
# ADDIS ABABA UNIVERSITY

## COLLEGE OF HEALTH SCINCE

## DEPARTEMENT OF MEDICAL LABORATORY SCIENCES

# Assessment of exposure risk to tuberculosis and associated risk factors among health facility workers in Addis Ababa; Ethiopia.

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March/2021

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# Assessment of Exposure risk to tuberculosis and associated risk factors among health facility Workers in Addis Ababa; Ethiopia.

A Research Thesis submitted to Department of Medical Laboratory science School of health science Addis Ababa University, for the partial fulfilment of Master of Science Degree in Clinical Laboratory Science (Diagnostic and Public Health Microbiology)

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This is to certify that the thesis prepared by **Jagmar Worku**, entitled:

"A**ssessment of exposure risk to tuberculosis and associated risk factors among health facility workers in Addis Ababa**and submitted in partial fulfillment of the requirements for Master of Science degree in Clinical Laboratory Sciences (Diagnostic and Public Health Microbiology) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

**Signed by the Examining Committee:**

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Chairman of the Department or Graduate Program Coordinator

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# Abbreviations

| | |
|---|---|
| AAU | Addis Ababa University |
| AHRI | Armauer Hansen Research Institute |
| ALERT | All African Leprosy and TB Rehabilitation and Training Center |
| BCG | Bacille Calmette-Guerin |
| CDC | Center for Disease Control and Prevention |
| CRPA | Current Recommended Practice Algorithms |
| ECDC | Europeans Center for Communicable Disease Prevention and Control |
| FDA | Food and Drug Administration Authority (American) |
| HCAI | Health Care Associated Infections |
| HCW | Healthcare workers |
| HIC | High Income Countries |
| INF-γ | Interferon Gamma |
| IGRA | Interferon Gamma Release Assay |
| LMIC | Low and Middle-Income Countries |
| LTBI | Latent Tuberculosis Infection |
| MTB | *Mycobacterium tuberculosis* |
| QFT | QuantiFERON |
| TB | Tuberculosis |
| TBIC | TB Infection Control |
| TST | Tuberculin Skin Test |
| WHO | World Health Organization |
| PLWA | People living with HIV/AIDS |

# Abstract

**Introduction**: Tuberculosis (TB) is one of the air born infectious disease that can easily be transmitted through inhalation of droplet nuclei contaminated with the disease-causing bacilli, *Mycobacterium tuberculosis (MTB)*. Due ti their occupations healthcare providers working in close care of Tb patients are assumed to be at a relatively increased risk of acquiring the infection.

**Objective:**to assess the level of latent TB infection (LTBI) as a proxy for assessment of exposure risk to TB and associated risk factors among healthcare workers in selected health facilities in Addis Ababa.

**Results**: An increased magnitude of LTBI was observed among the comparators 49.6% (67/135)and healthcare workers 47.64% (111/233). Laboratory personnel were significantly more exposed to LTBI than pharmacists with (OR =6.44, P-value =0.01). Secretaries have also found to have a higher odd of being positive for latent TB infection compared to IT personnel (OR=4.64, 95% CI = 0.86, 31.34, P-value= 0.0412). The total negative attitude to TB prevention score was 1.36% (5/368) and this score was zero among health care workers. There was no similar infrastructural set up among health facilities as waiting areas for 32% (8/25) of the sections were not well ventilated and 36% (9/25) sections were found to be with crowded hallways.

**Conclusion:** Although working in TB units heightens the level of direct exposure to the bacilli and further acquisition of LTBI, our data suggests that the risk of acquiring TB is not limited to health care providing facilities, but rather mirrors the situation in the community.



***Key Words:*** *Latent TB Infection.* Mycobacterium*tuberculosis, health care workers, Tuberculosis*

# 1. Introduction

## 1.1 Background Information

Tuberculosis (TB), a disease caused by *Mycobacterium tuberculosis* (MTB) and transmitted from person to person through air droplet contaminated by the bacterium, usually affects the lung and other body organs. Of the one fourth (23%) global population infected with MTB, 55.5 million individuals are at risk of developing the disease, leaving the majority containing the infection throughout their life without TB sign/symptom complex, a state that is often called Latent TB infection(1).A person with TB disease, on the other hand, develops a typical sign and symptoms complex that is often characterized by productive cough lasting for more than 2 weeks, unexplained weight loss, fever and loss of appetite, chest pain, night sweat, fatigue and chills(2).

Despite several efforts made to control the infection, TB remains to be the tenth cause of death worldwide and the first from a single infectious agent, causing an estimated 1.24 million death among HIV negative people and Additional 208,000 deaths of HIV positive individuals only in 2019(3).

Historically healthcare associated infections remained to be global health threatwhich caused 16 million extra days of hospital stay, 37,000 attributable death annually and contributing for an additional death of 110,000 only in Europe as evidenced by European Center for Diseases Prevention and Control, reported by WHO; and 47.9% pooled report of burden of healthcare associated infection only in adult intensive care units, reported by systemic review and meta-analysis. Concern for healthcare associated TB infection has remained silent for long periods, requiring much effort to understand and act up on the part occupational hazard of TB infection involves, as those working or receiving healthcare service are at higher risk of continuous exposure, acquiring TB infection and subsequently developing diseases(4, 5).

Repeated exposure to an environment contaminated by aerosols carrying *Mycobacterium tuberculosis* is known to cause TB infection. Healthcare workers specially those working in TB related healthcare facilities particularly with no or substandard safety practice are highly exposed to TB infection. This is much more exacerbated in the face of an increased threat of acquiring multidrug resistant (MDR) and extremely drug resistant (XDR) *Mycobacterium* infections(6).

Active TB infection in healthcare setting is often considered as an important occupational risk for healthcare workers. Despite the existing guidelines for infection control measures for nosocomial transition of MTB, most low-income settings have insufficient control measures, placing healthcare workers at a relatively higher risk for acquiring new and continuous infection. Occupational health is one of the neglected public health issues among healthcare workers in resource poor settings, exposing them to various forms of hazards and subsequently leading to poor wellbeing and work performance(5).

To estimate the exposure risk of healthcare workers totransmission of MTB, assessing the health condition of healthcare workers could be one possibility. To date, diagnosis of LTBI is carried out either using an intradermal injection of tuberculin, the tuberculin skin test (TST) or a whole blood interferon gamma release assay (QuantiFERON and T-spot assay)(7, 8). Such information is also scarce in Ethiopia, hence this research will contribute in the provision of updated information on the burden of LTBI in health facilities in the Country.

## 1.2 Statement of the problem

Beside the added effort for quality healthcare service provision and health system strengthening to caring the sick and injured, healthcare workers are highly exposed to biological hazards such as TB, HIV and other communicable diseases, in addition to other occupational hazards like physical, ergonomics, chemical and psychological stress. Several studies revealed that there is a high risk of developing latent TB infections among healthcare workers globally with a median prevalence of 63% in middle and low income countries and 24% in high income countries, also significantly associated with TB occupational hazards(9).

Healthcare professionals working in high TB burden settings are also reported to have an increased risk of developing latent TB infection where studies in Africa have also reported a relatively higher prevalence of latent TB infection such as 60% in Kenya (9-11).

In Ethiopia, where the estimated mortality of TB was26,200per 100,000 population and incidence of 151individualsaccording to WHO report of 2019, different studies reported the prevalence of latent TB infection in different segments of the population. To our knowledge, none of these reports were made from healthcare workers working on TB (12-14).

The result of the study, beyond being the firstin the determination of prevalence of LTBI to the specified population in the country, will be helpful to understand and generate a baseline data on the prevalence of LTBI among healthcare worker in comparison to other workers in those health facilities. In addition, the findings of this study provide recent information on the infrastructural condition of TB care units for the provision of TB related activities and attitude and practice of healthcare workers to prevention of TB in the study area.

## 1.3 Significance of the study

Generating a data showing the magnitude of TB infection among health facility workers (both healthcare workers and non-healthcare workers) is valuable in identifying the cause of MTB infection in the community and helps to systematically address the problem.The findings of the study also contribute to the identification of possible factors that contributed to an increased prevalence of TB in health facilities and the community at large and help in the programmatic management and intervention of community TB transmission.

The findings of this study also revealed infrastructural conditions within healthcare units dedicated for TB related activities and the attitude and practice of healthcare workers towards TB prevention. This is helpful to revise health policies and activities done so far to prevent the transmission of TB among healthcare workers and where and when to apply preventive treatment if necessary.

# 2 Literature review

## 2.1 Overall Magnitude of Tuberculosis

According to WHO report of 2019, TB remains to be the leading cause of death worldwide from a single infectious source causing death of 1.4 million people globally and estimated incidence of 8,690,000 cases only in the 30 high TB burden countries and which is said to be 165,000 and 26,200 estimated incidence and mortality respectively in Ethiopia only in 2018 (14).

The persistence of mycobacterium in human body without any sign and symptom comprises about 90% of overall cases of TB infections. This state of persistent expression of immune response to stimulation by Mycobacterium tuberculosis antigens with no evidence of clinical manifestation of active TB is known to be latent TB infection (LTBI) where there is no gold standard test for the identification of the pathogen with still having the chance of reactivation (15, 16).

With the increasing number of reports from all corners of the globe on the significant prevalence of LTBI among different population groups, the exact global burden is not well known with only an estimation of that 1.7 billion individuals of the world are infected with LTB. Different report from Ethiopia also indicated an increased prevalence of latent TB infection in different population group (17-22).

In line with endorsement of WHO for the great value of rapid diagnostic test for all TB presumptive cases, different WHO region countries implemented types of diagnostic algorithms based on infrastructural conditions, availability of funding, trained human resource and other factors. The WHO European region is one to recommend different diagnostic algorithms for different patient groups prioritizing molecular diagnostic tests. A model-based study conducted in Ethiopia HIV clinics among people living with HIV, concluded that combining WHO recommended symptom screen with X-pert is more sensitive and cost effective than current recommended practice algorithm (CRPA) which is based on symptom screening, smear microscopy and clinical TB diagnosis(23, 24).

## 2.2 Diagnosis of LTBI

In the fight of elimination of TB infection having effective and affordable diagnostic methods is a crucial issue for every nation in the globe. Experts are indicating that availability of cost effective and efficient diagnostic methods for LTBI for selected high risk groups together with availability of cost effective, short course and safest treatment algorithm will help by far the global TB elimination program and this will be the issue of global health authorities and middle- and high-income countries as well(25).

Latent tuberculosis infection has been diagnosed by tuberculin skin test for a long period of time having all the draw backs and limitations like interference of BCG vaccination on the test result, need of additional investigation of clients and poor specificity of the test to Mycobacterium *tuberculosis*. Yet a

direct mechanism of diagnosis of LTBI is not reported except IGRA which is an indirect immunological response test method with improved performance than TST for some population groups and limitation of increased cost, need of laboratory infrastructures and need of well-trained laboratory personnel. Additional skin tests like C-TB and Diaskintest are known to be developed and not available for routine diagnosis to date (7, 26).

Though there is no gold standard diagnostic method for LTBI which can differentiate it from active TB or effectively discriminate the different clinical stages of TB disease, gamma Interferon release assay is said to be with an improved sensitivity and specificity as compared to the conventional TST, where the Enzyme linked Imuno-Spot Assay (EILSpot) measures Interferon-γ releasing lymphocytes and the QuantiFERON Gold In tube Assay (QFT) Measures the concentration of IFN-γ released. The QFT is an in vitro test method which is based on the subsequent detection and measuring of the amount of cytokine specifically named IFN-γ released by lymphocytes which are exposed to Mycobacterium tuberculosis specific peptide proteins (ESAT-6, CFP-10 and TB7.7(P4)) (20, 27).

A recent study which compared QFT-GIT with the improved resent version of QFT GOLD in tube assay showed that the later have a better sensitivity and specificity than the former due to incorporation of CD8+ specific immune response detection (28).

## 2.3 Magnitude of LTBI Among healthcare workers

Latent TB infection has become a global public health problem as is prioritized by the UN high level political declaration targeting to provideat list 30 million preventive treatments from 2018 up to 2022 and reported by WHO 2019 (11).

Healthcare workers specially those working in developing countries are at an increased risk of occupational hazard of any kind, of which transmission of blood born pathogen, Musculoskeletal diseases, Latex allergies and work-related violence could be stated, and transmission of mycobacterium infection to be the significant occupational hazard. This is supported by a report of a matched cohort study of tuberculosis in health care workers with increased risk of developing active TB among health care workers as compared to the general population (29, 30).

Occupational TB infection remains to be an important health problem of nations of the world where occupational association is more evidenced in low and middle-income countries than high income countries. A systematic article reviews of occupational tuberculosis among health care workers in middle and low-income countries revealed that the pooled estimated prevalence of latent TB infection to be 58% (95% CI 53-55) with annual risk of TB infection 3.9%-13.4% with a range 2.6% to 11.3% attributable to occupational risk. This is supported by different reports depicting an increased chance of developing

active TB than the general population among healthcare workers and with higher prevalence of LTBI among healthcare workers residing in low and middle-income countries than high income countries(31, 32).

Among healthcare workers, those on TB care activities are at an increased risk of developing LTBI from occupational exposure, which can be understood by looking a report on the prevalence of LTBI in Georgian health care workers which is 55% only for those on TB related activities and 31% for those on non-TB related Healthcare facilities, which is 24.8% for TB laboratory staffs (high risk) and 14.8% for low-risk health care workers for the same study reported from Iran. A 9.9% and 27% prevalence of LTBI among same study groups has been reported from Germany and Brazil (33-36).

There is a relatively low report of LTBI among health care workers from Spain on the screening of healthcare workers for LTBI and Italy on risk of LTBI among health care workers which is said to be 5.98% and 5.5% respectively. It was only prevalence of 10.3% among participants supposed to be at high risk in Egypt, from a report of predictors of low prevalence of LTBI among Egyptian health care workers at intensive care and bronchoscopy unit (37-39).

## 2.3 Associated Risk Factors

The significant reports of prevalence of LTBI among health care workers from all corners of the globe is expected to be together with one or more associated risk factors, where age being significantly associated in different reports. Reports from China, Egypt, Brazil and India stated the significant association of LTBI with Age≥ 25 years as a village doctor, ≥ 30 years of health care working experience, ≥ 50 years with being community health agent, and increasing age and years in health profession. Working at high-risk area for TBI, higher annual exposure to TB, being foreign born for Germany, being new interant from high TB burden countries and increased exposure with inadequate infection control measure are also significantly associated risk factors reported from various studies (17, 21, 32, 35, 38, 40, 41).

A report on the prevalence of LTBI in HIV infected person in Sylvanus Olympio teaching hospital of Loḿe, capital of Togo reported a 76% prevalence indicating that being HIV positive will be one associated factor for contracting health care associated TB infection. This is supported by a study on the occupational risk factors for Tuberculosis among health care workers in KwaZulu-Natal, South Africa which reported a significantly greater odds ratio (OR:6.5) of developing TB infection among health care workers living with HIV. A contradictory finding is reported by a study on the prevalence of LTBI in persons with and without HIV infection in low HIV prevalence and intermediate TB burden countries which reported a significantly low response of HIV infected person to QFT-GIT tests(prevalence of 7% with adjusted OR of 0.28)(42-44).

Dual studies conducted in Maluti Adventist Hospital, Leseto and hospitals found in KuaZulu-Natal, South Africa on the knowledge, Attitude and practice of health care workers on infection prevention of TB, reported that; knowledge gap, poor infection control practice, infection control hindered by lack of resource, distrust of infection control effort among HCW and disproportionate focus on individual level personal protection practise particularly N-95 mask expose health care workers for occupational contracting of TB infection(41, 45).

There have been few studies conducted in Ethiopia to assess the occupational hazard of TB infections. One study conducted to assess the prevalence of TB among Addis Ababa City bus drivers and cash collectors reported prevalence of smear positive TB to be 4/903 and all form of TB to be 16/903 where there is no reported association with any of the Socio-demographic characteristics. Another study on the risk of TB infection in adolescences and adults in rural community in Ethiopia reported TST reactivity of ≥ 10mm to be 29% which varied with age, sex, income and history of house hold contact with TB cases (46, 47).

# 3Objective

## 3.1 General Objective

The objective of this study was to assess the level of latent TB infection (LTBI) as a proxy for assessment of exposure risk to TB and associated risk factors among healthcare workers in selected health facilities in Addis Ababa, Ethiopia from September/2019 up to May/2020.

## 3.2 Specific objectives

- To measure the prevalence of latent TB infection among healthcare workers working in high TB burden units of health facilities in Addis Ababa compared to those working in the same health facilities with relatively low occupational exposure to TB.
- To evaluate the attitude and practices of healthcare workers working in high TB burden health facilities using structured questionnaires.
- To assess the infrastructural and environmental condition of the working facilities, where healthcare workers conduct their routine experience using standardized observational checklist.

## 4. Hypothesis

Healthcare workers working in high TB risk healthcare units do have similar risk of contracting *Mycobacterium tuberculosis* infection with those healthcare workers working in low TB risk units.

# 5. Material and Methods

## 5.1 Study design and setting

The study was conducted in high TB burden units of healthcare facilities in Addis Ababa. Addis Ababa, the capital city of Ethiopia and Africa comprises 720 private higher and medium clinics, 43 private higher hospitals and 93 governmental health centers, 6 hospitals to be governed by city health administration and 5 hospitals under the federal ministry of health. Among public hospitals, 4 from the city health administration and another 4 from the federal ministry of health are known to provide TB directly observed treatment short course (DOTS) program, where the federal hospitals are accommodating center for MDR treatment. There are also 83 public health centers under the city health administration that provide TB DOTS program. Furthermore, there are 20 private higher clinics, 19 private hospitals and 8 clinics governed by non-governmental organizations (NGO) known to provide TB DOTS program. From these TB care providing healthcare facilities, 11 health facilities were selected (Table 1) using systematic random sampling method and a comparative cross-sectional study design was conducted from Sep/2019 up to May/2020. The strategy followed for the selection of study site and participant recruitment is annexed at the end of this thesis work (Annex 9).

Table 1: List of selected healthcare facilities included in the study:Assessment of exposure risk to tuberculosis among health facility workers in Addis Ababa, 2019 - 2020.

| S.No | Name of Health Facility |
|---|---|
| 1 | All Africa Leprosy and TB Rehabilitation and Training Center (ALERT) |
| 2 | Zewditu Memorial Hospital (ZMH) |
| 3 | Minilik II Hospital (MH) |
| 4 | St Peter's Hospital (SPH) |
| 5 | Hidassie Health Center (HHC) |
| 6 | Addisu Gebeya Health Center (AGHC) |
| 7 | Selam Health Center (SHC) |
| 8 | Ginbot 20 Health Center (GHC) |
| 9 | Addis Ketema Health Center (AKHC) |
| 10 | Felege Meles Health Center (FMHC) |
| 11 | Abebe Bikila Health Center (ABHC) |

## 5.2Population

### 5.2.1 Source population

The source population constituted all healthcare workers and supporting staff participating in healthcare delivery system in Addis Ababa.

### 5.2.2 Study population

All healthcare workers and supporting staff working in TB care delivery system in selected health facilities in Addis Ababa were considered as the study population.

## 5.3 Inclusion and Exclusion Criteria

### 5.3.1 Inclusion criteria

Those who have worked in the TB care service for at least 6 months and who gave a written informed consent were eligible for the study.

### 5.3.2. Exclusion Criteria

Individuals with a history of known active TB infection were excluded due to the nature of laboratory test selected for the study.

## 5.4 Sampling and sample size determination

### 5.4.1 Sample size determination

The sample size for the study was calculated based on the Fleiss with correction factor calculation scheme using epi-result sample size calculator available on web(48). This was done by considering two-sided significant level (1-α) 95%. Because Ethiopia is one of the high TB burden countries, the minimal power or percent chance of detecting the evidence to disprove the null hypothesis (1-β), was taken as 80%. In this comparative cross-sectional study, the ratio of sample size of exposed to non-exposed was considered to be 1. Due to lack of similar study in the specified population group, the percent of exposed with outcome was considered to be 50% and those non-exposed with outcome was considered as 35% assuming that one third of the general population is infected with LTB. Accordingly, A total of 368 participants were included in the study, of whom 233 were healthcare works with direct occupational risk of TB exposure and the remaining 135 were comparators, i.e., those who were working in the same health facilities but with no know direct occupational exposure to TB such as, finance officer, human resource officers and etc.

## 5.5 Dependent and Independent variables

### 5.5.1 Dependent variables

- LTBI status

### 5.5.2 Independent variables

- Socio-demographic characteristics (Age, Sex, marital status, income, year of experience)
- Previous history of TB house hold contact
- comorbidity
- BCG scar
- Presence of chronic disease
- Choice of transport system
- Professional category
- Attitude and practice to TB infection control
- Results of assessmentworking conditions of TB working units

### 5.6 Data Collection procedure

A structured (pre-tested at health facilities other than study sites) formal questioner was used to collect participant's socio-demographic data and other independent variables (see annex 7) in line with an observational checklist developed from reference standard (See annex 8) which was used to evaluate the infrastructure of TB service in selected facilities.

### 5.7 Sample collection,transportation and blood processing

All biological samples were handled following the international regulation for handling and transportation in order to avoid or minimize any potential risk of acquiring infections.A triple package sample transportation mechanism was used to maintain the standard transportation of collected samples to AHRI laboratory and ensuring safety at all stages. Approximately, 1 ml of venous blood was aliquoted into four separate tubes of the QuantiFERON-TB Gold In Tube kit (QFT-GIT) (Cellestis, Australia): one tube containing only Nil (a negative control), another tube containing mitogen, the third and fourth tubes contain TB1 and TB2, *M. tuberculosis*-specific antigens.All blood containing tubes were transported at ambient temperature. The number and labeling of tubes were also checked at the time of collection and receipt.

### 5.7.1 Incubation and harvesting of plasma

As soon as the blood samples were received at the AHRI lab, blood containing tubes were vigorously shaken for about 10 times. Following, the tubes were transferred to a 37$^{o}$C dry incubator and were incubated for 16-24 hrs. The following day, plasma samples were collected and stored at -20$^{o}$C until further assayed for interferon gamma (IFN-γ) using enzyme-linked immunosorbent assay (ELISA).

### 5.7.2 QuantiFERON TB Gold in Tube assay

Frozen plasma samples were pulled out of the freezers at AHRI lab and thawed at room temperature and run-in batches to measure the levels of IFN-γ, which was done using the QFT-TB Gold Plus ELISA Kit (Cellestis, QIAGEN, Australia).Optical densities (OD) of each well were captured within 5 minutes of stopping the reaction using a microplate reader fitted with a 450 ηm and 620 ηm reference filters. Test interpretation and results were analyzed using QuantiFERON-TB Gold Analysis Software (Version 2.71.2, Cellestis, Australia). A test for *M. tuberculosis* infection is considered positive if the amount of IFN-γ is ≥ 0.35 International Units (IU)/mL for (TB1 or TB2-Nil) and the test is valid if the (Mitogen-Nil) response is ≥ 0.50 IU/mL and/or (TB1 or TB2-Nil) is ≥ 0.35 IU/mL, according to the manufacturer's instruction(49).A positive response to the QFT test was considered as a correlate to the presence of LTB infection.

### 5.7.3. Data quality Assurance

All the pre-analytical, analytical and post-analytical stages were conducted according to the GCLP standards and validated SOPs. Training was provided at AHRI to perform the experiment before the

actual conduct of the study. To assure the quality of the final data the following activities were taken at the pre analytical, analytical and post analytical stage of sample analysis.

- Proper purchasing of reagents and supplies necessary for the study according to the available and affordable specifications.
- Verification of all the purchased supplies and reagents for the appropriateness of stated allowed working dates (expiry date), for appropriateness of supplies according to the pre stated specification, for any damage or leakage during receipt of the supplies.
- Assembly of all the necessary supplies, reagents and equipment necessary for the test were done every day before starting analyzing the sample.
- The appropriate training were given to selected sample collectors and the investigator by itself were subjected to take training on how to perform the QFT assay.
- All the necessary format for daily records of the study were prepared, evaluated for fit of purpose and availed, before the start of laboratory activities.
- Sample collection, transportation and receipt were followed for their appropriateness.
- The standard operating procedures availed by the owner of the laboratory were strictly followed.
- Integrity of working reagents were checked every day by running quality control material before every testing batch.
- Four level of standards were run in duplicate for each ELISA run.
- Explanatory job aids were prepared and posted near to working bench.
- Data were recorded on daily base using recording formats
- Verification of results were conducted together with advisors.
- Verified results were sent for data analysis
- Result back up were maintained using the most suitable and available backup system (Hard disk drive).

## 5.8Statistical considerations

Data entry was performed using epi-data version 3.1 available at (http://www.epidata) and analysis was performed by using STATA MP 15.0 available at (http://www.stata.com). Data wascleaned and double entered at AHRI data management unit. Regression statistics and Chi-square test were used to compare the association between the dependent and independent variables. A p-value < 0.05 was considered statistically significant.

We administered 10 questions to assess attitude of healthcare workers to TB prevention each having a maximum of 5 points which yield a total mark of 50 points. This is again changed to 100 to have percentage of score to be evaluated according to Likert's scale for evaluation of attitude of healthcare workers for TB prevention (''Negative'' for < 39%, ''Intermediate'' for 39% - 60% and ''positive'' for >60%).For assessment of practice of healthcare workers for prevention of nosocomial transmission of TB, we have administered 5 questions each with 3 point and 8 questions each with 2 point giving a total of 31 points. The final result is rounded to 100 to have percentage of score for practice of prevention of

transmission of TB among health facility workers and evaluated according to Bloom's cut of point (<59% ''unsatisfactory'', 59% - 80% ''Satisfactory'', >80% ''Excellent'') (50).

## 5.9Ethical consideration

Ethical approval was obtained from Addis Ababa University, Department of Medical Laboratory Sciences Ethics and Research Committee (DRERC/382/18/MLS), AHRI/ALERT Ethical Review Committee (AAERC/P040/18), St. Peter Research Ethics Committee (SPSH/REGD/HRERC) and from Addis Ababa Health Office Research Sub process (AAH33271/127). Written informed consent was obtained from all study participants. Although there is no mass INH prophylaxis provision in the Country, participants with positive IGRA test were notified about their test results with further clinical advice. Confidentiality of participants' information was maintained by using study identification codes, keeping participant's data in a locked cabinet and password protected computers.

## 5.10Result dissemination plan

The findings of this study will be presented to AAU, CHS, DMLS, AARHB and AHRI in a form of thesis. Following, the data will be presented on annual conferences of professional societies and other appropriate national and international scientific conferences. Manuscripts will also be prepared and published on peer-reviewed journals.

## Operational definitions

- Healthcare workers (HCW): - are those working in healthcare facilities assigned for direct or indirectly healthcare related activities as being physician, nurse, pharmacist, laboratory technologists, cleaner, runner and like others.

- Comparators: - are peoples working in healthcare facilities not directly related with healthcare service as in administrative worker (e.g., Finance officer, human resource officer, general service workers, secretaries, etc.)

- Occupational exposurerisk: - Is a condition of exposure to TB infection while carrying out routine healthcare activities in a specified healthcare unit. In this research work, HCWs who are positive for LTBI have TB exposure risk.

# 6 Results

## 6.1 Characteristics of study participants

A total of 11 health facilities from Addis Ababa were included, where 4 of them were hospitals, linked highly with TB/HIV related care and management and 7 were health centers known to provide TB patient care. The study sites reside in 3 different sub cities of Addis Ababa. A total of 368 participants were enrolled for this study, completed interview for demographic and attitudes to TB prevention assessments and provided blood for QFT testing, of whom 150 (40.76%) were from health centers and the remaining 218 (59.2%) were from hospitals. Of these, 233 (63.32%) were healthcare workersand the remaining 135 (36.68%) were supporting and/or administrative staffs of the health facilities. Of the 233 healthcare workers, the majority 89 (38.2%) were Nurses followed by Laboratory technologist 63 (27.04%), General practitioner 21 (9.01), Information Technology personnel21 (9.01%), Pharmacist 13 (5.58%) and others 26 (11.17%) and out of the 135 comparators majority were finance officers 32 (23.70%) followed by record room workers 16 (11.85%), secretary 12 (8.889%), porters 11 (8.15%), Human resource officers 8 (5.93%) and others 56 (41.48%). The proportion of study participants by facility is presented below (Table 2).

