PREVALENCE OF TUBERCULOSIS AND ASSOCIATED FACTORS AMONG ADULT HOUSEHOLD CONTACTS OF SMEAR POSITIVE PULMONARY TUBERCULOSIS PATIENTS TREATED IN PUBLIC HEALTH FACILITIES OF HARAMAYA DISTRICT, OROMIA REGION, EASTERN ETHIOPIA

MPH THESIS

ABINET ADANE GEDAMU

JUNE, 2019.

HARAMAYA UNIVERSITY, HARAR,

HARAMAYA UNIVERSITY

COLLEGE OF HEALTH AND MEDICAL SCIENCE DIRECTORATE OF GRADUATE STUDIES

PREVALENCE OF TUBERCULOSIS AND ASSOCIATED FACTORS AMONG ADULT HOUSEHOLD CONTACTS OF SMEAR POSITIVE PULMONARY TUBERCULOSIS PATIENTS TREATED IN PUBLIC HEALTH FACILITIES OF HARAMAYA DISTRICT, OROMIA REGION, EASTERN ETHIOPIA

A thesis submitted to the directorate of Graduate Studies,

HARAMAYA UNIVERSITY

In Partial Fulfillment of the Requirements for the Degree of **Masters of Public Health**

By

ABINET ADANE GEDAMU

Major advisor: Melake Demena (MPH, Assistant professor)

Co-advisor: Fitsum Weldegebreal (MSc, Assistant professor)

JUNE, 2019

HARAMAYA UNIVERSITY, HARAR,

APPROVAL SHEET

HARAMAYA UNIVERSITY

POSTGRADUATE PROGRAM DIRECTORATE

I hereby certify that I have read and evaluated this thesis` **`prevalence of TB and associated factor among adult household contact of smear positive PTB patient treated in public health facilities in Haramaya district, Oromia Region, Eastern Ethiopia**, By Abinet Adane I recommend that it will be submitted as fulfilling the thesis requirement

Major Advisor

Melake Demena (MPH, Assistant professor) _____ _____

Signature Date

Co-Advisor

Fitsum Weldegebreal (MSc, Assistant professor) _____ _____

Signature Date

As a member of the Board of Examiners of MPH Thesis Open Defense Examination, I certify that I have read and evaluated the thesis prepared by ABINET ADANE examined the candidate. I recommend that the thesis be accepted as fulfilling the thesis requirement for the master degree of General public health

_____	_____	_____
Chair person	Signature	Date
_____	_____	_____
Internal Examiner	Signature	Date
_____	_____	_____
External Examiner	Signature	Date

Final approval and acceptance of the thesis is contingent upon submission of its final copy to the Council of Graduate Studies (CGS) through the candidate's school graduate committee (SGC)

_____	_____	_____
Coordinator GS, COHS	Signature	Date
_____	_____	_____
Name of Dean, SGS	Signature	Date
_____	_____	_____
Name of Chairman, CGS	Signature	Date

DEDICATION

I dedicate this thesis manuscript to my beloved family and especially for my lovely wife Misrak assegid, Who have been the sources of passion and inspiration throughout my academic life and for their dedicated partnership in the success of my life.

STATEMENT OF THE AUTHOR

By my signature below, I declare that this thesis is my own work and that all sources of materials used for this thesis have been fully acknowledged. I have followed all the ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of the thesis. This thesis has been submitted in partial fulfillment of the requirement for MPH degree at Haramaya University and is deposited at the University library to be made available to borrowers under the rule of library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award for any academic degree, diploma or certificate.

Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgement of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the School of Graduate Studies when in his or her judgment the proposed use of the materials is in the interest of scholarship. In all other instants, however permission should be obtained from the author.

Name: Abinet Adane

Place Haramaya University

School/Department: GENERAL PUBLIC HEALTH

Date of Submission: ----------

BIO GRAPHICAL SKETCH

My name is Abinet Adane; I was born in 10/1/1984 GC. I completed my primary school at Kara mekela elementary school and secondary school in Deder Senior secondary school. After completion of my secondary school education, I joined Haramaya university by 2005 GC .I completed my Bachelor of Science in nursing in July 2007 GC. After completion of my first degree, I was employed in Cinaksen Health center of Cinaksen woreda in east hararghe zone in 2008 G.C and 2012 G.C .I joined East Hararghe Zonal Health department.

In July 2017, I joined school of graduate studies, Haramaya university through self sponsor to purse my post graduate studies in the program of general public health, which this volume is in partial fulfillment.

ACKNOWLEDGEMENTS

I would like to express my acknowledgment for Haramaya University, School of Graduate Studies giving me the chance of developing this thesis.

My deepest gratitude goes to my advisors: Melake Demena, Fitsum Weldegebreal and Hussein Mohammed (MPH) for their valuable comments and guidance throughout development of this thesis.

My heartfelt thanks also go to all Haramaya University College of Medicine and Health Science staff for their willingness and cooperation during searching for materials; as well as my friends and classmates for sharing me idea.

Special thanks goes to laboratory professional of diagnostic health facility of Haramaya district for their interesting helps in processing sample for diagnosis of TB case and study participant for their cooperation on giving response .

I would like to thanks East Hararghe Zonal Health department for their support on diagnostic supply that I used in this study for diagnosing TB case.

Lastly, I would like to thank, Haramaya District's Health Office and East Hararghe Zonal Health department for their valuable cooperation and contributions on providing me the background information of the study area and during data collection.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ABBREVATIONS AND ACRONYMS

AFB Acid Fast Bacilli

AIDS Acquired Immune Deficiency Syndrome

CHIS Community Health Information System

DM Diabetic Mellitus

FMOH Federal Ministry of Health

HHC House Hold Contact

HIV Human Immune Deficiency Virus

IHRERC Institutional Health Research Ethics Review Committee

LTBI Latent Tuberculosis Infection

MDR-TB Multi Drug resistance Tuberculosis

NTLCP National Tuberculosis and Leprosy control program

OR Odds Ratio

PTB Pulmonary Tuberculosis

SSA Sub-Saharan Africa

SS Sputum Smear

SPR Smear positivity rate

SPSS Statistical Package for Social Science

TB Tuberculosis

USAID United States Agency for International Development

WHO World Health Organization ‘

ABSTRACT

Background: Tuberculosis is an infectious airborne disease caused by *Mycobacterium tuberculosis*. It still remains a major public health problem which affects all age groups. Impact of risk factors at population level could vary depending on the local context, especially; risk of exposure is higher in household contact than members of the general population. Therefore, contact tracing is a key strategy for identifying tuberculosis case and provides additional support to the passive case finding.

However, evidences on prevalence and associated factors of tuberculosis among household contacts of smear positive pulmonary tuberculosis case is limited in Ethiopia in general and in study area in particular.

Objective: The aim of this study was to assess the prevalence and associated factors of tuberculosis among adult household contacts of smear positive pulmonary tuberculosis patients treated from July 1, 2017 to December 31, 2018 in Public health facility in Haramaya District, Oromia Region, Eastern Ethiopia, from February 20 to March 20, 2019.

Methodology: Community based cross sectional study was conducted. Sample of 454 study participant were selected from all adult Household contacts of smear positive pulmonary TB patient treated from July 1, 2017 to December 31, 2018 by using systematic sampling method. Contacts were traced by home to home visits by data collectors. Data were collected using 5% pretest structured questionnaire and laboratory examination processed by using fluorescent smear microscopy. Data was double entered to Epidata-3.1 and transferred and analyzed by statistical package for social science (SPSS) version -23. Possible associations and statistical significance between variables was measured using crude and adjusted odds ratio, P value <0.05 was used to declare statistical significance.

Result: The overall prevalence of tuberculosis was 35 (7.8 %) (95% CI: 5.8-10.0). Contacts eating meals less than three times per day were 4.3 times more likely to develop tuberculosis compared to counterpart (AOR= 4.3 :95% CI 1.61-11.55). Household contacts drinking raw milk were 4.1 times more likely to develop tuberculosis (AOR=4.1: 95% CI 1.43-11.90) compared to counterpart. Having family history of tuberculosis with more than one index case were 2.7 times (AOR= 2.7:95% CI: 1.02-6.92) more likely to develop tuberculosis than those having only one index case. Contacts living in poor ventilated houses had a risk of getting tuberculosis 4.0 times (AOR=4.0: 95% CI: 1.38-11.76), more likely than houses with good ventilation and contacts living in inadequate living room size were 3.4 times (AOR=3.4:95% CI, 1.30-8.86) more likely of getting tuberculosis compared to counterpart

Conclusion: In this study prevalence of tuberculosis among adult household contacts of smear positive pulmonary tuberculosis is high. Eating meals less than three times per day, drinking raw milk, having family history of tuberculosis other than index case, living in poor ventilated houses and inadequate living room size (<16m^2) were found to be contributors for tuberculosis infection in house-hold contacts. Therefore, in order to avert this condition improving consumption of meals per day, avoiding drinking raw milk and proper ventilation should be implemented according to the national protocol. Ministry of health and health facilities should play a role in providing awareness related to tuberculosis transmission.

Keywords: Prevalence, Smear positive tuberculosis, Household contacts, Haramaya district, Ethiopia

1. INTRODUCTION

1.1. Background

Tuberculosis (TB) is an infectious airborne disease caused by *Mycobacterium tuberculosis and* occasionally the disease can also be caused by *Mycobacterium bovis and Mycobacterium africanum*. The main source of infection is untreated smear-positive pulmonary tuberculosis (PTB) patient by discharging the bacilli. It typically affects the lungs (pulmonary TB) but can affect other sites as well (extra pulmonary TB) (FMOH, 2016). The probability of developing TB is much higher among people with low immunity status(WHO, 2018).

Tuberculosis (TB) disease remains a major public health problem which affects all countries and all age groups(FMOH, 2016). It is one of the top 10 causes of death and the leading cause from a single infectious agent and millions of people continue to fall sick with TB each year (more adults than children, and more men than women(WHO, 2018).

Ethiopia ranked eighth among the twenty-two high TB burden countries in the world and third rank in Africa (FMOH, 2016). The incidence rate of all forms of TB is estimated at 164 per 100 000 population, leading to an annual mortality rate of 27.5 per 100 000 population (WHO, 2018).

TB control strategy planning needs proper understanding of risk of progression to infection and disease (Otero et al., 2016).TB disease exclusively transmitted based on environmental and personal risk factors(Singh et al., 2013). Social mixing setting (together with overcrowding) and conditions which prolong the length of exposure to an infectious patient include health system-related factor such as delay in diagnosis increase TB transmission(KFF, 2018). In addition, the risk of infection following TB exposure is primarily governed by exogenous factors and intrinsic combination of the infectiousness of the source case, proximity to contact and social and behavioral risk factors including smoking, alcohol, and indoor air pollution (Shah et al., 2013).

TB patients with lung disease transmitted infection to risk groups by inhalation of infectious particles, identify and investigate for infected individual among contacts of patients with infectious tuberculosis is the best method of preventing later development of the disease in populations. It`s burden is controlled by improving case detection and reduce TB transmission through community by using contact investigation (WHO, 2018). In addition to this, contact tracing is very important to establish the primary source of the TB disease and to detect all those who are secondarily infected for proper diagnosis and prompt treatment (Omotowo et al., 2012) .

1.2. Statement of the problem

A recent publication (WHO Global TB Report 2018) showed that in 2017, there were an estimated 10 million incident cases and 12 million prevalent cases of TB globally, overall 90% were adults , 9% were people living with HIV (72% in Africa) and two thirds were in eight countries: India (27%), China (9%), Indonesia (8%), the Philippines (6%), Pakistan (5%), Nigeria (4%), Bangladesh (4%) and South Africa (3%) which included in 30 high TB burden countries. About 26% of incident TB cases occurred in Africa and 23% of the world's population are estimated to have a latent TB infection, and are thus at risk of developing active TB disease during their lifetime (WHO, 2018).

WHO reports that people of all ages are at risk, TB mostly affects adults during "their most productive years," posing significant challenges to the livelihoods of individuals as well as to developing economies (WHO, 2018). People who suffer from other conditions that impair the immune system are at a higher risk of developing active TB (USAID, 2016).

TB contact investigation used to reduce transmission and morbidity in contacts with active TB, and find contacts with latent Micro bacterium tuberculosis infection that are eligible for preventive therapy (FMOH, 2016).Furthermore, the likelihood of progression from LTBI to TB in household contacts is usually higher than in the general population. Therefore, household contacts of TB patients are considered a high-priority population for contact investigation and recommended as strategy by WHO and FMOH (WHO, 2012, Nair et al., 2016, FMOH, 2013). However, TB contact investigations are rarely and inconsistently carried out in resource-limited settings of low- and middle-income countries like Ethiopia (Wordvision, 2017).

Active tracing of contacts and screening for TB increased TB case detection and maintain effective treatment (Gupta et al., 2016, Lemos et al., 2004) . However, this practice has not been implemented according to protocol in Ethiopia specifically in east hararghe zone , where there is unacceptably low case detection rate of 58% between cases estimated and cases detected(EHZHO, 2018).

Studies conducted in Ethiopia on prevalence and associated factors of TB among house hold contact were very limited and the result shows as around 1% which is not consistent with high burden countries. There is no study conducted in East Hararghe zone even though, there is high proportion of smear positive PTB case. So, it is necessary to identify the factors which contribute to TB infection among contacts of known PTB at district level. Therefore, this study showed the overall status of tuberculosis among household contacts of smear positive TB in the district .

1.3. Significance of The study

The study helps for study participant in early case detection, prompt treatment and prevents further transmission within households.

Similarly it will help designing, monitoring, evaluation and implementing intervention measures on existing problems through providing feasible recommendations for health workers and different local non-governmental organizations (NGOs) working at Haramaya district to set appropriate intervention programmes.

It will be enable administrative and Health offices come up with better strategies to enhance its prevention. In addition to this, the study gives insight and serve as base line data for researchers .

1.4. OBJECTIVE

1.4.1. General objective

- ✓ To assess prevalence and associated factors of TB among adult household contacts of smear positive pulmonary tuberculosis patients treated from July 1, 2017 to December 31, 2018 in public health facilities of Haramaya District, Oromia Region, Eastern Ethiopia from February 20 to March 10, 2019.

1.4.2. Specific objectives

- ✓ To determine prevalence of tuberculosis among adult household contacts of smear positive pulmonary tuberculosis patients.
- ✓ To assess the associated factors of tuberculosis among adult household contacts of smear positive pulmonary tuberculosis patient.

2. LITERATURE REVIEW

TB Contact investigation involves the systematic evaluation of the contacts of known TB patients to identify active disease or latent TB infection (LTBI) and decrease TB transmission through community(WHO, 2018). Active case finding may be worth-while in contacts of patients with TB because they are at higher risk of exposure to the causative organism than members of the general population (Elias et al., 2016) . The risk of a contact becoming infected relates to the infectiousness of the TB patient, the duration and proximity of the contact and susceptibility of the contact (WHO, 2012)

2.1. Prevalence of TB among households contact

According to study conducted in 2013 in Peru the incidence of TB in house hold close contact of new smear-positive TB cases was 1918 per 100,000 person-years. TB burden in households was high, with 34 % of households having house hold contact with past, recent or incident TB in addition to the index case. Incidence of TB among house hold contacts was more than ten times higher than in the general population(Otero et al, 2016).

Across-sectional study conducted in Dharan Municipality of Nepal of 2010 showed that proportion of TB in house hold contact was high in male and elderly which was 1.6% (Gyawali et al., 2012). Another study conducted in Philippines shows remarkably high prevalence of TB infection, TB disease and bacteriological confirmed was 65.5%, 12.8%, and 1.8% respectively among household contacts (Sia et al., 2010).

Based on cross section study conducted in Peshawar of Pakistan showed that overall rate of TB disease among screened house hold contact was 21.6%. It is also mentioned that early identification and treatment of potential cases will eventually translate into reduced morbidity, mortality and transmission of infection in the community and among contact the proportion of male and rural area residence was 58.4% and 62.0% respectively (Javaid et al., 2016).

According to cross-sectional study conducted in Pakistan magnitude of TB among close contact was (22.7%) had smear-positive results. TB prevalence in urban households was 1504 per 100 000 population compared to 4044/100 000 in rural households ($P < 0.001$) and 2553/100 000 overall (Shah et al, 2013) and study conducted in Brazils showed about 13.6% of TB was detected from contact tracing, out of which 28% were asymptomatic. It was also reported in the same study that

there was greater occurrence when the contact lived with more than one source of infection (WHO, 2012).

According to national descriptive study conducted in seven centers of Pakistan medical research center (PMRC) throughout Pakistan from November 2010 to March 2012 magnitude of TB among house hold contact was 15.6% and showed that low-grade fever and weight loss were the most significant findings in contacts with pulmonary TB (Iqbal et al., 2013).

Study conducted based on exploratory cohort study design in Kolhapur, Maharashtra of India from July , 2013 to February,2014 showed that prevalence of TB among household contacts of newly diagnosed sputum smear (SS) positive TB index cases was 1.15% and achieved additional yield of 4.51% secondary cases(Gupta et al, 2016).

A systematic Review and Meta-Analysis conducted in low and middle income countries by 2013 on Yield of Contact Investigations in households of Patient showed that the prevalence of TB among all household contacts is estimated to be 3.1%. However, in high-TB prevalence countries, up to 22% of household contacts develop active tuberculosis (Fox et al., 2013) and another systemic review analysis showed pooled yield of household contact investigation for drug-resistant tuberculosis source cases and found a high overall yield for active tuberculosis cases (7.8%) and latent tuberculosis (47.2%)(Shah et al., 2014).

A community based two stages cross-sectional study was done in Pondicherry of India showed the prevalence of tuberculosis among the symptomatic of household contact, their spouse, and children, were 4.3%, 49% and 17.7% respectively. Early Identification of TB may help to prevent further spread of M. tuberculosis infection in the community (Kumar et al., 2016).

According to prospective cohort study conducted in Pakistan 2012 showed that the prevalence of TB among household close contact screen for TB was 22.7%. TB prevalence in urban homes with a smear-positive index case was 1504/100 000, while prevalence in rural households was 4044/100 000 ($P < 0.001$); it was 2553/100 000 overall. Household contacts accounted for almost 12% of all TB cases in the catchment area (Shah et al, 2014)

Cross-sectional study conducted in rural South Africa 2016 showed that prevalence of TB among household contacts of recently diagnosed TB patients was 3.9% which give additional yield of 8.5 per 100 index cases traced and household contact prevalence of TB was 3940 per 100 (Little et al., 2018).

Comparative meta-analyses of TB case finding interventions conducted in Ghana 2010, showed that contact investigation interventions contributed from 0.1% to 14.2% of notified sputum smear positive TB cases, with a yield of 0.6% to 4.8% of all forms of TB diagnosed through contact investigation (Javaid et al, 2016) . In addition, study conducted in high TB incidence countries like Nepal and Thailand showed that the TB prevalence among house hold was huge ,which means prevalence of TB among house hold contacts was 22% and 47.80% (Gyawali et al, 2012, Tornee et al., 2004).

A Cross sectional Retrospective study conducted in 2016 in Mwanza of Tanzania showed that prevalence of TB among house hold close contact of newly bacteriologic ally confirmed TB index was 6.4%. Active case finding strategy can provide an increased TB detection rate about 20 times higher and 306 per 100,000 people detection rate achieved than passive diagnosis (Beyanga et al., 2018).

A community-based cross-sectional study conducted in six zone of Oromia and Amhara region in Ethiopia 2014 revealed that among eligible close contacts 99.97% close contacts screened. Household, neighbor, work place and other contacts constituted 63%, 11.3%, 0.6% and 25.7% respectively. Prevalence of TB case among house hold close contact was 0.96% (Gashu et al., 2016). Another study conducted in two region of Ethiopia indicated that the prevalence rate of all forms of TB among household contacts of smear positive TB index cases to be over 10 times higher than the prevalence estimate of 211/100 000 in the general population. The prevalence rate was about 18 times higher in the Oromia Region and 6 times higher in Amhara Region (Jerene et al., 2015).

2.2. Factors associated with TB among house hold contact

2.2.1. Socio demographics factors

2.2.1.1. Age

According to study conducted in Ethiopia six zone of Oromia and Amahar region in 2014 indicated that the rate of active TB was higher in the age group of 25–34 years (AOR: 1.80 95% CI 1.2–2.62) and 35–44 years (AOR: 2.14 95% CI 1.42–3.22) as compared to under-five children (Gashu et al, 2016). Another study in Philippines shows that Older age group of 36-50 years with AOR; 6.7, 95% CI 2.8–16.3 were significantly associated with TB in household contacts (SiaI et al., 2010)

2.2.1.2. Sex

Cross-sectional study conducted in Thailand showed that the risk of tuberculosis infection significantly associated with exposure to mother with tuberculosis (AOR = 3.82,95%CI = 1.44-10.14), and exposure to father with tuberculosis (AOR = 2.55, 95%CI = 1.19-5.46) (Tornee et al, 2004). According to facility-based prospective case-control study conducted in Ambo hospital of West Ethiopia showed that male patients were 3.2 times more likely (95%CI: 1.4−7.0) to develop active Pulmonary Tuberculosis than female patients (Ephrem *et al.*, 2015).

2.2.1.3. Marital status

Facility-based prospective case-control study conducted in Ambo Hospital of West Ethiopia showed that being single and widowed or divorced individual 7.6 times (AOR=7.6 95%CI : 2.2-12.6 and p=0.001) and AOR=3.3 95% CI :1.7-8.5 and p=0.012) times more likely to develop active Pulmonary Tuberculosis than married (Ephrem et al, 2015). Another study in Gambia indicated that participants who were single and widowed/divorced had increased risk of TB infection by roughly 2-folds compared to married participants (Hill et al., 2006). However, study conducted in Tanzania showed that being married (OR, 3.3; 95% CI, 1.4–8.0;p= 0.012) had significant association with active Pulmonary Tuberculosis (Beyanga et al, 2018).

2.2.2. Socio-Economic factors

2.2.2.1. Educational status

Study conducted in Metema of Ethiopia showed that Educational Status had impact on risk of transmission of pulmonary TB that means: illiterate people were four times more likely to develop TB than those who had a secondary or higher level of education (AOR= 3.65 95% CI 2.31–5.76) (Tesema et al., 2015). Another study showed that prevalence of contact TB was higher among those HCs who were illiterate (71.4 per 1000). This showed that there was strong relationship between health and education regarding TB transmission (Gyawali et al, 2012). Another study in Pakistan indicated that 74.2% of index TB patient were illiterate (Iqbal et al, 2013).

2.2.2.2. Family size

Household family size had an impact on TB transmission .Study conducted in Gojam identified that people living with more than four family members per household were three times more likely to develop pulmonary TB than those living with fewer than four family members per household

(AOR =3.09, 95% CI 2.07–4.61)) (Tesema et al, 2015) .Similar study conducted in other place mentioned that people living within more than four family members were 3.605 times more likely to develop TB than those living within fewer four family members (AOR=3.605, 95% CI 1.717-7.570) (Meseret et al., 2017).

2.2.2.3. Income

According to Cross sectional study conducted in Kampala of Uganda indicated that prevalence of TB in poverty individual was 39.5 %(95% CI 34.3-44.7). This study generalized that poverty was one of the risk factors that increased smear positive rate, prevalence ratio 1.22, p=0.09 (Kirenga et al., 2015). Similar study conducted in Romani showed that low household income (OR=4.12, 95% CI 2.53-6.71),4.12 times more likely to develop TB than those have high household income (Dishimye et al., 2015). Patients with household income of less than1000 birr's per month were more than two times more likely to develop TB compared to those who had higher income (AOR=2.2;95%CI:1.28,3.78) (Shimeles E et al., 2019)

2.2.2.4. Occupation

According to study conducted in West Ethiopia showed that occupation status of daily labor were 3.2 times more likely (AOR=3.2 95%CI: 1.3- 9. At p: 0.012) to develop active Pulmonary Tuberculosis than government employer /public servant (Ephrem et al, 2015).

2.2.3. Environmental related factors

2.2.3.1. Housing condition

Systematic review conducted in sub-Saharan Africa in 2015 showed that living room size, poor ventilation and place of residence were found to increased risk of TB transmission in the house Hold (Saidu et al., 2014). Another Study conducted in Metema district showed the odd ratio of TB transmission were 3.11 (AOR= 3.11 95% CI 2.09–4.63) if size of living room less than 4 m^2 (Tesema et al, 2015).

According to case control study conducted in gojam district indicated that people living in a house floor made from mud (AOR=4.430 95% CI 1.739-11.286), houses with poor lighting (AOR= 4.532 95% CI 1.823-11.267) and houses with poor ventilation (AOR=3.736 95% CI 1.462-9.548) were at higher risk of getting TB 4.4, 4.5,and 3.7 times more likely to develop TB than those living in a house made from cement, those houses with good lighting and houses with good ventilation ,respectively (Meseret et al, 2017). Overcrowded housing and poor ventilation increase both the

likelihood of exposure to Mycobacterium tuberculosis (MTB) and progression to disease (Srivastava et al., 2015). The risk of TB infection transmission was high in setting with increased number of person/room (OR=2.78), having small sized house (OR=4.25) poor ventilation system with less no. of windows per room (OR=8.83) with p value of 0.0001(Khaliq et al., 2015) Patients who live in house with no window or one window were almost two times more likely to develop tuberculosis compared to people whose house has multiple windows (AOR=1.81;95%CI:1.06,3.07) (Shimeles E et al, 2019)

The risk of pulmonary TB transmission increased during absence of kitchen(AOR= 3.27 95% CI 1.99–5.35) or with living room (AOR= 1.75 95% CI 1.11–2.78) , without ceiling in the house (AOR= 1.46), a house without a window (AOR 4.42, 95% CI 2.46–7.95) or with only one window (AOR 1.91, 95% CI 1.25–2.92) were 3.27, 1.75, 1.46, 4.4 and 2 times more likely to develop TB respectively, when compared with living in a house with kitchen, with living room, presence of ceiling in house more than one window (Tesema et al, 2015).

Study conducted in Nepal indicated that Firewood for cooking purpose increases the incidence of TB. The prevalence of TB among household contacts using firewood was 45.7 per 1000 while low rate of 8.0 per 1000 was found among them who were using petroleum products for cooking (Gyawali et al, 2012)

2.2.3.2. Place of residence

According to prospective case-control study conducted in Ambo hospital of West Ethiopia showed that Patients who were from rural areas were 3.3 times (AOR=3.3 95% CI :1.3- 8.6 at p=0.012) more likely to develop active PTB than those who were from urban areas (Ephrem et al, 2015). Another study in Nepal indicated Risk of getting infected with TB among house hold contacts living in slum areas was five times more than in city area (AOR = 4.56, 95% CI = 1.25-16.71) (Gyawali et al, 2012).

2.2.3.3. Proximity to case

Study conducted in Nepal revealed that the risk of TB transmission was 3 times more likely in contacts who shared the same bed room as compared to those using separate rooms (AOR=3.07, 95%CI= 1.02-9.25 at p=0.036) (Gyawali et al, 2012).

2.2.4. Behavioral Related factors

Cross sectional study conducted in Kampala of Uganda showed that prevalence of TB in participant with alcohol use, smoking, Family history of TB, TB contact, and Diabetics was 50.7%, 26.3%, 17.5%, 11.5% and 5.4%, respectively (Kirenga et al, 2015). Other studies in three countries in West Africa have been shown that the host and environmental factors predicting pulmonary TB were smoking and family history of TB (Lienhardt et al., 2005). Similar study outside Africa also mention the predictors of bacteriologic ally-confirmed pulmonary TB among household contacts were being male sex, low body weight , alcoholism, gluco- corticoid therapy, and diabetes and this problem contributing for high prevalence of TB among House hold (Herzmann et al., 2017).

2.2.4.1. Drinking Alcohol

Study conducted in gojam of Ethiopia indicated that drinking alcohol identified as a risk factor for TB infection which means participants who consumed alcohol were 3.799 times (AOR=3.799 95% CI :1.237-11.666) more likely to have TB compared with those participants who did not drunk alcohol (Meseret et al, 2017). Systemic review conducted by world health organization indicated that consumption of more than 40 g alcohol per day, and/or having an alcohol use disorder increase risk of active TB by three folds (AOR=3.50 ,95% CI: 2.01–5.93) (Lönnroth et al., 2008).

2.2.4.2. Drinking raw milk

Cross sectional Study conducted in Tanzania reported that cultural practice of eating uncooked meat and drinking fresh raw cow blood increased the likelihood of TB disease by roughly 2-folds compared to those who did not engaged in such practice. They also argued that intake of unpasteurized cow milk was statistically significant in increased likelihood of TB infection compared to those who consumed boil cow milk and goat milk (Finanga et al., 2008) .Another study in Gojam of Ethiopia showed that drinking raw milk (AOR=7.275 ,95% CI :3.267-16.202) was a risk of getting TB infection. Persons who ever drunk raw milk were 7.275 times more likely to develop TB than those did not exhibit such behavior (Meseret et al, 2017)

2.2.4.3. Chewing khat

According to case control study conducted in gojam of Ethiopia indicated that prevalence of TB among participant who chewing khat was 7% that showed this factor not significantly associated

with Tuberculosis (Meseret et al, 2017) .Another study conducted in west Ethiopia revealed that participant who chewing khat were 2.6 times more likely to develop active Pulmonary TB than those who did not chewing khat (AOR=2.6,95% CI :1.1-5.9 at p=0.029) (Ephrem et al, 2015).

2.2.4.4. Family history of TB

A study conducted in Meteme district of Ethiopia showed that history of contact with TB patients had a twofold increased risk of contracting TB than those with contact history (AOR= 2.05 ,95% CI: 1.35–3.12) (Tesema et al, 2015) .Similar study conducted in Gojam of Ethiopia showed that presence of family history of TB was 5.374 times more likely to get TB than people not having family history of TB (AOR=5.374,95% CI:2.145-13.46 at p=0.001) and history of contact with TB patient out of family was 5.103 times more likely to get TB(AOR=5.103 ,95%CI :1.024-25.418) (Meseret et al, 2017) .Similarly study conducted in south India indicated that contacts of index cases who had a history of TB in the family had 2.5 (AOR=2.5, 95% CI: 1.1-5.7) times the risk for TB disease as compared to those without a family history of TB (Nair et al, 2016). Similar study conducted in Romania showed that presence of TB patient in the house hold was 4.35 times more likely to get TB than people not having family history of TB (AOR=4.35,95% CI:1.42-13.36 at p=0.005) (Dishimye et al, 2015)

2.2.4.5. Meals frequency

Study conducted in Tanzania indicated that house hold contact of TB patient consuming less than three meals a day (AOR=3.7, 95% CI:1.6–8.7 at p= 0.009) had 4 times more likely developing Tuberculosis than contact which consume meals greater than three per a day (Beyanga et al, 2018) . Under nutrition increases the risk of latent TB infection progressing to active TB. Action on chronic under nutrition and nutritional support to TB affected households are consistent with the SDGs and have a potential for a significant impact on TB incidence, especially in poor and marginalized communities. Food insecurity at the household level is common in India and is a strong risk factor for progression of latent infection to active TB in household contacts(MOH, 2017). Malnutrition is an important risk factor for tuberculosis (TB) because cell-mediated immunity (CMI) is the key host defense against TB. In malnourished individuals, the likelihood is increased of primary or latent infection progressing to active disease .(Cegielski and McMurray 2004) .Another study conducted in Pakistan indicated that house hold contact of TB patient consuming less than three meals a day (AOR=4.408, 95% CI:3.50–5.55 at p= 0.001) had 4 times

more likely developing Tuberculosis than contact which consume meals greater than three per a day (Khaliq et al, 2015)

2.2.4.6. Knowledge of TB

Study conducted in Vietnam showed that 66.2% of house hold contact aware that contact with prolonged cough should go for TB screening (Thanh et al., 2014). Another study in rural south Africa indicated that 24% contacts reporting seeking care for their symptoms; none of these household contacts had confirmed prevalent TB (Little et al, 2018). Another study conducted in Nigeria revealed that awareness of contact tracing at baseline and post intervention were 18.2% and 85.2% (X^2= 158.4,DF =1, p= 0.000; CI: 15.8-82.2) for the study group respectively; 18.4% and 26.0% (X^2=3.31, DF =1, p= 0.069; CI: 9.9-24.7) for the control group (Ekwueme et al., 2014). A community based cross sectional survey conducted from February to March 2009 in rural Community of Southwest Ethiopia showed that individuals who could read and write were more likely to be aware about TB [AOR = 2.98,(95%CI: 1.25, 7.08)] and more likely to know that TB is caused by a microorganism [(adjusted OR = 3.16, (95%CI: 1.77, 5.65)] than non-educated individuals. Males were more likely to know the cause of TB [(adjusted OR = 1.92, (95%CI: 1.22, 3.03)] than females and 83% of participant had ever heard of TB (Abebe et al., 2010). Study conducted in Romania showed that poor knowledge of TB (OR=3.46, 95% CI 1.97-6.07more likely to develop TB than good knowledge individuals (Dishimye et al, 2015)

2.2.4.7. Time of registration by TB index case

According to study conducted in high burden setting of Ethiopia indicated that the rate of active TB was 1.77 times higher among contacts whose index cases registered for treatment within the last 12 months than contacts that had been exposed 24 or more months earlier (AOR= 1.77 , 95% CI :1.42–2.21) (Gashu et al, 2016). Another study in Philippines showed that history of TB was associated with TB disease, and longer duration of cohabitation was associated with TB infection. The high rates of TB disease and infection observed in household contacts have important implications in TB control. The findings of this result support that contact investigation had contribution as a high-yield strategy for TB control in high-prevalence countries (Sia et al, 2010).

2.3. Conceptual framework

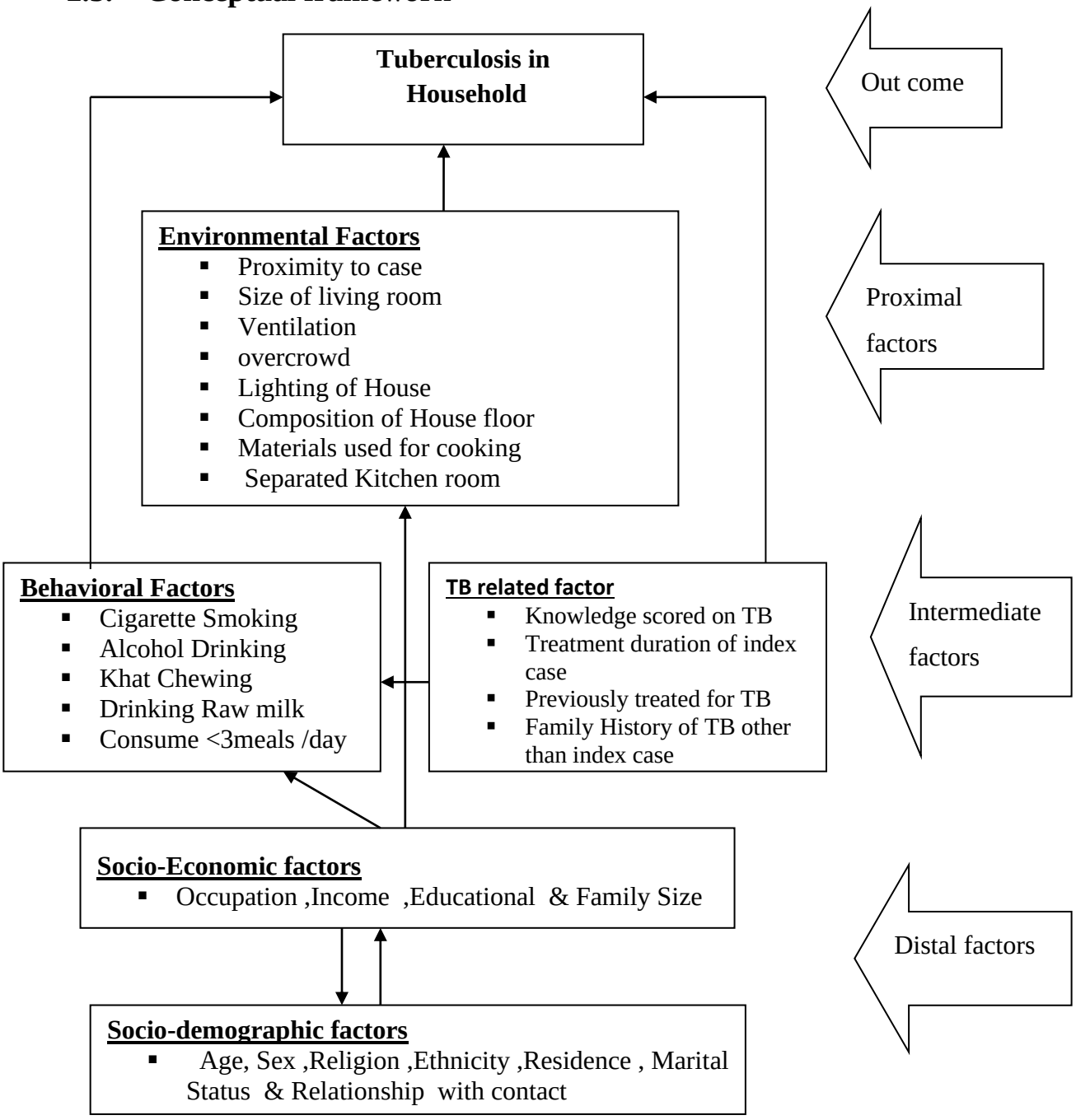

Figure 1. Conceptual framework for the study on prevalence and associated factors of Tuberculosis among adult household contact of smear positive pulmonary TB patient in Haramaya district, Eastern Ethiopia, 2019 **(Ephrem et al, 2015, Meseret et al, 2017, Gashu et al, 2016)**

3. METHODOLOGY

3.1. Study area and period

The study was conducted in Haramaya district Eastern Oromia, Ethiopia. Haramaya is one of 24 districts in East Hararghe Zone; located at 520 KM from Addis Ababa; capital city of Ethiopia, and 20 KM from Harar Town; capital of Harari region, with a total land area of 525.64 sq km. It is bordered by Kurfachelle district in north, Dire-Dawa administration in south, Kersa and Kombolcha districts in west and East respectively. According to population projection set by 2018, total population of the woreda is 304,276 among which 152,442 (50.1%) are males and 151,834 (49.9%) are females. Administratively, the district has 2 urban and 31 rural kebeles. There are eight health centers, 12 private clinics and one hospital in the Haramaya district. All governmental health facilities were provide diagnostic and treatment service of tuberculosis (Haramayaworedaadministrativeoffice, 2018).

This study was conducted from February 20 to March 20, 2019.

3.2. Study design

Community based cross-sectional study was employed.

3.3. Source population

All adult household contacts of smear positive pulmonary TB patients treated in public health facilities in Haramaya District.

3.4. Study population

All adult household contacts of smear positive pulmonary TB patients treated from July 1, 2017 to December 31, 2018 in public health facility in Haramaya District.

3.5. Eligibility criteria

3.5.1. Inclusion criteria

Adult house hold contacts of smear positive pulmonary tuberculosis patients who were on treatment from July 1, 2017 to December 31, 2018 in all public health facility in Haramaya District.

3.5.2. Exclusion criteria

The exclusion criteria were adult household contacts who were on anti TB during this period and Critically sick and mentally ill were excluded.

3.6. Sample size Determination

For objective-1 :- Sample size was estimated by using single population proportion formula considering TB prevalence among adult house hold contacts in the Oromia and Amhara region was 1 % (Gashu et al, 2016) with 1% margin of error; and 95% confidence level. Based on this assumption the actual sample size for the study compute as follows:

$$n = \frac{(\mathbb{Z}\alpha_{/2})^2 * P(1-P)}{d^2}$$

$$= \frac{1.96^2 * 0.01(1-0.01)}{0.01^2}$$

$$= \frac{3.8416 * 0.0099}{0.0001}$$

$$= 380$$

Whereas: -
Z=1.96 for 95% confidence interval
D=.01, margin error
P=0.01, prevalence of TB among house hold contacts of TB patient from previous study
n= sample size study population

Therefore, by adding 5% non-respondents rate, 380 *5%=19+380=399.

For objective -2 :- Sample size was determined by using double population proportion formula using Stat-calc module of Epi-Info 7.1.3 and calculated as follows.

Table 1: Sample size determination for second objective of the study on prevalence of TB and factor associated house hold contact in Haramaya district, Eastern Ethiopia, 2019.

S/N	Factors	Pulmonary TB status		AOR	1-β (%)	Sample size (by adding 5 % non response rate)	Reference
		Yes (exposed)	No (non Exposed)				
1	Lighting status	P1=58%	P2=42%	4.532	80%	275	(Meseret et al, 2017)
2	Ever drunk raw milk	P1=35%	P2=65%	7.275	80%	210	(Meseret et al, 2017)
3	Time of index case registered	P1=47.5%	P2=52.5%	1.77	80%	454	(Gashu et al, 2016)
4	ever drunk alcohol	P1=27	P2=73	0.094	80%	90	(Meseret et al, 2017)

N.B: P1= % of outcome in exposed, P2=% of outcome in unexposed, AOR=adjusted Odds Ration, 1-β =Power=80%, 95% CI and 5% α= significance level with equal ratio of exposed to unexposed group. The final sample size for this study was 454.

3.7. Sampling method and sampling technique

Eight health centers and one hospital were included based on provision of TB diagnosis and treatment service in Haramaya district. All smear positive pulmonary TB patient registered and treated with anti TB drugs from July 1, 2017 to December 31, 2018 were included in the study. According to information from all public health facilities in Haramaya district, a total of 240 smear positive PTB patients (index case) were registered and treated. Among patient registered, 36 (15%) were in Finkile Hc, 32 (13%) in Adelle HC, 25 (10%) in Karodada Hc, 33(14%) in Ugaz Hc, 10(4%) in Bala Hc, 10(4%) in Damota Hc, 21(9%) in Sharif kalid Hc, 24(10%) in Aumara HC and 49(20%) in Haramaya Hospital. Total household contacts of smear positive pulmonary TB patients were obtained from district's current Community Health Information System (CHIS) register available at health post. Adult household contacts of smear positive TB patients were allocated to each of 9 health facilities by probability proportion sampling method and Sample of 454 study participant were selected from all adult household contacts of smear positive pulmonary TB patient treated from July 1, 2017 to December 31, 2018 by using systematic sampling method at regular interval of every 2^{nd} participatory from list of sampling frame. Household Contacts were traced by home to home visits based on index case address.

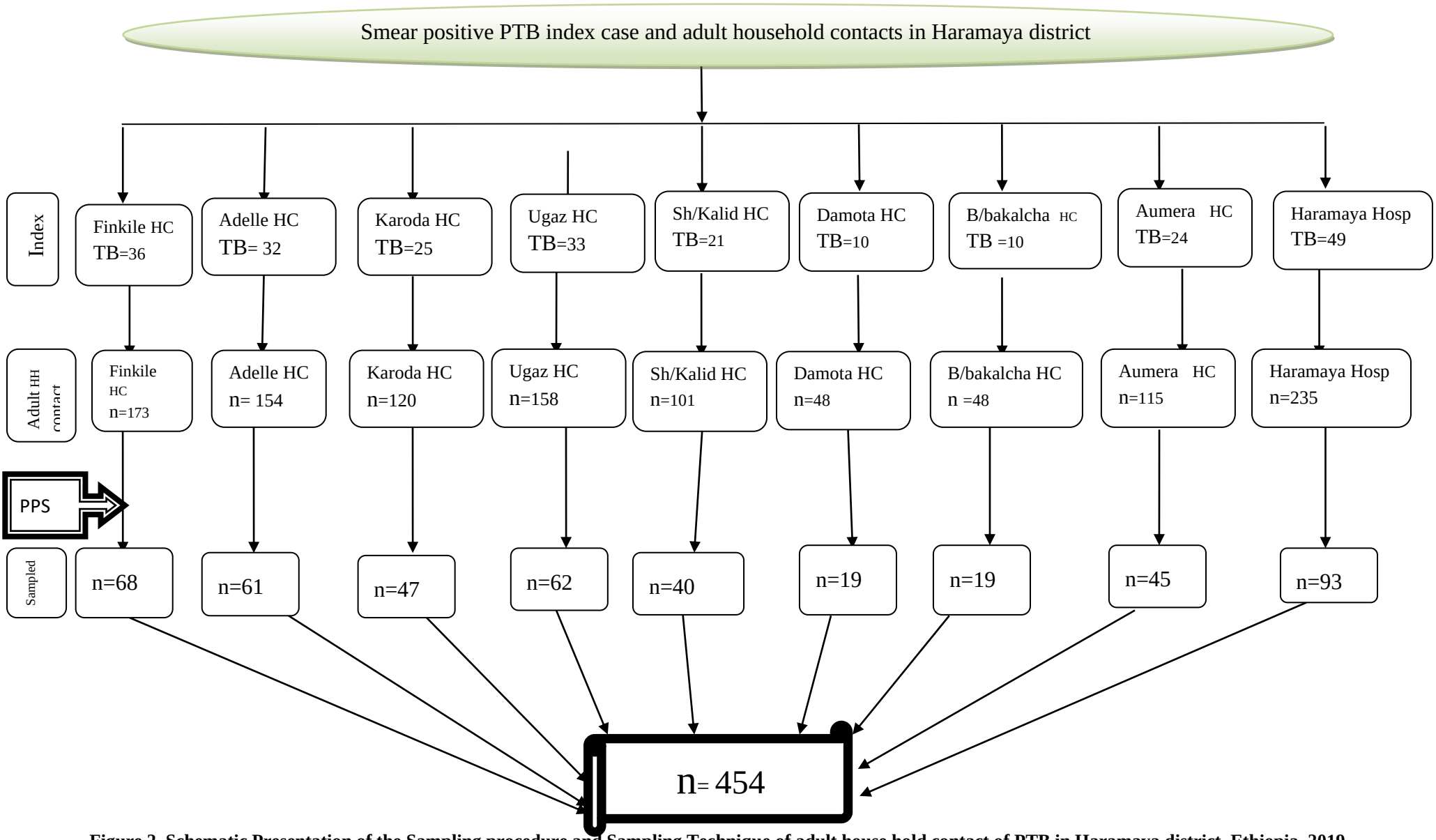

Figure 2. Schematic Presentation of the Sampling procedure and Sampling Technique of adult house hold contact of PTB in Haramaya district, Ethiopia, 2019.

N.B : TB= Smear positive PTB index case n = House hold contacts of smear positive PTB index case , PPS = probability proportional sampling

3.8. Data collection Method

Data were collected using a pre- tested structured closed ended questionnaire prepared by reviewing prior study and other materials on the topic (Meseret et al, 2017, Gashu et al, 2016). The questionnaire was translated into Afan Oromo and back to English to ensure its consistency. Nine nurse professionals as data collectors and two public health officers as supervisors were trained on data collection tools and how to observe, measuring area and collect sample and transport to Health facility to minimize bias and maintain the quality of data. The supervisors and principal investigator were supervising and monitor field works and check quality of collected data daily.

The data were collected through face to face interview, observing the house condition, measuring area of house and collect data from adult household contacts (participants). Interview and observation were conducted prior to sputum sample collection after informing; getting consents and screen house hold contacts by using symptoms based algorithm. Household Contacts were traced by home to home visits. Sputum microscopy was used to determine tuberculosis among adult house hold contacts. House hold contacts were requested to submit two sputum specimens and the 1^{st} sample collected after getting consents and the 2^{nd} sample collected after conducting interview with in 30 minute to 1 hours and sputum sample was collected in a 50 ml screw cap and leak proof containers by data collectors at house hold level (FMOH, 2016). Sputum collected at household level was transported to Health facility using triple packaging and by maintaining cold chain within 5 days. Participants were advised to submit sputum not containing food particle and minimize amount of saliva. Sputum microscopy was done by fluorochrome staining technique for acid fast bacilli. TB patient were diagnosed if participants had at least one sputum smear positive(FMOH, 2016).

3.9. Study variables

3.9.1. Dependent variable

- Pulmonary Tuberculosis(+ve for AFB)

3.9.2. Independent Variable

- **Socio-demographic factors**
  - Age of household contact
  - Sex of household contact
  - Religion status of household contact
  - Ethnicity status of household contact
  - Residence household contact
  - Marital status household contact
  - Relationship with contact
- **Socio-Economic factors**
  - Occupation status of HH contact
  - Income status of HH contact
  - Educational status of HH contact
  - Family size status of HH contact
- **Behavioral related Factors**
  - Cigarette smoking status
  - Alcohol drinking status
  - Khat chewing status
  - Drinking raw milk status
  - Meals per day
- **Environmental related Factors**
  - Proximity to index case
  - Size of living room
  - Ventilation status of household
  - Lighting of the house
  - Composition of house floor
  - Materials used for cooking
  - Availability of separate kitchen room
- **Tuberculosis related factor**
  - Family history of Tuberculosis other than index case
  - Knowledge scored on TB
  - Treatment duration of index case
  - Previous treated for TB

3.10. Operational definitions

Household: People living within one residence (house) (WHO, 2018).

Household contact (yes): If a person living permanently for at least for 6 month within one house who shared the same enclosed living space with the TB patient.

Screened household contacts: If a household contact person screened for TB by Health worker between date of treatment started of TB patient and interviewed (Thanh et al, 2014).

Index case: Smear positive pulmonary TB case identified within a household registered and treated from July 01, 2017 – December 31, 2019 at health facility and identified as first case.

Tuberculosis case: If a TB case diagnosed bacteriologic ally by using smear microscopy and start anti-TB treatment (Ephrem et al, 2015).

Income: The monthly household income will be classified as low if monthly per capita income less than 1000 Ethiopian Birr, medium if monthly income 1000-1500 and high if it is greater than 1500 Ethiopian Birr (worku et al., 2014)

Overcrowding – a house was deemed to be overcrowded when the area of the room per person was less than 4 m2 (Tesema et al, 2015).

Lighting of the houses: A house considered good if it is possible to read document written in pencil in the center of 4x4m of the room and'' Poor" if it is difficult to read (Tesema et al, 2015).

Ventilation of the house -A house considered ''good'' if the house has two and above windows and "Poor'" if it has one or no window (Tesema et al, 2015).

Proximity to case :" Yes", if Household contact use the same bed with index case " No" ,otherwise (Gyawali et al, 2012).

Duration of index cases register for treatment: Duration of time between register for TB treatment of index case and interview date of House hold contact.

Availability of separate kitchen: - "Yes", if there is separated room for cooking purpose and "No" if there is no separated kitchen room.

Size of living room: "Adequate "if the area of living room was at least 4 x4 m2 and in adequate if it is less than $4x4m^2$.

Meal frequency: -"yes" if contacts eating meals at least three times per day and "no`" if contacts eating meals less than three times per day.

Adults-an adult is considered as a person who is 18 years old or more (Olijira et al., 2016).

Knowledge of house hold contact was measured as a composite indicator by considering responses related to causes of TB (yes, if response is germ), transmissibility (yes), modes of transmission (yes, if by coughing or sneezing), curability (Yes), knowing sign and symptoms (yes, if mention at least cough), Vaccination (yes if heard about vaccine), and contact tracing (Yes, if know purpose). If at least 4 of the above questions were correctly answered knowledge was considered adequate and inadequate TB knowledge, if answered less than 4 question (Gelaw 2016) (Paramasivam et al., 2016).

3.11. Data quality control

Data collectors and supervisors were trained for two days on the data collection tools. In addition, pre testing of the questioner was under taken on 5% of sample household- contacts (22 HH contacts) in rural keble of Aweday within a week prior to actual study and its findings was used to modify questioner. Questioner was prepared in English and then translated to Afan Oromo (local language) and then, was back translated to English by two independent language translators. Collected data were checked manually on daily basis to check its completeness and consistency at onsite. Double data entry was done by two separate individual to crosscheck data entry. The recommended procedure for specimen collection, proper labeling and storage was followed strictly. The sample was rejected if it was contain food particle. Internal and external quality control was also ensured for AFB smear microscopy test. An experience laboratory professional was re-checking 128 smear slides which is selected based on SPR and total number of negative slide. The result showed that there is no discordant slide found and Physical assessment of the five criteria (thickness, smear size, cleanness, staining quality and evenness) was greater than 92%.

3.12. Data analysis

The collected data was checked and rechecked for consistency and data was entered using Epi Data version 3.1software, then exported into SPSS version 23 software for data processing and analysis. Data cleaning was performed by running frequencies and cross tabulations to check accuracy, outliers, consistencies, and missing value. Descriptive summary (Frequency distribution, proportion, mean & standard deviation) was used to summarize the variable. Continuous variables like age, income and room size were transformed into categorical variables before they were analyzed. First,

frequency of all the variables in the questionnaire was determined. Secondly, cross tabulation was done between important variables and their significance was seen by Bivariate & multivariable logistic regression. Variables with a p-value of less than 0.25 in the bivariate analysis were entered into the final model. By calculating odds ratios, their 95% confidence limits and P-value less than or equal to 0.05 was taken as statistically significant. Important variables were entered and analyzed using multiple logistic regressions in order to control for confounding variables. All the assumptions of regression analysis (model adequacy and multi-co linearity of independent variables) were checked to be satisfied using appropriate methods. The absence of multi-co-linearity was checked by using VIF/tolerance, it was 1.1. The model adequacy was checked by using Hosmer and Lemeshow goodness of fit test had P value >0.05. Finally, the result of the study was presented using graphs and tables.

3.13. Ethical consideration

The ethical approval and clearance was obtained from Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University College of Health and Medical Science. Official letter was submitted to administrative body of Zone and permission was taken from East Hararghe zonal Health department and Haramaya district. Informed, voluntary, written and signed consent was obtained from participants, after explanation about purpose, procedure, potential risk and benefit of study and maintains confidentially through omitting their personal identification, conducting the interview in private place and the data was used for the research purpose only.

Identification of patient was only possible through numeric code and identified TB case was linked to health facility for registration and starting TB treatment.

3.14. Information dissemination

This study's findings will be communicated to Haramaya University, Advisors and Program Coordinator through written and Oral Presentations as partial fulfillment of the degree of Master of PH in General public Health .It will also be communicated to East Hararghe Zone Department and Haramaya district Health Office in addition to district's healthcare facilities and at large communities. The results of the research shall also be presented on different seminars, meetings and workshops. Further efforts will be made to prepare a manuscript for publication on national and international peer reviewed journal.

4. RESULTS

4.1. Socio-demographic characteristics of participants

A total of 240 indexes TB case were identified from all Health facility and all index case included in the study. Among these 122(51%) were male and 118(49%) were female. Most of index cases (80%) were from rural area. From a total of 454 planned study participants, 451 were included in this study, with a response rate of 99.3 %. The mean (±SD) age of the study participants was 31.0(±11.7) years with a minimum age of 18 years and maximum age of 75 years. About half 228 (50.6%) of the respondents were female in gender. Majority (73.8%) of the study participants was residing in rural area and 60.1% of study participants were married. One hundred seventy six (39%) of contact relationships with cases were siblings followed by husband 24.8%, wife 23.3% and others 12.9%. Three hundred thirty eight (74.9%) of study participant were farmer in occupation (Table-1).

Table-1: Socio-demographic characteristics of adult household contacts of smear positive PTB patients treated in public health facility of Haramaya district Eastern Ethiopia, 2019 (n= 451).

Socio-demographic Variables		Frequency	
		Number	Percent (%)
Age (Year)	18-27	212	47.0
	28-37	116	25.7
	>= 38	123	27.3
Gender	Male	223	49.4
	Female	228	50.6
Marital Status	Single	156	34.6
	Married	271	60.1
	Divorced	16	3.5
	Widowed	8	1.8
Ethnicity	Oromo	435	96.5
	Amhara	11	2.4
	Others	5	1.1
Religion	Muslim	441	97.8
	Orthodox	10	2.2
Residence area	Urban	118	26.2
	Rural	333	73.8
Educational level	Not read and write	258	57.2
	Read and write	73	16.2
	Primary (1-8)	83	18.4
	Secondary (9-12)	25	5.5
	Collage and above	12	2.7

Occupation	Farmer	338	74.9
	Government Employ	5	1.1
	House wife	37	8.2
	Merchant	14	3.1
	Daily labor	15	3.3
	Student	42	9.3
Relationship to the index case	Husband	112	24.8
	Wife	105	23.3
	Sibling	176	39.0
	Others	58	12.9
Monthly income of the family	<1000	273	60.5
	1000-1500	67	14.9
	>1500	111	24.6

4.2. Environmental characteristics of study participants

Four hundred sixteen (92.7%) of houses of the study participants were made from mud and wood. Majority (67.6%) of household contacts houses had good ventilation and 314(69.6%) of the houses had good lighting status. Three hundred sixty sixes (81.2%) of the respondents had separate kitchen room and 408 (90.5%) of the respondents used wood for cooking food (Table- 2).

Table 2: Housing condition of adult household contacts of smear positive PTB patients treated in public health facility of Haramaya district Eastern Ethiopia, 2019 (n= 451).

Variables		Frequency	
		Number	Percent (%)
Composition of house floor	Mud	418	92.7
	Cement& other	33	7.3
Ventilation status	Good	305	67.6
	Poor	146	32.4
Lighting status	Good	314	69.6
	Poor	137	30.4
Overcrowded	Yes	167	37.0
	No	284	63.0
Cooking energy	Electric	20	4.4
	Wood	408	90.5
	others	23	5.1

Separated kitchen room	Yes	366	81.2
	No	85	18.8
Duration of index cases registered for treatment	≤ 6 month	125	27.7
	> 6 month	326	72.3
Proximity to TB index case	sleep on the same bed	217	48.1
	sleep on different bed	234	51.9
Living room size	In adequate	148	32.8
	Adequate	303	67.2

4.3. Behavioral related characteristics of participants

One hundred nine (24.2%), 206 (45.7%), 104 (23.1%) and 12(2.7%) of study participants had habit of smoking cigarette, chewing Khat, consumed raw milk and drinking alcohol respectively. Majority 389(86.3%) of study participant had a habit of eating meals ≥ 3 per day. Majority (67.6%) of study participants had no family history of TB (Table -3)

Table-3 : Behavioral related characteristics of adult household contacts of smear positive PTB patients treated in public health facilities of Haramaya district , Eastern Ethiopia, 2019 (n= 451).

Host(behavioral) related Variables		Frequency (%)	
		Number	Percent (%)
Drinking alcohol	Yes	12	2.7
	No	439	97.3
Cigarette smoking	Yes	109	24.2
	No	342	75.8
Chewing khat	Yes	206	45.7
	No	245	54.3
Drinking raw milk	Yes	104	23.1
	No	347	76.9
Meals per day	>= 3 meals per day	389	86.3
	< 3 meals per day	62	13.7
Previously treated for TB	Yes	53	11.8
	No	398	88.2
Family history of TB other than index case	Yes	146	32.4
	No	305	67.6

4.4. Knowledge status of study participants

Among adult household contacts enrolled in this study 362 (80.3%) of household contacts had adequate knowledge of TB (Table -4).

Table 4: Knowledge status of adult household contacts of smear positive PTB patients treated in public health facilities of Haramaya district, Eastern Ethiopia, 2019 (n= 451).

Knowledge related Variables		Frequency	
		Number	Percent (%)
Cause of TB	Germ/Bactria	275	61.0
	Other	14	3.1
	Not know	162	35.9
TB is transmittable	Yes	403	89.4
	No	48	10.6
Mode of TB transmit ion	Cough	392	86.9
	Feeding	19	4.2
	Sexual	2	.4
	Do not know	38	8.4
TB is curable	Yes	413	91.6
	No	38	8.4
Knowing sign and symptom of TB	Yes	367	81.4
	No	84	18.6
Knowing importance of BCG vaccination	Yes	256	56.8
	No	195	43.2
Importance of contact screening	Yes	236	52.3
	No	215	47.7
Over all Knowledge scored on TB disease	Inadequate	89	19.7
	Adequate	362	80.3

4.5. Prevalence of TB among PTB positive household contacts

The overall prevalence of tuberculosis was 35/451 (7.8%) (95% CI: 5.8-10). Among household contacts, 206 (45.6%) were symptomatic (had cough > 2 week) and of these 91 (44%) had chest pain, night sweating and fever. The proportion of Tuberculosis among presumptive TB cases was 35 (16.9%).

Among detected tuberculosis cases relatively higher proportion was observed among age group of 28-37 years(48.6%), male (57.1%), married (71.4%), farmer (85.7%), having monthly average income of <1000 birr (82.9%) and illiterate (74.3%) respondents(Table -5).

4.6. Factors associated with prevalence of Tuberculosis

In bivariable analysis, variables such as age, income, ventilation status, lighting status, overcrowded, separate kitchen, living room size, proximity to index case, treatment duration of TB index case, family history of TB, smoking cigarette, chewing Khat, drinking raw milk, frequency of meals per day and over all knowledge scored on TB were found to be significant at p-value less than 0.25 and considered as candidates for multivariable analysis.

In multivariable analysis frequency of meals per day, ventilation status, living room size, drinking raw milk and family history of TB other than index case remained statistically significant at p-value less than 0.05.

Study participants eating meals less than three times per day were 4.31 times more likely to acquire TB as compared to those eating meals more than three times per day [AOR=4.31; 95%CI= 1.607-11.545]. Study participants who had history of drinking raw milk were about 4 times more likely to develop tuberculosis than those who were not [AOR=4.12, 95% CI =1.431-11.900,]. The odds of getting TB was about 3 times higher among house hold contacts who had history of TB within family other than index case as compared to those who were not [AOR=2.7,95%CI =1.015-6.921].

The study participants living in the houses with poor ventilation were at risk of getting TB 4.0 times more likely than to develop tuberculosis compared to their counterparts [AOR = 4.02, 95% CI = 1.382-11.756]. Similarly, The likelihood of having TB was about 3 times higher among the contacts dwelling in inadequate room size (less than 4x4m per person) when compared to those who were living in adequate room size (AOR =3.4,95%CI=1.304-8.857) (Table 5).

Table 5: Predictors of Tuberculosis among adult household contacts of smear positive PTB patients treated in public health facility of Haramaya district, Eastern Ethiopia, 2019 (n= 451).

Variables	Category	Tuberculosis		COR (95%CI)	p-value	AOR(95%CI)	p-value
		Yes	No				
Age (Year)	18-27	13(6%)	199(94%)	1		**1**	
	28-37	15(13%)	99(87%)	2.3(1.06-5.06)	0.04	1.9(0.55-6.87)	0.31
	>=38	7(6%)	118(94%)	0.9(0.35-2.34)	0.84	0.3(0.07-1.22)	0.09
Monthly income of the family	<1000	29(11%)	244(89%)	13.1(1.76-97.20)	0.01	6.5(0.63-68.38)	0.12
	1000-1500	5(7%)	62(93%)	8.9(1.01-77.65)	0.05	15.1(1.06-217.09)	0.06
	>1500	1(1%)	110(99%)	1		1	
Ventilation status **	Good	6(2%)	294(98%)	1		1	
	Poor	29(19%)	122(81%)	11.7(4.71-28.77)	0.00	4.0(1.382-11.76)	**0.01**
Lighting status	Good	13(4%)	301(96%)	1		1	
	Poor	22(16%)	115(84%)	4.4(2.16-9.09)	0.00	0.78(0.20-3.09)	0.72
Overcrowded	Yes	23(14%)	144(86%)	3.6(1.75-7.49)	0.00	1.3(0.47-3.44)	0.63
	No	12(4%)	272(96%)	1		1	
Separated kitchen	Yes	18(5%)	348(95%)	1		1	0.53
	No	17(20%)	68(80%)	4.8(2.37-9.85)	0.00	1.4(0.47-4.40)	
Living room size *	In adequate	24(16%)	124(84%)	5.1(2.44-10.81)	0.00	3.4(1.30-8.86)	**0.01**
	Adequate	11(4%)	292(96%)	1		1	
Proximity to TB index case	sleep on the same bed	19(9%)	198(91%)	8.5(4.12-17.59)	0.00	1.9(0.61-6.32)	0.26
	sleep on the different bed	16(7%)	218(93%)	1		1	
Treatment duration of index case	≤ 6 month	15(12%)	110(88%)	2.1(1.03-4.22)	0.04	1.3(0.46-3.41)	0.66
	> 6 month	20(6%)	306(94%)	1		1	
Family hx of TB other than index case *	Yes	22(15%)	124(85%)	4.0(1.95-8.16)	0.00	2.7(1.02-6.92)	**0.047**
	No	13(4%)	292(96%)	1		1	
Smoking cigarette	Yes	18(17%)	91(83%)	3.9(1.87-7.63)	0.00	1.4(0.50-3.86)	0.54
	No	17(5%)	325(95%)	1		1	
Chewing khat	Yes	28(14%)	178(86%)	5.4(2.28-12.52)	0.00	2.7(0.91-7.74)	0.07
	No	7(3%)	238(97%)	1		1	

Drinking raw milk **	Yes	27(26%)	77(74%)	14.9(6.50-33.97)	0.00	4.1(1.43-11.90)	**0.01**
	No	8(2%)	339(98%)	1		1	
Meals per day **	>= 3 meals per day	14(4%)	375(96%)	1		1	
	< 3 meals per day	21(34%)	41(66%)	13.7(6.49-29.02)	0.00	4.3(1.61-11.55)	**0.004**
Overall knowledge scored on TB case	Inadequate	21(24%)	68(77%)	7.7(3.72-15.84)	0.00	2.0(0.72-5.54)	0.18
	Adequate	14(4%)	348(96%)	1		1	

-* shows association having p value below 0.05 and ** association having p value below 0.01. OR =Odd ratio, COR = Crude odd ratio, AOR=Adjusted odd ratio, CI= Confidence interval

5. DISCUSSION

The prevalence of Tuberculosis was found to be 7.8% (95% CI: 5.8-10.0). Moreover, frequency of meals per day, ventilation status, living room size, drinking raw milk and family history of TB other than index case were factors significantly associated with Tuberculosis among adult household contacts of TB patients

The prevalence is comparable with reports from Sub Sahara (7.8%) (Shah et al, 2014), Ghana (0.1%-14%) (Javaid et al, 2016) and Tanzania (6.4%) (Beyanga et al, 2018). But, higher than reports from study done in Nepal (1.6%) (Gyawali et al, 2012), India (1.15%)(Gupta et al, 2016), Pondicherry of India (4.3%)(Kumar et al, 2016), rural South Africa (3.9%) (Little et al, 2018) and Ethiopia (1%) (Gashu et al, 2016) .This variation in prevalence might be related to differences in study- population, living situation, and overcrowding which is an important risk for respiratory disease including tuberculosis (Kompala et al., 2013) It is also lower than from previous studies conducted in Peru (34%) (Otero et al, 2016), Philippines (12.8%) (Sia et al, 2010), and Pakistan (15.6%) (Iqbal et al, 2013). This could be associated with sample size of the study and diagnostic methods used in TB diagnosis (FMOH, 2016).

This study revealed that the likely hoods of TB among house hold contacts eating meals less than three times per day was 4.3 times higher when compared with those who eat meals three times or greater per day. This finding is in line with studies conducted in Tanzania (Beyanga et al, 2018)and Pakistan (Khaliq et al, 2015). This might be due to under nutrition or nutritional deficiency impairs cell mediated immunity which can lead to progression of latent infection to active TB disease and it may be explained by differences in the socioeconomic status, life style, and feeding pattern of contacts (WHO, 2013, Chandrasekaran P et al., 2017).

Our study found that household contacts who drink raw milk were 4.1 times more likely to develop TB compared to their counterparts .This result is comparable with studies conducted in Tanzania (Finanga et al, 2008) and Gojam district of Ethiopia (Meseret et al, 2017). It might be due to intake of infected milk with TB bacteria and by disseminating from the initial location in the abdomen to other parts of the body via the blood stream, the lymphatic system, or by direct extension to other organs (Girmay et al., 2015)

The likelihood of TB among households having family history of TB other than index case were 2.7 times higher when compared with those who not have family history of TB (AOR= 2.795% CI: 1.015-6.921). This is in line with the studies done in India(Nair et al, 2016), Metema district of

Ethiopia (Tesema et al, 2015) and Gojam of Ethiopia (Meseret et al, 2017). It is also in line with WHO report which stated that there was greater occurrence of TB when the contact lived with more than one TB case (WHO, 2012). It might be due to increased expelled bacilli and maximize the exposure within house hold.

The study finding showed that contacts living within the houses with poor ventilation were a risk of getting TB 4.0 times more likely than houses with good ventilation. This finding is in line with the studies done in Pakistan (Srivastava et al, 2015), India (Khaliq et al, 2015), meta analysis in sub Sahara Africa (Saidu et al, 2014), Addis Ababa, Ethiopia (Shimeles E et al, 2019), Metema district, Ethiopia (Tesema et al, 2015) and Gojam, Ethiopia (Meseret et al, 2017). This might be due to poor ventilation increased the likelihood of exposure to tuberculosis by increasing the concentration of TB bacteria within households However, good ventilation reduces the concentration of TB bacteria so it will decrease the transmission of tuberculosis(WHO, 2009).

The other factor associated with occurrence of TB among house hold contacts was living in houses with inadequate living room size. Household contacts living in inadequate living room size was 3.4 times more likely to get TB than those living in adequate room size. This finding in line with the studies done in Sub Sahara Africa (Saidu et al, 2014), Pakistan (Khaliq et al, 2015) and Metema district of Ethiopia (Tesema et al, 2015).This might be due to enclosed spaces and poor air circulation accelerate transmission of airborne infection including Tuberculosis(WHO, 2009).

Majority of socio-demographic factors used in this study did not show statically significant association with the presence of TB in household contacts. However, community based study done in high burden setting in Ethiopia (Gashu et al, 2016) and Philippines (Sia et al, 2010) showed significant association of older age group with the presence of TB. Similarly occupational status of household contacts were not significant in this study with presence of TB which was inconsistent with study conducted in west Ethiopia (Ephrem et al, 2015) .This might be due to difference within study population, life style and socio economic factors .

Generally, the findings of the present study are important in pointing out tuberculosis prevalence and factors highly associated with the presence of TB in Haramaya district among contacts of PTB infected cases treated at health care facilities. It could provide helpful insights for policy makers and program implementers to design feasible prevention and control measures in the district.

6. Limitation and Strength of the study

6.1. Limitation of the study

Causal inferences (temporal relationship) cannot be drawn out of the findings since the study is a cross-sectional one and smear negative cases were not further investigated using sodium hypochlorite (NaOCl) concentrated technique.

During observation there might be intra observer variation. Proper training was given to data collectors to minimize these biases.

Some of variable (meal frequency) are not standard to be assessed.

6.2. Strengthen of the study

It was conducted in communities of Haramaya district; where prevalence of tuberculosis was not known.

7. CONCLUSION AND RECOMMENDATION

7.1. Conclusion

The overall prevalence of TB among house hold contact in this study is high. Eating meals less than three times per day, drinking raw milk, having family history of TB other than index case, living in poor ventilation houses and inadequate living room size were factors contributing to the infection of TB in household contacts.

7.2. Recommendations

Based on our findings the following recommendations have been forwarded.

Communities and study participant

- Community should avoid raw milk consumption and should use boiled milk.
- Community should give attention and improve ventilation status of house.
- Attention should be given for improved design and construction of houses.

District health office and health facilities

- Health facilities should conduct early screening of house hold contact
- strengthen health education regarding housing condition (proper ventilation and adequate of rooms) of the community, harm of drinking raw milk and consumption of food to prevent and reduce TB infection in the community
- Providing health education for new TB patients how to protect their family and community
- Further study which confirm or support the finding of this study would be recommended.

REFFERENCES

Abebe , G., Amare Deribew , A., Apers , L, Woldemichael , K, Shiffa, J., Tesfaye, M., et al. (2010). Knowledge, Health Seeking Behavior and Perceived Stigma towards Tuberculosis among Tuberculosis Suspects in a Rural Community in Southwest Ethiopia, PLoS ONE 5(10): e13339. doi:10.1371/*journal.pone.*0013339.

Beyanga , M., Kidenya , B.R., Adima , L.G, Ochodo , E., Mshana , S.E. & Kasang , C.H. (2018). Investigation of household contacts of pulmonary tuberculosis patients increases case detection in Mwanza City, Tanzania, *BMC Infectious Diseases* (2018) 18:110.

Cegielski, JP & McMurray , DN (2004) . The relationship between malnutrition and tuberculosis: evidence from studies in humans and experimental animals. *Int j tuberc lung dis* 8(3):286–298.

Chandrasekaran P, Saravanan N, Bethunaickan R & S., Tripathy (2017). Malnutrition: Modulator of immune responses in tuberculosis ;8: 1316. https://doi.org/10.3389/fimmu.2017.01316. eCollection 2017. Review. *PMID:* 29093710.

Dishimye, P, Domokos, B, Stillo, J, Seghrouchni, F, Mrtabe, O, Homordean, D, et al. (2015). Acase control study of risk factors associated with pulmonary tuberculosis in romania: experience at a clinical hospital of pneumology,*Clujul Medical* No.1, 2015: 54-59.

EHZHO (2018). East Hararghe zonal Annual TB program performance report ,East Hararghe zone Tuberculosis control,2018, Harar,Ethiopia.

Ekwueme , O.C., Omotowo , B.I. & Agwuna , K.K. (2014).Strengthening contact tracing capacity of pulmonary tuberculosis patients in Enugu, southeast Nigeria: a targeted and focused health education intervention study,2104,Nigeria. *BMC Public Health* 2014, 14:1175**.**

Elias, D., Akuffo, H., Abate, E., Mekonnen, Y., Aseffa, A. & Britton, S. (2016). Risk of tuberculous infection in adolescents and adults in a rural community in Ethiopia,.*Int J Tuberc Lung Dis* 20(2):218–222 Q2016.

Ephrem, T. , Mengiste, B., Mesfin, F. & Godana, W. (2015). Determinants of active pulmonary tuberculosis in Ambo Hospital, West Ethiopia, *Afr J Prm Health Care Fam Med.* 2015;7(1), Art. #608 ,8 pages.

Finanga , S.G, Mørkve O, Kazwala RR, Cleaveland S, Sharp JM & Shirima G (2008). The role of livestock keeping in tuberculosis trends in Arusha, Tanzania,*IJTLD* ;7:695-704.

FMOH (2013). Pocket guide on clinical management of TBL and TB/HIV for general health workers march 2013 Addis Ababa,Ethiopia .

FMOH (2016). Guidelines for clinical and programatic managment TB,TB/HIV and Leprosy in Ethiopia sixth edition,2016,Addsi,Ababa,ethiopia.

Fox, G.J. , Barry, S.E., Britton, W.J. & Marks, B.G. (2013),Contact investigation for tuberculosis: a systematic review and meta-analysis, *Eur Respir J 2013; 41: 140–156 DOI:* 10.1183 / 09031936. ,ERS 2013,Volume 41 number .

Gashu, Z., Jerene, D., Ensermu, M., Habte, D., Melese, M., Hiruy, N., et al. (2016). The Yield of Community-Based "Retrospective"Tuberculosis Contact Investigation in a High Burden Setting in Ethiopia,. *Plos one | DOI:10.1371/journal.pone.*0160514 August 2, 2016.

Gelaw , SM (2016) . Socioeconomic Factors Associated with Knowledge onTuberculosis among Adults in Ethiopia. Volume 2016, Article ID 6207457,11 pages.

Girmay, A., Weldegbriel , S. & Afera , B. (2015) . Assessment of bovine tuberculosis in dairy farms and its public health importance in and around adigrat district.

Gupta, M., Saibannavar, A.A. & Kumar, V. (2016). Household symptomatic contact screening of newly diagnosed sputum smears positive tuberculosis patients -An effective case detection tool,Lung India 2016 Mar-Apr; 33(2): 159-162.

Gyawali, N., Gurung, R., Poudyal, .N, Amatya, R., Niraula, S.R., Jha, P., et al. (2012),Prevalence of tuberculosis in household contacts of sputum smears positive cases and associated demographic risk factors, *Nepal Med Coll J* 2012; 14(4): 303-307.

Haramayaworedaadministrativeoffice (2018) r.

Herzmann , C., Sotgiu G, Bellinger O, Diel R, Gerdes S, Goetsch U, et al. (2017) . TB or not TB consortium. Risk for latent and active tuberculosis in Germany. Infection 2017;45(3):283–290. Epub 2017 Nov 19. *PMID*: 27866367.

Hill , PC, Jackson-Sillah D, Donkor SA, Otu J, Adegbola RA & C., Lienhardt (2006). Risk factors for pulmonary tuberculosis: a clinic-based case control study in The Gambia, *BMC Public Health* 2006;6:1-7.

Iqbal, R., Munir, K., Bashir, S., Arif, A., Rao, M.H., Mirbahar, A., et al. (2013). Screening for Tuberculosis among Household Contacts of Index Patients, *Pakistan Journal of Medical Research, 2013* (October - December), No. Vol. 52, No. 4 44 4, 2013.

Javaid, A., Khan, A.M., Khan, M.A., Mehreen, S., Basit, A., Khan, R.A., et al. (2016). Screening outcomes of household contacts of multidrug-resistant tuberculosis patients in Peshawar, Pakistan,. *Asian Pacific Journal of Tropical Medicine*2016; 9(9): 909–912.

Jerene, D, Melese, M, Kassie, Y, Alem, G, Daba, Sh, Hiruye, N, et al. (2015). The yield of a tuberculosis household contact investigation in two regions of Ethiopia, *Int j tuberc lung dis 19(8):898–90.*

KFF (2018),The U.S. Government and Global Tuberculosis Efforts,key facts ,September 2018 | Fact Sheet.

Khaliq , A., Khan, IH., Akhtar, MW. & Chaudhry, MN. (2015) Environmental Risk Factors and Social Determinants of Pulmonary Tuberculosis in Pakistan, *Epidemiology (sunnyvale) 2015,* 5:3 DOI: 10.4172/2161-1165.100020.

Kirenga, B.J., sengooba, W., Muwo, C., Nakiyingi, L., Kyaligonza, S., Kasozi, S., et al. (2015). Tuberculosis risk factors among tuberculosis patients in Kampala, Uganda: implications for tuberculosis control,BMC Public Health (2015) 15:13 DOI 10.1186/s12889-015-1376-3.

Kompala, T., Shenoi , S. & Friedland , G. (2013). Transmission of Tuberculosis in Resource-Limited Settings**,** Curr HIV/AIDS Rep. 2013 Septemer .

Kumar, V.A., Kalaiselvan, G. & Dongre, A.R. (2016). Prevalence of Tuberculosis among Household Contacts in Pondicherry: Active Case Finding Among New Smear Positive Cases,. *Online Journal of Health and Allied Sciences ISSN 0972-5997,*Volume 15, Issue 1; Jan-Mar 2016 .

Lemos, A.C., Matos, E.D., Sampaio, D.B. & Netto, E.M. (2004). Risk of Tuberculosis Among Household Contacts in Salvador, Bahia,Brazil, *the Brazilian Journal of Infectious Diseases* 2004;8(6):424-430.

Lienhardt , C., Fielding , K. , Sillah J, Bah , B. , Gustafson , P., Warndorff , D., et al. (2005). Investigation of the risk factors for tuberculosis: a case–control study in three countries in West Africa, *Int J Epidemiol*, 2005; 34(4):914–23.

Little, K.M., Msandiwa, R., Martinson, N., Golub, J., Chaisson, R. & Dowdy, D. (2018). Yield of household contact tracing for tuberculosis in rural South Africa, *BMC Infectious Diseases* (2018) 18:299.

Lönnroth , K , