KIBOGORA POLYTECHNIC

FACULTY OF BIOMEDICAL SCIENCES

DEPARTMENT OF MEDICAL LABORATORY SCIENCES

Topic: EVALUATION OF PULMONARY TUBERCULOSIS INFECTION AMONG HIV POSITIVE PATIENTS ATTENDED MUHIMA AND KIBAGABAGA DISTRICT HOSPITALS, RWANDA FROM 2013 TO 2018

Research paper submitted in fulfillment of the requirements for the bachelor' degree with honor in biomedical laboratory sciences.

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DECLARATION

We, KWIZERA Laban and GAHIRWA J. Baptiste hereby declare that this is our original work and not a duplication of any similar academic work. It has therefore not been previously or concurrently submitted for any other degree, diploma or other qualification to Kibogora Polytechnic or any other institution. All materials cited in this paper which are not my own have been duly acknowledged.

Signed……

Date……

Signed…….

Date…….

Declaration by the Supervisor

We declare that this work has been submitted for examination with our approval as KP Supervisor

Supervisor's name: …….

Signed……

Date……

ABSTRACT

Background: Tuberculosis is among 10 top killer WHO, 2016.

Tuberculosis and Human immunodeficiency virus (HIV) are the leading independent global causes of death among patients with infectious diseases. Additionally, due to the shared immune defense mechanisms, they are the leading cause of co-morbidities globally. World Health Organization (WHO) indicate that there are more than 9 million new active cases of TB and close to 2 million deaths per year, and that 2.6 million new cases of HIV infection and 1.8 million AIDS-related deaths occur per year. However, little information was found regarding the proportion of TB/HIV co-infection in the study area Thus, this study was aimed to evaluate pulmonary Tuberculosis infection among HIV positive patients attended Muhima and Kibagabaga hospitals.

A cross-sectional retrospective study was conducted to evaluate HIV patients affected by tuberculosis for a period of six years from 2013-2018 at Muhima and kibagabaga districts hospital. Data recorded in patients file for suspected tuberculosis and laboratory logbook was collected. After data collection data were entered in computer Microsoft excel. Socio-demographic and clinical characteristics of HIV patients infected by tuberculosis was analyzed using SPSS.

Among 1869 HIV patients suspected and diagnosed for tuberculosis, 573 was infected by tuberculosis. Male was more affected than female 52.2 and 47.8% respectively. There is no age group most affected by tuberculosis in interval between 20 years and the positive cases increased when the GeneXpert start to be used.

DEDICATION

This study is wholeheartedly dedicated to our beloved parents, who have been our source of inspiration and gave us strength when we thought of giving up, who continually provide their moral, spiritual, emotional, and financial support. To our brothers, sisters, relatives, friends, and classmates who shared their words of advice and encouragement to finish this study. To our mentor supervisor who keeps our hope on heart by guiding and strengthening us. And lastly, we dedicated this book to the Almighty God, thank you for the guidance, strength, power of mind, protection and skills and for giving us a healthy life. All of these, we offer to you.

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LISTS OF ABBREVIATIONS, ACRONYMS AND SYMBOLS

AIDS: Acquired Immunodeficiency Syndrome

BCG: Bacillus Calmette Guerin Vaccine

HIV: Human immunodeficiency virus

KP: Kibogora Polytechnic

MDR-TB: Multi drug resistance tuberculosis

MT: *Mycobacterium tuberculosis*

P: Proportion

PCR: Polymerize Chain Reaction

SPSS: Statistical Package for the Social Sciences

TB: tuberculosis

WHO: Word Health Organization

ZN: Ziehl neelsen

LED: Auramine

DH: District hospital

CHAPTER ONE: GENERAL INTRODUCTION

1.0. INTRODUCTION

This chapter includes the background, problem statement, objectives, research questions, justification, and significance of the study and scope of the study.

1.1. BACKGROUND

Tuberculosis is a deathful bacterial disease caused by *Mycobacterium*. It mostly affects the lungs (pulmonary TB), besides it can affect other organs as well (extra-pulmonary TB), globally data of 9.6 million people contracted with TB and 1.5 million deaths occurred in 2014 in fact, TB is among disease which kills those infected with Human Immunodeficiency Virus (HIV).

Recently, WHO (Word Health Organization) reported that 12% of the 9.6 million new TB cases were HIV-positive It is known that in HIV patients, active TB is occurred by the reactivation of endogenous latent disease as well as re-infection with a new strain, epidemiological studies evinced that, co-infection with HIV can elevate the risk of latent TB reactivation by 20-foldand is the most potent risk factor known for the advancement of TB infection to active disease This further led to the parallel pandemic of TB in some sub-Saharan African populations where 10%–15% of the adult population suffered from multiple infections.((Mama, 2018).study conducted in Tanzania on Pulmonary tuberculosis among people living with HIV/AIDS attending care and treatment in rural northern Tanzania, The prevalence of tuberculosis was 20/233 (8.5%)((Ngowi, 2008). In Rwanda research conducted on Evaluation of the Rapid Scale-up of Collaborative TB/HIV Activities in TB Facilities in Rwanda, 2005-2009, WHO estimated that the incidence of TB disease in Rwanda was 361 per 100,000 population and 41% of patients with TB disease were infected with HIV((Eric S Pevzner, 2011)

Human immunodeficiency virus (HIV) and Tuberculosis are the first and second leading causes, respectively of death globally due to a single infectious agent. Due to the shared immune defense mechanisms between the two diseases, TB is a leading preventable cause of death among people living with HIV and vice versa. Sometime pulmonary tuberculosis in people living with HIV is drug resistant, and this is caused by mismanagement like: people do not complete a full course of TB treatment, health care providers prescribe the wrong treatment (wrong dose or length of time) and commonly occur in people who don't take TB drug regularly or people who do not take all of their TB drug.

Mycobacterium tuberculosis infects the host mainly through inhalation of aerosolized bacilli; alveolar macrophages are the primary target cells for this intracellular pathogen.

Detection of *M. Tuberculosis* by innate cells recognizing pathogen-associated molecular patterns, via toll-like receptors (TLRs) and nucleotide-binding oligomerization domain receptors, initiates a local inflammatory response and results in increased numbers of macrophages and dendritic cells (DCs) in infected lung tissue and draining pulmonary lymph nodes. Following activation by cytokines and innate receptor agonists, infected macrophages ((A, 2017).

1.2. PROBLEM STATEMENT

Tuberculosis has been a major killer worldwide for centuries and has now exceeded HIV/AIDS and malaria as the world's largest cause of death from an infectious disease so it's why it is a burden (Dye 2015; (WHO, 2016) .

One third is estimated to be co-infected with Tuberculosis, while in world 33.2 million persons infected with the human immunodeficiency virus (HIV). In 2008 there were an estimated 1.4 million new cases of Tuberculosis among persons with HIV infection, and TB accounted for 26% of acquired immune-deficiency syndrome (AIDS) related deaths.

The relative risk of TB among HIV-infected persons, compared with that among non-HIV-infected persons, ranges from 20 to 37-fold, depending on the severity of the HIV epidemic. In 2008, 1.4 million TB patients globally were tested for HIV, and 81 countries, of which many are located in sub-Saharan Africa, tested more than half of their TB patients for HIV. Only 4% of all HIV-infected persons were screened for TB in the same year. ((Uwizeye, 2010)TB continuous as

an enormous public health issue amongst the developing countries, due to HIV pandemic, poverty, movement of displaced people and emergence of multidrug-resistant strains. A previous study evidenced that, in most of the developing countries, HIV pandemics, diabetes, malnutrition, alcoholism, smoking cigarette, active TB contact, extreme poverty, and homelessness are common identified risk factors pertaining to Tuberculosis. TB has been implicated as a significant cause of morbidity and mortality. For instance, Ethiopia is enlisted seventh amongst in the countries with maximum TB burden in the world. The prevalence of TB among HIV positive patients in Ethiopia currently stands at 9.1 % (Aseer Manilal *et al*., 2018).

In the African Region, 76 % of TB patients knew their HIV status in 2012, the prevalence of TB/HIV co-infection was 43 % in Africa and as high as 50–80 % in parts of sub-Saharan Africa, TB /HIV co infection is high burden in Africa ((Desalegn, 2016). The proportion of TB/HIV co-infection from Ethiopia reports is 6.3–20 % ((Mekonnen, 2015).

In Rwanda, the TB-specific totality rate is 7.5% and TB is the most common opportunistic infection among people living with HIV/AIDS (PLWHA). However, the number of TB cases has doubled during the last 10 years, and almost 40% are HIV-positive, this is a big burden (E. (Rugigana, 2010).*Mycobacteria tuberculosis* in Rwanda is still killing many people as well as developing multidrug resistance.

- Policies about tuberculosis: Ensure early case detection and diagnosis through quality-assured bacteriology
- Provide standardized treatment with supervision and patient support
- Ensure effective drug supply and management
- Monitor and evaluate performance and impact.

The challenges: It is not possible to distinguish all of the factors that contributed to the decline of TB before the widespread introduction of chemotherapy or the reasons why progress has since stalled. The emergence of highly drug-resistant tuberculosis, including MDR TB (resistance to at least isoniazid and rifampicin) and XDR TB (MDR plus resistance to at least one fluoroquinolone and one injectable antitubercular antibiotic), has proved a serious hurdle for effective control of tuberculosis in many settings. Assuming lifelong latent infection, about one-

third of humanity could still be infected with *Mycobacteria tuberculosis.* Sufficiently strong surveillance and drug resistance laboratory testing are yet adequate available.

