: Refers to a positive reaction to a subsequent TST for previously negative individuals due to stimulation of their ability to react to the TST by previous inoculations.

Hypersensivity: Refers to undesirable reactions produced by the normal immune system, including allergies and autoimmunity.

LIST OF ABBREVIATION

TST	Tuberculin Skin test
LTBI	Latent tuberculosis infection
PPD	Purified protein derivative
ATB	Active Tuberculosis
AFB	Acid fast bacilli
BCG	Bacillus Calmette-Guérin
CDC	Centers for disease control
CXR	Chest X-ray
EPTB	Extra Pulmonary tuberculosis
DM	Diabetes mellitus
HIV	Human immune deficiency virus
cART	Combination Anti-Retroviral Therapy
AIDS	Acquired Immuno deficiency syndrome
SPARK	Slum Partnerships to Actively Respond to Tuberculosis
IHSU	International Health Sciences University
NTLP	National Tuberculosis and Leprosy Program
CKD	Chronic Kidney Disease
EEA	European Economic Area
IL	Interleukin

ABSTRACT

Back ground: TB latency has created a serious hindrance to Global TB control. The Tuberculin skin test (TST) can be used to detect Latent tuberculosis infection (LTBI) and appropriately inform TB control programs. The main objective of this study was to at assess the Tuberculin skin test (TST) positivity rate among all IHSU students.

Methods: A cross sectional research study design was used to assess the positivity rate of tuberculin skin among students at International Health Sciences University (IHSU) in August 2018. 0.1ml of Purified protein derivative (PPD) was intradermally introduced on long axis of the fore arm. An induration of ≥5 mm diameter was taken to be positive. Univariate and multivariate method were used to assess the risk factors associated with LTBI.

Results: A total of 205 participants were sampled for TST test. The TST positivity rate was years (Z= 2.96, P=0.023) courses of Laboratory (Z= 3.12, P=0.002) and Nursing (Z= 2.21, P=0.027) long time of clinical placement for more than four months (Z= 3.81, P=<0.001) and smoking (Z= 3.97, P=<0.001).

Conclusion and recommendations: Tuberculin skin test positivity rate among IHSU students was lower than the studies around Kampala and male students were more affected than girls. The risky factors were associated with a positive LTBI were age, course, duration of placement and smoking. This suggests that health care providers should put on protective equipment like N95 masks, work under Biosafety cabinets and carry out routine screening test for LTBI. Those found positive be advised to do further tests like Zeihl Neelsen, Chest X-ray and culture and sensitivity

Keywords: Latent tuberculosis infection, Tuberculin skin test and TB control.

CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter contained information about Back ground, Problem statement, Objectives, Research questions, significance and conceptual frame work of the study.

1.1 Background

Tuberculin skin Test (TST) positivity is a measure by size of induration the level of TB infection among patients. A positive Tb skin test or TB blood test only identifies that a person has been infected with TB bacteria but doesn't tell whether the person has latent TB infection (LTBI) or has progressed to TB disease. Other tests such as a chest x-ray and sputum sample are needed to see whether the person has TB disease. A positive TST/Purified protein derivative (PPD) in a person who received BCG vaccine is interpreted as latent TB infection (LTBI)(Collins, Geadas and Ellner, 2016).

Tuberculosis is an infectious disease caused by bacillus *Mycobacterium tuberculosis*(Dagnew *et al.*, 2012). It mainly affects lungs through inhalation of tubercle bacillus although extra pulmonary tuberculosis occurs as well as latency(Houben and Dodd, 2016). Most of the bacilli get trapped in the upper airways and expelled by ciliated mucosal cells. A small fraction generally (<10%) finds its way to alveoli and remain viable with little replication leading to latent tuberculosis. However, these progress to active tuberculosis when the host's defense system weakens (Jane and Mbchb, 2014 and Lee, 2016).

Global report shows that 9.6 million new TB cases occur and 1.5 million people die annually especially in Africa and South East Asia (WHO, 2015). Tb ranks the 2nd leading cause of mortality and morbidity (6.0-15%) both in middle and low income countries where Uganda is among (Heunis *et al.*, 2017,WHO, 2013 and (Kizza *et al.*, 2015).Despite the efforts to reduce death rate due TB, its challenge remains high in poor communities with China , India and Saharan Africa taking the lead due to HIV infection, multidrug resistance and poor health facilities (WHO, 2017 and Zumla *et al.*, 2015).

Reports have shown that latent tuberculosis infection (LTBI) occurs among all age groups including infants, children and adults although prevalence increases with age from (36-65 years). Geographical conditions also have a role in the distribution where the template regions of USA and Europe are less affected(Florence N. Kizza *et al.*, 2015). In medical students, majority (49.5%) of active tuberculosis develop from latent tuberculosis from the first

exposure when they become immune suppressed(Andrews *et al.*, 2012 (Devasahayam J Christopher *et al.*, 2011). About 2.6 million people worldwide have LTBI that possess a big reservoir of individuals (5-10%) at risk of progression to active TB disease majority within the first two years of exposure (Basera, *etal.*, 2017).

Detection of TB is through microscopy chest x-ray and gene expert (Rose *et al.*, 2012 and E. Oren *et al.*, 2016). However, for latent tuberculosis, individuals are asymptomatic and thus use of serological methods is paramount. Several tests have been developed including interferon gamma release assay, quinterferon tube and physical examination with performance differences(Verhagen *et al.*, 2014). The tuberculin skin test is cheap, quick and thus has largely been employed in screening for exposure to TB even with no signs and symptoms. The test uses a sensitivity of (99.9%) and specificity of (92.7%) (Mancuso *et al.*, 2017)Latent tuberculosis infection (LTBI) transmissibility for tuberculosis remains a great challenge to the global infectious diseases especially in the developing countries in Saharan Africa(Houben and Dodd, 2016). Although are measures to prevent and treat latent tuberculosis infection have been advanced, the latency phase has remained difficult to deal with since it leads to active tuberculosis especially in developing world like Uganda(Song *et al.*, 2014). As population worldwide increases the frequent interaction takes place especially in highly densely populated areas like China, Russia, India, south Korea, the risk of exposure increases and is catalyzed by reduced immunities especially HIV / AIDS, iv drug users like steroid, cocaine as LTBI progresses to active tuberculosis (Getahun *et al.*, 2015)

Many medical students in their trainings and health workers are at a risk of acquiring the infection from their schools as well as hospitals where they are attached to get hands on experiences. Since the presentation of LTBI in asymptomatic form poses a risk to the community in case they turn into active patients. Latent tuberculosis infection among Medical students in USA and Western Europe ranges from (4.0%-4.4 %) especially among immigrants. On the other hand, Latent tuberculosis infection in Africa and Asia ranges from (27.0%-58.0%) due to poor preventive and intervention measures (Horsburgh and Rubin, 2011)

1.2 Statement of the problem

Latent stage of TB has for long remained a major challenge to deal with in control of the TB epidemic. This is mainly attributed to being asymptomatic but also difficult to diagnose(Durando *et al.*, 2015). Developing active TB is common among those with LTBI (5-10%) within 5 years of exposure and no intervention has been sought (Ai *et al.*, 2016 and Zenner *et al.*, 2017). There are several methods of diagnosing TB that include microscopy, culture, radiology and molecular methods routinely used. The sensitivity of these methods is negligible in detecting latent TB (WHO, 2012 and WHO, 2014).The Tuberculin skin test has for long been used to assess for latent TB and those exposed have been initiated on anti TB prophylaxis (CDC, 2000). However, the Tuberculin skin test has not been widely used as a choice in diagnosis (Armstrong and Jordan, 2015).

International health sciences university (IHSU) medical students in their levels of clinical placements are exposed to index TB patients. Moreover, they have not yet been acquainted with safety measures to prevent contraction of the disease and yet they randomly mix with non-medical students and increase the spread of infection (Gallegos Morales *et al.*, 2017 and Nasehi *et al.*, 2016). Previous studies have reported a high Latent Tuberculin prevalence of (5.8% to 9.2%) among healthcare students (Durando *et al.*, 2013) compared to (40%) non-medical students (Florence N. Kizza *et al.*, 2015). Therefore this study will recruit all students of IHSU to assess the positivity rate of the tuberculin skin test.

1.3 Objectives

1.3.1 Main objective of the study

To assess the positivity rate and the risk factors associated with tuberculin skin test among IHSU students in August 2018.

1.3.2 Specific objectives

1) To assess the positivity rate of tuberculin skin test among IHSU students in different faculties using purified protein derivative (PPD) in August 2018.
2) To assess the demographic factors associated with a positive to tuberculin skin test among all IHSU students in August 2018.
3) To assess the diseases predisposing to a positive to tuberculin skin test among IHSU students in August 2018.
4) To assess the behavioral practices associated with a positive to tuberculin skin test among IHSU students in August 2018

1.4 Research questions

1) What is positivity rate of tuberculin skin test among IHSU students in different faculties using Purified protein derivative in August 2018?
2) What are the demographic factors associated with a positive to tuberculin skin test among IHSU students in August 2018?
3) What are the diseases predisposing to a positive to tuberculin skin test among IHSU students in August 2018?
4) What are the behavioral practices associated with a positive to tuberculin skin test among IHSU students in August 2018?

1.4.1Significance of the study

The study aimed at assessing of the TST positivity rate among all IHSU students using PDD by manteaux technique and make comparisons of which group of students were more at a risk of exposure. Also the study gave enough information of the quickest method of latent tuberculosis diagnosis and encourages students to put preventive measures during their practical attachments and clinical practice after school to minimize the continuous activation of tuberculosis from Latency stage and cause further spread to the communities outside school and health facilities.

1.4.2 Justification of the study

Many students get exposed to health hazards and nosocomial infections during their stay at the University and clinical placements. This study helped policy makers to make it a prerequisite to screen students before joining training institutions, treat the infected ones and prevent the spread of the infections to health students and the general public. Therefore this

study was worthy to be done since there is need to identify Simple, cheap and most efficient standard operating procedures for early detection of LTBI and stop the spread TB.

1. 5 Conceptual Framework

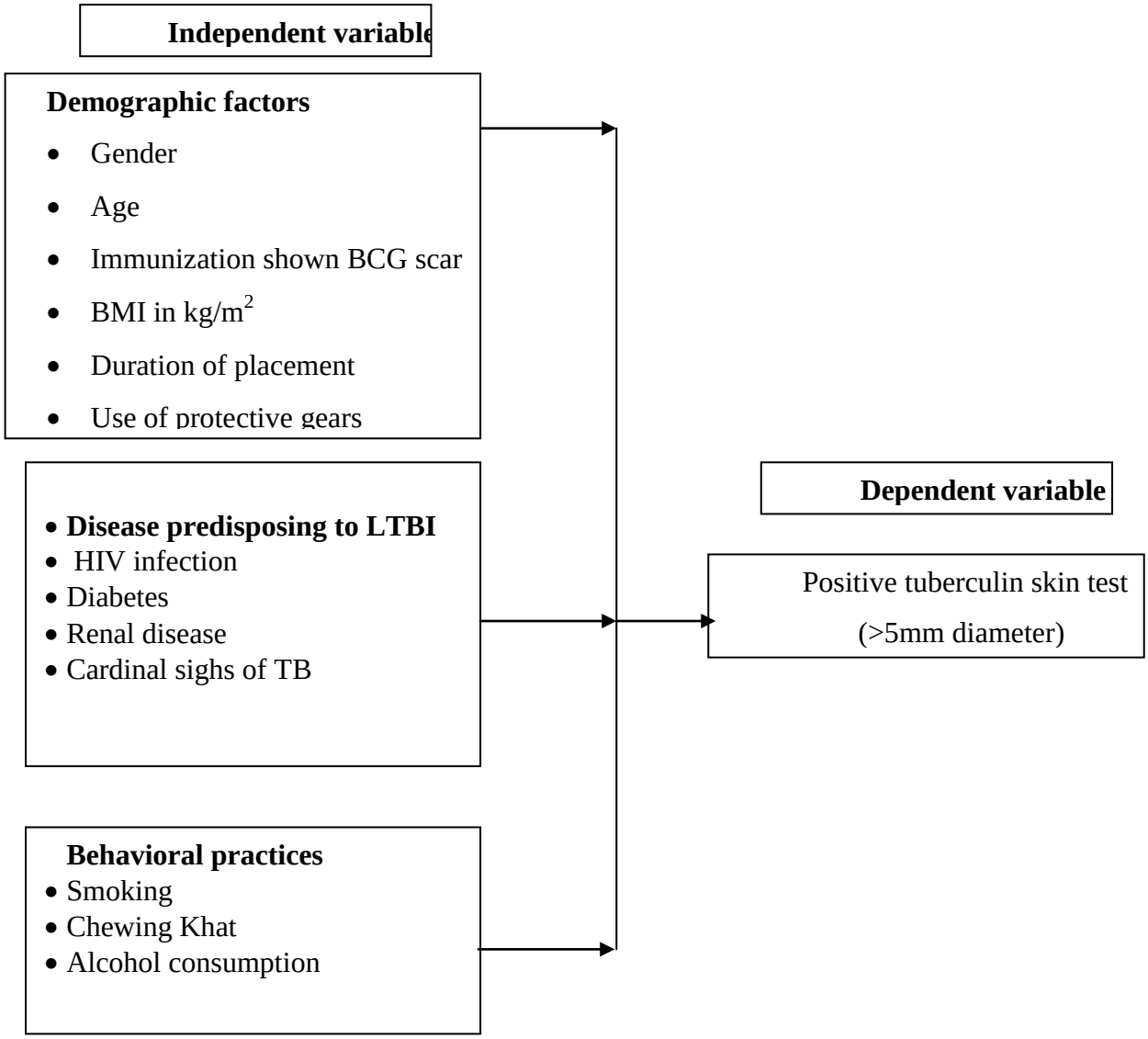


Figure 1: Conceptual framework of the study about the positivity rate and the possible risk factors associated with tuberculin skin test among IHSU students

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter reviewed the previous researches done from the different parts of the World about the positivity rate of the Tuberculin skin test. The risk factors associated with positivity were discussed as well.

2.1 Positivity rate of tuberculin skin test

In United States of America, tuberculin skin test positivity is low and ranges from 4.7%-6.7% among people born in USA but slightly higher (15.9%) among the foreigners(Jewett *et al.*, 2016).The higher rates of infection among immigrants in the USA may be due to the differences in race and ethnicity. These pose a risk of transmission since Immunization and vaccination coverage is poor in the USA yet some students join adult institutions un screened for TB. Students exchange programs has contributed to spread of infection among those who go to high endemic areas of TB like China, Indonesia and Sub Saharan Africa when they come close to close infectious patient (Larsen *et al.*, 2018 and (Buckley *et al.*, 2016). Also vulnerable populations have been found prone to positive TST between 3.0% among Canadian indigenous people and 5.3-6.6% for foreigners. On a good note, positive adherence and compliance to LTBI treatment and use of targeted skin testing for vulnerable populations like students, refuges and homeless people has kept TST positivity low in Canada (Klotz *etal.*, 2012).

Unlike US and Canada, Latin America especially along San Luis US-Mexico border, TST positivity rate is much higher 37.0% 95 % CI: 0.15, 0.61 among medical workers and (24.1%) among non-medical workers. Smoking, general poverty and alcoholism among migrant workers are the associated risk factors for increased TST positivity rate while sharing needles for intravenous drug use, overcrowding, underserved healthcare have promoted infection transmission among the general population (E. Oren *et al.*, 2016).This is higher than the study of Nuevo Leon and Tamaulipas with TST positivity rate at for the community (19%; 95%) (Oren *et al.*, 2015). Seddon *et al.*, (2016) has indicated that TST positivity remains high (52.0%) despite increasing social economic wellbeing of Lima, population increase and multiple BCG vaccination increase reactivity of TST. Also migrant citizens with Un diagnosed and Un treated active TB have caused elevated LTBI. Failure to complete treatment for those who start LTBI Therapy constantly has challenged efforts to know those

at high risk developing Active tuberculosis(Blumberg and Ernst, 2017). Lack of existent screening policies for Latin American countries has contributed to transmission of many infections including LTBI (Perez-Porcuna *et al.,* 2016).

In Western Europe, it has been found out that, TST positivity ranges between (2.7 4.9%) for local students in United Kingdom, Germany and Italy. The low rates have been attributed to strict immigration control measures and screening procedures before students join Universities. However lower incidences have been reported in other developed countries like Japan between 0.7-1.0 % attributed to, good public health welfare through patient talk experience (Ogiwara *et al.,* 2013).Most of indigenous European students have limited exposure to infectious diseases like TB unlike foreigners from high TB endemic areas but positivity increases progressively as students take more time in the Universities due frequent interaction with foreign students and active TB patients (Gallegos Morales *et al.,* 2017). Reactivation of previous LTBI and clinical practice remains a challenge to efforts to stop infection transmission in Europe. Poor implementation of policies to fight infections has caused LTBI (31.4%- 35%) in Portugal(Costa and Silva, 2010).
Research has shown that Paralyzed Health care systems in Eastern Europe and other former Soviet member States like Ukraine has resulted into elevated HIV infections among Students between (4.9%-17.9%). This has caused the high levels of LTBI in Eastern Europe(Raviglione and Sulis, 2016).

Lately, European Union member states have used interventions like restricting border entries like Hungary and Italy, screening and early treatment for those found positive to LTBI(Bonini *et al.,* 2017). Contact tracing , surveillance and follow up those who are TST positive has kept TST low in the region which are lucking in low and middle income countries (Van Der Werf *et al.,* 2016 and Pollock *et al.,* 2012).
Rotational training of students in middle income countries has been associated with TB exposure where only 15.4% of the preclinical students have a positive TST compared to 52.3% of clinical students. Most of the students do not report exposure incidences for intervention and the reaction strength increase as students' progress to upper years compared to new arrivals mostly, Laboratory, nursing and medical sections(Habibi and Hajipour, 2016). It has been found that 0.45-1.6.0% university students are born with HIV and risk of turning positive to TST is high despite early initiation of (Nasreen,*etal.,* 2016 and Zhang *et al.,* 2013).

In North Africa, TST positivity ranges from 13.6%-26%. Relatively low incidences have been attributed to better infection control measures like use of N95 mask for all new students during attachment, strict biosafety practice and surveillance programs especially in Egypt un like Tunisia where such interventions are lucking (Hefzy *et al.*, 2016 and Toujani *et al.*, 2017). In the Horn of Africa, LTBI has been found among 46.7% and no difference was noted between males and females. Pastoral communities have been associated with reactivity to TST (Dagnew *et al.*, 2012). This has also been manifested in Malta where (45.0%) immigrant students from this region have LTBI although, congestion in detention centers, poor nutrition and poor hygiene create an opportunity for reactivity *Mycobacterium tuberculosis* bacteria (Padovese *et al.*, 2018 and Moges *et al.*, 2015).

In East Africa, nosocomial infection is a common finding among health workers and students. It has been reported that TST positivity rate among medical student's ranges from (25.0-62.1%). Congestion in student hostels is a common finding where 4-6 students share a single room, sharing dining halls for meals especially in public universities (Nduba et al., 2015). The challenge to establish LTBI infection is that most researches only cater for medical students in internship living non-medical students due to limited resources unlike in developed world where all students are screened (Nduba *et al.*, 2015).On the other hand (62%) Health care workers and students are more exposed than (39%) social workers due to interaction with positive patients during their medical practice than social workers. Increased TST positivity rate is also a result of poverty, high house hold density, displaced people due to war like Northern Uganda and influx of refugees from South Sudan and Democratic Republic of Congo(Rutanga *et al.*, 2015 and Jensen *et al.*, 2013).

Mugerwa *et al.*, (2013) indicates that latent tuberculosis infection is high among medical students is (44.8%) and (35.2%) amongst veterinary lower than (57%) health care workers. The high TB prevalence and having gone to a boarding school than a day school are the risk factors. High exposure during training could also increase LTBI levels among students. Also community LTBI is at (49.0%) among adults and is associated with poor ventilation at work place and attending congested school by many students in adult institutions. However the studies LTBI among non- medical students is not known in Uganda (Lou *etal.*, 2015). Different exposures and health status of and individual cause varying level of indurations and this determines different cut off point. An Induration of 5mm and above is interpreted as a positive result among HIV-positive persons, Recent contacts of persons with infectious TB

disease, Persons with fibrotic changes on a chest radiograph, Patients with organ transplants and other immunosuppressed patients receiving the ≥ 15 mg/day of prednisone for ≥ 1 month(Adetifa *et al.*, 2015). In North American and Western Europe BCG vaccination no longer offers full protection against TB and it has been found that 50 % students with BCG scar test positive to TST and have indurations more than 5mm compared to 34% students without a known Bacillus Calmette-Guérin BCG Vaccination (Foster *et al.*, 2016).
About (29.7%) immunocompetent individuals test negative to TST with indulations of 0.00 mm. However (53.9%) these test positive after a second TST is done due to booster effect and increases indurations between 6.5-10 mm(Lee, 2016).

The induration for nonanergic uninfected students is (91.1%) at a cutoff value of 10 mm and 95.2% at a cutoff value of 5 mm Anergy among HIV positive students. The impaired mediated cell immunity brings about false negative that is overcome by reducing the cutoff point. However this only works for minimal mean TST valves but has no effect on complete absence of responsiveness(Cobelens *et al.*, 2006). Serial measurements on participants with and without BCG scars shows that at the start the diameter is always lower in the first 24 hours (3.9mm-5.2mm) and increases gradually up to 48 hours (5.4-10.0mm).

However at 72 hours usually the reading does not differ by 2.0 mm diameter and any changes are brought by technical errors that may result during inoculation, prolonged hospitalization, delayed hypersensitivity and errors caused during reading the TST test (Ozturk *et al.*, 1997) Overlaps of induration happens between (15-22 mm) among nurses and laboratory students due to risk of exposure during training while 0.00 mm occurs among new entrants (Adetifa et al., 2015).However nursing have been found with (5%) having induration more than 10mm than general population due to direct contact with Active patients (Lamberti *et al.*, 2015).
Health workers and students indurations has been estimated to be 10-15mm while non-clinical staffs range from 5-8 mm due to working in poorly ventilated environment with contaminated aerosols(Kargi *et al.*, 2017). The level of seniority among students contributes to higher TST indurations even low endemic countries ranging from (11.0-17.0 mm)(Asif, Baugh and Jones, 2015). Shero *et al.*, (2014)shows that individuals with smear positive Pulmonary TB can have elevated indurations (18.1mm) compared to that of household contacts (13.6 mm),

In the Gulf region, indurations are generally above 10mm mainly in clinical and post graduate students, children whose parents have HIV (Hassan and Diab, 2014 and (Nassaji and Ghorbani, 2015). On the other hand,13% of the cleaners have indurations less than 5mm unlike doctors nurses and laboratory at 15% with indurations above 10 mm (Onur et al., 2012, Sharma and Bisht, 2017). This is similar to Ugandan setting where most of students react to TST above 10mm diameter due to poor infection control in air, late diagnosis and treatment and Immunosuppression especially due to HIV infection Christopher et al., 2011 and Getahun et al., 2015.

2.2 Demographic factors

Social demographic factors have direct influence on LTBI in our communities especially risky groups like students, refuges and hard to reach groups like prisoners, congested households. These factors ranged from age, sex, Age, BCG scar, BMI kg/ m2, duration of placement, Use of protective gears and clinical and preclinical students.

2.2.1 Age

Wood *et al.,* (2010) reported that Susceptibility to latent tuberculosis infection begins in early childhood and peaks with age. The mean annual positivity rate among school children with indulations ⩾10 mm has been found to be from 3.9% in the 5–10 years and 7.9% above 15 years. This trend steadily increases up to 28.0% at 25 years. During adolescence social interaction and discovery increases leading to exposure to infectious disease like HIV, lung disease which suppress immunity and predispose them to LTBI while in young children less than five years severe malnutrition and pneumonia could be the predisposing factors (Chisti *et al.*, 2013). Exposure to culture confirmed positive TB person in a house hold puts all members at risk especially children who may not know preventive measures of infections especially in Philippines (5.98%), Mexico (1.05%) and Vietnam (3.67%) (Carvalho *et al.*, 2018). It has been found LTBI infection is high among the married people from 31 years due to close association with a partner with active TB yet diagnosis of latent tuberculosis is still a challenge in TB management (Perez-Porcuna *et al.,* 2016)

Due to the fact that latent tuberculosis infection affects age brackets, most countries use different techniques and cut off points to confirm positive test and this has rendered age difficult to rely on especially in Western Europe and USA due to good public health care treatment (Shero *etal.,* 2013). However most affected students between 19-30 years

worldwide is as a result of occupational and environmental exposures where (20.0%) are positive to LTBI especially in low economic countries and 8.0% for old age among reach countries (Lacerda *et al.,* 2017).

2.2.2 Gender

Most of the findings have shown that male's students have latent tuberculosis infection than females. Latent tuberculosis differs from place to place between (32.6-62.0%) for males unlike females around (25.2%). Behavioral smocking, working in coal mines with very poor ventilation resulting into pneumoconiosis and chronic obstructive pulmonary disease, pastoralism due to Mycobacterium bovis cause false positive TST reaction and result into latent tuberculosis infection (Jin *et al.*, 2018). (Legesse *et al.*, 2011).However other sources show latent tuberculosis infection is low due to low endemicity unless the students have been to high endemic areas (Ringshausen *et al.*, 2013). Most females with latent tuberculosis is due to gastrostomy (CDC, 2011)Although the classical signs of TB may be absent, arthritis and joint pains which occassinary have been found as markers of positive TST due to their effects on reducing body's immunity (Farhia mohamud yusuf, 2014)

2.2.3 Immunization shown by BCG Scar

Most countries use BCG Vaccination to protect children from Mycobacterium tuberculosis. However this does not offer full protection to an individual (Mahomed *et al.*, 2013)Low incidence countries like USA no longer uses BCG apart from vulnerable groups like immigrant children, children born in prisons and those born to HIV positive mothers (Davenne and Mcshane, 2016). Delay to vaccinate infants leads to (1.8%) infants to develop active tuberculosis later in time especially both in middle and low income countries (Brant, 2015). Although it is widely used, (34.4-39.3%) adults with BCG scars test positive to TST indicating that BCG does not offer full protection against especially adults who may be exposed to *Mycobacterium tuberculosis*. When the infectious dose finds the immunity low, a person gets LTBI and can lead to active TB condition incase treatment is not done early enough (Belo and Naidoo, 2017 and(Group, Vaccines and Secretariat, 2017). Majority of health workers and students develop Latent tuberculosis due to repeated exposure to Mycobacterium especially in developing countries(Roy *et al.*, 2014).

2.2.4 Body mass index (BMI) kg/m2

High Body mass index has been linked with increased low density lipoprotein levels which is a marker for type 2 diabetes mellitus. It has been reported that people with BMI ≥ 28.0 kg/m2 test positive to LTBI although the mechanism of reaction has not been understood Cleary (Zhang *et al.*, 2017). However treatment failure to insulin, family history of obesity and previous history of untreated LTBI among students are underlying factors of reduced immunity therefore positive TST (Firănescu *et al.*, 2017). Failure to do exercises results into obesity and increased BMI, however the height size ratio is not associated to latent tuberculosis infection especially among the Caucasians because of the short legs (National Center for Chronic Disease Prevention and Health Promotion, 2010). Individuals with low body mass index <18.5 kg/m2 have low serum albumin levels 3.4 g/dl than normal body mass index 18.5 and 24.9 kg/m2 with serum albumin levels 3.7 to 4.8 g/dl . This is a marker of malnutrition that triggers diminished secondary immunity. This results in low levels CD4/CD8 ratios and diminished antibody production and reduced cytokines IL-17A, IL-17A, IL-22 and IL-1 family responses to infections. The diminished immune responses accelerates primary TB infection or reactivates Latent tuberculosis (Anuradha *et al.*, 2016).

2.2.5 Duration of placement

Nosocomial infections like TB are common among the permanently employed health workers for long in health facilities than medical students and students who had been on placement for so long; probably over 4 months (Nasehi *et al.*, 2016). Latent tuberculosis infection among students ranges from (0.8-3.0%) among medical students in low endemic countries and (6.9% to 72%) among high endemic countries (Ai *et al.*, 2016). Research shows that latent tuberculosis infection is due to deployment in a highly infectious department for long, lack of awareness of prevention methods amongst many new students, previous contact to an infected TB patient, poor hospital ventilation services in developing countries, congestion, HIV infection, missing BCG vaccination and failure to report incidences of exposure Belo and Naidoo, 2017, (Narasimhan *et al.*, 2013). However different study sites consider different departments to be highly infectious and some students have been involved in different activities like milk processing where consumption of low milk and animal gases may activate Mycobacterium bovis and cause LTBI (Dogra, Dwivedi and Aghi, 2017).

2.2.6 Use of protective gears.

Use of protective gears to prevent hospital acquired infections varies between (5.7 - 19.1 % in developed countries compared to (3.5-12 % in developing countries(WHO, 2013).Most of the students in developed countries are trained about infection control like use of N95 aspirators, open window and doors for fresh ventilation, coughing etiquettes. This is done due to good knowledge and practice of infection control(Engelbrecht *et al.*, 2016 and (Montagna *et al.*, 2014). Most of students have been vulnerable to latent TB infection due to concentrating on taking orders from the superiors (73%), commitment to give patient care in under resourced situations (69.0%) and worry about performance in the exams(66%) rather than putting on protective gears (Westhuizen *etal.*, 2015). Poor labeling of waste and biohazard materials in hospitals have risked many students to acquiring latent tuberculosis infection particularly new and preclinical students (Agaya *et al.*, 2015).

Non-medical students (13.7%) in Asia have poor or no knowledge about the LTBI due to lack of education by their parents. This has resulted into underutilization of protective gears like N95 mask even if they are available (Rana *et al.*, 2015). However, Europe and India have improved awareness through use of questionnaires to new entrants, educational intervention using Television and internet to boost use of protective gears as preventive methods among vulnerable students offering courses in humanities (Milind *et al.*, 2017).

2.2.7 Clinical Vs. preclinical

Clinical students have similar exposure to contaminated aerosol than preclinical students but this varies in different countries(Lamberti et al., 2014). About 5% of students under training acquire latent tuberculosis compared to 1.5% preclinical students due to high exposure, neglect of use of preventive equipment and use of non-effective vaccines, (Traldi, Nery and Talarico, 2012 and Christopher *et al.*, 2011). However preclinical students test positive due to having been to a boarding school before joining the University, being close to a health facility between 20-30 meters (Maro *et al.*, 2018)

Manuscript, (2014)shows that Preclinical students develop latent tuberculosis due to previous history of hospitalization, living in refugee camps in war tone areas especially in middle east and Africa where early diagnosis and treatment is difficult due to political instability (WHO, 2016).

2.3 Diseases predisposing to LTBI

2.3.1 HIV infection

HIV infection has been reported to be leading factor in developing LTBI that progresses to active tuberculosis. In Europe (10.0-14.9%) have latent tuberculosis especially those with CD4 Less than 500 cells/ml due to increased viral load leading to immunosuppression(Pollock *et al.*, 2012).

Delays to start combination Anti Retro Viral therapy (cART) results into 12% of people developing LTBI and active

TB (Van Der Werf *et al.*, 2016 and (Auguste *et al.*, 2016). Early treatment people with positive TST both in low, middle, and high income countries has been found to reduce active tuberculosis (Person, Lane and Sterling, 2013). In East Africa 9.5% children with CD4 less than 200 cells/ml have TB pre ART which drops to 8.6% and CD4 increases above 200 cells/ml after ART(Jonnalagadda *et al.*, 2010 (Qun Wang, Syed Jamal, Michael S. Detamore, 2011). Despite this progress, Multidrug resistance to cART, tuberculosis and exposure to more than two risk factors like injection drug use and alcoholism cause HIV to be a leading cause of latent and active tuberculosis especially in Asia and Sub-Saharan Africa (Feng *et al.*, 2014 and Gao, Zheng and Fu, 2013).

2.3.3 Renal disease

Renal disease has little or no impact on the cause of latent tuberculosis infection. Chronic kidney disease is common among between 19- 53 years. Latent tuberculosis among Individuals with renal diseases is due to infections that results into renal failure like alcoholism, smokers, low BMI, Hepatitis B and C, diabetes nephropathy, hypertensive nephrosclerosis and glomerulonephritis and long term use of steroid drugs (Fonseca *et al.*, 2013) Latent tuberculosis varies between 11-25% for individuals with CKD and those undergoing dialysis respectively. Malnutrition causes Low serum albumin levels predisposing an individual to latent tuberculosis infections(Shu *et al.*, 2015). Procedures involving solid organ transplant like kidney, liver results into immunosuppression of the patient and could result into latent tuberculosis infection (Yeganeh *et al.*, 2017).

2.3.4 Diabetes

Non communicable diseases like Diabetes mellitus has been associated with (5.9%) LTBI among adults of low TB incidences like USA. Although the pathology is not discussed, it has been pointed that Diabetes reactivates LTBI and may develop active tuberculosis (Marissa

etal 2017). Being on treatment of diabetes mellitus type 1 for more than five years exposes the body to depleted defense system there by enhancing activation of *Mycobacterium tuberculosis* (E Oren *et al.*, 2016).

2.3.5 Cardinal signs of TB

Most of the patients with LTBI do not show clinical signs like, weight loss, malaise and loss of appetite and do not transmit TB(Esmail *et al.*, 2014) However coughing leads to exhalation of infectious droplets on nuclei that are inhaled by Non TB individual and may develop latent tuberculosis infection(Yeung *et al.*, 2016).

2.4 Behavioral practices

2.4.1 Smoking

Latent tuberculosis infection in USA and Europe is between (5.3-8.3%). The infection occurs among people ≥20 years of age. All population are affected but the risk varies from never smokers (4.1%), current smokers (6.6%) and former (6.2%) (Feng *et al.*, 2014).Smoking more cigarrete packs per day is an increased risk although the habitual smoking is more common among Mexican–American, blacks and African migrants. The inhaled environmental pollutants especially from cigarettes provides new insights into the role of macrophage lysosomal inflammation in compromising host defense against *Mycobacteria* (Berg *et al.*, 2016).

2.4.2 Chewing Khat

Khat is a socially accepted herb especially in East Africa and the Arabian Peninsula. However due to global migration it is increasing in United States and Europe(Alvi *et al.*, 2014). About (40%) students who chew Khat develop latent tuberculosis infection and (20%) of these students start smocking, smoke cigarrete and drink alcohol that result into drug abuse especially in Ethiopia (Wolde et al., 2017). Khat is rich Cathionone similar to amphetamine structurally. This has immunomodulatory effects on macrophages and suppresses production of IL2, B cell proliferation and cytotoxic T lymphocytes which compromises the immune system and reactivates Mycobacterium tuberculosis (Alvi et al., 2014 and Jaber *et al.*, 2016).

2.4.3 Alcohol consumption

WHO, (2013) global tuberculosis report indicated that excessive alcohol consumption results into LTBI and consequently active tuberculosis. Most alcohol consumers develop alcohol disorders between (7-16%) that results into treatment failure and outcome leading to relapse of Mycobacterium tuberculosis especially India (Suhadev *et al.*, 2011)

In high TB burden countries alcoholism contributes to over (50%) TB cases due to social aspect of sharing drinking equipment Like cups and tubes that lead to leaking of Mycobacterium tuberculosis (Jasmer, Nahid and Hopewell, 2002).Alcoholism is associated with sharing cigarettes among alcoholics in both middle and low income countries there by increasing risk of transmitting infections especially in poor communities of Sub-Saharan Africa (Mumpe-mwanja *et al.*, 2015).

A meta-analysis which included studies published up to 2007, indicated that alcohol consumption of more than 40 g of ethanol per day or a diagnosis of an alcohol use disorder resulted in a nearly three-fold increase in the risk of tuberculosis (Lonnrot, et al., 2008). Based on this study, alcohol consumption was estimated to be responsible for approximately 10% of all incident cases and deaths due to tuberculosis (Rahm, et al., 2009).

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter discussed the methodology used in study including the study design, sample population, study area, sampling methods, study variables, data collection, data management and ethical considerations.

3.1 Study design and duration

Across sectional research study design was used to assess the positivity rate of tuberculin skin, demographic factors, disease predisposing factors and behavioral practices associated with a positive to tuberculin skin test among all IHSU students in August 2018

3.3 Sources of data

The study was both primary and secondary data.

3.3.1 Primary Data

Primary data was information gathered by the researcher from study participants. Researcher administered questionnaires that contain both open and closed ended questions were used to get data from the participants. These were administered by the researcher to the study participants.

3.3.2 Secondary Data

This was information related to positivity rate of tuberculin skin test, risk factors associated to IHSU students who tested positive to tuberculin skin test in August 2018. The acknowledged sources were used in different legal medical forums were cited in relation to study specific objectives which included; social demographic, diseases predisposing and behavioral practices among all consenting students of IHSU in August 2018. These included online journals, Library books, research dissertations, learning websites and electronic books.

3.4 Study area

The study was conducted at International Health Sciences located along St. Barnabas Road at the 3rd floor of the building that houses International Hospital Kampala,Namuwongo Makindye division a southeastern of Kampala. It is located 6 kilometers from the central district of Kampala. The University was established in 2008 and is a private for profit University. It is officially licensed and recognized by National council for higher education

with an enrolment between 500 and 999. The programs offered are foundation course, diploma in clinical medicine, Diploma in pharmacy, BMLS, BNS, BPH, MPH and SoBAT. E-Learning and exchange programs are also offered to students.

IHSU provides several non-academic facilities to students like sports, community outreaches to society.

3.5 Study population

3.5.1 Target Population

The study was carried out among all among registered IHSU students in their respective courses

3.5.2 Eligibility criteria

3.5.3 Inclusion criteria

The study population considered was only consenting IHSU students currently registered with the University August 2018.

3.5.4 Exclusion criteria

All registered students and were unwilling to participate in the study, mentally ill or very ill were excluded from the study. Students without fore limbs were also exculuded.

3.6 Sample size determination

The sample size of respondents who were all IHSU students were selected using Kish and Leslie sample size formula given below, (Kish, and Leslie, 1965).

$$n = \frac{Z2\ PQ}{d2}$$

Where: n = the minimum sample size

z = is the Z-Value at ∞=1.96 at 95% confidence level

d = Degree of accuracy.

P= is the estimated Tuberculin Skin Test positivity rate of 44.8% among medical students (Mugerwa *et al.*, 2013).

q = Is given by 1-P.

$$n = \frac{Z^2 \times P\ (1-P)}{d^2}$$

$$n = \frac{1.96 \times 1.96 \times 0.448 \times 0.552}{0.05 \times 0.05}$$

$$n = \frac{3.8416 \times 0.247296}{0.0025}$$

$$n = \frac{0.9500123136}{0.0025}$$

N= 380 study participants.

We used 205 study participants because they consented to participate in the study.

3.7 Sampling

3.7.1 Sampling Technique

Simple random probability method was used to allow equal chances for every registered student in IHSU to have an equal chance to participate in the study.

3.8 Sampling Procedure

Simple Random probability method was used to allow equal chances for every registered student in IHSU to have an equal chance to participate in the study. This helped us select the 380 respondents from all the years of registration.

3.9 Study variables.

As discussed in the conceptual frame work above, the study variables in this study were.

3.9.1 Independent variables.

Social-demographic factors that were considered in this study are; age, gender, BCG scar, BMI in kg/m2, duration of placement, use of personal protective equipment, clinical and preclinical.

Diseases predisposing to LTBI like HIV infection, Diabetes, Renal disease, and cough

Behavioral practices include, smoking, chewing khat and alcohol consumption among IHSU all students.

3.9.2 Dependent variables

Tuberculin skin test positivity rate among IHSU students.

3.9.3 Data collection tool

A researcher administered questionnaire with both open and closed ended questions was used. The questionnaire was useful because it was cheap to administer, completed by the respondents at his/her time of convenience and preserved confidentiality. The questions were precise and entered easily for data analysis.

3.9.4 Laboratory methods

Intradermally inoculation by Manteaux technique was used to deliver 0.1ml of Purified Protein Derivative (PPD). This was practically performed by the research assistant Mr.Akona Jacob who holds a Bachelor's degree in medical laboratory science from International Health Sciences University. All results were read after 72 hours by measuring the size of induration at the site of innocuration using plastic meter rule as seen in color plates in appendix V

3.9.5 Procedure

Patient preperation was made to avoid injured sites, scars, previous inoculated sites for last three days and Erythema was observed for 24 hours. The reagent to used was Statens Serum Institute Copenhagen Denmark (PPD RT23 SS1)

3.9.6 Reading the results diameter (mm).

The test results were read after 72 hours of administration of 0.1 ml of PPD. Those that had undulations of 5.00mm and above were considered positive.

3.9.7 Results interpretation

An induration of 5 and above was considered to be positive especially those with chronic infections like HIV and liver and renal diseases.

3.10 Data management

Research assistants were trained and obtain informed consent from the participant. Data was collected, privacy and confidentiality maintained. Data was analyzed, reported and kept under lock and key.

3.10.1 Data Analysis

Data was edited coded and entered into excel sheet and exported to Epistata for analysis. Univariate and multivariate logistic regression methods were used to analyze the data. Under Univariate, Pie chart, Tables, Frequency, percentage distributions were used. Multivariate methods were used to compare the variable using $\chi 2$, Z values and those whose p-value is <0.05 were significantly associated with the TST positivity rate.

3.10.2 Quality control

The interview guide and a questionnaire was pre tested before subjecting it to the respondents to test its performance on reliability and efficiency. The results provided were used to improve the questionnaire before applying it to the field to collect the data for analysis.

3.10.3 Ethical clearance.

Research clearance for the study was obtained from Clarke International University research ethics committee before commencement of the study. Informed consent was sought from study participants and confidentiality was guaranteed at all levels. Respondents' rights including withdraw of their participation in the research whenever they wished was also considered and treated with much respect.

3.10.4 Plan for dissemination

Results from the study were presented into a dissertation that was submitted to IHSU for quality assurance assessment. The results were also presented to the research examination board of Institute of allied health for defense.

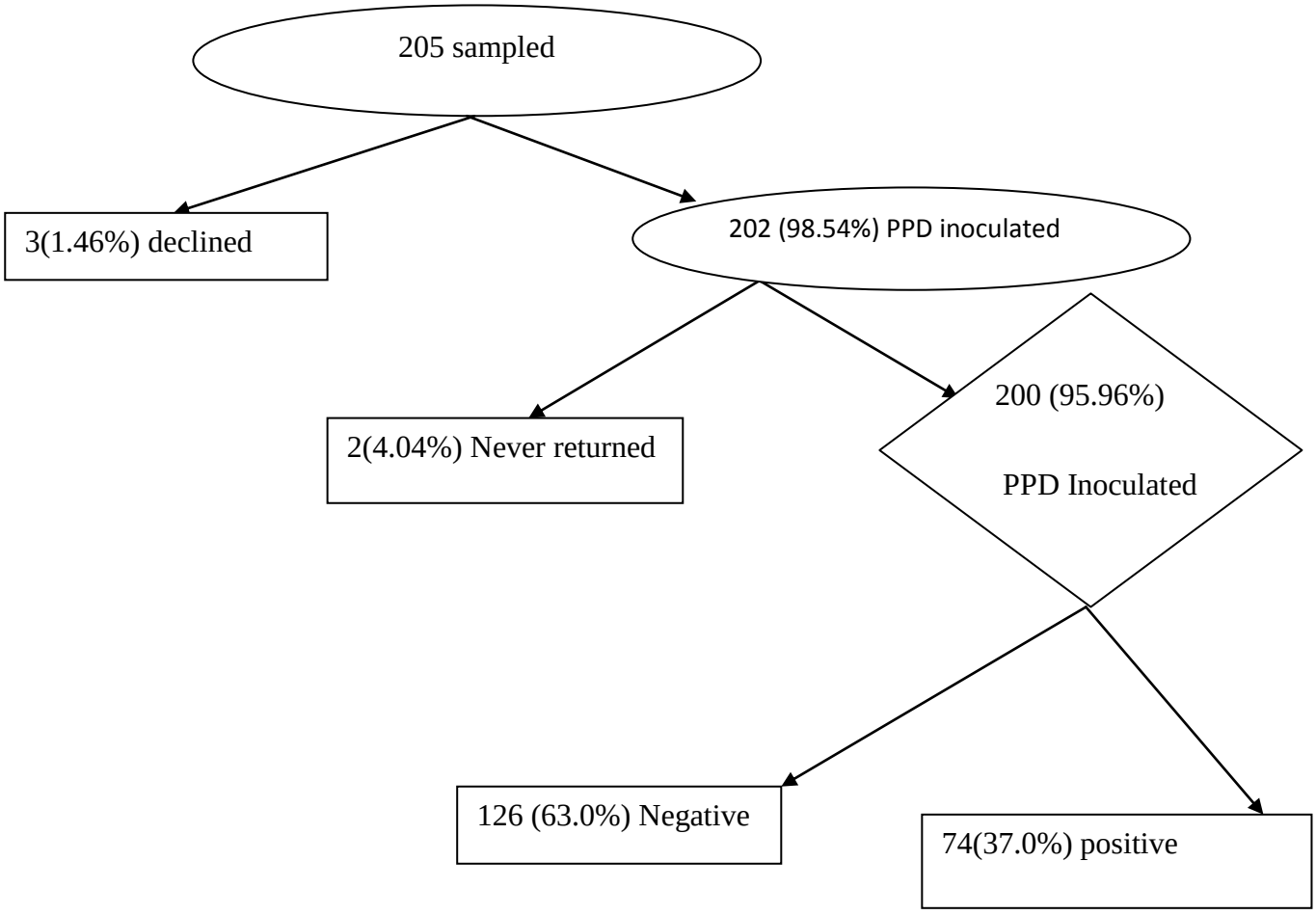
CHAPTER FOUR: RESULTS

4.0 Introduction

This chapter presented the findings of the study about tuberculin skin test positivity rate among all IHSU students. The factors considered under this study were demographic, diseases predisposing and behavioral characteristics that could cause students to test positive to Tuberculin skin test (TST). In this study, 205 participants were sampled and 133 (64.8%) were males while 72 (35.12%) were Females. The mean age of participants was 24 years and age was categorized into 18-25, 26-35, 36-45 and above 46 years.

From the total of 205 participants sampled, 3 (1.46%) declined while 202 (98.45%) accepted to be inoculated with 0.1 international units of the purified protein delivertive (PPD). Among those who were inoculated 2 (4.04%) never returned for reading while 200 (95.96%) returned for reading. [74(37.0%)] tested Positive to Tuberculin skin test while 126(63.0%) tested negative to TST as illustrated in the figure1 bellow.

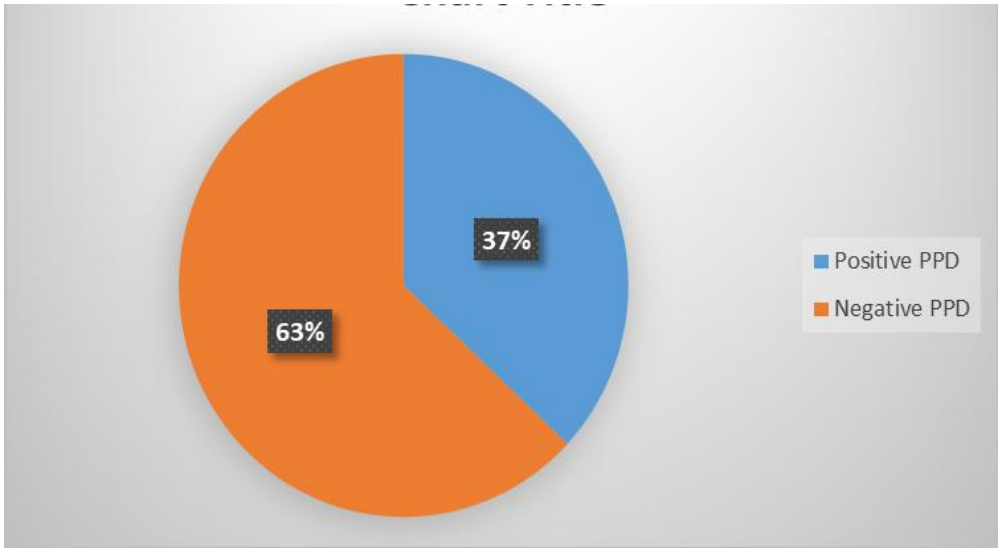
Figure 2: Bellow shows the distribution of the number of students who participated in the study.



4.1Tuberculin skin test positivity rate among study participants.

In this study, 205 students were randomly selected from International Health Sciences (IHSU). [74(37.0%)] turned Positive to Tuberculin skin test while 126(63.0%) tested negative as shown in the Pie- Chart below.

Figure 3: Showing TST positivity rate among all IHSU students



4.2 Demographic characteristics of the study participants.

In this study, demographic factors considered were, Age, Gender, year of study, course BCG, scar, BMI kg/m2 and the use of personal protective equipment. Of the 205 participants selected 133 (64.8%) were males and 72 (35.12%) were Females. Considering different years of registration, students offered Courses of Bachelors in Medical Laboratory science (BMLS), Bachelor's in Nursing Sciences(BNS),Diploma in clinical medicine(DCM),Diploma in pharmacy (DPHAR), Foundation course (FDN), Public health (PH) and School of applied business technology (SoBAT) in August 2018. The presence or absence of the BCG scar, body mass index (BMI) kgm2, duration on clinical placement, Use of personal protective equipment (PPE) of participants were assessed as shown in table one below.

Table 1: Demographic characteristics of the study participants.

Variable	Category	Frequency	Percentage (%)
Gender	Male	133	64.8
	Female	72	35.12
Age	18-25	128	62.44
	26-35	48	23.41
	36-45	29	14.15
	46 and above	0.0	0.00
Year of study	One	93	45.37
	Two	19	9.27
	Three	63	30.24
	Four	10	4.88
	Foundation	21	10.24
Course	BMLS	30	14.63
	BNS	60	29.27
	DCM	50	24.39
	DPHAR	10	4.48
	FND	21	10.24
	PH	14	6.83
	SoBAT	20	9.76
BCG Scar seen	Yes	151	73.66
	No	54	26.34
BMI kg/m2	18.5 and bellow	34	16.59
	19.5-24.5	102	49.76
	25.5-30.5	66	32.20
	31.5-36.5	03	1.46
Duration of placement(Mor	No placement	122	59.51
	1	13	6.34
	2-3	44	21.46
	4-6	26	12.68
Use PPE	Yes	10	4.88
	No	195	95.12

4.3 Diseases predisposing to LTBI

In this study, the diseases predisposing to LTBI among IHSU students assessed were HIV/AIDS, diabetes, renal disease and Cardinal TB signs. Those who had HIV were 3(1.46%) while 202(98.58%) did don't have HIV, Diabetic students were 3(1.46%) and 203(98.58%) were not diabetic, Renal diseases were 36(17.56%), 157(76.59%) did not have renal disease while 12(26.83%) were not sure about renal infections and those with cardinal TB signs were 55(5.85%) while 150(73.17%) reported no TB signs. Those with TB signs, 24(11.71%) had coughed for more than two weeks 23(11.22%) had night sweats 01 (0.49%) had malaise and none reported weight loss as illustrated in the table 2 bellow.

Table 2: Showing Diseases predisposing to LTBI.

Variable	Category	Frequency	Percentage (%)
HIV/AIDS	Reactive	03	1.46
	None Reactive	202	98.54
Diabetic	Yes	03	1.46
	No	203	98.58
Renal disease	Yes	36	17.56
	No	157	76.59
	Not sure	12	26.83
Cardinal TB signs	Yes	55	5.85
	No	150	73.17
Specific sign	Cough more than two weeks	24	11.71
	Night sweats	23	11.22
	Weight loss	00	0.00
	Malaise	01	0.49
	No TB signs	157	76.59

4.4 Behavioral practices that are risky to LTBI among the study participants.

The study participants were also assessed for their behavioral practices that could risk them to acquire LTBI. These included smoking 73 (53.61%), nonsmokers 123(64.39%). The frequency among smokers were as follows, once a day 17(8.29%), twice a day 55(26.82%) and three times 01(0.49%) a da. Khat chewing were (80.49%) while 40(19.51%) never chewed khat. The frequency of the daily Khat chewing was as follows Once a day

24(11.71%), and 82(40%) drunk alcohol while 123(60%) did not drink alcohol as shown in the table 3 below.

Table 3: Behavioral practices risky to LTBI among the study participants.

Variable	Category	Frequency	Percentage (%)
Smoke	Yes	73	53.61
	No	123	64.39
Yes smoke	Once a day	17	8.29
	Twice a day	55	26.82
	Three times a day	1	0.49
Chew Khat	Yes	165	80.49
	No	40	19.51
Yes Chew Khat	Once a day	24	11.71
	Twice a day	04	1.95
	Three times a day	12	5.85
Consume alcohol	Yes	82	40.0
	No	123	60.0
Yes consume alcohol	Once a day	04	0.98
	Twice a day	62	30.24
	Three times a day	00	0.00

4.4.1 Univariate analysis of Demographic factors associated with the TST positivity

Following Univariate analysis, it was revealed that all the demographic factors were significantly associated with a positive Tuberculin skin test (TST). Positivity rate was high among males (43.08% n=56) compared to females (25.71%n=18). Gender especially being a male was a significant risk factor ($\chi 2$ = 5. 5.88; P=0.015). This could have been due to 3-4 males sharing a single room, Khat chewing and negligence to put on protective equipment unlike their female counter parts. TST Positivity increased with age 36-45 (96.55% n=28) ($\chi 2$= 74.06; P<0.001) and Year of study ($\chi 2$ = 147.00; P<0.001). Most of these students were in Top up classes while direct students were in year three and four. This could have been due to exposure during service and prolonged stay in the University and increased the risk of exposure to Mycobacterium tuberculosis bacteria. Students from Nursing showed the highest positivity (66.67% n=40. $\chi 2$ = 59.56; P<0.001). Oftenly the nurses reported not using PPE due

to scarcity and rotating in different sections like medical and TB wards. This could have increased their risk of exposure to LTBI. Most of the study participants had BCG (46.98% n=70) and normal BMI 19.5-24.5 Kg/m2. Despite global use of BCG vaccine to protect infants from TB, this study revealed that irrespective of vaccination and body size, LTBI affects all people as long as there is an exposure ($\chi 2$= 34.97; P<0.001) and ($\chi 2$ =104; P<0.001) respectively. Those who were placed longer for clinical attachment had a higher risk of acquiring LTBI. That is., Prolonged stay at placement 2-3 month 88.64% n=39, 4-6 months 100% n=25) ($\chi 2$ = 145.32; P<0.001) and majority did not use PPE (38.74% n=74., ($\chi 2$ = 5.53; P= 0.019).

Table 4: Showing Univariate analysis of Demographic factors associated with the TST positivity among study participants.

Variable	Category	Neg	Pos	Total	$\chi 2$ - value	P. value
Gender	Female	52(74.29)	18(25.71)	70	5.88	**0.015**
	Male	74(56.92)	56(43.08)	130		
Age	18-25	104(83.87)	20(16.13)	124	74.06	**<0.001**
	26-35	21(44.68)	26(55.32)	47		
	36-45	01(3.45)	28(96.55)	29		
Year of study	One	86(95.56)	4(4.44)	90	147.01	**<0.001**
	Two	14(77.78)	4(22.22)	18		
	Three	6(9.68)	56(90.32)	62		
	Four	0(0.00	10 (100)	10		
	Foundation	20(100)	0(0.00)	20		
Course	BMLS	23(79.31)	06(20.69)	29	59.56	**<0.001**
	BNS	20(33.33)	40(66.67)	60		
	DCM	25(51.02)	24(48.98)	49		
	DPHAR	06(60.0)	04(40.0)	10		
	FOUNDATION	20 (100)	0(0.00)	20		
	PUBLIC HEALTH	14(100)	0(0.00)	14		
	SoBAT	18(100)	0(0.00)	18		
BSC Scar	YES	79(53.02)	70(46.98)	149	24.97	**<0.001**
	NO	47(92.16)	04(7.84)	51		
BMI Kg/m2	18.5 and bellow	30(93.75)	02(6.25)	32	104.00	**<0.001**
	19.5-24.5	86(86.00)	14(14.00)	100		
	31.5-36.5	00(0.00)	03(100)	03		
Duration placement	1 Months	12(0100)	00(0.00)	12	145.32	**<0.001**
	2-3 Months	05(11.36)	39(88.64)	44		
	4-6 Months	00(0.00)	26(100)	26		
PPE USED	NO	117(61.26)	74(38.74)	191	5.53	**0.019**
	YES	09(100)	00(0.00)	09		

4.4.2 Univariate analysis of Diseases predisposing to TST positivity among study participants

Under the diseases predisposing to LTBI, all were found to be associated with a positive TST. These were HIV/AIDS (100% n=03 ($\chi 2$ =5.19, P. 0.023) and Diabetes 100% n= 03 ($\chi 2$ =5.19, P. 0.023). However HIV and diabetes were limited by their small numbers. Those with renal disease were (91.67% n=36. $\chi 2$ =59.76, P. 0.001) and having specific TB signs was a risk factor ($\chi 2$ 33.30, P=0.001) as in the table 5 bellow.

Table 5: showing Univariate analysis of Diseases predisposing to TST positivity among study participants

Variable	Category	Negative	Positive	Total	$\chi 2$ - valu	P. value
HIV/ AIDS	Non-reactive	126(63.96)	71(36.04)	83	5.19	**0.023**
	Reactive	00(0.00)	03(100)	03		
Diabetic	No	126(63.96)	71(36.04)	197	5.19	**0.023**
	Yes	00(0.00)	03(100)	03		
Renal disease	Yes	03(8.33)	33 (91.67)	36	59.76	<**0.001**
	No	111(73.03)	42(26.97)	153		
	Not sure	12(100)	00(0.00)	12		
Cough	Yes	16(30.19)	37(25.17)	53	33.30	<**0.001**
	No	110(74.83)	37(69.81)	147		
Specific signs	Cough more than weeks	00(0.00)	24(100)	24	33.33	<**0.001**
	Night sweats	16(79.19)	05(23.81)	21		
	Malaise	00(0.00)	01(100)	01		

4.4.3 Univariate analysis of the Behavioral practices and TST positivity among study participants.

It was found out that all behavioral practices were risk factors to a positive TST . These were smoking (66.20% n=47 ($\chi 2$=40.26; P<0.001). Habitual smocking leads to inhalation of environmental pollutants that eventually compromises with the body's defense system and activates Mycobacterium tuberculosis organism and cause LTBI. Khat chewing (100% n=40 ($\chi 2$=85.14; P<0.001). Khat is rich in Cathionone similar to amphetamine structurally and has immunomodulatory effects on macrophages and hinders production of cytotoxic T lymphocytes. This compromises with the body's immunity and reactivate Mycobacterium tuberculosis organism that could cause LTBI and active TB. Alcohol consumption (70% n=56) ($\chi 2$=62.29, P<0.001). Alcoholism results into o alcohol disorders and treatment failure there by reactivating Mycobacterium tuberculosis organism and cause LTBI that could progress to active TB. This is shown in table 5 bellow.

Table 6: Univariate analysis of the Behavioral practices and TST positivity among study participants.

Variable	Category	Neg	Pos	Total	$\chi 2$ - valu	P. value
Smoke	No	102(79.07)	27(20.93)	129	40.26	**<0.001**
	Yes	24(30.83)	47(66.20)	71		
Yes Smoke	Once a day	04(66.67)	02(33.33)	06	76.09	**<0.001**
	Twice a day	17(28.33)	43(71.67)	60		
	Thrice a day	00(0.00)	11(100)	11		
Chew khat	No	126(78.75)	34(21.25)	160	85.14	**<0.001**
	Yes	00(0.00)	40(100.0)	40		
Consume alcohol	No	102(85.0)	18(15.0)	42	62.29	**<0.001**
	Yes	24((30.0)	56(70.0)	80		
Yes consume alc	Once a day	04(66.67)	02(33.33)	06	76.09	**<0.001**
	Twice a day	17(28.33)	43(71.67)	60		
	Thrice a day	00(0.00)	11(100)	11		

4.4.4 Multivariate analysis of all variables and TST positivity among study participants.

A multivariate analysis was performed for all the variables considering a P value <0.21 to cater for confounders. Only three factors were found significantly associated with TST positivity rate among study participants. These are Age between 36-45 years (Z=2.96; P= 0.023), Course especially BMLS (Z=3.12; P=0.002) followed by BNS (Z=2.12; P= 0.027) and duration of placement (Z=3.81; P<0.001) as seen in table 6 below.

Table 7: Multivariate analysis and TST positivity rate among study participants.

Variable	Categories	Results		Univariate analysis		Multivariate analysis	
		Pos	Neg	$\chi 2$ - value	P. value	Z - value	**P. value**
Gender	Female	52(74.29	18(25.71	5.88	0.015	0	**0**
	Male	74(56.92)	56(43.08)			0.82	**0.415**
Age	18-25	104(83.87)	20(16.13)	74.06	0.000	0	**0**
	26-35	21(44.68)	26(55.32)			0.001	**0.99**
	36-45	01(3.45)	28(96.55)			2.96	**0.023**
Year of stud	Foundation	20(100)	0(0.00)	147.00	0.000	0	**0**
	One	86(95.56)	4(4.44)				
	Two	14(77.78)	4(22.22)				
	Three	6(9.68)	56(90.32)				
	Four	0(0.00	10 (100)				
Course	BMLS	23(79.31)	06(20.69)			3.12	**0.002**
	BNS	20(33.33)	40(66.67)			2.21	**0.027**
	DCM	25(51.02)	24(48.98)			0.128	**0.85**
	DPHAR	06(60.0)	04(40.0)				
	Foundation	20 (100)	0(0.00)	59.56	0.000		
	Public Health	14(100)	0(0.00)				
	SoBAT	18(100)	0(0.00)				
BSC Scar	NO	47(92.16)	04(7.84)				
	YES	79(53.02)	70(46.98)				
BMI Kg/m2	18.5 and bello	30(93.75)	02(6.25)				
	19.5-24.5	86(86.00)	14(14.00)	34.97			
	31.5-36.5	00(0.00)	03(100)				
Duration placement	Never been placement	109(92.37	09(7.63)	104.00	0.000		
	1 Months	12(0100)	00(0.00)				
	2-3 Months	05(11.36)	39(88.64)				
	4-6 Months	00(0.00)	26(100)			3.81	**<0.001**
PPE USED	NO	117(61.26)	74(38.74)	5.53	0.019		
	YES	09(100)	00(0.00)				
Smoking	Once a day	04(66.67)	02(33.33)	76.09	<0.001		
	Twice a day	17(28.33)	43(71.67)			3.97	**<0.001**
	Thrice a day	00(0.00)	11(100)				

CHAPTER FIVE: DISCUSSION OF RESULTS

5.0 Introduction

This chapter presented the findings of the study based on specific objectives that included; demographic, diseases and behavioral characteristics to assess the positivity rate of tuberculin skin test among IHSU students in August 2018.

5.1 Tuberculin skin test Positivity rate

In this study the Tuberculin skin test (TST) positivity rate was 37.0%. This lower than that of Makerere University where the latent tuberculosis infection (LTBI) was at 44.8% (95% C.I= 38.4,51.3%) among medical students significantly higher than non-medical students 24.1% but similar to that of veterinary students 35.2% (Mugerwa *et al.*, 2013). This could have been due to a higher LTBI rate around Kampala 49.0% among adults and Sub-Saharan Africa (Joseph kenyi Loul 2015) unlike in North Africa where TST positivity among medical students ranges between 13.6%-26.0% attributed to proper infection control measure (Hefzy *etal.*,2016)and Toujani *etal.*,.,2017). On the other hand, similar findings among medical workers along San Luis US-Mexico border showed that (TST) positivity rate was 37.0%, (95% CI: 0.15, 0.61) (Oren, et al., 2016). Similar to this study the risky factors were hostel congestion, smoking and alcoholism. However TST was lower than the findings at Lima University (52.0%) despite increased social economic wellbeing (Martinez et al., 2013).

On the other hand, analogous results had been reported in developed countries like Portugal 35% due to poor implementation infection control policies (Costa and Silva, 2010). This was found higher than United States of America (U.S.A) 4.7-6.7% and Europe 2.7-4.9% for indigenous Americans and Europeans. This has been achieved through strict border measures like Hungary and Italy to reduce on illegal migrants from highly endemic areas like Africa, China and Indonesia, vaccination, early detection and diagnosis and use of personal protective equipment like N95 masks which are lucking here in developing countries. Despite the above successes in reduction of LTBI, TST positivity rate has been reported to be between 15.4%-15.9% in U.S.A and Europe to exchange programs of students who go for internships in highly endemic areas like Sub Saharan Africa, ethnic minorities like blacks and vulnerable communities like refuges, homeless people and illegal migrants who entre undocumented and avoid screening for LTBI although these rates are very low compared to African findings, they are higher among these in European and U.S.A communities (European economic area,

2016) and Pollock *et al.*, 2012), (Zenner *et al.*, 2017 and Gallegos Morales *et al.*, 2017),(Van Der Werf *et al*., 2016 and Bonini *et al*., 2017).

5.1 Demographic factors associated to a positive TST test.

Age. Findings showed that, students' age between 36-45 years was significantly associated with positive test for tuberculin skin test (Z=2.96, P= 0.023). It was revealed that having served in the health care setting for a long time predisposed one to latent tuberculosis infection. This could be the reason students who were between 36 and 45 were more infected as they served longer in health care and had got a high TB exposure unlike students who were younger and had not been in any active health care. On the contrary, the most affected students globally were between 19-30 years. This was a result of occupational and environmental exposures where (20.0%) were positive to LTBI especially in low economic countries and 8.0% for old age among reach countries (Lacerda *et al.,* 2017).

Course. Among all the courses, students who studied Bachelors 'of Medical Laboratory Science Students (BMLS) and Bachelors 'of nursing science (BNS) had the most positive TST (Z=3.12, P= 0.002) and (Z=2.21, P= 0.027) respectively. This high test positivity among BMLS students may be explained by exposure to sputum in the laboratory during tests that contained *Mycobacterium tuberculosis* during their course of study while the nurses could have acquired the bacteria on the ward when they were providing nursing care to patients. Similar findings were reported that preclinical students test positive only after having been to a boarding school before joining the University, being close to a health facility between 20-30 meters (Maro et al., 2018). The other courses like foundation, public health and school of applied business and technology were not practical while those in year one and year two the exposure was minimal and infectious does could not have been inhaled to cause LTBI.

Duration of placement. Students who had been on clinical placement for four months and above 6 months were more at risk of contracting LTBI (Z=3.81, P= 0.001). This was common among the 3rd and 4th year students who frequently went for clinical placements yet PPE were not oftenly used due to scarcity, working under pressure from instructors to pass exams, poor hospital ventilation and lack of awareness of spread and prevention of LTBI. This was similar to 6.9%-72.0% LTBI in highly endemic areas like Uganda (Nasehi *etal.*, 2016 and Block *etal.,* 2015).

Body mass index. Normal BMI 19.5-24.5 Kg/m^2 was significantly associated with latent LTBI ($\chi 2$ =104 P= <0.001) contrally to what is documented. None of the study participants had BMI ≥ 28.0 Kg/m^2 which is a risk factor to LTBI. BMI ≥ 28.0 Kg/m^2 is linked to Type 2 diabetes mellitus which could lead to Insulin treatment failure although family history of obesity could lead to lowered immunity and reactivate Mycobacterium tuberculosis to cause LTBI. None of the students reported such cases more over diabetic patients were very few.

Immunization shown by BCG Scar. Despite initial association of BCG scar with a positive LTBI test ($\chi 2$ = 24.97, p=<0.001). It was found to be insignificantly associated with a LTBI. This meant that regardless of using BCG vaccine to protect children from TB, anybody could develop LTBI and TB as long as there has been exposure. This was similar to 34.4%-39.3% adults with BCG scar but test positive to TST (Belo and Naido, 2017).

Personal protective equipment (PPE). Most of the students were not using PPE due to scarcity and lack of awareness about their use and this was insignificantly associated with LTBI Agaya *etal.,* 2015and Rana *etal*., 2015*).*

5.2 Diseases predisposing factors to a positive TST among study particpants.

Diseases. No disease condition was found to be significantly associated with LTBI as it had been presumed. At bivariate analysis, disease conditions such as HIV/AIDS ($\chi 2$ =5.19, P. 0.023), Diabetes ($\chi 2$ =5.19, P. 0.023), Renal disease ($\chi 2$ =59.76, P. 0.001) and having TB signs ($\chi 2$ 33.30, P=0.001) were found to be associated with a positive TST but after modeling to cater for confounders, none of them was associated with a positive TST. Possible cause of false association could be due to small numbers of respondents who reported having these diseases. Thus sample size was a major factor in drawing a conclusion over diseases association.

5.3 Behavioral practices associated with a positive TST among study participants.

Smoking. Only Smoking was significantly associated with a positive LTBI test LTBI (*Z*= 3.97., p= <0.001). Habitual smoking is common among people of ≥ 20 years and above who were majority in this study. Most of the smokers reported drinking, chewing khat especially males. This could have been due to peer pressure influence since most of male participants were sharing a single room unlike females. This was similar to Mexican-Americans, blacks and African migrants. Inhaled pollutants lead to lysosomal inflammation and compromise the host's defense system (Berg *etal.*, 2016). However chewing Khat and Alcoholism could not independently be risk factors associated with Latent tuberculosis infection.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter presented the conclusion and recommendations to the study. They are based on study specific objectives that included; to assess the positivity rate of tuberculin skin test among IHSU students in different faculties using Purified Protein Derivative, to assess the demographic factors, diseases predisposing to a positive to tuberculin skin test and behavioral practices associated with a positive to tuberculin skin test among all IHSU students.

6.1 Conclusion

There was a low prevalence of TST positivity rate among study as compared to other studies done in Kampala District. TST Positivity was significantly associated to age, course of study smoking and duration on placement.

6.2 Recommendations

1. Students are advised to carry out routine screening test for LTBI. Those found positive be advised to do further tests like Zeihl Neelsen, Chest X-ray and culture and sensitivity. Those found positive be advised to do further tests like Zeihl Neelsen, Chest X-ray and culture and sensitivity.
2. Students who have been on placement for a long duration should be immunized for TB to develop immunity.
3. Students who have studied at the university for more than two years should be immunized against TB infection.
4. Students studying Bachelors' Medical Laboratory Science and Bachelor's in Nursing Science should be given more protection against TB infection through use of protective gears like N95 masks and work under Biosafety cabinets and immunization.
5. HIV positive students should refrain from getting in contact with patients and people with signs and symptoms of TB such as persistent cough.
6. Students should avoid risky behavioral practices such as; smoking, khat chewing and alcoholism.
7. There should be a study to assess the use of lateral flow urine lipoarabinomannan assay (LF-LAM) for the diagnosis and screening of active tuberculosis in people living with HIV

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APPENDICES

APPENDIX 1 CONCENT FORM

We are asking you to take part in a research study called: Assessment of the tuberculin skin test positivity rate among international health sciences university students

The person who is in charge of this research study is Kabera Michael. The research will be conducted at International Health Sciences University

District of Kampala Uganda.

Purpose of the study

The purpose of this study is to:

The study is aimed at determining the LTBI positivity rate and distribution among IHSU students using PDD by manteaux technique and make comparisons of which group of students are more at a risk of exposure.

Also the study will give deep reaching information of the quickest method of latent tuberculosis diagnosis and encourage students to put preventive measures during their practical attachments and clinical practice after school to minimize the continuous activation of tuberculosis from Latency stage causing further spread to the communities outside school and health facilities.

Study Procedures

You are being asked to participate in this study, as you are an International Health Sciences University student(s) who can help us to better determine the tuberculin skin test positivity rate among university students.

If you take part in this study, you will be asked to:

Take part in a one-time, one-on-one, semi-structured interview and inoculation of purified protein delivertive antigen.

The maximum time required for interview is approximately one hour;

The interview will take place at a location most convenient to you as the participant;

The interview will be transcribed, in the form of field notes, to ensure accuracy in reporting your statements;

Benefits

There will be no direct benefits connected with your participation in the study, but the information you will provide will be useful in determination of the tuberculin skin test positivity rate among IHSU students

Risks or Discomfort

The risks involved in this research are minimal. They are similar to the daily experiences you encounter and there are no documented risks to those who take part in this study.

Compensation

There will be no compensation in form of physical cash or incentives. Participation is completely voluntary because the data collected is strictly for academic purposes

Privacy and Confidentiality

We will keep your study information and records private and confidential. Whoever would like to see your study records must seek legal approval and keep them completely confidential? However, only the research team, including the Principal Investigator and those involved with the study get access to your records.

In case of publication of what I have learned from this study, l will not include your name. Therefore the public will not know who you are.

Voluntary Participation / Withdrawal

Participation in this study is voluntary and therefore do not feel you have been forced to participate in this study. You are free to participate in this research or withdraw at any time of convenience. There is no penalty or loss of benefits you are entitled to get if you discontinue taking part in this study.

You can get the answers to your questions, concerns, or complaints

For any enquires, questions, concerns or complaints about this study, or experience an adverse event or unanticipated problem, contact the researcher on 0772060567/0703060567.

For questions about your rights as a participant in this study, general questions, or have complaints, concerns or issues you want to discuss with someone outside the research, contact the IHSU-REC Chairperson Dr. Samuel Kabwigu on (0779610100) & the executive secretary of UNCST on (0414-705500) respectively.

Please check which box best describes your assessment of understanding of the above informed consent document:

I have read the above informed consent document and understand the information provided to me regarding participation in the study and benefits and risks. I give consent to take part in the study and will sign the following page.

I have read the above informed consent document, but still have queries about the study; and therefore decline to take part in the study.

…… ……..

Signature of Person Taking Part in Study Date

……..

Printed Name of Person Taking Part in Study

…… Signature of Person

Obtaining Informed Consent / Research Authorization Date

……

Printed Name of Person Obtaining Informed Consent / Research Authorization

APPENDIX II: QUESTIONNAIRE

I, Kabera Michael, a fourth year student of International Health Science University pursuing a Bachelor's degree in Medical Laboratory Science. I am the Principal Investigator (PI) of the study titled: "Assessment of the positivity rate and the possible risk factors associated with tuberculin skin test among all IHSU students''.

I therefore seek your cooperation to be provided with some information regarding the health matter at hand; the information obtained will aid in improving the health status of the students and will be treated as highly confidential

Instructions:

Please tick YES/NO in the corresponding box and give reason(s) for your answer.

Section A: Social demographic factors associated with positive Tuberculin Skin Test

1. What is your gender?

a) Male ☐ b) Female ☐

2. What is your age?

a) 18-25 years ☐ b) 26-35 years ☐

c) 36-45 years ☐ d) 50-59 ☐

3. What is your year of study?

a) Year one ☐ b) Year Two ☐

c) Year three ☐ d) Year Four ☐

e) Foundation year ☐

4. What is course do you study?

a) Medical Laboratory Science ☐ b) Bachelors in Nursing ☐

c) Diploma in clinical Medicine ☐ d) Diploma in pharmacy ☐

e) Foundation course ☐ g) SoBAT ☐

Immunized against tuberculosis

5. BCG scar observed

a) Yes ☐ b) No ☐

Body mass index kg/m2

6. What is the Body Mass Index?

a)18.5 and bellow ☐ b) 19.5-24.5 ☐

c) 25.5-30.5 ☐ d) 31.5-36.5 ☐

Duration of placement

7. i) For how long have you been on placement?

a) Have never been to placement ☐ b) 1 months ☐

b) 2-3 months…… ☐ d) 4- 6 months…… ☐

ii) Do you regularly use personal protective equipment to protect against Latent TB infection?

a) Yes ☐ b) No ☐

ii) If yes, what personal protective equipment do you use?

a) N95 Masks ☐ b) biosafety cabinet ☐

Comorbidities associated with positive Tuberculin Skin Test

HIV infection

8. What is your HIV status?

a) Reactive ☐ b) Non-reactive ☐

Cancer

9. i) Do you have any type of cancer?

a) Yes ☐ b) No ☐

Diabetes

10.) Are you diabetic?

a) Yes ☐ b) No ☐

Renal disease

11. i) Do you have any renal disease?

a) Yes ☐ b) No ☐

c) Not sure ☐

Cardinal signs of TB infection

12. i) Do you present any Cardinal signs of TB infection?

a) Yes ☐ b) No ☐

ii) If yes, mention them?

a) Cough for more than two weeks ☐

b) Night sweats ☐

c) Weight loss ☐

d) Malaise ☐

Behavioral practices associated with positive Tuberculin Skin Test

Injection

Smoking

13. i) Do you smoke?

a) Yes ☐ b) No ☐

ii) If yes, how often do you smoke?

a) More than 4 times a day ☐ b) Thrice a day ☐

a) Twice a day ☐ d) Once a day ☐

Chewing Khat

14. i) Do you chew khat?

a) Yes ☐ b) No ☐

ii) If yes, how often do you chew Khat?

a) More than 4 times a day ☐ b) Thrice a day ☐

a) Twice a day ☐ d) Once a day ☐

Alcohol consumption

15. i) Do you consume alcohol?

a) Yes ☐ b) No ☐

ii) If yes, how often do you consume alcohol?

a) More than 4 times a day ☐ b) Thrice a day ☐

a) Twice a day ☐ d) Once a day ☐

Subsidiary section

Participant consented to take part in the study

a) Yes b) decline

Results in mm diameter

a) Less than 5 mm b) 5-10mm

c) 10-15mm d) 15 mm and above

Thanks for your cooperation.

APPENDIX 111: MAP OF THE STUDY AREA

APPENDIX 1V: Management protocal for expected hypersensitivity reaction to PPD

Hypersensitivity and anergy may occur between 5-60 minutes after PPD inoculation. This could be due to HIV infection, cancer and some immunosuppressive drugs that could cause transient or continuing suppression of cellular hypersensitivity mediated by T-lymphocytes. This results in a patient inability to mount Delayed Type Hypersensitivity (DTH) to skin antigens like tuberculin, coccidioidin, histoplasmin and mumps. Information about possibility of anergy was obtained before inoculation of PPD. This included anaphylaxis, flushing, cough conge loss of voice quality congestion, edema, tachycardia, dizziness vomiting and hypotension although these vary from patient to patient.

Treatment was made ready by using antigen preperation like

Trichophyton intended for the diagnosis and/or treatment of immediate type hypersensitivity reactions.

Tetanus toxoid useful in assessing DTH responsiveness.

Adrenaline for those presenting with Bronchospasm, Gastrointestinal symptoms, laryngeal edema and hypotension. Intramuscular injection in the lateral or anterior thigh would be preferred than subcutaneous injection since adrenaline absorption is more rapid than subcutaneous administration.

Dosage 0.3-0.5 ml of 1:100 dilutions intramuscular 5-15 minutes. Shorter interval doses administered depending on the severity. In case of no response for the first dose, second dose would be administered in case of intravascular constriction and fluid volume depletion followed by resuscitation and contact made to emergency department of international hospital (IHK).

Skin necrosis. Gentian violet would be applied to the site of the lesion

APPENDIX V: Referral: To the chest physician outpatient department IHK Kampala

Kindly do receive and manage this CIU student refered to you. He/she has been found with a positive tuberculin skin test but we need to investigate him/her for a possibility of active TB

Student name……Laboratory Number…….age…..gender M/ F.

Date of PPD testing…….

Date of PPD reading…….

TST results…….(mm)

Clinical findings…….. Symptoms……

Referral form.

Title : Chest x-ray and/ sputum for AFB's

Referring Researcher Kabera Michael

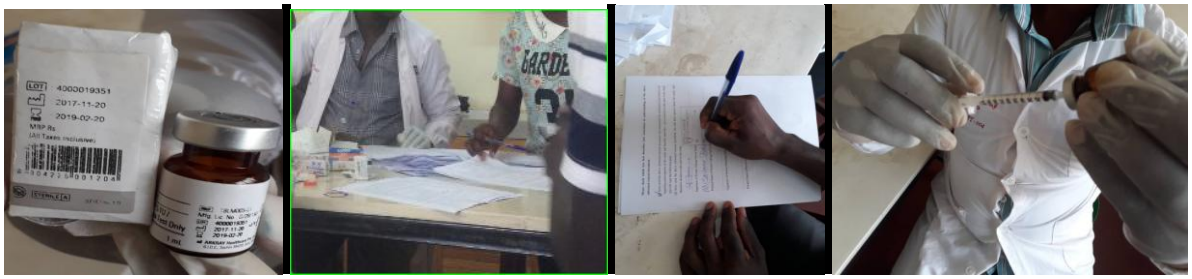
Sign ……. Date…….

Contact m.kabera@studen.ciu.ac.ug, m.kaberamicheal@gmail.com

Phone 0772-060567/ 0703-060567

APPENDIX VI: Images of the procedures involved in carrying out the procedure**.**

Phase 1



1 2 3 4

Key

1: Reagent Kit showing purified protein derivative

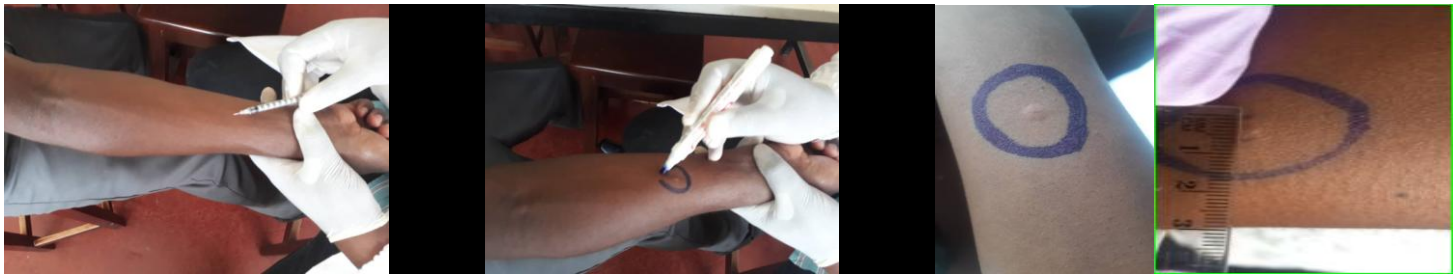
2: Patient education and counseling about the procedure of TST and latent tuberculosis infection.

3: Consenting study participant.

4: Researcher withdrawing 0.1ml of PPD using an insulin syringe.

Phase 11

1 2 3 4



5 6

Key

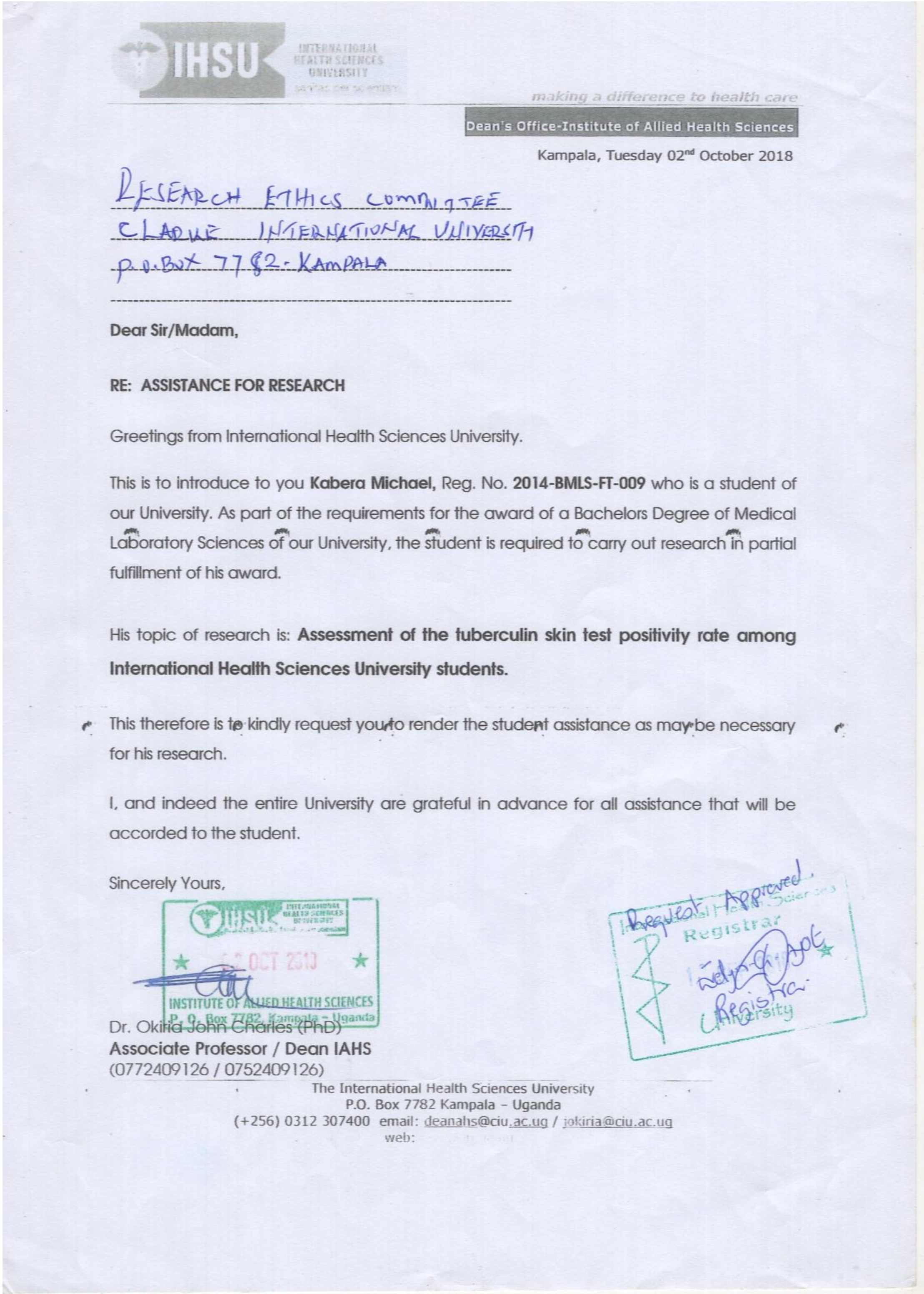
1: 0.Iml PPD administered on the lateral axis of the fore arm.

2: Site of inoculation marked for clear location during TST reading

3: Reaction after inoculation at 0 hours

4 : 5and 6: One of the positive tests after 72 hours.

APPENDIX VII: INTRODUCTORY AND CORRESPONDENCE LETTER



IHSU INTERNATIONAL HEALTH SCIENCES UNIVERSITY

making a difference to health care

Dean's Office-Institute of Allied Health Sciences

Kampala, Tuesday 02nd October 2018

RESEARCH ETHICS COMMITTEE
CLARKE INTERNATIONAL UNIVERSITY
P.O.BOX 7782-KAMPALA

Dear Sir/Madam,

RE: ASSISTANCE FOR RESEARCH

Greetings from International Health Sciences University.

This is to introduce to you **Kabera Michael,** Reg. No. **2014-BMLS-FT-009** who is a student of our University. As part of the requirements for the award of a Bachelors Degree of Medical Laboratory Sciences of our University, the student is required to carry out research in partial fulfillment of his award.

His topic of research is: **Assessment of the tuberculin skin test positivity rate among International Health Sciences University students.**

This therefore is to kindly request you to render the student assistance as may be necessary for his research.

I, and indeed the entire University are grateful in advance for all assistance that will be accorded to the student.

Sincerely Yours,

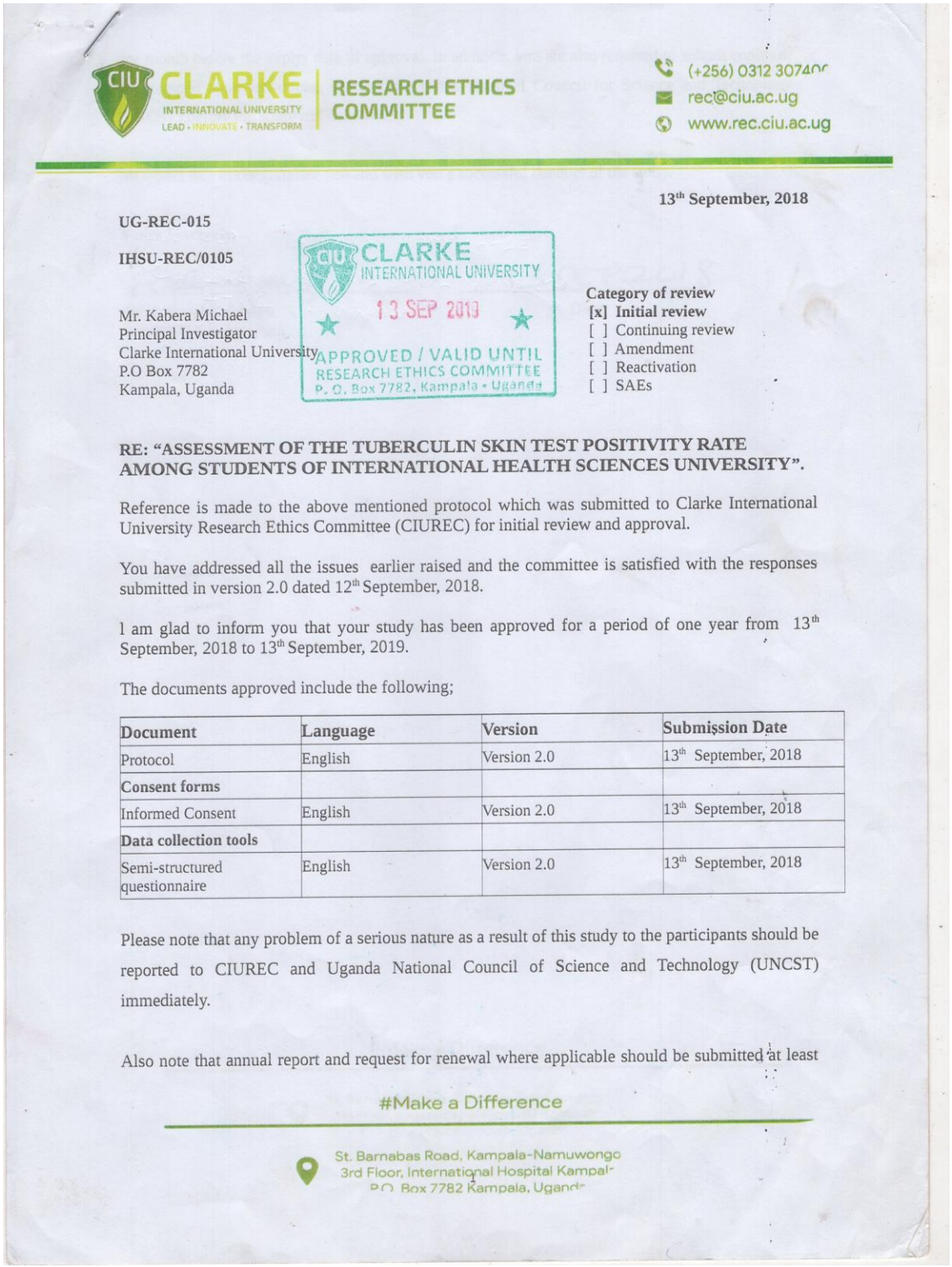
IHSU — 02 OCT 2018 — INSTITUTE OF ALLIED HEALTH SCIENCES, P. O. Box 7782, Kampala - Uganda

Request Approved. Registrar

Dr. Okiria John Charles (PhD)
Associate Professor / Dean IAHS
(0772409126 / 0752409126)

The International Health Sciences University
P.O. Box 7782 Kampala - Uganda
(+256) 0312 307400 email: deanahs@ciu.ac.ug / jokiria@ciu.ac.ug
web:

APPENDIX VIII: APPROVAL LETTER FROM RESEARCH ETHICS COMMITTEE



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13th September, 2018

UG-REC-015

IHSU-REC/0105

CLARKE INTERNATIONAL UNIVERSITY
13 SEP 2018
APPROVED / VALID UNTIL
RESEARCH ETHICS COMMITTEE
P. O. Box 7782, Kampala - Uganda

Mr. Kabera Michael
Principal Investigator
Clarke International University
P.O Box 7782
Kampala, Uganda

Category of review
[x] Initial review
[ ] Continuing review
[ ] Amendment
[ ] Reactivation
[ ] SAEs

RE: "ASSESSMENT OF THE TUBERCULIN SKIN TEST POSITIVITY RATE AMONG STUDENTS OF INTERNATIONAL HEALTH SCIENCES UNIVERSITY".

Reference is made to the above mentioned protocol which was submitted to Clarke International University Research Ethics Committee (CIUREC) for initial review and approval.

You have addressed all the issues earlier raised and the committee is satisfied with the responses submitted in version 2.0 dated 12th September, 2018.

I am glad to inform you that your study has been approved for a period of one year from 13th September, 2018 to 13th September, 2019.

The documents approved include the following;

Document	Language	Version	Submission Date
Protocol	English	Version 2.0	13th September, 2018
Consent forms			
Informed Consent	English	Version 2.0	13th September, 2018
Data collection tools			
Semi-structured questionnaire	English	Version 2.0	13th September, 2018

Please note that any problem of a serious nature as a result of this study to the participants should be reported to CIUREC and Uganda National Council of Science and Technology (UNCST) immediately.

Also note that annual report and request for renewal where applicable should be submitted at least

#Make a Difference

St. Barnabas Road, Kampala-Namuwongo
3rd Floor, International Hospital Kampala
P.O. Box 7782 Kampala, Uganda

one month before the expiry date of approval. In addition, you are also required to submit copies of the stamped approved documents to the Uganda National Council for Science and Technology (UNCST) before the study can commence.

We would like to congratulate you and wish you a successful conduct of the study.

Yours Sincerely,

13 SEP 2018

Dr. Samuel Kabwigu
CIUREC Chairperson

Date