**Table2: Proportion of participants by selected health facilities for the study assessment of exposure risk to tuberculosis among health facility workers in Addis Ababa, Ethiopia; 2019-2020.**

| Site | Frequency | % | cumm. |
|---|---|---|---|
| AGHC | 25 | 6.79 | 6.79 |
| AKHC | 20 | 5.43 | 12.23 |
| ALE | 65 | 17.66 | 29.89 |
| FMHC | 24 | 6.52 | 36.41 |
| GHHC | 24 | 6.52 | 42.93 |
| HHC | 23 | 6.52 | 49.18 |
| KMHC | 10 | 2.72 | 51.9 |
| MH | 48 | 13.04 | 64.95 |
| SHC | 25 | 6.79 | 71.74 |
| StPH | 49 | 13.32 | 85.05 |
| ZMH | 55 | 14.95 | 100 |

The proportion of females who participated in the study was twice than males (Table 3) withmedian age of 29 years (19-59 years). Other demographic characteristics of the study population are summarized on Table 3.

**Table 3: Demographic characteristics for the study assessment of exposure risk to tuberculosis among health facility workers in Addis Ababa, Ethiopia; 2019 - 2020.**

| Age group of Participant's (years) | Frequency | Percent | cum. |
|---|---|---|---|
| <20 | 3 | 0.82 | 0.82 |
| 20-30 | 215 | 58.42 | 59.24 |
| 31-40 | 105 | 28.53 | 87.77 |
| 41-50 | 29 | 7.88 | 95.65 |
| >50 | 16 | 4.35 | 100 |
| Sex | | | |
| Female | 243 | 66.03 | 66.03 |
| Male | 125 | 33.97 | 100 |
| Average monthly income(Birr) | | | |
| <= 5379.48 | 248 | 67.39 | 67.39 |
| 5379.81-7688.06 | 82 | 22.28 | 89.67 |
| 7688.11-10121.95 | 29 | 7.88 | 97.55 |
| >=10123.36-15109.21 | 9 | 2.44 | 100 |
| Marital status | | | |
| Single | 178 | 48.37 | 48.37 |
| Married | 179 | 48.64 | 97.01 |
| Divorced | 10 | 2.72 | 99.73 |
| Widowed | 1 | 0.27 | 100 |
| Year lived in Addis Ababa | | | |
| <1 year | 11 | 2.99 | 2.99 |
| 2-3 years | 26 | 7.07 | 10.05 |
| 4-5 years | 19 | 5.16 | 15.22 |
| 5-6 years | 17 | 4.62 | 19.84 |
| 7-10 years | 43 | 11.68 | 31.52 |
| >=11 years | 252 | 68.48 | 100 |
| Year of experience | | | |
| <1 years | 28 | 7.61 | 7.61 |
| 1-2 years | 52 | 14.13 | 21.74 |
| 2-3 years | 60 | 16.3 | 38.04 |
| 3-4 years | 41 | 11.14 | 49.18 |
| 4-5 years | 28 | 7.61 | 56.79 |
| 5-10 years | 119 | 32.34 | 89.13 |
| >10 years | 40 | 10.87 | 100 |
| Presence of BCG Scar | | | |
| No | 147 | 39.95 | 39.95 |
| Yes | 221 | 60.05 | 100 |
| Choice of transport system | | | |
| Private | 16 | 4.35 | 4.35 |
| Public service | 100 | 27.17 | 31.52 |
| Minibus taxi | 215 | 58.42 | 89.95 |
| City bus | 37 | 10.05 | 100 |
| Total | 368 | 100 | |

## 6.2 LTBI and associated risk factors

The total prevalence of LTBI among the study population was (48.37%, N=178), wherethe majority of the cases were among healthcare workers (62.36%, N=111) compared to Comparators (37.64%, N=67). With an increased proportion of LTBI among comparators (49.63%, N=67) than healthcare workers (47.64%, N=111) the risk of exposure to TB acquisition seems similar in both the healthcare workers and comparators (OR 1.08, 95% CI (0.69, 1.69), p-value=0.3974). Excluding 12 occupations with very low frequency of record (<=3), the lower prevalence was found among general practitioner, pharmacist, secretary, card room, porter and nurse with prevalence of 11.24%, 15.38%, 25.0%, 37.5%, 43.75% and 44.94% respectively. Half the participants with the following occupations were found to be positive for IFN-γ test; record room workers, Mechanic, guardian, data clerk, Cashier, logistician and driver with prevalence of 50%. The remaining 6 occupation come up with relatively higher prevalence of LTBI; with prevalence of 53.97%, 57.14%, 59.38%, 60.71%,62.5% and 75% among Lab personnel, cleaner, finance, IT, HR and adherence workers respectively. Prevalence of LTBI by occupations is presented under annex at the end of thesis work. (See Annex:12)

The total prevalence of LTBI was relatively higher in hospitals than health centers (OR= 1.47 (95%CI, 0.94, 2.28), p-value =0.0435 (Figure 1).

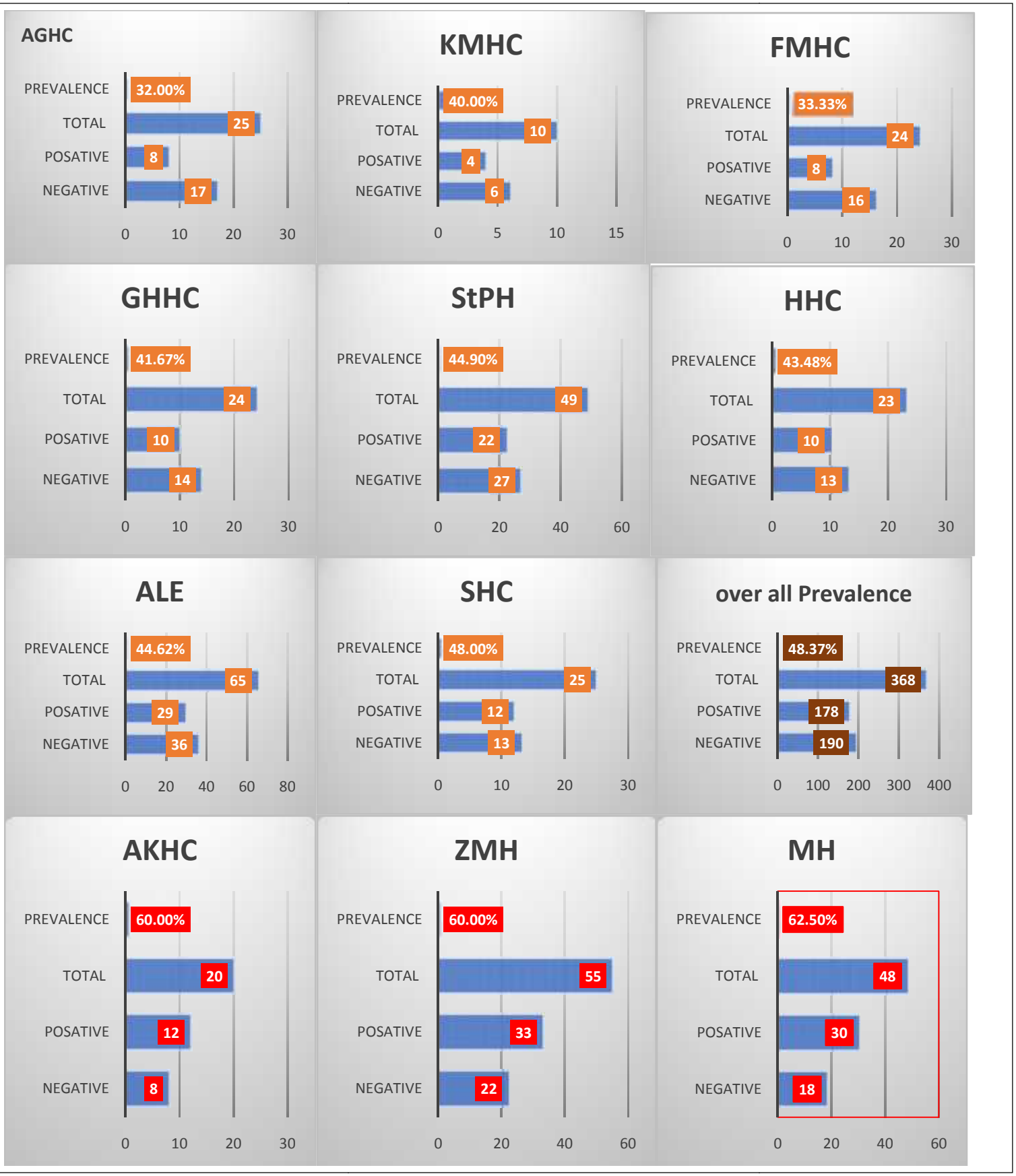


**Figure 1: Prevalence of LTBI by study sites for the study assessment of exposure risk for tuberculosis among health facility workers in Addis Ababa, Ethiopia; 2019 - 2020.**

**Table 4: Independent Risk Indicators of LTBI for the study assessment of exposure risk for tuberculosis among health facility workers in Addis Ababa, Ethiopia; 20219 - 2020.**

| Variable | No | No IGRA positive (%) | COR (95% CI) | AOR (95% CI) | P-value |
|---|---|---|---|---|---|
| Sex | | | 1.68(1.04, 2.70) | | 0.033 |
| Female | 243 | 107 (44.03) | | Reference | |
| Male | 125 | 71 (56.80) | | 1.67 (1.06, 2.64) | 0.0135 |
| Age group | | | 1.36(0.96, 1.91) | | 0.083 |
| <20 | 3 | 0(0) | | NA | |
| 20-30 | 215 | 91 (42.33) | | Ref | |
| 31-40 | 105 | 61 (58.10) | | 1.89 (1.18, 3.03) | 0.0056 |
| 41-50 | 29 | 16 (55.17) | | 0.60 (0.25, 1.40) | 0.1338 |
| >50 | 16 | 10 (62.50) | | 0.44 (0.13, 1.39) | 0.0959 |
| Income | | | 1.20(0.86, 1.68) | | 0.275 |
| >=10123.36 | 9 | 4 (44.44) | | Ref | |
| <=5379.48 | 248 | 114 (45.97) | | 1.06 (0.28, 4.05) | 0.4504 |
| 5379.81 - 7688.06 | 82 | 39 (47.56) | | 1.13 (0.28, 4.53) | 0.4597 |
| 7688.11-10121.95 | 29 | 21 (72.41) | | 3.28 (0.7, 15.71) | 0.0058 |
| Marital status | | | 1.05 (0.69, 1.60) | | 0.811 |
| Divorced | 10 | 2 (20.00) | | Ref | |
| Single | 178 | 77 (43.26) | | 3.05 (0.63, 14.77) | 0.0194 |
| Married | 179 | 98 (54.75) | | 4.84 (1, 23.43) | 0.1301 |
| Widowed | | | | NA | NA |
| 2 or more TB sign and symptoms | | | 0.59 (0.19, 1.81) | | 0.359 |
| Yes | 16 | 7 (43.75) | | Ref | |
| No | 352 | 171 (48.58) | | 1.21 (0.39, 3.93) | 0.4526 |
| Choice of transport system | | | 1.18 (0.97, 1.44) | | 0.098 |
| Private | 16 | 4 (25.00) | | Reff | |
| Minibus taxi | 215 | 94 (43.72) | | 4.66 (1.02, 21.33) | 0.1137 |
| City Buss | 37 | 21 (56.76) | | 3.5 (0.96, 12.75) | 0.0326 |
| Public service | 100 | 59 (59.00) | | 4.32 (1.3, 14.33) | 0.0114 |
| Presence of BCG scar | | | 0.92 (0.59, 1.44) | | 0.729 |
| Yes | 221 | 106 (47.96) | | Ref | |
| No | 147 | 72 (48.98) | | 1.04 (0.67, 1.62) | 0.4662 |
| Presence of chronic medical condition | | | 1.76 (0.63, 4.92) | | 0.281 |
| None | 348 | 165 (47.41) | | Ref | |
| Yes | 20 | 13 (65.00) | 1 | 2.06 (0.8, 5.29) | 0.0965 |
| Presence of TB household contact | | | 1.69 (0.76, 3.75) | | 0.195 |
| No | 337 | 160 (47.48) | | Ref | |
| Yes | 31 | 18 (58.06) | | 1.53 (0.73, 3.23 | 0.1734 |
| | | | | | |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Location of study participants | | | 1.19 (0.72, 1.96) | | 0.497 |
| Health center | 151 | 64 (42.38) | | Ref | |
| Hospital | 217 | 114 (52.53) | | 1.5 (0.99, 2.29) | 0.0435 |
| Category of participants | | | 1.02 (0.61, 1.71) | | 0.936 |
| Participants | 233 | 111 (47.64) | | Ref | |
| Comparators | 135 | 67 (49.63) | | 1.08 (0.69, 1.69) | 0.3974 |

## 6.3 Attitude and practice of participants to TB infection control

As the comparator groupwas not directly involved in TB care and prevention practices, the TB prevention practices were assessed only among the 233 health care workers.

Overall, the median attitude scored among the study population was 84% (range: 22-100%), where this scorewas 94% (range: 40-100%) among healthcare workers and 62% (range: 22-88%) among comparators.

From among all study participants 5/368 (1.35%) showed a negative attitude for TB prevention where 74/368 (20.1%) showed intermediate attitude and the remaining 289/368 (78.53%) showed a positive attitude towards TB prevention. From among non healthcare workers, only few 5/135 (3.71%) showed a negative attitude for TB prevention from where majority 62/135 (45.9%) and 68/135 (50.37%) showed an intermediate and positive attitude for TB prevention respectively. None of healthcare workers showed a negative attitude for Tb prevention where only 12/233 (5.15%) showed an intermediate attitude and majority 221/233 (94.849%) showed a positive attitude for TB prevention.

The comparators were not evaluated for TB prevention practices, as they are not directly involved on the TB care practices. The median score for TB prevention among healthcare workers were 60% with 98% maximum score and 20% minimum score.

According to Bloom's cut of point majority of healthcare workers (45.06%, 105/233) scored unsatisfactory practice towards TB prevention where (42.91%, 100/233) and (12.02%, 28/233) scored satisfactory and excellent practice of TB prevention respectively.

## 6.4 Infrastructural assessment of TB care units in health facilities

Infrastructural assessments were done for 27 sections in the 11 health facilities included in the study, where 2 sectionswere dropped due to incomplete information. From among the assessedsections, 8 (32%) were from health centers and the remaining 17 (68%) were from hospitals. In our assessment we have included 6 types of sections; (TB clinic, Tb laboratory, Medical Emergency, ART, Medical OPD, and TB ward). Findings of the assessment are displayed in the table below (table 6).

From among the sections 2 TB clinics employed Clinical evaluation for Tb screening and another two TB clinics used clinical evaluation augmented with either of the diagnostic method (AFB, Gen X-pert, x-ray) as a tool for conducting annual TB screening. Only one medical outpatient department reported to utilize both clinical evaluation and diagnostic options for undergoing annual Tb screening.

Nine(36%) sections employed a combination of techniques to assign healthcare workers for TB related activities looking for training on TB IC, Qualification and knowledge on TB and random selection and rotation.

**Table 5: Assessment of healthcare facilities for the study Assessment of TB exposure risk among health facility workers in Addis Ababa, Ethiopia; 2019 - 2020.**

| | Total (N) | % | Sections assessed | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Tb Clinic | | Tb laboratory | | Emergency | | ART OPD | | Medical OPD | | TB ward | |
| | 25 | 100 | 9 | | 4 | | 4 | | 4 | | 1 | | 3 | |
| Assessment indicators | n | % | n | % | n | % | n | % | n | % | n | % | n | % |
| Follow updated national or local guid line | 14 | 56 | 4 | 44.44 | 1 | 25 | 2 | 50 | 3 | 75 | 1 | 100 | 3 | 100 |
| Do have updated written SOP for TB prevention | 8 | 32 | 4 | 44.44 | 1 | 25 | 1 | 25 | 2 | 50 | 0 | 0 | 0 | 0 |
| Do have up to date policy for TB prevention | 8 | 32 | 5 | 55.56 | 2 | 50 | 0 | 0 | 0 | 0 | 1 | 100 | 0 | 0 |
| Trained TB IC focal person assigned | 15 | 60 | 8 | 88.89 | 1 | 25 | 2 | 50 | 0 | 0 | 1 | 100 | 3 | 100 |
| Scheduled training on TB IC available | 9 | 36 | 7 | 77.78 | 1 | 25 | 0 | 0 | 0 | 0 | 1 | 100 | 0 | 0 |
| Annual TB screening available | 5 | 20 | 4 | 44.44 | 0 | 0 | 0 | 0 | 1 | 25 | 0 | 0 | 0 | 0 |
| Free and Confidential HIV testing available | 3 | 12 | 1 | 11.11 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 100 | 1 | 33 |
| Corrective action available if personnel get exposed to TB | 25 | 100 | 9 | 100 | 4 | 100 | 4 | 100 | 4 | 100 | 1 | 100 | 3 | 100 |
| Record of incidence TB Among personnel is available | 14 | 56 | 7 | 77.78 | 1 | 25 | 1 | 25 | 2 | 50 | 1 | 100 | 2 | 67 |
| Availability of N-95 Mask | 10 | 40 | 4 | 44.44 | 1 | 25 | 1 | 25 | 1 | 25 | 1 | 100 | 2 | 67 |
| Availability of disinfectants for Bench cleaning | 24 | 96 | 8 | 88.89 | 4 | 100 | 4 | 100 | 4 | 100 | 1 | 100 | 3 | 33 |
| Availability of Gown for routine daily work | 24 | 96 | 8 | 88.89 | 4 | 100 | 4 | 100 | 4 | 100 | 1 | 100 | 3 | 33 |
| Availability of Glove with appropriate size | 25 | 100 | 9 | 100 | 4 | 100 | 4 | 100 | 4 | 100 | 1 | 100 | 3 | 33 |
| Availability of Budget for TB IC | 5 | 20 | 5 | 55.56 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| cougher identified and tracked fast | 17 | 68 | 8 | 88.89 | 1 | 25 | 2 | 50 | 3 | 75 | 1 | 100 | 2 | 67 |
| supplies and information available for cougher | 11 | 44 | 6 | 66.67 | 0 | 0 | 1 | 25 | 2 | 50 | 1 | 100 | 2 | 67 |
| WHO recommended diagnostics are the first choice | 24 | 96 | 8 | 88.89 | 4 | 100 | 4 | 100 | 4 | 100 | 1 | 100 | 3 | 100 |
| Waiting areas well ventilated | 16 | 64 | 6 | 66.67 | 4 | 100 | 1 | 25 | 3 | 75 | 1 | 100 | 1 | 33 |
| patients not crowded in hall ways and waiting areas | 15 | 60 | 6 | 66.67 | 4 | 100 | 1 | 25 | 2 | 50 | 1 | 100 | 1 | 33 |
| sputum collection areas away from others and clearly labelled | 19 | 76 | 7 | 77.78 | 3 | 75 | 1 | 25 | 4 | 100 | 1 | 100 | 3 | 100 |
| admitted TB cases isolated with Adequate ventilation | 7 | 28 | 2 | 22.22 | NA | NA | 1 | 25 | 2 | 50 | 1 | 100 | 1 | 33 |

Only 3 (12%) sections (1 TB clinic and 2 ART clinics) reported to look for TB infection control training for assignment of healthcare workers on TB related activities where 7 (28%) section used only random selection and rotation and another 6 (24%) sections used Knowledge and qualification on TB for assignment of healthcare workers on TB related activities.

The record time for incidence of TB among healthcare workers ranges from the past 7 years up to the past 1 year. Accordingly, 60 healthcare workers were registered on TB treatment log book where 25 of them (41.67%) reside in a TB ward registered for the past 7 years. A total of 8 personnel (13.33%) has been found on registration book of 1 TB clinic and with a registration year of the past 6 years.

Most of the cases, 42 (70%) were pulmonary positive TB cases confirmed by acid fast bacilli staining technique (AFB) where 6 of them were confirmed by a molecular method (Gen X pert Riff assay technology).The detailed finding of infrastructural assessment of the study 'Assessment of exposure risk to tuberculosis among health facility workers in Addis Ababa' is annexed under Annex 1 at the end of this thesis paper.

# 7 Discussion

We have assessed the prevalence of LTBI among healthcare worker and comparators, who are non-healthcare providers working in a health facility using an IFN-g release assay (IGRA), QFT test. The present study also assessed the perceived attitude and practices among healthcare workers and comparators to TB prevention and further evaluated the infrastructure facilities of selected health care facilities.

The observed overall prevalence of LTBI was significantly higher in our study population (48.37%) compared to other places reported elsewhere: the globe (24.8%), Saudi Arabia (9.1%)(1, 51). The relatively higher proportion of LTBI in our study population was also observed in studies conducted elsewhere: in Kenya (60%)(10)and in rural India (50%)(11).

Unlike the report of significantly increased prevalence of LTBI among healthcare workers than School workers(10); in our study, neither study category of healthcare workers nor comparatorsdo have statistically significant odds of being positive for IGRA test, tending to fail to disprove the null hypothesis; where comparators are 1.08 times more exposed to LTBI than healthcare workers (OR 1.08, 95% CI (0.69, 1.69) and (P, 0.3974), and which can be explained by the higher proportion of participants than comparators participated in this study and increased attitude of TB prevention of healthcare workersthan comparators beside being in the same compound where sometimes patient also visits administrative offices.

Though with no statistically significant difference and in a slightly different pattern to other reports(22, 36), we have found the highest prevalence of LTBI among adherence team members who were working on HIV affected population (75%) followed by laboratory personnel (53.97%), logistician (50%), nurse (44.94%), card room (37.50%), pharmacist (15.38%) and general practitioner (11.24%); where laboratory personnelwere significantly (6.44) times more exposed to LTBI than pharmacists with P-value of 0.01.

In our multivariate analysis Gender were found to be an independent risk factor for LTBI. Whereas LTBI were less likely to occur in an Age group less than 30 and among those working in a health centerSame way to the report from Elias Dan, et al, Legesse, et al, Gallegos M et al, Nasehi et al and He G, et al; who put increased odds of LTBI among males and unlike the report of Elias D, et al as no significant association of LTBI with marital status (33, 47, 52-54).Accordingly, being in an age group 31-40 years and working at hospital were significantly associated with positive IGRA test result.We found sex as a statistically significant independent risk for LTBI (aOR= 1.67,95%CI (1.06-2.24), P-value=0.0135) and being maleis significantly associated with LTBI with single degree of freedom of Pearson’s chi2 (1)= 5.3873, P-value= 0.020. However, this was contrary toastudy by K. M. McCarthy et al (55). A few studies

have further shown a higher prevalence of TB infection in males compared to females(56, 57), possibly suggesting a role gender plays in acquisition of LTB infection or disease susceptibility.

Though not supported by additional reports we have found income group of 7688.11ETB-10121.95ETB to be statistically significantly associated to positive IGRA test result as seen by Pearson's $chi^2(4)$ to be 8.7536, p-0.0276 though this was not an independent risk factor for LTBI with aOR of 0.32 95%CI 0.12-0.80, p-0.0056.

Though among Choices of transport system; using public service bus and city bus were not an independent risk factors of LTBI with aOR of 0.23, 95%CI 0.05-0.08, p-0.0114 and aOR of 0.12, 95%CI 0.05-1.07, p-0.0326 respectively;both (using public service buss and City Buss) do have statistically significant association for LTBI than using minibus taxi with Pearson's $chi^2$ (3) 10.9267, p-0.0174 and $chi^2$ (3) 10.9267, p-0.0006 respectively.

In our study we have found that BCG vaccination do have no statistical significant association with IGRA result with Pearson's $Chi^2$= 0.0365, p-0.849 which is supported by couple of other studies (Teklu T. et al, Shablon A. et al, Pai M. et al, and Alemnew F. et al) whereas Prado T. et al; reported as those with no BCG scare are statistically significantly more likely to be latently infected by MTB (21, 34, 35, 58, 59).

Though, a cross sectional study conducted in china (Zhang X. et al) and contact screening done in France, Paris (Fournier A. et al) reported increased risk of LTBI among TB house hold contacts; we have found neither significant odd of being independent risk factor for LTBI (aOR 0.65, 95%CI, 0.28-1.46 p-0.1734) nor statistical significant association (Pearson's $chi^2$ (1) = 1.2741, p-0.259) between presence of Tb house hold contact and LTBI which may be explained by a lower number of participants reported to have TB house hold contact (31/365) and the degree of the reported contact was not well studied (22, 60, 61).

Unlike the report from Semarang, Indonesia on the prevalence and demographic risk factors of LTBI among healthcare workers (Erwati M., Adriany M. et al) where co-morbidity was the only risk factor for LTBI (OR=3.39, 95% CI: 0.99–11.62, p=0.04); our study showed that presence of chronic medical condition do not have statistical significant odds for being independent risk factor for LTBI (aOR =0.50, 95%CI (0.16, 1.35),P-value=0.0965) and is not statistically associated with LTBI with Pearson's $chi^2$ (1) 0.1429, p-0.705 which may share a similar explanation as for TB house hold contact (62).

Looking for the overall prevalence of LTBI by year lived in AA, our study showed no consistent increment of proportion of positive IGRA with increasing year lived in Addis Ababa.This is even with increasing number of participants in the age group 7-10 years and >= 10 years which is not comparably discussed with the finding of other reports due to lack of report of magnitude of LTBI in association with

living in Addis Ababa. Though this finding needs to be studied further the possible explanation will be the uncertainty of how long will antibodies produced in human body against TB specific peptide proteins remain detectable by IGRA test method and the response of CD4 positive T-helper cells and CD8 positive cytotoxic lymphocytes should be analyzed independently with a pre-determined scientifically valid cut of point.

Reports from Indonesia (which reported comorbidity as the only risk factor for LTBI)and Georgia, did not include year of experience as an independent risk factor for LTBI where as a report from South Africa stated time spent with TB patient (not directly year of experience) to be Independent risk factor and has significant association with LTBI. An old study from India (Pai M. et al.) reported year in healthcare profession (11-20 years and >20 years) as a significant risk factor for LTBI where a report from Kenya also stated as increased year of employment is associated with increased odd of developing LTBI. In our study we did not found statistically significant evidence for year of experience to be an independent risk factor for LTBI with aOR 1.03, 95%CI 0.95, 1.13, p- 0.471, where there was no persistent increment on the proportion of Positive LTBI as age group in years increases and though only year of experience between 8 – 9 years showed minimal (statistically significant) effect on LTBI (aOR=0.20, 95%CI (0.04, 0.90);P-value= 0.0162) (10, 11, 36, 44, 62).

Though the total negative attitude to TB prevention score of our study shows 1.36% (n=5), We found zero negative attitude to TB prevention among health care workers who were regarded as study participants formerly for this specific study. In our study majority of healthcare workers (N=221, 94.85%) showed a positive attitude to TB prevention and few (N=12, 5.15%) showed Intermediate attitude. A study from South Africa (Bhebhe LT, Van Rooyen C, Steinberg W) which employed a similar scale of evaluation also reported a similar finding of attitude of Health care worker to nosocomial TB prevention even though they have employed a bit different questioner. This similar study also reported a closer finding of Practice of healthcare workers to nosocomial TB prevention; 36.4%, 52.7%, 10.9% for unsatisfactory, satisfactory and excellent respectively; where we have found 45.06% N=105 unsatisfactory, 42.92% N=100 satisfactory and 12.02% N=28 excellent TB prevention practice(45).

In our study, we have been employing an amended format of simplified version of WHO check list for evaluating healthcare organization for the prevention of transmission of TB infection. Accordingly, 25 sections related to TB HIV healthcare services residing in 11 different healthcare organizations were evaluated in which few major and many minor gaps have been identified in accordance to prevention of healthcare transmission of TB infection as stated in the annexed table (Anex-10).

Without existence of strong data recording of incidence of TB among healthcare workers as evidenced by only 14 sections out of 25 keep records of incidence of TB among healthcare workers and out of which

only 5 of them started keeping records since the past 2 years only; a total of 60 healthcare workers were found registered on TB treatment log book which could be one possibility to see the silent risk of acquisition of healthcare associated TB infection.

Though most of the sections included in this study (24/25) reported having enough stock of disinfectants, gown and gloves, most (15/25) do not have N-95 mask for the routine TB care service which worsen the situation in that only 5 out of 25 sections do have annual TB screening and same account of sections do have budget for TB prevention activities.

From among the assessed sections most (60%, 15/25) do have a trained TB infection control focal person which were contraindicated by our finding of where only 36% (9/25) of sections undertake a scheduled training on TB infection control and only 32% (8/25) sections follow updated Tb infection control guide line; which could be one opportunity to look through to bring all efforts towards prevention of transmission of TB be success full.

# 8 Limitation and strength of the study

Although TB infection can be acquired from the community, especially in high TB burden settings, this study lacks the inclusion of another pure comparator group, who are working out of a health facility such as schools or banks to clearly estimate the burden of TB in the community during the study period. However, prior studies conducted in school children (Wassie et al. 2013) could be used as retrospective comparator groups to see the real burden of LTBI in the community.

In its strength, our study tried to see the magnitude of LTBI among health facility workers using the currently available test method (QFT TB Gold-In Tube Assay) with better sensitivity and much better specificity to IFN-γ produced against MTB specific peptide proteins. We have also assessed the attitude and practice of health facility workers for TB prevention together with infrastructural conditions of health facilities for TB infection prevention.

# 9 Conclusion and recommendation

## 9.1 Conclusion

In our study we have found a significantlyincreased prevalence of LTBI among both study categories (Participants and comparators) with a total prevalence of LTBI 48.37% which is in accordance to other study reports from low- and middle-income and high TB endemic countries and higher than other studies from high income and low TB endemic countries. Our total prevalence of LTBI is also much higher than the global estimate of LTB infection which worsen the situation due to the fact that our study participants were healthcare workers, who would be at a risk of reactivation to active TB that later becomes a public health emergency concern.

According to our finding, use of city buses and public transportation vehicles were found to be significant associated risk factors, which indicates a need for better ventilation practices in those means and crowded settingsfurther looking for an additional data if they are an independent risk factors.

Though the magnitude of negative attitude to TB prevention among all participants was minimal (1.36%) intermediate attitudes to TB prevention looks higher (20.11%) where significant magnitude of unsatisfactory practice to TB prevention (45.6%) were seen among healthcare workers which is higher than satisfactory (42.92%) and much higher than excellent practice to TB prevention among healthcare workers (12.02%).

## 9.2 Recommendation

In our study both healthcare workers and comparators demonstrated increased prevalence of LTBI with no statistically significance difference between each other and the increased total prevalence of LTBI among health facility workers should be considered as an ice-burg to have possible interventions and to conduct further studies in comparison with the general population. One of the predisposing factors for working at hospital being associated risk factor for LTBI needs to be further investigated and appropriate measure needs to be taken as it may provide a promising future to cut the chain for transmission of LTBI. The inconsistent implementation of national and/or local guideline for prevention of healthcare transmission of tuberculosis infection from healthcare facility to healthcare facility and the sub-standard infrastructural availability as seen in most healthcare facilities may present an obstacle in the fight against prevention of transmission of TB infections among health facility workers which requires mitigation plan to undertake subsequent training on TB IC to health facility workers, awareness creations and infrastructural availability. .

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# Annexes

## Annex:1 Participant Information Sheet English Version

ADDIS ABABA UNIVERSITY COLLEDGE OF HEALTH SCIENCE DEPARTEMENT OF MEDICAL LABORATORY SCIENCE

Participant Information Sheet

Introduction

My Name is Jagmar Worku. I am a student of Master of Science at Addis Ababa University, Collage of Health science Department of Medical Laboratory science. Together with AHRI we are conducting a research on occupational hazard of MTB on healthcare workers in Addis Ababa. Ethiopia is one of the 11 high TB burden countries where occupational exposure to TB infection is believed to be high. I am going to give you further information and invite you to be part of this research. Before you diced to be part of the research you can talk to anyone you feel comfortable with, about the research

You can stop me at any time of the information flow if there happen something unclear and I am responsible to explain taking enough time. If you have questions later you can ask them of me, the school or the sponsor (AHRI)

Purpose of the research

Tuberculosis (TB) is a disease caused by a bacterium known as Mycobacterium tuberculosis and transmitted from person to person by air droplet containing the bacterium. The disease can affect the lung and other body organs. Because there is a time gap between invasion of our body by the bacterium and development of sing and symptoms, peoples my stay long before knowing they are infected. This is due to the fact that our body immune system restricts the bacterium from going far to cause a disease and when the pathogen gets the chance to overcome the immune system a disease is going to happen to the person. This study is design to screen those healthcare workers who are at greater risk of developing Mycobacterium Tuberculosis infection.

Research Intervention

Beside taking information using a questioner and observational check list this research will involve collection of blood from the arm which is about 4ml (approximately 1 tea spoon full of blood)

Participant information

We are inviting all health care workers working in TB units to participate in the research.

Dear our participant, Do you know why you are chosen to participate in this study? Do you know what the study is about?

_____

_____

Voluntary participation

You participation in this research is entirely voluntary. It is your choice to participate or not. Whether you choose to participate or not, all the benefit/service you receive from your organization will continue and nothing will change

If you diced not to be part of the research, Do you know what your options are? Do you know that you do not have to take part in this research study, If you do not wish to? Do you have any question? _____
_____

Procedure and Protocol

We will take a blood sample which is about 4ml (1 tea spoon full) from your arm using a vacutainer tube. The amount of blood to be collected is in 1ml (1 tea spoon of blood, up to the mark of the tube 'by showing the tube to the participant' in each 4 of the tube designed only for this purpose). The separated blood component (plasma) will be used for this research and the remaining amount will be stored in deep freezer for further studies after the end of this study considering your additional consent.

Risk

By participating in this research, you will have only minimal risk which may arise during blood sample collection even which we try to minimize to our best by employing well experienced professionals, otherwise no any other risk will come to you.

Benefits

There will be no any direct benefit for you, the society you reside or the community at large at this stage of the research, but you are helping us to find the answer for the question we are looking for and based on the research finding positive changes will follow for the infrastructural and safety of healthcare workers and subsequent training will be given to tackle the problem. At most you are helping the nation to have an insight to the control and stop strategies of the deadly bacilli

Reimbursement

We will give you 100 ETB to pay for your transportation incase as we may get late while filling the questioner and collection of blood specimen and this may help you compensate the time you spent with us and help you reach next place on time. You will not be given any other money or gift to take part in this research

Confidentiality

It is possible that if others in your work area are aware that you are participating, they may ask you question we will not be sharing the identity of those participating in this research.

The information that we collect from this research will be kept confidential. Information about you that will be collected during the research will be put away and no one but the researcher will be able to see it. Any information about you will have a number on it instead of your name. Only the researcher will know what your number is and will lock the information up. It will not be shared except Dr. Liya Wasse, the research supervisor from AHRI, the research sponsor, ethical review committee and Mr. Kassu Desta (research advisor from the school).

Result Sharing

The knowledge that we get from doing this research will be shared to the school of medical laboratory science, Addis Ababa University; AHRI (research Sponsor) and to different organization from which participants are selected through hard copy dissemination of information. Following will be discussion of the findings and the recommendations with different stake holders including all healthcare workers who participate willingly

Confidential information will not be shared in any way and we will publish the result in order that other interested people will learn from our research.

Right to refuse or Withdraw

You do not have to take part in this research if you do not wish to do so. You may stop participating in this research at any time you choose. It is your choice and all your right will still be respected.

Who to Contact

If you have any question you may ask them of now or later, even after the study has started. If you wish to ask question later, you may ask any of the followings:

1. Jagmar worku (Principal Investigator; 0910753811; kakulani@gmail.com)

2. Mr. Kassu Desta (MSc, PHD fellow, Assistant professor, Addis Ababa University school of Medical laboratory science, research advisor; 0911107099; kassudesta2020@gmail.com)

3. Dr. Liya Wasse (PhD, senior researcher at AHRI, research supervisor; 0911664975; weassieliya@gmail.com)

THANK YOU VERY MUCH

## Annex:2 Participant Information Sheet Amharic Version

በአዲስአበባዩኒቨርሰቲ

ጤናሳይንስኮሌጅ

የህክምናላቦራቶሪትምህረትክፍል

ለተሳታፊዎችመረጃማቀበያቅፅ

መግቢያ

ስሜጃግማርወርቁይባላል፡፡በአዲስአበባዩኒቨርስቲየህክምናላቦራቶሪትምህርትክፍልየሁለተኛዲግሪተማሪስሆንከአርማወርሀንሰንየጥናትእና ምርምርተቆምጋርበመተባበርአዲስአበባውስጥበሚገኙየቲቢንበሽታለመከላከልእናለማከምበሚሰሩክፍሎችውስጥየሚሰሩሰራተኞችለበሽታ ውያላቸውንተጋላጭነትለማጥናትእየሰራንእንገኛለን፡፡

ኢትዮጵያአለምላይካሉየቲቢበሽታበከፍተኛሁኔታከተንሰራፋባቸው 11
አገራትመካከልየምትጠቀስሲሆን፤ከጤናአገልግሎትጋርበተያያዘለቲቢበሽታየመጋለጥእድልበብዛትሊኖርእንደሚችልይገመታል፡፡

በጥናቱዙሪያተጨማሪመረጃዎችንልሰጥዎትእንደምችልእየገለፅኩሎትየጥናቱተሳታፊእንዲሆኑኢጋብዘታለሁ፡፡የጥናቱተሳታፊለመሆንከመወ ሰንዎበፊትማንኛውንምአይነትዝግጅትእንዲያደርጉእናየተሻለመረጃሊሰጠኝይችላልብለውከሚያስቡትማንኛውምሰውጋርመወያየትእናመ ማከርየሚችሉመሆኑንላረጋግጥልዎእወዳለው፡፡

መረጃውንበማቀብልዎወቅትያልተረዱትወይንምግልፅያልሆነነገርካለበማንኛውምሁኔታሊያስቆሙኝአናማብራሪያሊጠይቁኝመብትአለዎ፡፡ እኔምየማብራራትግዴታአለብኝ፡፡ከዚህበኋላምጥያቄቢፈጠርብዎ፣እኔን፣ትምህረትክፍሉንወይንምኢጋርመስራቤቱንየመጠየቅመብትዎየተ ጠበቀነው፡፡

የጥናቱአላማ

ቲቢወይንምበተለምዶየሳንባበሽታየሚባለውማይኮባክተሪዬምቱውበርክሎስሲተብሎበሚጠራውበሽታአምጪተህዋስየሚመጣሲሆንየሚ ተላለፈውምተህዋሱንበያዙየአየርቅንጣቶችነው፡፡ይህበሽታሳንባንእናየተለያዩየሰውነትክፍሎችንሊያጠቃይችላል፡፡

ተህዋሱሰውነታችንውስጥየገባበትጊዜእናየህመሙንምልክቶችማሳየትየምንጀምርበትጊዜከመራራቁየተነሳበዙሰዎችተህዋሱበሰውነታቸውው ስጥስለመግባቱሳያቁሊቆዩይችላሉ፡፡ይኸውምበሰውነታችንበሽታመከላከልአቅምላይየተመሰረተነው፡፡

የዚህጥናትአላማምየህክምናአገልግቱንየሚሰጡሰዎችበበሽታውየመጠቃት/የመጋለጥእድላቸውምንያህልእንደሆነለመተንበይነው፡፡

የጥናቱሂደት

ይህጥናትበመጠይቅእናመረጃበመሰብሰቢያቅፅመረጃዎችንከመሰብሰብባሻገርከተመረጡእናፈቃዳቸውንከሰጡተሳታፊዎችላይአንድየሾርባ ማንኪያየሚገመትየደምናሙናከክንድላይበመሰብሰብየሚሰራነው፡፡

የተሳታፊዎችየአመራረጥሁኔታ

ቲቢንለማከምበሚረዱክፍሎችውስጥየሚያገለግሉእናበስራውም 6
ወራትእናከዚያበላይየቆዩማናቸውምግለሰቦችበጥናቱእንዲሳተፉተጋብዘዋል፡፡

ውድተሳታፊያችንስለምንእንዲሳተፉእንደተመረጡእናጥናቱስለምንእንደሆነመልሰውሊነግሩንይችላሉ

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በፈቃደኝነትላይየተመሰረተተሳታፊነት

የተከበሩተሳታፊያችን፤በጥናቱላይመሳተፎሙሉበሙሉበርሶፈቃድላይየተመሰረተሲሆንአሁንምይሁንቀጥሎበጥናቱላይለመቀጠልወይንምለ
ማቆምመብቱየርሶነው፡፡በጥናቱላይበመሳተፍዎወይንምባለመሳተፍዎበሚሰሩበትመስራቤትውስጥበሚኖርዎቆይታምንምአይነትተፅእኖእን
ደማይፈጠርብዎላረጋግጥልዎእወዳለው፡፡

በጥናቱላለመሳተፍቢፈልጉምንአማራጭእንዳልዎተረድተዋል/ማንኛውምጥያቄካልዎትእባክዎያቅርቡት;

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.....
.....

ስነስረአትእናደንብ

ይህጥናትከግራወይንምከቀኝክንዶላይየደምናሙናመሰብሰብንይጠይቃል፡፡ሆኖምለጥናቱአላማበተዘጋጁአራትየተለያዩየደምናሙናመሰብሰ
ቢያብልቃቶችእኛንዳንዳቸውአንድየሻይማንኪየሚያህልደምመሰብሰቢያስችሉበአጠቃላይበግምትአንድየሾርባማንኪያየሚያህልደምይሰበ
ሰባል፡፡በመቀጠልምደሙተጣርቶለጥናቱአላማየሚሆነውንያህልከተጠቀምንበኻላቀሪውንለሌላተጨማሪጥናትበፈቃድዎመሰረትበረዥምጊ
ዜማቀዝቀዣውስጥእናስቀምጠዋለን፡፡

አደጋ

ይህጥናትላይበመሳተፍዎየደምናሙናበሚወሰድበትሰአትሊኖርከሚችልመጠነኛህመምእናከቆዳበታችበራሱጊዜየሚጠፋመበለዝከመፈጠሩ
ባሻገርለከፋጉዳትሊዳርጎየሚችልነገርየለም፡፡ይህንንምለመከላከልየደምናሙናየመወሰድየተሻለልምድያላቸውንባለሙያዎችለመጠቀምእን
ሞክራለን፡፡

ጥቅም

በዚህየጥናቱእድሜላይለርሶ፣ለሚሰሩበትከባቢወይንምለማህበረሰቡየሚደረግየተለየጥቅምየለም፡፡ሆኖምእዚህጥናትላይበመሳተፍዎየጥናቱ
ንመሰረታዊጥያቄዎችእንድንመልስየሚረዱንሲሆንከጥናቱመጠናቀቅበኻላአገልግሎቱንየሚሰጡየጤናጠቓማት፣አገልግቱንየሚሰጡሰራተኞ
ችእንዲሁምማህበረሰቡተጠቃሚይሆናል፡፡ከምንምበላይየህንበማድረግዎገዳይየሆነውንየቲቢበሽታለመቆጣጠርየሚደረገውንጥረትአጅጉን
ይረዳሉ፡፡

ወጪመጋራት

እዚህጥናትላይእንዲሳተፉለማድረግየምንሰጥዎምንምአይነትስጦታወይንምገንዘብባይኖርምጊዜዎንከኛጋርበማሳለፍዎለሚፈጠርቦየትራንስ
ፖርትአልያምማንኛውምመጉላላትያካክስሎትዘንድብር 100 የምንሰጥዎይሆናል፡፡

ሚስጥራዊነት

ጥናቱንበምናካሂድበትወቅትበስራከባቢዎያልተለመዱእንቅስቃሴዎችሊኖሩእንደሚችሉይጠበቃል፡፡ሆኖምእርሶንየሚያውቁግለሰቦችበጥና
ቱላይእየተሳተፉእንደሆንተረድተውጥያቄዎችንቢጠይቁንምንአይነትምላሽአንሰጥም፡፡ለጥናቱየሚያስፈልጉንንመረጃዎችየምንሰበስብባቸው
ንቅፆችየጥናቱባለቤትብቻበሚጠቀመውሳጥንውስጥየሚቆለፍባቸውሲሆንሌላማንምሰውእንዳያያቸውይደረጋል፡፡በተጨማሪምመረጃዎች
ንበምንሰበስብበትጊዜየተሳታፊዎቻችንንስምየማንጠቅስሲሆንበምትኩምሚስጥራዊቁጥሮችንእንጠቀማለን፡፡

የጥናቱንውጤትማሳወቂያመንገዶች

ሚስጥራዊከሆኑመረጃዎችበስተቀርከጥናቱየምናገኛቸውንእውቀቶች፤ለአዲስአበባዩኒቨርሲቲ፣ለአርማወርሀንሰንምርመርተቓምእንዲሁምጥ
ናቱለተካሄደባቸውጤናተቓማትበወረቀትበታተመመድብልየምናሰራጭሲሆንጥናታዊግኝቱምበተለያዩመድረኮችላይለውይይትይቀርባል፡፡

ያለመሳተፍመብት

በዚህጥናትላይየሚሳተፉትሙሉበሙሉመፈቃደኝነትላይሲሆንያለመሳተፍመብትዎየተጠበቀነው፡፡በማንኛውምሰአትምከጥናቱእራስዎንየ
ማግለልመብትአለዎት፡፡

አድራሻ

በጥናቱላይምንምአይነትጥያቄቢኖርዎአሁንወይንምቀጥሎመጠየቅይችላሉ፡፡ጥናቱከተጀመረበኻላምቢሆንየሚፈጠርብዎንጥያቄዎችለማቅ
ረብከዚህበታችየተቀመጡትንአድራሻዎችይጠቀሙ፡፡

1.አቶጃግማርወርቁ (ተመራማሪ፣ 0910753811)

2.አቶካሱደስታ (በአዲስአበባዩኒቨርሲቲህክምናላቦራቶሪትምህረትክፍልመምህርእናእረዳትፕሮፌሰር፣የጥናቱአማካሪ፣ 0911107099)

3.ዶ/ርሊያዋሴ (በአህሪቀደምትተመራማሪእናየጥናቱአማካሪ፣ 0912041961)

መረጃውንስለተከታተሉእናመሰግናለን!!

## Annex: 3 Consent form English version

I have read the following, or it has been read to me. I have had the opportunity to ask question about it and any question that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Name of Participant _____

Signature of the participant _____

Date: _____/_____/_____

dd mm yy

If illiterate

I have witnessed the accurate reading of the consent form to the participant, and the individual has had the opportunity to ask question. I confirm that the individual has given consent freely.

Name of Witness:_____

And thumb print of the participant

Date_____,/_____/_____

dd mm yy

Statement by the researcher/ person taking the consent

I have accurately read out the information sheet to the potential participant and to the best of my ability made sure that the participant understand that the following will be done:

1. Questioner will be filed out
2. Blood sample will be collected and tested for the level of biomarkers important for the identification of TB infection.
3. Result dissemination and publication of data.

I Confirm that the participant was given an opportunity to ask question about the study and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving freely and voluntarily.

The copy of this informed consent has been provided to the participant ID:_____

Name of person taking the consent:_____

Signature_____ Date:_____/_____/_____

## Annex:4 Consent Form Amharic Version

ስምምነትመግለጫቅፅ

የጥናቱንአላማአንብቢወይንምተነቦልኝበሚገባየተረዳሁሲሆንያልገቡኝንጥያቄዎችእንድጠይውምበቂእድልተሰጥቶኛል::በመሆኑምበፈቃደኝነትለመሳተፍመስማማቴንበፊርማዬአረጋግጣለው::

ስም፡ ……

ፊርማ፡ ……

ቀን፡ ……

ማንበብእናመፃፍለማይችሉ

ግለሰቡበፈቃደኝነትእንዲሳተፉአስፈላጊውመረጃየተነበባለቸውመሆኑንእናግለሰቡምወደውእናፈቅደውስለመሳተፋቸውምስክርነቴንእሰጣለው::

የመስካሪሥም፡ ……

የተሳታፊዉየጣትአሻራ

ቀን፡ ……

የጥናቱባለቤትወይንምመረጃውንየሚሰበስበውሰው.ቃል

የመረጃማቀበያቅፁንለተሳታፊውበሚገባገለፃያደርኩሲሆንየተዘረዘሩትተግባራትእንደሚፈፀሙምያቅሜንያህልለማስረዳትሞክሪያለው::

1.መጠይቅእነደሚሞላ

2.የደምናሙናእንደሚወሰድእናእንደሚመረመርቀሪውምለተጨማሪጥናትእንደቀመጥ

3.ስለመረጃአሰረጫጨት

ግለሰቡጥናቱላይየተሳተፉትበሙሉፈቃደኝነትመሆኑንእያረጋገጥኩየተጠየቁጥያቄዎችንምየምችለውንያህልመልስሰጥቻለውእንዲሁምየቅፁንግልባጭለተሳታፊመለያቁጥር …… ሰጥቻለው::

የተሳታፊውንፈቃድየወሰደውሰው

ስም፡ ……

ፊርማ፡ ……

ቀን፡ ……

## Annex:5 Informed consent for sample storage and future use

Additional consent for exposure risk assessment for tuberclosis

If any of the blood sample I have provided for this research project is unused or left over when the project is completed (thick one choice from the following)

I wish my blood sample destroyed immediately

I wish my blood sample destroyed after _____ period of time

I gave permission for my blood sample to be stored indefinitely and be used for the same or other research purpose.

I have read the information, or it has been read to me. I have had the opportunity to ask question about it and my question have been answer to my satisfaction. I consent voluntarily to have my sample stored in the manner and for the purpose indicated above.

Name of Participant: _____

Signature:_____

Date:_____/_____/_____

dd mm yy

If illitrate

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has the opportunity to ask question. I confirm that the individual has given consent freely.

Name of Witness:_____

Thumb Print of the participant

Date: _____/_____/_____

dd mm yy

Statement by the researcher or person taking the consent

I have read out the information sheet to the potential participant, to the best of my ability made sure that the participant understands the following will be done:

Blood sample collected from, will be stored and used for same or other research project in the future.

I confirm that the participant was given an opportunity to ask question about the nature and manner of storage of sample, and all the questions asked by the participant have been answer correctly and to the best of my ability. I confirm that the participant have not been coerced given freely and voluntarily.

A copy of this ICF has been provided to the participant ID:_____

Name of researcher/ person taking the consent _____

Signature:_____ Date _____/_____/_____

## Annex: 6 Informed Consent for sample storage and future use Amharic Version

ከጥናቱየሚተርፍንየደምናሙናማስቀመጥእናወደፊትመጠቀምአንዲቻልፍቃድመጠየቂያቅፅ

ለዚህጥናትአላማየሰጠሁትየደምናሙናከጥናቱመጠናቀቅበኻላቢተርፍ (ከተዘረዘሩትአንዱንይምረጡ)

የተረፈውየደምናሙናወዲያውኑእንዲወገድእወዳለሁ

የተረፈውየደምናሙናከ..... ጊዜበኻላዕንዲወገድእወደዳለሁ

የተረፈውየደምናሙናየተፈለገውጊዜያህልእንዲቀመጥእናለተመሳሳይወይንምሌላጥናትእነዲውልፈቃዴንሰጥቻለው

ከበላይየሰፈረውመረጃመቢገባተነበልኛል/አንብቤዋለው::የፈለኩትንጥያቄእንድጠይቅተፈቅዶልኝአመርቂምላሽአግኝቻለው::ሆኖምየሰጠሁትየደምናሙናከላይበሰፈረውመስፈርትመሰረትአስፈላጊውእነዲሆንቃሌንሰጥቻለው::

የተሳታፊውሥም: .....

ፉርማ: .....

ቀን: .....

ማንብብእናመፃፍለማይችሉ

ቅፁበአግባቡእናተሳታፊውበሚረዱትመልኩየተነበበላቸውመሆኑንእያረጋገጥኩየጠየቁትጥያቄበአግባቡተመልሶላቸውበፈቃዳቸውከላይከ ተዘረዘሩትየተለየውንስለመምረጣቸውእመሰክራለው::

የመሰካሪሥም: .....

ፊርማ: .....

ቀን: .....

የተሳታፊውየጣትአሻራ

የጥናቱባለቤትወይንምመረጃውንየሰበሰበውሰውቃል

የመረጃማቀበያቅፁንለተሳታፊውበሚገባያነበብኩላቸውሲሆንበተቻለኝመጠንከታችየተገለፀውእንደሚፈጠርበአግባቡእንዲረዱእናእነዲያ ውቁትሞከሪያለው::

የተሰበሰበውናሙናቢተርፍለተፈለገውጊዜያከልተቀምጦለተመሳሳይወይንምለሌላምርምርእነዲውልፈቃዴንሠጥቻለው::

ተሳታፊውስለናሙናውአቀማመጥእናየወደፊትጥቅምበሚገባዕንዲረዱያደረኩሲሆንየጠየቆቸውንጥያቄዎችበተቻለኝአቅምለመመለስሞክሪ ያለው::የዚህንቅፅግልባጭምለተሰታፊውየሰጠውመሆኔንእገልፃለው::

የጥናቱባለቤት/መረጃውንየሰበሰበውሰውስም.....

ፊርማ: .....

ቀን: .....

## Annex:7Structured questioner for assessing exposure risk of healthcare workers to tuberculosis

### ADDIS ABABA UNIVERSITY COLLEDGE OF HEALTH SCINCE DEPARTEMENT OF MEDICAL LABORATORY SCINCE

**Structured questioner for assessing exposure risk to tuberculosis among health facility workers in Addis Ababa**

**Participants Code: _____**

**A, Demographic data**

Participants Age _____ Sex Male ☐ Female ☐

Monthly Income ≤5379.48 ETB ☐

5379.81 - 7688.06 ☐

7688.11-10121.95 ☐

10123.36-15109.21

≥15110.22

Occupation:

- Professional Nurse ☐
- Clinical Nurse
- General Practitioner
- Public health officer ☐
- Pharmacist/druggist
- Runner
- Radiology ☐
- X-ray technician ☐
- Medical specialist
- Medical Laboratory technologist
- Cleaner ☐
- Other ☐ Specify: _____

Years you lived in Addis Ababa:_____

Marital Status

- Single ☐
- Married ☐
- Divorced
- Widowed ☐

IGRA test result: _____

A. Study Question for the assessment of Occupational Hazard of TB among Healthcare workers

| S.No | Question | Answer | |
|---|---|---|---|
| 1 | With the above-mentioned professional history, have you engaged in one or more of the following units? And for how long? | Tick | Numerical values/ interviewer's comment |
| | 1.1. Triage | | |
| | 1.2. TB DOTS Clinic | | |
| | 1.3. TB Ward | | |
| | 1.4. TB Laboratory | | |
| | 1.5. X-Ray/ radiology Unit | | |
| | 1.6. Pharmacy/ Clinical Pharmacy | | |
| | 1.7. Others | | |
| 2 | Do you have a Bacilli calumetGuinean (BCG) Scaron your upper arm? | | |
| 3 | Have you ever been in one or more of medical conditions stated bellow and for how long? | | |
| | 3.0. None | | |
| | 3.1. Substance Abuse | | |
| | 3.2. Silicosis | | |
| | 3.3. Cancer of the head and neck | | |
| | 3.4. Lymphoma | | |
| | 3.5. End stage renal disease | | |
| | 3.6 Chronic Malabsorption Syndrome | | |
| | 3.7. Diabetes Mellitus | | |
| | 3.8. Prolonged Corticosteroid therapy | | |
| | 3.9. leukemia | | |
| | 3.10. Hematological and reticuloendothelial disease | | |
| | 3.11. Intestinal bypass/Gastrostomy | | |
| 4 | Did you take any of the following drug and for how long? | | |
| | 4.0. None | | |
| | 4.1. Prednisone | | |
| | 4.2. Any medication for the treatment of rheumatoid arthritis | | |
| | 4.3. Other, please mention | | |
| | | | |

| | | | |
|---|---|---|---|
| 5 | In your house hold/ nearby, was there any one taking anti TB Drug or known to be infected by MTB? And what is your relation with? | | |
| | 5.1. No | | |
| | 5.2. Yes | | |
| | | | |

| C.1. Questions to assess Attitude of Health care workers on TB Infection prevention measures please choose one of the stands that best fits for your answer. | | | |
|---|---|---|---|
| S.no | Statement | participant's stand | Code |
| 1 | Healthcare workers working in TB care facilities are at risk of developing TB Infection. | Strongly Agree=1<br>Agree=2<br>No idea=3<br>disagree=4<br>strongly disagree=5 | |
| 2 | The pathogen/the agent to cause MDR or XDR TB is different from the one that Cause non-resistant TB in its mode of transmission. | Strongly Agree=1<br>Agree=2<br>No idea=3<br>disagree=4<br>strongly disagree=5 | |
| 3 | Ethiopia Is one among high TB burden countries according to WHO Classification | Strongly Agree=1<br>Agree=2<br>No idea=3<br>disagree=4<br>strongly disagree=5 | |
| 4 | proper use of PPE like; N95 Mask, lab coat, eye goggle, safety cabinet, respirators, HEPA filters and e.t.c can reduce the chance of acquiring TB infection from TB patients | Strongly Agree=1<br>Agree=2<br>No idea=3<br>disagree=4<br>strongly disagree=5 | |
| 5 | beyond giving the right care for their patients, health care workers can do some not to acquire TB from their patients | Strongly Agree=1<br>Agree=2<br>No idea=3<br>disagree=4<br>strongly disagree=5 | |

| | | | |
|---|---|---|---|
| 6 | Most of the mechanisms that health care works can contract TB infection are not unforeseen (are known). | Strongly Agree=1<br>Agree=2<br>No idea=3<br>disagree=4<br>strongly disagree=5 | |
| 7 | A person can stay long without developing any sign of TB while acquiring the bacterium | Strongly Agree=1<br>Agree=2<br>No idea=3<br>disagree=4<br>strongly disagree=5 | |
| | | | |
| S.no | Statement | participant's stand | Code |
| 8 | with regard to transmission of TB, infrastructure of TB care facilities should be different than other non-TB care clinics | Strongly Agree=1<br>Agree=2<br>No idea=3<br>disagree=4<br>strongly disagree=5 | |
| 9 | TB care facilities should Spend their money on giving training on TBIC for health care workers as this can make a difference on the prevention of transmission of TB | Strongly Agree=1<br>Agree=2<br>No idea=3<br>disagree=4<br>strongly disagree=5 | |
| 10 | Despite it's being major public health important disease, TB has something to do with the social, economic, political and other matters of a nation. | Strongly Agree=1<br>Agree=2<br>No idea=3<br>disagree=4<br>strongly disagree=5 | |

| C.2 Question About Practice of Health care Workers for the prevention of TB. Please Choose one from the answers that best fits your answer. | | | |
|---|---|---|---|
| S.no | Question | Answer | Code |
| 1 | have you ever seen a TB Policy manual in or around your working environment (a copy dedicated for the section you are working in)? | Yes=1<br>No=2<br>I do not know=3 | |
| 2 | Are there standard operating procedures, short notes, job aids, safety signs around your working environment that are posted to remind cares to be taken while conducting routine jobs? | Yes=1<br>No=2<br>I do not know=3 | |
| 3 | Do you have an experience to refer to those documents prepared to help prevent the transmission of TB infection? | Yes=1<br>No=2<br>I do not know=3 | |
| 4 | Do you practice TB infection prevention measures in your | | |

| | | | |
|---|---|---|---|
| | day to day experience? | | |
| | 4.1. using the appropriate PPE materials | Yes=1<br>No=2 | |
| | 4.2. Ventilation of the working Unit by opening windows or any other mechanism. | Yes=1<br>No=2 | |
| | 4.3. Disinfection of working surroundings before and after work. | Yes=1<br>No=2 | |
| | 4.4. following proper functioning of the safety cabinet | Yes=1<br>No=2<br>NA=3 | |
| | 4.5. Following the appropriateness of air pressure in the working unit | Yes=1<br>No=2<br>NA=3 | |
| 5 | If your Answer is Yes for Q.4.1. , which of the following you use usually? | | |
| | 5.1. Safety gown | Yes=1<br>No=2 | |
| | 5.2. Glove | Yes=1<br>No=2 | |
| | 5.3. Mask (N95) | Yes=1<br>No=2 | |
| | 5.4. eye goggle | Yes=1<br>No=2 | |
| 6 | do you put off your PPE Materials (including safety gown) before leaving your working section | Yes=1<br>No=2 | |
| 7 | If your Answer is NO for Q.6., which PPE you do not do so and Why | | |
| | 7.1. Safety Gown. B/C I do believe it is safe to do so. | Yes=1<br>No=2<br>Forgetting to do so=3<br>only b/c of habit=4 | |
| | 7.2. Glove B/C I do believe it is safe to do so. | Yes=1<br>No=2<br>Forgetting to do so=3<br>only b/c of habit=4 | |
| | 7.3. Mask. B/C I do believe it is safe to do so. | Yes=1<br>No=2<br>Forgetting to do so=3<br>only b/c of habit=4 | |

| | | | |
|---|---|---|---|
| | 7.4. Eye Google B/C I do believe it is safe to do so. | Yes=1<br>No=2<br>Forgetting to do so=3<br>only b/c of habit=4 | |
| 8 | Have you been Screened for TB Infection? | Yes=1<br>No=2 | |
| 9 | If Yes for Q.8. by which of the following method | TST=1<br>QFT=2<br>Only by clinical Evaluation=3<br>Other, specify_____ | |

## Annex:8 Observational Check List for the study Assessment of exposure risk to tuberculosis among health facility workers in Addis Ababa.

# ADDIS ABABA UNIVERESITY COLLEDGE OF HEALTH SCIENCE SCHOOL OF Allied HEALTH SCIENCE DEPARTEMENT OF MEDICAL LABORATORY SCIENCE

### Observational Cheek list for Evaluating High risk TB facilities in selected Health Institutions of Addis Ababa for the study Assessment of exposure risk to tuberculosis among health facility workers in Addis Ababa

This cheek list is amended from Simplified version of WHO cheek list for evaluating health care organizations for the prevention of transmission of TB infection.

Name of the Institute: _____

Section/Unit: _____

Name of Responding person: _____ Responsibility:_____

| S.No | Cheek List | Yes | No | NA | Not known | Comment |
|---|---|---|---|---|---|---|
| 1 | Does your Organization have an up to date Policy on TB infection Control at each professional level and organizational at large? | | | | | |
| 2 | If not, does your organization follow updated national or other local guidelines? | | | | | |
| 3 | Does your Organization have an updated written procedure for Tb infection control?<br><br>(specify which procedure is followed on the comment part) | | | | | |
| 4 | Is there a Tb infection control focal person responsible for training and follow up of implementation of policies and procedures? | | | | | |
| 5 | Does your organization provide scheduled training for healthcare workers on TB infection control strategies and how to?<br><br>If Yes how frequently? (on the comment part) | | | | | |
| 6 | Are Healthcare workers in the organization | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | provided, at list annual Tb screening access?<br><br>Please specify where they get the access on the comment part. | | | | | |
| 7 | If Yes for Cheek point 6, Which Diagnostic Method is employed? (specify on the comment part) | | | | | |
| 8 | Which requirements are considered in your organization to assign health professional for TB related activities.<br><br>o Training on Tb infection Control<br>o Competence on the use of TB infection control strategies<br>o Immune statute of healthcare worker<br>o Previous History of TB infection and other related diseases which can possibly compromise immune status<br>o Qualification and knowledge on TB and related issues<br>o By random selection and rotation/no any other selection criteria is employed | | | | | |
| | | Yes | No | NA | Not known | Comment |
| 9 | Is there a free and confidential testing of HIV for Health care workers assigned for TB related activities or/ for those new workers before their assignment? | | | | | |
| 10 | Once health care worker working on Tb related activities is identified to be TB infected, what are those following activities?<br><br>o Root cause analysis will be done on how he/she gets infection of TB. (see documents if any)<br>o The subject will only be allowed to stay home for extended period of time till complete recovery<br>o Special policy and SOP is available to help the subject recover and stop spread of the infection to others including the staffs and families. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | o Nothing will be done/things may continue as usual. | | | | | |
| 11 | Does your organization keep record of occurrence of active TB infection among health care workers if any? | | | | | |
| 12 | Is there enough supplies for a reasonable consumption that help prevent the transmission of TB infection among health care workers?<br><br>o Face mask (N-95)<br>o Disinfectants for the proper handling of working benches<br>o Single use lab coats with proper size<br>o Glove with appropriate size. | | | | | |
| 13 | Does your organization allocate budget for the prevention of TB infection among health care workers. | | | | | |
| 14 | Are patients with cough are identified on arrival at the facility, given guidance on cough, etiquette, separated from other patients and saft-tracked through all waiting areas, including consultations, investigations and drug collection | | | | | |
| | | Yes | No | NA | Not known | Comment |
| 15 | Are supplies (tissue, surgical mask, cloths) and Tb information readily available for Tb (coughing patients) | | | | | |
| 16 | Is there a tracking mechanism (E.g register) and person responsible for monitoring turn-around time from TB screening to diagnosis, and from Tb diagnosis to treatment initiations | | | | | |
| 17 | The median time between screening positive for TB symptoms and actual diagnosis is no more than one day | | | | | |
| 18 | The median time between actual diagnosis and treatment initiations is no more than one day. | | | | | |
| 19 | Is WHO recommended rapid diagnostics, e.r | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Xpert MTB/RIF is the first TB diagnostics test. | | | | | |
| 20 | Are waiting areas well ventilated (i.e Windows and doors open when risible) and there is clear display of message on cough hygiene in all areas frequented by patients. | | | | | |
| 21 | Are patients not crowded in hallways or waiting areas | | | | | |
| 22 | Are sputum samples collected in a well ventilated, clearly designated areas away from others; preferably outdoors | | | | | |
| 23 | Are diagnosed Tb cases who are hospitalized, are isolated or grouped according to drug sensitivity status in room with adequeat natural ventilation or negative pressure. | | | | | |

Number of Healthcare workers registered In TB treatment log book for the past ……. years: ……: P neg……; P pos:- AFB……. Gen X-pet……..

## Annex: 9 Strategy for study site selection and participant recruitment

Based on a simple preliminary assessment conducted at ALERT center TB care services for the composition of human resource for the specified service provision and adding my previous work experience in different government health centers and NGO clinics; the type and number of participating organizations are selected. Accordingly, 22 government health centers will be included where 284 number of participants are expected to be recruited and 13 participants will be found from each health center. A total of 48 participants will be recruited in such a way that 12 from each of the 4 government hospitals. Among the 8 NGO DOTS clinics known to provide TB care service 2 will be included in this study where 12 participants 6 from each will be recruited for the study. 24 participants will be recruited from the selected 5 private higher Hospitals among the 19 known to provide TB DOTS program.

The schematic assumption which uses the preliminary assessment as a base line is displayed in the table below.

**Table 6: strategy for study sites selection and participant recruitment for the studt Assessment of exposure risk among health facility workers in Addis Ababa, Ethiopia; 2019 - 2020.**

| | | | | | Calculated sample size | | 364 | |
|---|---|---|---|---|---|---|---|---|
| organization | total N | expected no of HCW per Org. units | number | total Eligible persons | expected percent of participant to be included | Approximation | No: of Organizations to be included in the study | No: of participant to be Recurieted from each Orgs |
| Government Health Centers | 84 | DOTS clinic | 2 | 1092 | 77.83 | 78% | ~22 | A total of 284 where 13 participants from each Health Center will be recruited |
| | | Triage | 3 | | | | | |
| | | ART clinic | 2 | | | | | |
| | | TB laboratory | 5 | | | | | |
| | | TB/ART pharmacy | 1 | | | | | |
| | | total | 13 | | | | | |
| Government Hospital | 4 | DOTS clinic | 1o | 92 | | | | A total of 44 where 12 from Each hospital will be recruited |
| | | ART clinic | 5 | | | | | |
| | | ART pharmacy | 3 | | | | | |
| | | TB laboratory | 5 | | | | | |
| | | total | 23 | | | | | |
| | 2 | MDR section DOTS | 10 | 76 | | | | |
| | | MDR Ward | 23 | | | | | |
| | | MDR TB Lab | 5 | | | | | |
| | | total | 38 | | | | | |
| | | Sum total | 61 | 168 | 11.97 | 12% | ~4 | |
| NGO clinics | 8 | DOTS clinic | 2 | 48 | 3.42 | 3% | ~2 | A total of 12 where 6 from each NGO Clinics |
| | | TB laboratory | 2 | | | | | |
| | | ART clinic | 2 | | | | | |
| | | total | 6 | | | | | |
| DOTS private Higher Hospital | 19 | DOTS clinic | 2 | 95 | 6.77 | 7% | ~5 | A total of 24 where 6/5 from each Private higher hospital will be |
| | | TB laboratory | 2 | | | | | |
| | | TB pharmacy | 1 | | | | | |
| | | Total | 5 | | | | | |
| | | | Sum Total | 1403 | 100.00 | 1 | 33 | 364 |

## Annex:10 Infrastructural assessment for the study Assessment of exposure risk among health facility workers in Addis Ababa, Ethiopia; 2019 - 2020

| | Response | Tb Clinic | Tb laboratory | Emergency | | ART OPD | Medical OPD | TB ward | Total |
|---|---|---|---|---|---|---|---|---|---|
| Follow updated national or local guid line | Yes | 4 | 1 | 2 | | 3 | 1 | 3 | 14 |
| | No | 5 | 1 | 2 | | 1 | 0 | 0 | 9 |
| | NA | 0 | 2 | 0 | | 0 | 0 | 0 | 2 |
| Do have updated writen SOP For TB prevension | Yes | 4 | 1 | 1 | | 2 | 0 | 0 | 8 |
| | No | 5 | 3 | 3 | | 2 | 1 | 3 | 17 |
| Do have up to date policy for TB prevention | Yes | 5 | 2 | 0 | | 0 | 1 | 0 | 8 |
| | No | 4 | 2 | 4 | | 4 | 0 | 3 | 17 |
| | | Tb clininc | Tb laboratory | Emergency | | ART OPD | Medical OPD | TB ward | Total |
| is there a trained TB IC focal person | yes | 8 | 1 | 2 | | 0 | 1 | 3 | 15 |
| | no | 1 | 3 | 2 | | 4 | 0 | 0 | 10 |
| Is there scheduled training on TB IC | yes | 7 | 1 | 0 | | 0 | 1 | 0 | 9 |
| | no | 2 | 2 | 4 | | 4 | 0 | 3 | 15 |
| | I do not Know | 0 | 1 | 0 | | 0 | 0 | 0 | 1 |
| Is there annual TB screening | yes | 4 | 0 | 0 | | 1 | 0 | 0 | 5 |
| | no | 5 | 4 | 4 | | 3 | 1 | 3 | 20 |
| Screening method employed | (1)Clinincal evaluation | 2 | 0 | 0 | | 0 | 0 | 0 | 2 |
| | Chest X ray | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| | IGRA | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| | TST | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| | AFB | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| | GXP | 0 | 0 | 0 | | 0 | 0 | 0 | 0 |
| | Combination of 1 and any other | 2 | 0 | 0 | | 0 | 1 | 0 | 3 |
| | | Tb clininc | Tb laboratory | Emergency | | ART OPD | Medical OPD | TB ward | Total |
| Selection criteria for Assignment of TB related Activities | Tranining on TB IC | 1 | 0 | 0 | | 2 | 0 | 0 | 3 |
| | Qualification and Knowledge on TB | 4 | 1 | 0 | | 1 | 0 | 0 | 6 |
| | Random selection and rotation | 0 | 1 | 3 | | 1 | 0 | 2 | 7 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Combination of any two of the above | 4 | 2 | 1 | | 0 | 1 | 1 | 9 |
| Availability of free and Confidential HIV testing | Yes | 1 | 0 | 0 | | 0 | 1 | 1 | 3 |
| | No | 8 | 4 | 4 | | 4 | 0 | 2 | 22 |
| | | Tb clininc | Tb laboratory | Emergency | | ART OPD | Medical OPD | TB ward | Total |
| Is there a corrective action if personnels get exposed to TB | yes | 9 | 4 | 4 | | 4 | 1 | 3 | 25 |
| IAR | yes | 2 | 0 | 0 | | 0 | 0 | 0 | 2 |
| | No | 7 | 4 | 4 | | 4 | 1 | 3 | 23 |
| Subject will be allowed to stay home for long time | yes | 9 | 4 | 4 | | 4 | 1 | 3 | 25 |
| Special policy available | yes | 1 | 1 | 0 | | 0 | 0 | 0 | 2 |
| | No | 8 | 3 | 4 | | 4 | 0 | 3 | 22 |
| | Not Applicable | 0 | 0 | 0 | | 0 | 1 | 0 | 1 |
| Nothing will be done, things will go normal | yes | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |
| | No | 4 | 2 | 3 | | 1 | 0 | 2 | 12 |
| | Not applicable | 4 | 2 | 1 | | 3 | 1 | 1 | 12 |
| | | Tb clininc | Tb laboratory | Emergency | | ART OPD | Medical OPD | TB ward | Total |
| Availability of recored of incidence TB Among personnels | yes | 7 | 1 | 1 | | 2 | 1 | 2 | 14 |
| | No | 2 | 3 | 3 | | 2 | 0 | 1 | 11 |
| Since when is the recored kept | Since 1 year | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |
| | Since 2 year | 1 | 1 | 1 | | 1 | 1 | 0 | 5 |
| | Since 3 year | 2 | 0 | 0 | | 0 | 0 | 0 | 2 |
| | Since 4 year | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |
| | Since 5 year | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |
| | Since 6 year | 1 | 0 | 0 | | 0 | 1 | 0 | 2 |
| | Since 7 Year | 0 | 0 | 0 | | 1 | 0 | 1 | 2 |
| Number of personnels registered on TB | none | 0 | 0 | 1 | | 0 | 0 | 0 | 1 |
| | 1 personnel | 1 | 1 | 0 | | 0 | 0 | 1 | 3 |
| | 2 personnels | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| log book | 3 personnels | 2 | 0 | 0 | | 1 | 1 | 0 | 4 |
| | 5 personnels | 1 | 0 | 0 | | 1 | 0 | 0 | 2 |
| | 8 personnels | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |
| | 25 personnels | 0 | 0 | 0 | | 0 | 0 | 1 | 1 |
| | | Tb clininc | Tb laboratory | Emergency | | ART OPD | Medical OPD | TB ward | Total |
| Number of Pulmonary Negative TB posetive personnels | None | 1 | 1 | 1 | | 0 | 1 | 2 | 6 |
| | 1 P neg | 1 | 0 | 0 | | 1 | 0 | 0 | 2 |
| | 2 P neg | 1 | 0 | 0 | | 1 | 0 | 0 | 2 |
| | 3 P neg | 2 | 0 | 0 | | 0 | 0 | 0 | 2 |
| | 6 P neg | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |
| Number of Pulmonary Posetive TB posative personnels | None | 2 | 0 | 1 | | 0 | 0 | 0 | 3 |
| | 1 P pos | 1 | 1 | 0 | | 0 | 0 | 1 | 3 |
| | 2 P pos | 3 | 0 | 0 | | 1 | 0 | 0 | 4 |
| | 3 P pos | 0 | 0 | 0 | | 1 | 1 | 0 | 2 |
| | 25 P pos | 0 | 0 | 0 | | 0 | 0 | 1 | 1 |
| Number of AFB Posetive TB posetive personnels | None | 1 | 1 | 1 | | 0 | 0 | 1 | 4 |
| | 1 AFB pos | 1 | 0 | 0 | | 1 | 0 | 0 | 2 |
| | 2 AFB pos | 2 | 0 | 0 | | 0 | 1 | 0 | 3 |
| | 3 AFBP pos | 2 | 0 | 0 | | 0 | 1 | 0 | 3 |
| | 25 AFB pos | 0 | 0 | 0 | | 0 | 0 | 1 | 1 |
| Number of GXP posetiveTB Posativepersonnels | None | 5 | 0 | 1 | | 0 | 1 | 1 | 8 |
| | 1 GXP pos | 0 | 1 | 0 | | 2 | 0 | 1 | 4 |
| | 2 GXP pos | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |
| | | Tb clininc | Tb laboratory | Emergency | | ART OPD | Medical OPD | TB ward | Total |
| Availability of N-95 Mask | Yes | 4 | 1 | 1 | | 1 | 1 | 2 | 10 |
| | No | 5 | 3 | 3 | | 3 | 0 | 1 | 15 |
| Availability of Disinfectants for Bench cleaninng | Yes | 8 | 4 | 4 | | 4 | 1 | 3 | 24 |
| | No | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |
| Is there Availability of Gown for rootine daily work | Yes | 8 | 4 | 4 | | 4 | 1 | 3 | 24 |
| | No | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |
| Is there Availability of Glove with appropriate size | Yes | 9 | 4 | 4 | | 4 | 1 | 3 | 25 |
| is there Availability of Budget for TB IC | Yes | 5 | 0 | 0 | | 0 | 0 | 0 | 5 |
| | No | 4 | 4 | 4 | | 4 | 1 | 3 | 20 |
| | | Tb clininc | Tb laboratory | Emergency | | ART OPD | Medical OPD | TB ward | Total |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Are patient With cough identified and tracked fast | Yes | 8 | 1 | 2 | | 3 | 1 | 2 | 17 |
| | No | 1 | 3 | 2 | | 1 | 0 | 1 | 8 |
| Are supplies and informations available for coughing patients | Yes | 6 | 0 | 1 | | 2 | 1 | 2 | 12 |
| | No | 3 | 3 | 3 | | 2 | 0 | 1 | 12 |
| | Not Applicable | 0 | 1 | 0 | | 0 | 0 | 0 | 1 |
| Is there a tracking mechanism for monitoring of TAT from TB screening to diagnosis and from diagnosis to treatment initiation | Yes | 7 | 1 | 0 | | 0 | 0 | 0 | 8 |
| | No | 2 | 2 | 4 | | 4 | 1 | 3 | 16 |
| | Not Applicable | 0 | 1 | 0 | | 0 | 0 | 0 | 1 |
| The median time from TB screening Posative to Actual Dx is no more than one day | Yes | 7 | 0 | 0 | | 0 | 0 | 0 | 7 |
| | No | 2 | 3 | 4 | | 4 | 1 | 3 | 17 |
| | Not Applicable | 0 | 1 | 0 | | 0 | 0 | 0 | 1 |
| The median time from TB Dx Posative to Tx is no more than one day | Yes | 7 | 0 | 0 | | 0 | 0 | 0 | 7 |
| | No | 2 | 3 | 4 | | 4 | 1 | 3 | 17 |
| | Not Applicable | 0 | 1 | 0 | | 0 | 0 | 0 | 1 |
| | | Tb clininc | Tb laboratory | Emergency | | ART OPD | Medical OPD | TB ward | Total |
| Are WHO recommended diagnostics the first choice | Yes | 8 | 4 | 4 | | 4 | 1 | 3 | 24 |
| | No | 1 | 0 | 0 | | 0 | 0 | 0 | 1 |
| Are Waiting areas well ventilated | Yes | 6 | 4 | 1 | | 3 | 1 | 1 | 16 |
| | No | 3 | 0 | 3 | | 1 | 0 | 1 | 8 |
| | Not Applicable | 0 | 0 | 0 | | 0 | 0 | 1 | 1 |
| Are patients not craweded in hall ways and waiting areas | Yes | 6 | 4 | 1 | | 2 | 1 | 1 | 15 |
| | No | 3 | 0 | 3 | | 2 | 0 | 1 | 9 |
| | Not Applicable | 0 | 0 | 0 | | 0 | 0 | 1 | 1 |
| Are sputum collection areas | Yes | 7 | 3 | 1 | | 4 | 1 | 3 | 19 |
| | No | 2 | 1 | 2 | | 0 | 0 | 0 | 5 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| away from others and clearly labeled | Not Applicable | 0 | 0 | 1 | | 0 | 0 | 0 | 1 |
| Are admited TB cases isolated with Adequet ventilation | Yes | 2 | 0 | 1 | | 2 | 1 | 1 | 7 |
| | No | 0 | 1 | 2 | | 0 | 0 | 2 | 5 |
| | Not Applicable | 7 | 3 | 1 | | 2 | 0 | 0 | 13 |

## Annex:11 Distribution of Occupation by category for the study Assessment of exposure risk to tuberculosis among health facility workers in Addis Ababa, Ethiopia; 2019 - 2020.

| S.no | Occupation | comparators | Participants | total |
|---|---|---|---|---|
| 1 | Secretary | 12 | 0 | 12 |
| 2 | record room | 16 | 0 | 16 |
| 3 | porter | 11 | 5 | 16 |
| 4 | HR | 8 | 0 | 8 |
| 5 | finance | 32 | 0 | 32 |
| 6 | nurse | 0 | 89 | 89 |
| 7 | general practitioner | 0 | 21 | 21 |
| 8 | lab technologist | 0 | 63 | 63 |
| 9 | card room | 0 | 8 | 8 |
| 10 | pharmacist | 0 | 13 | 13 |
| 11 | IT | 7 | 21 | 28 |
| 12 | phlebotomy | 0 | 3 | 3 |
| 13 | cleaner | 4 | 3 | 7 |
| 14 | lab attendant | 0 | 1 | 1 |
| 15 | mechanic | 4 | 0 | 4 |
| 16 | guardian | 6 | 0 | 6 |
| 17 | adherence | 0 | 4 | 4 |
| 18 | data clerk | 3 | 1 | 4 |
| 19 | cashier | 7 | 1 | 8 |
| 20 | logistician | 4 | 0 | 4 |
| 21 | electrician | 3 | 0 | 3 |
| 22 | driver | 4 | 0 | 4 |
| 23 | food handler | 1 | 0 | 1 |
| 24 | engineer | 1 | 0 | 1 |
| 25 | communication | 3 | 0 | 3 |
| 26 | child_femal affair | 2 | 0 | 2 |
| 27 | training | 1 | 0 | 1 |
| 28 | planning | 1 | 0 | 1 |
| 29 | messenger | 2 | 0 | 2 |
| 30 | laundry | 1 | 0 | 1 |
| 31 | biomedical | 2 | 0 | 2 |
| | total | 135 | 233 | 368 |

**Annex:12 Prevalence of LTBI by occupational category for the study assessment of exposure risk to tuberculosis among heath facility workers in Addis Ababa, Ethiopia; 2019 - 2020.**

| Occupation | category | Number of Participants | no of IGRA +ve | prevalence (%) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| phlebotomy | participant | 3 | 0 | 0 |
| electrician | comparator | 3 | 0 | 0 |
| engineer | comparator | 1 | 0 | 0 |
| training | comparator | 1 | 0 | 0 |
| planning | comparator | 1 | 0 | 0 |
| messenger | comparator | 2 | 0 | 0 |
| biomedical | comparator | 2 | 0 | 0 |
| general practitioner | participant | 89 | 10 | 11.24 |
| pharmacist | participant | 13 | 2 | 15.38 |
| Secretary | comparator | 12 | 3 | 25 |
| card room | participant | 8 | 3 | 37.50 |
| porter | Both | 16 | 7 | 43.75 |
| nurse | participant | 89 | 40 | 44.94 |
| Total prevalence | | 368 | 178 | 48.37 |
| record room | comparator | 16 | 8 | 50 |
| mechanic | comparator | 4 | 2 | 50 |
| guardian | comparator | 6 | 3 | 50 |
| data clerk | Both | 4 | 2 | 50 |
| cashier | Both | 8 | 4 | 50 |
| logistician | comparator | 4 | 2 | 50 |
| driver | comparator | 4 | 2 | 50 |
| lab technologist | participant | 63 | 34 | 53.97 |
| cleaner | Both | 7 | 4 | 57.14 |
| finance | comparator | 32 | 19 | 59.38 |
| IT | Both | 28 | 17 | 60.71 |
| HR | comparator | 8 | 5 | 62.50 |
| adherence | participant | 4 | 3 | 75 |
| lab attendant | participant | 1 | 1 | 100 |
| food handler | comparator | 1 | 1 | 100 |
| communication | comparator | 3 | 3 | 100 |
| child_femal affair | comparator | 2 | 2 | 100 |
| launder | comparator | 1 | 1 | 100 |

## Annex:13 Proportion of occupations by category for the study assessment of exposure risk to tuberculosis among health facility workers in Addis Ababa, Ethiopia; 2019 - 2020.

| Comparators | | | healthcare workers | | |
|---|---|---|---|---|---|
| List | Number | proportion | List | Number | Proportion |
| Secretary | 12 | 8.89 | nurse | 89 | 38.20 |
| record room | 16 | 11.85 | general practitioner | 21 | 9.01 |
| porter | 11 | 8.15 | lab technologist | 63 | 27.04 |
| HR | 8 | 5.93 | card room | 8 | 3.43 |
| finance | 32 | 23.70 | pharmacist | 13 | 5.58 |
| IT | 7 | 5.19 | phlebotomy | 3 | 1.29 |
| cleaner | 4 | 2.96 | IT | 21 | 9.01 |
| mechanic | 4 | 2.96 | cleaner | 3 | 1.29 |
| guardian | 6 | 4.44 | lab attendant | 1 | 0.43 |
| data clerk | 3 | 2.22 | adherence | 4 | 1.72 |
| cashier | 7 | 5.19 | data clerk | 1 | 0.43 |
| logistician | 4 | 2.96 | cashier | 1 | 0.43 |
| electrician | 3 | 2.22 | porter | 5 | 2.15 |
| driver | 4 | 2.96 | Total | 233 | 100 |
| food handler | 1 | 0.74 | | | |
| engineer | 1 | 0.74 | | | |
| communication | 3 | 2.22 | | | |
| Child-female affair | 2 | 1.48 | | | |
| training | 1 | 0.74 | | | |
| planning | 1 | 0.74 | | | |
| messenger | 2 | 1.48 | | | |
| laundry | 1 | 0.74 | | | |
| biomedical | 2 | 1.48 | | | |
| Total | 135 | 100 | | | |

# Declaration

The undersigned declared that this thesis complied with the regulations of the University and met the accepted standards with respect to originality and quality. We also declare the research has been conducted with optimal scientific, ethical and technical standards.

M.Sc. candidate: Jagmar Worku (BSc, AAU)

Signature: _____

Date of submission: _____

This thesis submitted with our approval as advisors.

Advisors:

1. Mr. Kassu Desta (MSc, PhD Candidate, AAU)

   Signature: _____

   Date: _____

2. Dr. Liya Wassie (PhD, AHRI)

   Signature: _____

   Date: _____