1.3. OBJECTIVES

1.3.1. General objective

To evaluate pulmonary Tuberculosis infection among HIV positive patients attended Kibagabaga and Muhima Hospitals from 2013 to 2018

1.3.2. Specific objectives

1. To identify the pulmonary tuberculosis in HIV positive patients attended kibagabaga and Muhima district hospitals for 6 years ago.
2. To identify the most group of age affected with pulmonary tuberculosis in HIV positive patients attended Kibagabaga and Muhima district hospitals for 6years ago.

1.4. Research questions

What was the number of pulmonary tuberculosis infection among HIV positive patients attended Kibagabaga and Muhima Hospitals for 6years ago?

What was the most group of age affected with pulmonary Tuberculosis infection among HIV positive patients attended Kibagabaga and Muhima Hospitals for 6years ago?

1.5. Justification of the study

The current study was important due to the knowledge of pulmonary Tuberculosis in HIV positive patients are high burden in Rwanda(M. Gasana, 2016)

This study helped us to know actually the number of pulmonary Tuberculosis infection among HIV positive and the most group of age affected with pulmonary Tuberculosis infection to the patients attending Kibagabaga and Muhima Hospitals as well as give the knowledge about TB and medical treatments.

1.5.1. Personal interest

The study provided the actually data about *mycobacteria tuberculosis* and also the knowledge about treatments and preventions.

1.5.2. Scientific and academic interest

This research project will help the scientists to continue for evaluating TB /HIV co-infection and help the students to make good research about TB.

1.5.3. Socioeconomic interest

This research project will be usefully in both socially and economically because of ending this research will provide the knowledge of TB about mode of transmission, prevention, symptoms and treatments and save the time for doing activities without illness.

1.6. SCOPE OF STUDY

1.6.1. In time

The research project was conducted from March to June 2019

1.6.2. In space

The study was carried out in Kibagabaga and Muhima district hospitals

1.6.3. In domain

The study was done in domain of Microbiology.

CHAPTER TWO: LITERATURE REVIEW

2.0. Key terms

TB: Tuberculosis

DR: Drug resistance

HIV: Human Immunodeficiency Virus

MDR-TB: Multi drug resistance tuberculosis

TB-HIV Coinfection:

Risk factors:

Latent TB - the bacteria remain in the body in an inactive state. They cause no symptoms and are not contagious, but they can become active (WHO, ASSESSMENT ON TB, 2016).

Active TB - the bacteria do cause symptoms and can be transmitted to others (Romha G, 2018).

Prevalence: Statistical concept referring to the number of cases of a disease, which are present in a particular population at a given time (medicinenet.com).

Infection: A condition marked by subjective complaints, a specific history, and clinical signs, symptoms, and laboratory or radiographic findings caused by microorganisms ((R, 2011).

Mortality rate: Number of deaths occurring in a population over a given period of time, usually annually ((Benito, 2000).

Morbidity rate: Number of population, who are affected by a particular disease in over a given period ((Ayalewet al., 2015).

Prevention: any measure such as information, campaigns, vaccination, and early diagnosis intended to limit health related risks ((Abramowitz, 2007)

2.1. NATURAL HISTORY OF TUBERCULOSIS

The cardinal event in the pathogenesis of TB, whether in apparent or overt is the implantation of *Mycobacterium tuberculosis* in the tissues. Lung is the most frequent portal of entry. The organism enters the lung from the inhalation of air borne droplets which have been coughed out by 'open' sputum-positive pulmonary TB patients who have received no treatment, or have not been treated fully. The initial contact with the organism results in few or no clinical symptoms or signs. The tubercle bacillus sets up a localized infection in the periphery of the lung. Four to six weeks later, tuberculin hypersensitivity along with mild fever and malaise develops. In the majority of patients, the process is contained by local and systemic defenses. Rupture of the sub-pleural primary pulmonary focus into the pleural cavity may result in the development of TB pleurisy with effusion. Less commonly, tubercle bacilli may be ingested and lodge in the tonsil or in the wall of the intestine. This form of TB occurs following the ingestion of contaminated milk or milk products. Rarely, TB can occur as a result of direct implantation of the organisms into the skin through cuts and abrasions. This form of TB is a health hazard faced by health care workers and laboratory staff who handle materials infected with Mycobacterium tuberculosis.
Primary Tuberculosis from the implantation site, the organisms disseminate via the lymphatics to the regional lymph nodes. The lesion at the primary site of involvement, draining lymphatics and the inflamed regional lymph node constitute the primary complex. When the primary site of implantation is in the lung; it is called Ghon's focus. The draining lymphatics and the involved lymph nodes ((De, 2016).

2.2. SIGNS AND SYMPTOMS PULMONARY TUBERCULOSIS

Latent TB is asymptomatic; the symptoms of active TB include: Coughing, sometimes with mucus or blood, Chills, Fatigue, Fever, Loss of weight, Loss of appetite, Night sweats ((McIntosh, 2017).

2.3.THE CAUSES OF PULMONARY TUBERCULOSIS

Tuberculosis is a disease caused by bacteria (*mycobacterium tuberculosis*) that is mostly often affect lungs. Tuberculosis is curable and preventable. It is spread through the air when a person with TB (whose lungs are affected) coughs, sneezes, spits, laughs, or talks.

Tuberculosis is contagious, but it is not easy to catch. The chances of catching TB from someone you live or work with are much higher than from a stranger. Most people with active TB who have received appropriate treatment for at least 2 weeks are no longer contagious. Reference Since antibiotics began to be used to fight TB; some strains have become resistant to drugs. Multidrug-resistant TB (MDR-TB) arises when an antibiotic fail to kill all of the bacteria, with the surviving bacteria developing resistance to that antibiotic and often others at the same time.

MDR-TB is treatable and curable only with the use of very specific anti-TB drugs in the second line drugs. In 2012, around 450,000 people developed MDR-TB ((Newman, 2017)

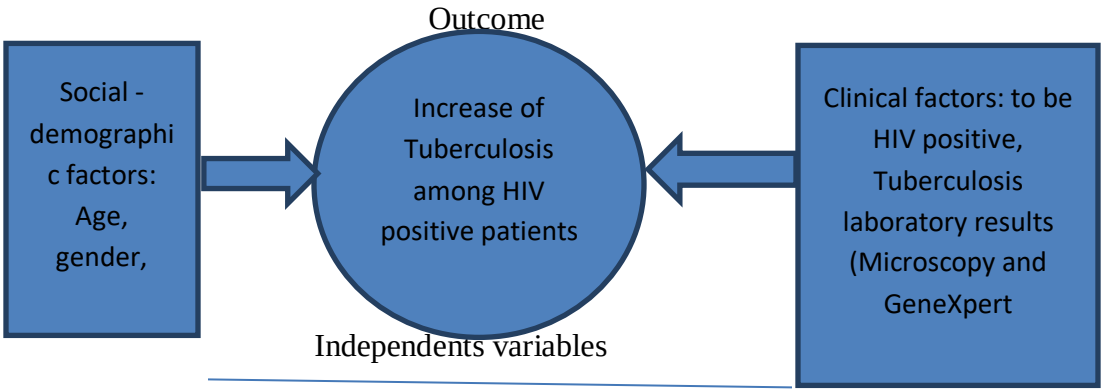
2.4. RISK FACTORS FOR PULMONARY TUBERCULOSIS/HIV PATIENTS

Risk factors influence the probability of infection, disease, or outcome and operate on many scales (physiological, genetic, environmental, and behavioral). Once an individual has been exposed to a person with infectious pulmonary TB, his or her risk of developing subclinical TB infection depends on factors that influence either the ability of the person infected to transmit the disease or the susceptibility of the person exposed to infection and disease. Infected persons who are acid-fast bacillus smear- or culture-positive ((Tornee, 2005), who have cavitary disease, destructive lesions in the lung where the bacilli multiply to high levels ((Rodrigo, 1997).or frequent cough ((Loudon, 1967),or who have delayed treatment ((al, 2008). are major transmitters of TB infection.

Risk factors relevant to the exposed host most often reflect the social and environmental determinants of heavy exposure and include living in densely populated spaces ((MacIntyre, 1997), being incarcerated((Chadha, 2016) . and working in occupations such as health care that involve frequent social or direct contact with TB patients (Hanifa, 2009). Most studies suggest that, among similarly exposed contacts, the risk of TB infection does not vary much by host attributes. However, some recent studies report that genetic loci are associated with differential risk of infection among household contacts exposed to an infectious case (Lienhardet, 2008). While evidence indicates that smoking increases the risk of TB (Ezzati, 2008). In contrast to infection, disease progression is known to be highly dependent on host risk factors, the most important of which include HIV/AIDS co-infection (Selwyn, 2010). Low body mass index

(Lönnroth *et al*., 2010). Exposure to tobacco (WHO 2015d) and biomass fuels indoor air pollution (Bates, 2007).Diabetes mellitus (Murray, 2008), and heavy alcohol use (Lönnroth*et al*., 2008). Host-specific risk factors also affect TB outcomes, including the risks of failing therapy, relapsing after treatment, and dying a TB-related death. In addition to HIV/AIDS, smoking and diabetes are recognized biological risk factors for poor treatment outcomes (Kim, 2014706)and some studies have implicated other co morbidities such as iron overload (Yokoyama, 2004). renal dysfunction and hematological malignancies (Keane, 2001) show that multiple risk factors often converge in individuals living in income poverty, further amplifying their risk of disease, the other risk factor is amount of CD_4 Counts.

2.5. THEORETICAL FRAMEWORK



This section shows the relationship between independent variables and dependent variables for T B infection.

Independent variables

- ✓ Malnutrition
- ✓ Alcohol use
- ✓ Active smoking
- ✓ Persons who have been recently infected with TB bacteria
- ✓ Are pregnant,
- ✓ Are younger than 5 years old or older than 65 years old
- ✓ Persons with medical conditions that weaken the immune system

Dependent variables

Indoor pollution air with MTB

Close contacts of a person with infectious TB diseases

Persons with Medical Conditions that Weaken the Immune System

Exposure to tobacco

Amount of CD_4 Counts.

2.6. PATHOGENESIS OF TUBERCULOSIS

The largest increase in Tuberculosis has occurred in locations and demographic groups with the highest HIV prevalence, which suggests that the epidemic of HIV is at least partially responsible for the increase of Tuberculosis, there is evidence that immune responses in Tuberculosis and in other infection induce cytokines that enhance the replication of HIV and this drives the patient into full picture of AIDS.

Low CD4 cells in HIV-infected persons indicates severely depressed immunity that makes them susceptible to fresh TB infection or reactivation of latent infection and rapid degradation of clinical condition. It has already been established that TB attributed to a six-fold to seven-fold increase of viral load in HIV positive population. Unlike cryptococcal meningitis or toxoplasmosis, which occur at very low CD4 counts, TB is unique in that it can occur over a wide range of CD4 counts, although it is more frequent at CD4 counts < 300 cells/μl. According to an estimate of World Health Organization, TB has become one of the leading causes of death among HIV-infected persons (Pargaonkar, 2016).

2.7. EFFECT OF TUBERCULOSIS ON THE DISTRIBUTION OF OTHER DISEASES

TB affects the presence and nature of other diseases, possibly conferring protective effects. Microbial infections have the potential to influence the balance between CD4+ T-cell functional subsets by stimulating innate immune responses and by altering cytokine profiles, with positive or negative consequences for health ((Sallusto, 2014). *Mycobacterium tuberculosis* infection

may also protect against asthma, possibly by shifting the innate and acquired Th2 response to a Th1 subset that reduces the inflammatory response. A study conducted in japan found that strong tuberculin responses following BCG immunization were associated with less asthma, rhino conjunctivitis, and eczema in later childhood ((Shirakaw, 2016). A study of South African children found an inverse association between M. tuberculosis infection and atopic rhinitis (Obihara*et al* 2005). Comparisons among countries have found that asthma tends to be more common where TB is less common ((Shorncliffe, 2015).

2.8. ASPECTS OF IMMUNE RESPONSE TO *MYCOBACTERIA TUBERCULOSIS* INFECTION

M. tuberculosis infects the host mainly through inhalation of aerosolized bacilli; alveolar macrophages are the primary target cells for this intracellular pathogen. Detection of M. Tuberculosis by innate cells recognizing pathogen-associated molecular patterns, via toll-like receptors (TLRs) and nucleotide-binding oligomerization domain receptors, initiates a local inflammatory response and results in increased numbers of macrophages and dendritic

Cells (DCs) in infected lung tissue and draining pulmonary lymph nodes. Following activation by cytokines and innate receptor agonists, infected macrophages elicit direct bactericidal effectors functions, such as reactive oxygen or nitrogen intermediates, or expression of small GTPases that can regulate endosomal trafficking. DCs can phagocytose the bacteria in

lung tissue, migrate to draining lymph nodes, and initiate the adaptive immune response by priming naïve T Lymphocytes Cell-mediated immunity is essential for control of Tuberculosis

Infection; activation of both CD4+and CD8+T cells is seen inactive TB in humans, during infected lung are thought to control infection by producing interferon gamma (IFN-c) in response to mycobacterium antigens presented by macrophages. In turn, IFN-c activates

Macrophages to kill the intracellular bacteria through reactive nitrogen and oxygen intermediates, and by inducing phagolysosome formation. However, these mechanisms might

even be present in susceptible hosts, in which the infection progresses to disease. The full knowledge of the constituents of an effective protective immune response to TB is still incomplete. In the M. Tuberculosis–infected host there is also a robust humoral

response, with a wide spectrum of antibodies of different specificities and isotopes; although secondary to the cellular immune responses in terms of protection, B cells as well as certain Ab responses have been shown to be capable of playing an

Important role in protective immunity to TB ((ld, 2016)

2.9. Tuberculosis reactivation by Human Immunodeficiency Virus

It is generally thought that one-third of the world's population is latently infected with *Mycobacteria tuberculosis*, although the data supporting this notion may be questioned. Also, the rate of progression from infection to disease varies greatly. Approximately 10% of M. Tuberculosis–infected individuals are thought to develop overt clinical disease and about half of them develop disease more than two years after infection; these cases are commonly named ''reactivation'' or post-primary TB. Thus, the lifetime risk of developing active TB in immune competent adults is estimated to be 5%–10% during their lifetime, but in HIV-positive individuals this risk is increased to 5%–15% annually. In the latent phase of TB, the bacteria are not completely eradicated despite a seemingly robust Th1 immune response. A failure or an alteration of the quality or levels of the protective adaptive immune responses or of the cross-talk with innate immune responses leads to reactivation of infection. Several immune mechanisms, such as increased levels of FoxP3+Treg cells, increased production of IL-27, TGF-b, PGE-2, SOCS1, or the decoy receptor D6, or diminished levels of IFN-c, TNF, and polyfunctional specific T cells, are believed to play a role in such reactivation ((Rotenberg, 2016)

TREATMENT OF TUBERCULOSIS

First-line treatment of drug-susceptible tuberculosis

TB drugs - the first line drugs

The five first line TB drugs are: Isoniazid, Rifampicin (In the United States rifampicin is called rifampin) Pyrazinamide, Ethambutol and Streptomycin. These are the anti-tubercular drugs that generally have the greatest activity against TB bacteria.

Rifampicin and isoniazid are the most potent drugs for susceptible TB and are taken throughout the course of first-line treatment ((McIlleron, 2017).

Second-Line Treatment of Multi drug resistance tuberculosis

The treatment of drug-resistant TB is evolving, and recommendations are changing rapidly. Four factors make it difficult to arrive at clear, generalizable recommendations. First, individual strains vary in their susceptibility, and customized regimens might be more appropriate, when possible. Second, testing susceptibility to pyrazinamide and second- and third-line agents is neither widely available nor consistently reliable. Third, many agents have limited availability due to their cost or limited production. Finally, few comparative studies are available to provide data on which to make optimal treatment decisions.

In general, these second- and third-line agents are less potent and must be administered for a more extended period of time, ranging from 9 to 24 months. They are also more difficult to administer, as most regimens contain agents such as kanamycin and amikacin that must be administered by injection. These drugs are far more toxic than first-line agents, causing a range of drug-specific side effects. Nevertheless, it has been possible to achieve MDR TB cure rates of 60–80 percent irrespective of HIV/AIDS status in settings with severe resource constraints and patients with advanced disease ((Meressa, 2017).

Table 1:Treatment in specific situations

Group A : Fluoroquinolones	**Group B : Second line**	**Group C : Other core second line drugs**	**Group D: add-on drugs (not part**

	injectable drugs		**of the core MDR-TB Regime)**
Levofloxacin (Lfx)	Amikacin (Am)	Ethionamide/Prothionamide (Eto/Pto)	D1 Pyrazinamide
Moxifloxacin (Mfx)	Capreomycin (Cm)	Ethionamide/Prothionamide (Eto/Pto)	D1 Ethambutol (E)
Gatifloxacin (Gfx	Kanamycin (Km)	Cycloserine / Terizidone (Cs Trd)	D1 High-dose isoniazid
	(Streptomycin)	Linezolid	D2 Bedaquiline
			D3 Meropenem

Treatment in specific situations

Regimens for treating tuberculosis in children are identical to those for adults. Correct dosing by weight is essential, and the most appropriate formulation of combination medications receives ongoing advocacy (WHO 2013c).

Tuberculosis in pregnancy can be treated with isoniazid, rifampicin, pyrazinamide, and ethambutol. However, Streptomycin, amikacin, and kanamycin may cause fetal ototoxicity and should not be used if possible (Donald 2016). The safety of other drugs used to treat MDR TB has not been well studied in pregnancy. Treatment should be individualized, with expert review. Contraceptive advice during MDR TB treatment is essential.

Glucocorticoids may limit the inflammatory damage associated with tuberculosis (Crotchety and others 2013). Evidence supports the use of glucocorticoids for tuberculosis meningitis (Prasad and Singh *et al*., 2008).

2.11. DIAGNOSIS OF TUBERCULOSIS INFECTION

A complete medical evaluation for TB disease includes the following five components:

- Medical history

- Physical examination
- Test for M. tuberculosis infection
- Chest radiograph
- Bacteriologic examination of clinical specimens

2.11.1. Medical History

When conducting a medical history, the clinician should ask if any symptoms of TB disease are present; if so, for how long, and if there has been known exposure to a person with infectious TB disease. Equally important is obtaining information on whether or not the person has been diagnosed in the past with TB disease.

TB disease most commonly affects the lungs and is referred to as pulmonary TB disease. Symptoms include: Cough (especially if lasting for 3 weeks or longer) with or without sputum collection, Coughing up blood (hemoptysis)Chest pain, Loss of appetite, Unexplained weight loss, Night sweats, Fever, Fatigue.

2.11. 2. Physical Examination

A physical examination is an essential part of the evaluation of any patient. It cannot be used to confirm or rule out TB disease, but it can provide valuable information about the patient's overall condition, inform the method of diagnosis, and reveal other factors that may affect TB disease treatment, if diagnosed.

2.11.3. Test for *Mycobacteria tuberculosis* Infection

Selection of the most suitable tests for detection of M. tuberculosis infection should be based on the reasons and the context for testing, test availability, and overall cost effectiveness of testing. Currently, there are two methods available for the detection of M. tuberculosis infection in the United States. The tests are: Mantoux tuberculin skin test (TST); and Interferon-gamma release assays (IGRAs) Quanta FERON-TB Gold In-Tube test (QFT-GIT) T-SPOT®.TB test.

These tests may help clinicians differentiate people infected with M. tuberculosis from those uninfected. However, a negative reaction to any of the tests does **not** exclude the diagnosis of TB disease or LTBI.

2.11.4. GeneXpert

Method: Integrates and automates sample processing, nucleic acid amplification, and detection of the target sequences in simple or complex samples using real-time PCR. The system consists of an instrument, personal computer, barcode scanner, and preloaded software for running tests on collected samples and viewing the results. The system requires the use of single-use disposable GeneXpert cartridge that holds the PCR reagents and hosts the PCR process. Because the cartridge is self-contained, cross-contamination between samples is eliminated. GeneXpert MTB/RIF includes reagents for the detection of tuberculosis and RIF's resistance as well as a sample processing control (SPC) to control inhibitor for adequate processing of the target bacteria and to monitor the presence of (s) in the PCR reaction. The Probe Check Control (PCC) verifies reagent rehydration, PCR tube filling in the cartridge, probe integrity, and dye stability. (WHO, *et al* 2010).

Principle of GeneXpert

- Real-time PCR (amplification and detection at the same time)
- No wet interface between instrument and cartridge to eliminate carry-over
- Total internal control of reagents system – No separate external positive or negative controls required
- Integrated ultrasonic lysis of cells for release of DNA
- Software instructions to individual module motherboards to coordinate valve movement and integral hydraulic drives
- Smart fluidics - Flow of liquids directed by micro valves – Allow using micro quantities of reaction components
- Automated data analysis and results interpretation (Global Laboratory Initiative, *et al.*,2018)

Procedures of GeneXpert

Sample preparation: direct sputum

- Carefully unscrew the lid of sputum container

- Pour 2 volumes of sample reagent (SR) directly into 1 volume of sputum in the sputum container (1 ml of sputum is the minimum quantity, while 3-4 ml is the optimal quantity required)
- For larger volume specimens (over 4 ml), a portion of SR from a second bottle would be needed, as each bottle contains 8 ml of SR
- Replace the lid, and shake vigorously 10-20 times (one back and forth movement is a single shake), or vortex
- Incubate at room temperature for 10 min
- After 10 min of incubation, again shake (or vortex) the specimen vigorously 10-20 times
- After additional 5 min of incubation, sample should be perfectly fluid before being tested, with no visible clumps of sputum. If still viscous, wait 5-10 more minutes before inoculating in the cartridge (2-4 ml of the final solution)

Sample preparation: processed sputum sediment

- Add 1.5 ml of sample reagent to 0.5 ml of suspended sediment from digested/decontaminated and concentrated sputum specimen (Note: ratio of SR to sample 3:1)
    - Replace the lid, and shake vigorously 10-20 times (one back and forth movement is a single shake), or vortex
    - Incubate at room temperature for 10 min
    - After 10 min of incubation, again shake (or vortex) the specimen vigorously 10-20 times
    - After additional 5 min of incubation, sample should be perfectly fluid before being tested with no visible clumps of sputum
    -

Reading the test result

Results of GeneXpert should be interpreted along with clinical, radiographic, and other laboratory findings. The GeneXpert MTB/RIF assay does not replace the need for smear with microscopy for acid-fast bacilli, culture for mycobacteria, and growth-based drug susceptibility testing, in addition to genotyping for early discovery of outbreaks.

Results from the GeneXpert MTB/RIF assay indicate whether or not MTBC was detected in the sample. In some instances, the result is "invalid," whereby the test should be repeated.
If MTBC was detected, the results will also state whether resistance to RIF was

- **Detected**: Mycobacteria have a high probability of resistance to RIF; should be confirmed by additional testing. If RIF resistance is confirmed, rapid molecular testing for drug resistance to both first-line and second-line drugs should be performed so that an effective treatment regimen can be selected.
- **Not detected**: Mycobacteria are probably susceptible to RIF; all tests that are positive for MTBC should have growth-based susceptibility testing to first-line TB drugs.
- **Indeterminate:** the test could not accurately determine if the bacteria are resistant to RIF. Growth-based susceptibility testing to first-line TB drugs should be performed.

2.12. CULTURE

Diagnosis of tuberculosis can only be made by culturing *Mycobacterium tuberculosis* organisms from a specimen taken from the patient

Colonies of *Mycobacterium tuberculosis* growth on a culture plate as part of a TB culture test CDC/Dr George Kubica

A culture test involves studying bacteria by growing the bacteria on different substances. This is to find out if particular bacteria are present. In the case of the TB culture test the test is to see if the TB bacteria Mycobacterium tuberculosis, are present.

The substances are either solid substances on culture plates, or bottles of liquid known as culture broths. The substances are chosen to make it as easy as possible for the bacteria to grow.

The bacteria are usually contained in a sputum sample taken from the patient suspected of having TB in their lungs. But TB can occur in other parts of the body. When extra pulmonary TB (disease outside the lungs) is suspected, then a variety of other clinical specimens such as urine can be submitted for examination.[1]

Mycobacterium tuberculosis is called acid-fast bacilli (AFB) because after an acid wash the bacteria retain the colour of the stain. They can then be seen under the microscope

2.13. TUBERCULOSIS PREVENTION

There are three obvious strategies for preventing tuberculosis: vaccination, infection control, and chemoprophylaxis or isoniazid preventive therapy (IPT). Arguably, the most useful but perhaps least appreciated preventive intervention is simply the early diagnosis and rapid initiation of effective treatment of TB cases, thus reducing the infectious burden and reducing transmission. TB is unusual among infectious diseases, in that appropriate treatment of the individual patient may be the most effective public health intervention to protect the population.

2.13.1 Preventive Therapy

There are two approaches to preventive therapy. For HIV-positive individuals at high risk for many opportunistic infections, cotrimoxazole is recommended routinely, and in high-burden countries between 50 and 87 percent of HIV-positive patients are receiving this preventive therapy (WHO 2015b).

2.14. VACCINATION

The most widely used vaccine in the world is BCG (Bacillus Chalmette Guerin Vaccine), which is given to about 100 million children annually. Isolated in 1908, following attenuation through 431 passages of a virulent M. bovis isolated from a human TB case, BCG was found to be protective to some extent in multiple animal models of TB. In its first human trial in 1921, it was found to protect a child heavily exposed in a household at high risk. Considerable evidence indicates that giving BCG to young children is effective at preventing tuberculosis meningitis and disseminated (Mangtani *et al*., 2014).

CHAPTER TREE: METHODOLOGY

3.0. INTRODUCTION

This chapter contains: research design, study area description, target population, sampling technique, sample size, data collection method, ethical consideration, inclusion criteria, exclusion criteria and limitation of the study.

3.1. STUDY DESIGN

A retrospective study was carried out among HIV positive patients attending Kibagabaga and Muhima district hospitals. The study carried out between the months of March and June 2019.

3.2. STUDY AREA DESCRIPTION

This study project was carried out at Kibagabaga and Muhima district hospitals. Kibagabaga was located at Gasabo district, Kimironko sector, Rugero cellule. The hospital received patients from Gasabo district and those who came in other surrounding districts (Kicukiro, Nyarugenge), and elsewhere. It had a Capacity of bed: 225, bed occupancy rate: 80-90%, average length of stay: 3 days and Seven health canters, 203 total patients per month, 600 per trimester, 20 positives rate for TB per month as well as it had a special service like Intensive Care unit and MDR-TB. Muhima hospital is located in Kigali city Nyarugenge district Muhima sector, this hospital has difference services including laboratory where our data comes from their recorded log books of microbiology

3.3. TARGET POPULATION

The study project targeted all HIV positive patients attending Kibagabaga and Muhima district hospital from 2013 to 2018.

3.4. SAMPLE DESIGN

3.4.1 Sample size

All HIV positive patients attended Muhima and Kibagabaga district hospital from January,2013 up to December 2018

3.4.1 Inclusion criteria

All HIV positive patients from 2013 to 2018.

3.4.2 Exclusion criteria.

All HIV negative patients, All HIV positive patients who disagree to sign the consent form.

3.5.DATA COLLECTION METHOD

Non Probability Convenience

3.5.1 Data collection instrument

In our study we used log books that were in the microbiology service to collect the information about pulmonary tuberculosis among HIV positive patients. And data were wrote down on our datasheet collection

3.6. DATA ANALYSIS

The data from the target population was Gather coded and entered with personal digital assistant where compiled, filtered and analyzed using statistical package for social sciences (SPSS) software version 20 and Microsoft excel

3.7. ETHICAL CONSIDERATION

The study carried out after getting the approval recommendation from Kibogora Polytechnic, and we were also permitted to collect data by the administration of Muhima and Kibagabaga district hospitals by their approval letter of data collection, and in the laboratory was a code used where by no names appeared to keep confidentiality of the patient. And it is understandable what plagiarism entail and aware of University's policy in this regard.

CHAPTER FOUR: DATA PRESANTATION, ANALYSIS AND INTERPRETATION

4.0 INTRODUCTION

In this chapter the raw data from datasheet collection are presented, analyzed and interpreted. The result of study evaluation of pulmonary tuberculosis among HIV positive patients attended Muhima and Kibagabaga District are presented. The chapter ends up by the summary of the findings. The data analysis was done using the Statistical Package for Social Sciences (SPSS) Windows, version 20, and the results were presented using graphs.

4.1 PRESENTATIN OF FINDINGS AND INTERPRETATION

4.1.1 Frequency of Tuberculosis among HIV patients according to gender

This figure 4.1 shows the distribution of HIV patient infected by tuberculosis according to gender. Male was more affected than female.

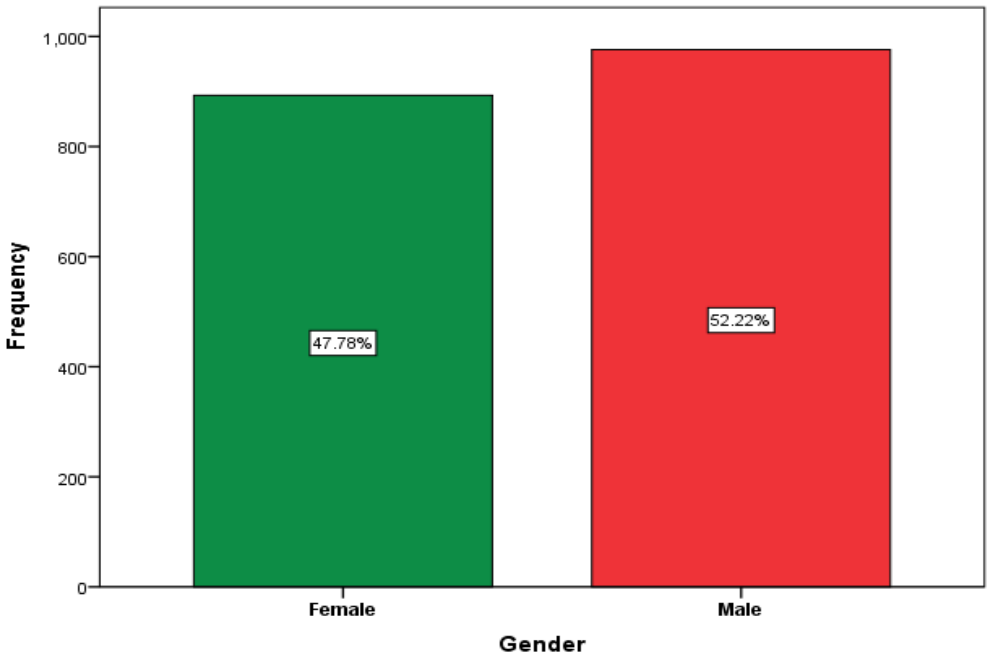


Figure4. 1:Frequency of Tuberculosis among HIV patients according to gender

4.1.2 Distribution of tuberculosis in HIV patients according to age group

This figure 4.2 below shows the distribution of Tuberculosis in HIV infected patients according to age group. In the defined age group 1-20, 21-40, 41-60, 61-80, 81-100 TB was distributed as follows, 8.4,49.0, 35.0,7.4, 0.4 percent respectively.

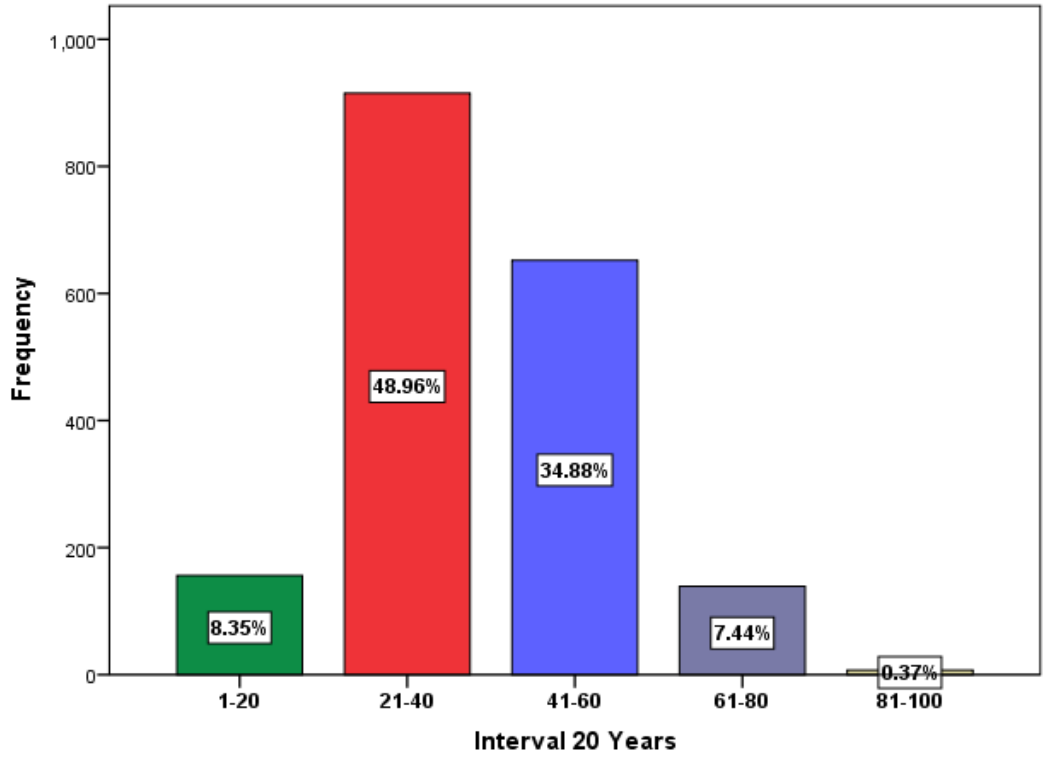


Figure4. 2:Distribution of tuberculosis in HIV patients according to age group.

4.1.3 Microscopic result by using ZN1

The figure 4.3 show the microscopic result of tuberculosis in HIV infected patients by using ziehl Neelsen 1 the study shows that in all suspected, the negative had high frequency compare to positive cases

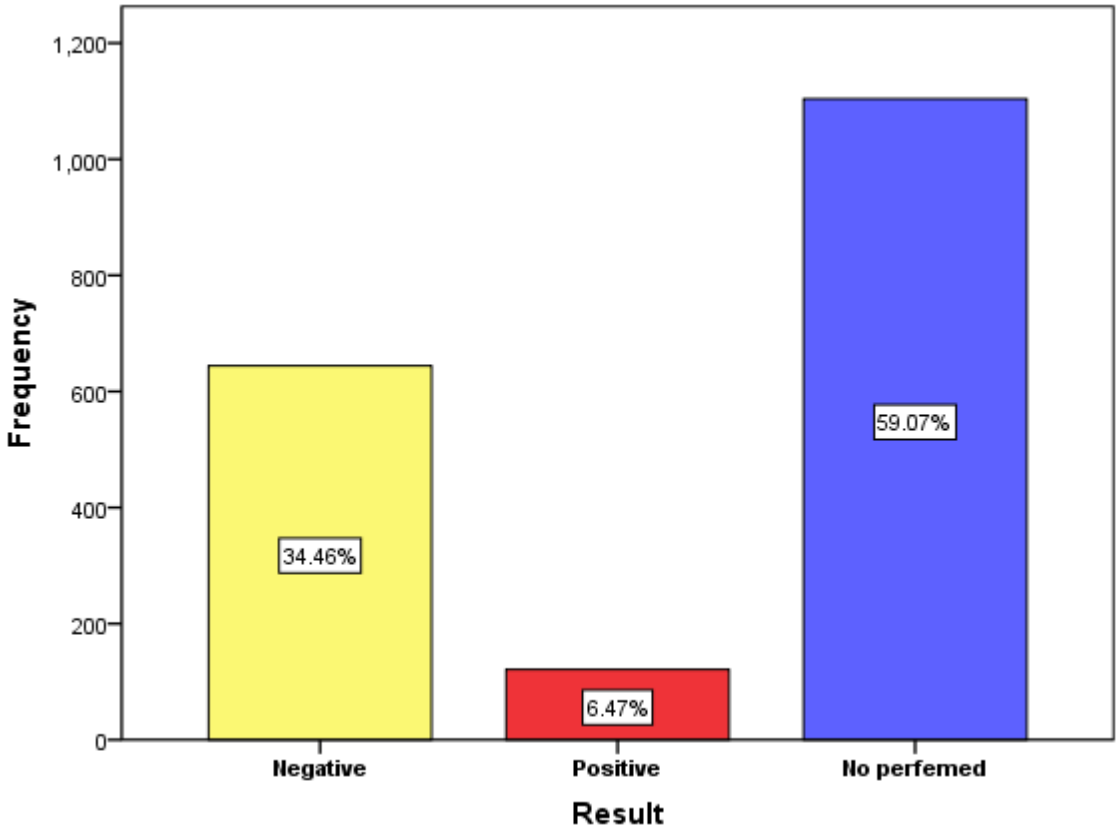


Figure4. 3:Microscopic result by using ZN1

4.1.4 Microscopic result by using ZN2

The figure 4.4 show the microscopic result of tuberculosis in HIV infected patients by using ziehl Neelsen 2, study shows the result of suspected on ZN1 and also test of ZN 2 perfumed again as confirmatory test.

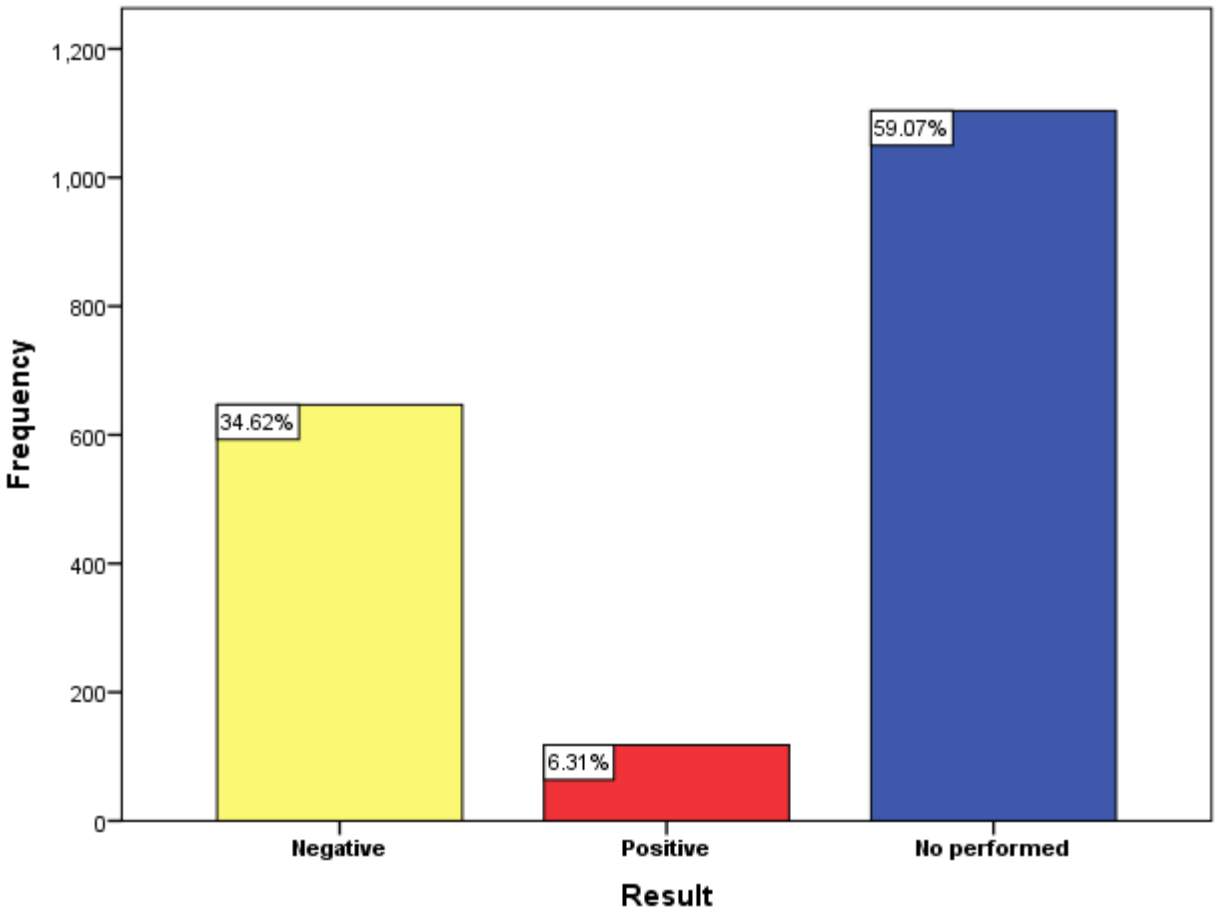


Figure4. 4:Microscopic result by using ZN2

4.1.5 Microscopic result by using LED 1

The figure 4.5 show the microscopic result of tuberculosis in HIV infected patients by using fluoresce microscopy 1 the study shows that in all suspected, the negative had high frequency compare to positive cases

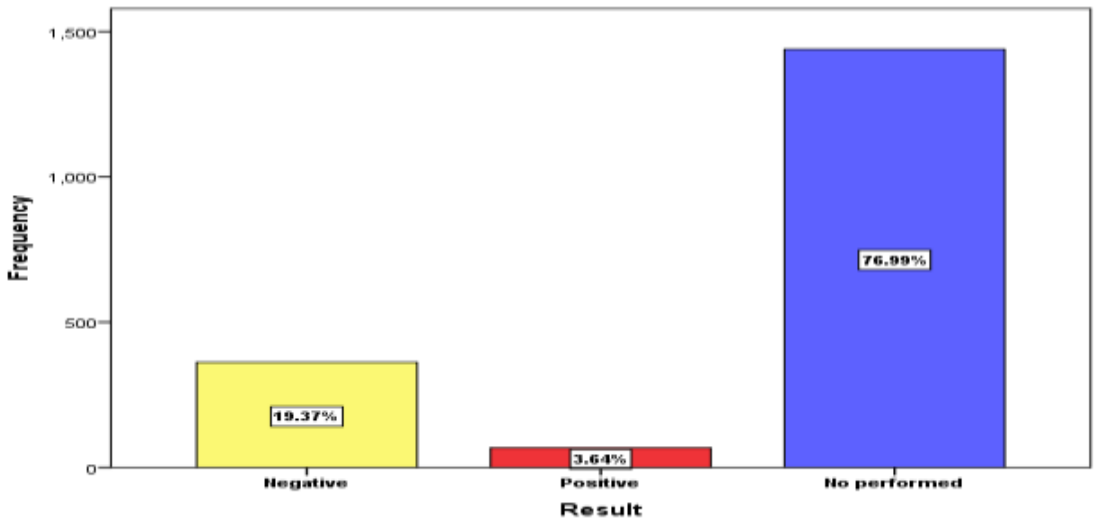


Figure4. 5:Microscopic result by using LED 1

4.1.6 Microscopic result by using LED2

The figure 4.6 show the microscopic result of tuberculosis in HIV infected patients by LED 2, study shows the result of suspected on LED 1 and also test of LED 2 perfumed again as confirmatory test

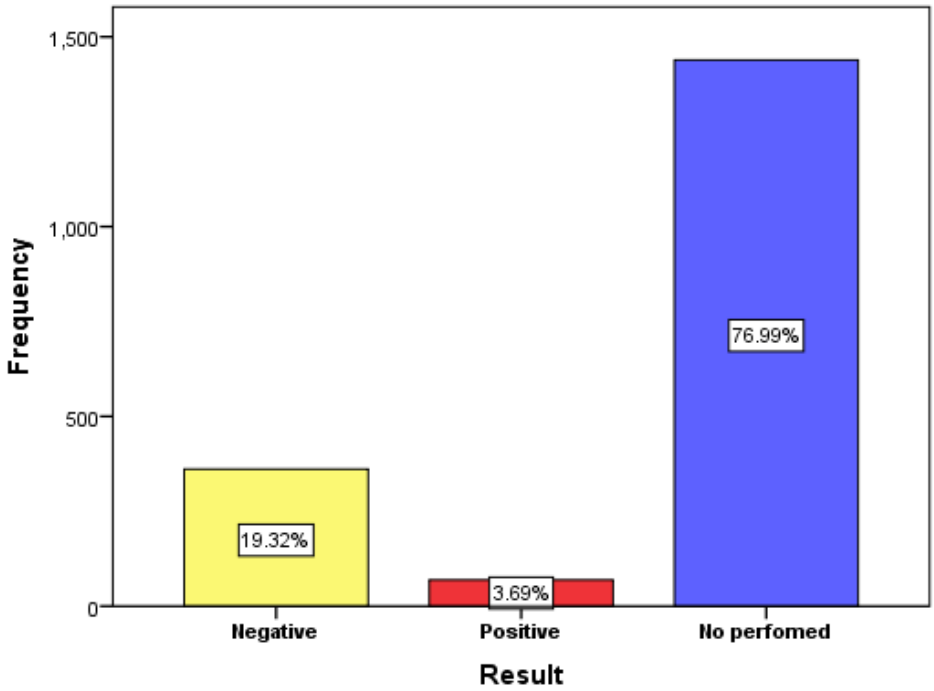


Figure4. 6:Microscopic result by using LED2

4.1.7 Microscopic result by using GeneXpert

The figure 4.7 show the microscopic result of tuberculosis in HIV infected patients by using GeneXpert study shows the result of suspected by using molecular biology technic (GeneXpert), the positive cases increasing when we compared to others technic above

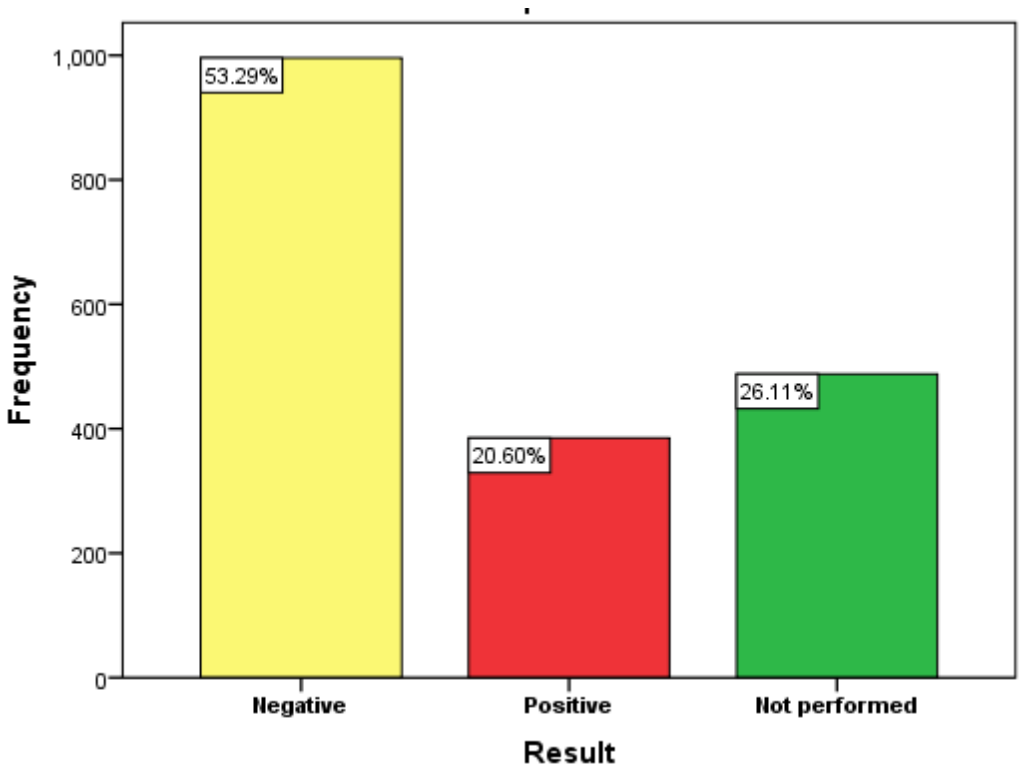


Figure4. 7:Microscopic result by using GeneXpert

4.1.8 Negative and positive cases among suspected TB in HIV patients at Muhima DH 2013-2018

The figure 4.8 show that negative and positive cases among suspected TB in HIV positive patients at Muhima district hospital from 2013 to2018, the positive case of tuberculosis has increased from 24 in 2013 to 45 in 2018

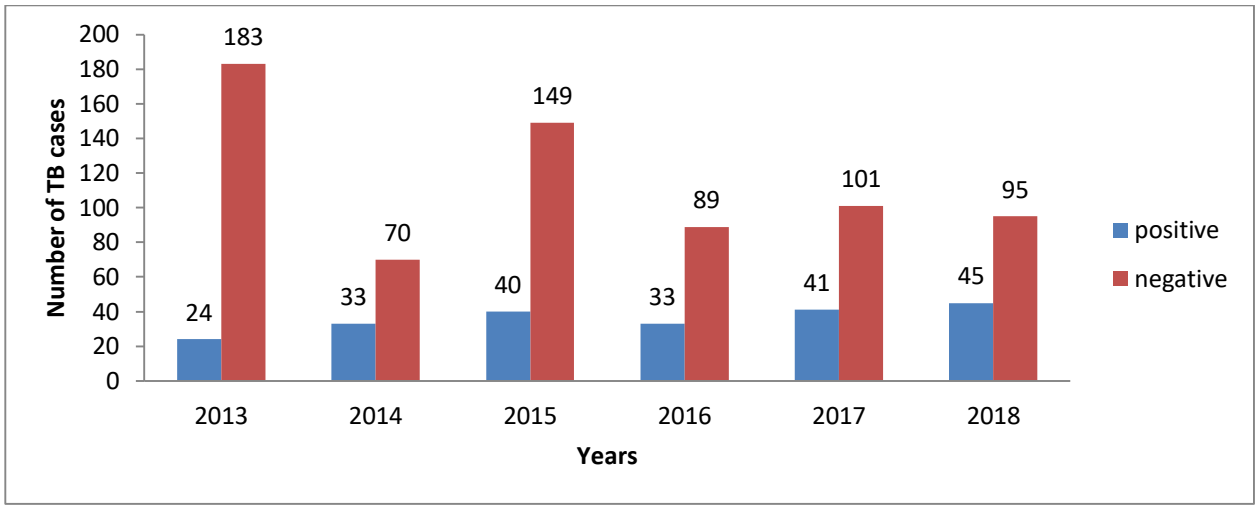


Figure4. 8: Negative and positive cases among suspected TB in HIV patients at Muhima DH 2013-2018

4.1.9 Negative and positive cases among suspected TB in HIV patients at Kibagabaga DH 2013-2018

The graph 4.9 show that neg4ative and positive cases among suspected TB in HIV positive patients at Kibagabaga district hospital from 2013 to 2018, the positive case tuberculosis has increased from31 in 2013 to 41 in 2018

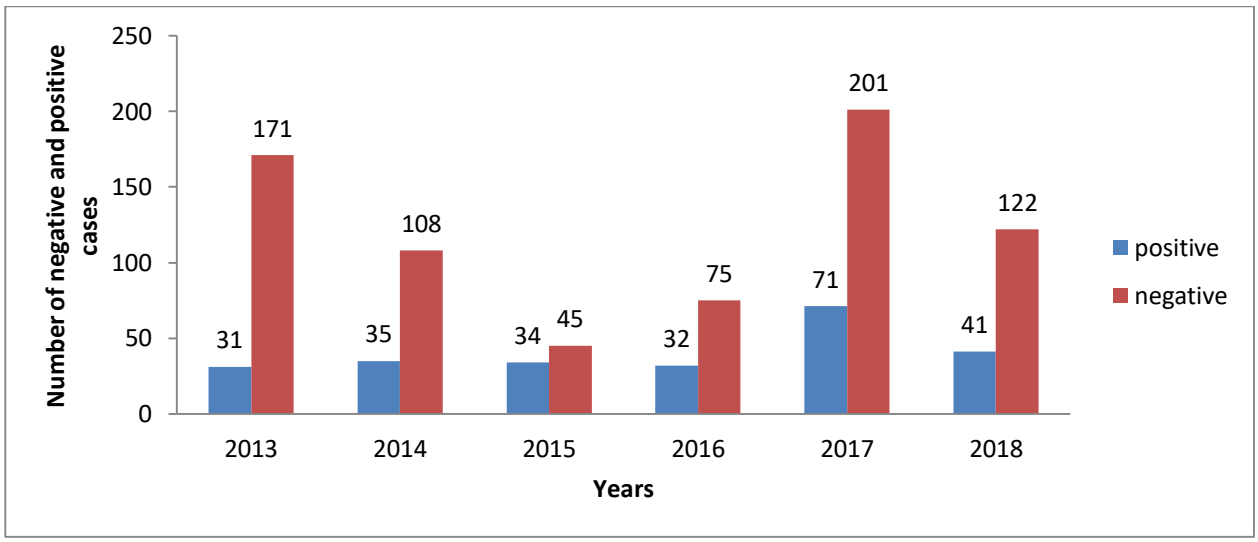


Figure4. 9:Negative and positive cases among suspected TB in HIV patients at Kibagabaga DH 2013-2018

4.1.10 Relationship between age groups and result on GeneXpert

The figure 4.11 shows that the relationship between age groups of 20 interval by the association is like difference but is not true, it is same according the ball chat, it means that the more people at the same group, they increasing result performance.

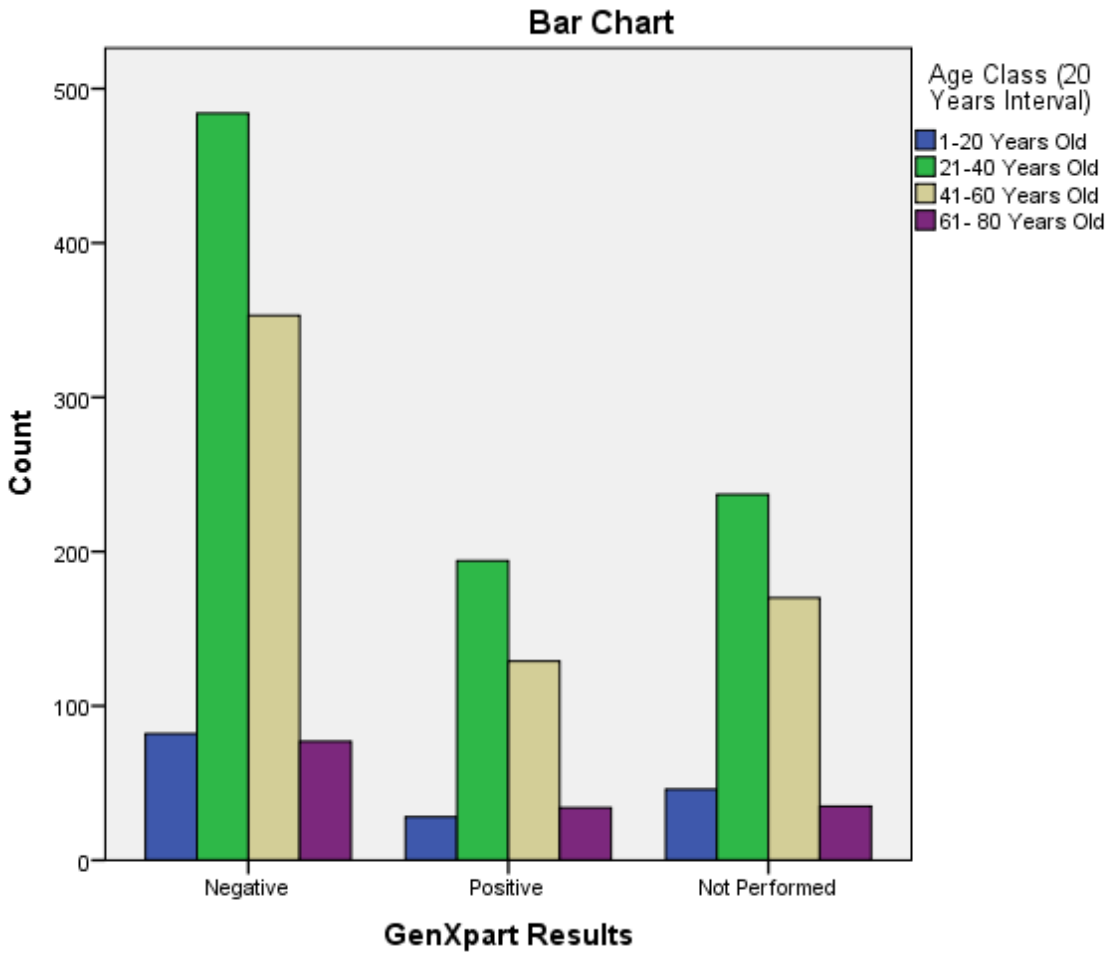


Figure4. 10:Relationship between age groups and result on GeneXpert

Relationship between age group (interval of 20 years) and result on GeneXpert

By ANOVA table show that association between age group and result on GeneXpert was found chi- square 188.894 and p-value 0.639 it means that there is no signification.

Figure4. 11:Relationship between age group (interval of 20 years) and result on GeneXpert.

	Sum of Squares	Sig.
Between Groups	188.894	.639

Pearson's Chi-square Tests was used with Fisher Exact Tests where appropriate. Significance was set at p<.05 at 95 CI.

4.2. DISCUSSION OF FINDINGS

This study was aimed to evaluate Tuberculosis infection among HIV positive patients attended Kibagabaga and Muhima Hospitals from 2013 to 2018.The sample size of our study was 1869 participants living with HIV virus which was suspected to have tuberculosis. We analyzed data collected using SPSS software, Microsoft excel and our findings focused on the objectives of the study

All this patient asked to be screened for tuberculosis by laboratory techniques, microscopy and molecular biology GeneXpert. Among 1869 HIV patients suspected TB laboratory microscopy techniques using either zeihl Neelsen or Auramine staining was performed in which 190 was found TB positive and 1294 was fount TB negative where 385 tested MTB positive rifampicin not resistant using molecular technique GeneXpert. We collected socio-demographic and clinical characteristics of our study participants using patient's file and tuberculosis laboratory log book designed for suspected tuberculosis patients.

For socio-demographic characteristics, findings from our study shows that age group between 21-40 was more infected which occupied 48.9% of the total HIV positive patients infected by TB but this does not mean the most affected age group is between 21 to 40 because the frequency goes up thanks to the most suspected patients included in this age group. They were followed by age group 41-60with 34.8% which was the second to have most suspected patients and 1-20 age group was 8.3%. by using Pearson's Chi-square Tests the relationship between age group and result on GeneXpert has no significance because of p-value(0.639) is above p-value 0.05 .This

finding online with other study conducted by *Ingrid V.at al* in the study conducted on Intensive Tuberculosis Screening for HIV-Infected Patients Starting Antiretroviral Therapy in Durban, South-Africa", they found that the age group 31-43 was also among infected by tuberculosis in HIV patients (Ingrid V.*at al)*.

This study shows also that in socio-demographic characteristics, the distribution of HIV patient infected by tuberculosis according to gender, male was more affected than female 52.2% and 47.8% respectively compare to the study on Pulmonary tuberculosis among people living with HIV/AIDS attending care and treatment in rural northern Tanzania show the social demographic according to gender, the female were most affected at 70% while male were at 30%(BJ Ngowi, SG Mfinanga 2008)

This study shows that at Muhima DH in 2013 total suspected were 207, the positive cases was 24 and negative 183. In 2014 total suspected 103, the positive cases were 33 and negative were 70.in 2015 total suspected were 189, the positive cases were 40 and negative were 149.in 2016 total suspected were 122, the positive cases were 33 and negative 89. In 2017 total suspected were 142, the positive cases were 41 and negative were 101.in 2018 total suspected were 140, the positives cases were45 and negatives were 95. The overall suspected were 903 the positive cases were 216 and negative were 687

At Kibagabaga DH in 2013 total suspected were 202, the positive cases were 31 and negative 171. In 2014 total suspected 143, the positive cases were 35 and negative were 108.in 2015 total suspected were 79, the positive cases were 34 and negative were 45.in 2016 total suspected were 107, the positive cases were 32 and negative 75. In 2017 total suspected were 272, the positive cases were 71 and negative were 201.in 2018 total suspected were 163, the positives cases were41 and negatives were 122. The overall suspected were 966 the positive cases were 244 and negative were 722

4.3 RESULT ANALYSIS

Our study shows that during use of microscopic technic either ZN or LED the number suspected were high but the positive cases of tuberculosis were low this is means the technic used to detect tuberculosis was not more specific because there were most cases where on ZN or LED were negative but on GeneXpert became positive, from this analysis we found that positive

cases increased when ZN and LED replaced by the most specific technic(GeneXpert),our study shows that from 2013 to 2018 positive cases increased

The association between age group and GeneXpert technic show that the group with high frequency had more positive but did not means it was the most affected age group this is approved by Pearson's Chi-square Tests show that the relationship between age group and result on GeneXpert has no significance because of p-value (0.639) is above 0.05

CHAPTER FIVE: CONCLUSION AND RECOMMANDATIONS

5.0 INTRODUCTION

The chapter presents the study conclusion and recommendations, based on the study objectives and research questions, and the chapter ends up be the suggestions on future research studies for similar with this.

5.1 CONCLUSION

In conclusion, this study aimed to evaluate pulmonary tuberculosis infection among HIV positive patients attended Kibagabaga and Muhima Hospitals from 2013 to 2018.From year 2013 to 2018 tuberculosis in HIV patients has increased because use of the most specific technic (GeneXpert) in suspected attended Muhima and Kibagabaga district hospital. Male and female suffering by tuberculosis but the most affected was male. And our study shows that there is no age group most affected by pulmonary tuberculosis

5.2. RECOMMADATION

To use GeneXpert in all district hospitals and if it is possible in health center

To strengthen preventive measures within the person living with HIV patient

Sensitization of the community to be screened for TB

On site screening of tuberculosis by health officers

Implementation of policies and procedures of tuberculosis screening, treatment and prevention.

In order to obtain accurate results, the GeneXpert must be used in diagnosis of tuberculosis because it gives the specific result compare to others technics

5.3. SUGGESTION FOR FURTHER STUDIES

To Researchers

A similar study can be conducted in other district and referral hospitals to compare the findings and compare similarities in evaluation of tuberculosis infection among HIV positive patients

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Shorncliffe, W. a. (2015). ASSESSMENT OF TB. *CDC* , 897.

APPENDICES

Appendix 1 :DATASHEET COLLECTION

Nº	**Hospital**	**Year**	**Lab Nº**	**Sex**	**Age**	**Zn1**	**Zn2**	**Led1**	**Led2**	**Genexpert**	**Hiv Status**
1											
2											
3											
4											
5											
6											
7											
8											
9											

Appendix 2:REQUEST LETTER FOR MUHIMA

KIBOGORA POLYTECHNIC

STUDENT PROJECT'S LETTER

DATE 16th JULY.2019

To whom it may concern:

We write this letter to humbly request you to allow Mr KWIZERA Raban and Mr GAHIRWA Jean Baptiste to conduct project work at MUHIMA DISTRICT HOSPITAL

The above mentioned is bonafide student of Kibogora Polytechnic pursuing Bachelor's degree in Biomedical Laboratory Sciences.

This candidate is currently conducting a project entitled **evaluation of pulmonary tuberculosis infection among adult HIV positive patients attending Muhima district hospital**

We are convinced that your institution will constitute a valuable source of information pertaining to their work. The purpose of this letter is to humbly request you to avail them with the pertinent information they may need. We pledge to ensure that all provided information will be used in the strict academic purpose.

Any assistance rendered to the candidate will be highly appreciated.

Approved by:

MUNYANDAMUTSA Fulgence

Head of department/Biomedical Laboratory Sciences

Kibogora Polytechnic

Appendix 3:ACCEPTANCE LETTER FOR MUHIMA

REPUBLIC OF RWANDA

KIGALI, 31st July 2019

KIGALI CITY

NYARUGENGE DISTRICT

MUHIMA HOSPITAL

P.O. BOX 2456 KIGALI

Tel./Fax: +25250377

E-mail: muhima.hospital@moh.gov.rw

Accorded by
Joseph Hakizimana
Quality Manager
MSH

LABORATORY SERVICE
Signature:
Date:

KWIZERA Laban

Re: Your request to conduct research

Dear **Laban,**

Reference made to your letter received on july 18th2019 requesting to conduct research at Muhima District Hospital for your research proposal entitled: *"Evaluation of pulmonary tuberculosis infection among adult HIV positive patients attending Muhima District Hospital ".*

I would like to inform you that your request is approved and at the end the administration of Muhima Hospital shall need to be given the final report of your study.

Yours sincerely,

MANIRAGUHA YEZE Aimee Victoire

Chief Ethic Committee

MUHIMA HOSPITAL
ETHIC COMMITTEE

Cc:

- Human Resources Officer
- Director of Nursing
- Head of ARV'S and TB Services

Appendix 4:REQUEST LETTER FOR KIBAGABAGA

KIBOGORA POLYTECHNIC

STUDENT PROJECT'S LETTER

DATE 16th ,JULY.2019

To whom it may concern;

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This candidate is currently conducting a project entitled **evaluation of pulmonary tuberculosis infection among adult HIV positive patients attending Kibagabaga district hospital**

We are convinced that your institution will constitute a valuable source of information pertaining to their work. The purpose of this letter is to humbly request you to avail them with the pertinent information they may need. We pledge to ensure that all provided information will be used in the strict academic purpose.

Any assistance rendered to the candidate will be highly appreciated.

Approved by:

MUNYANDAMUTSA Fulgence

Head of department/Biomedical Laboratory Sciences

Kibogora Polytechnic

Appendix 5:REQUEST ACCEPTANCE FOR KIBAGABAGA

REPUBLIC OF RWANDA

Kibagabaga, 09./.08. 2019

N° 541....HOP/KIBAG/2019

KIGALI CITY

GASABO DISTRICT

KIBAGABAGA HOSPITAL

B.P. 6260 KIGALI

EMAIL: Kibagabaga.hospital@moh.gov.rw

TO: Head of department/Laboratory sciences of **KIBOGORA POLYTECHNIC**

Re: Acceptance letter

Dear sir,

Reference is made to your letter dated 17th July 2019 requesting for your students: GAHIRWA Jean Baptiste and KWIZERA Laban to allow them to have access to information they need in our laboratory to conduct their research project on **Evaluation of pulmonary tuberculosis infection among HIV positive patients** pursuing bachelor's degree in biomedical laboratory sciences

Thus, we are honoured to inform you that the request of GAHIRWA Jean Baptist and KWIZERA Laban were approved .

Thank you for usual collaboration .

Sincerely;

For

Dr MUTAGANZWA Avite,

Director General of Kibagabaga District Hospital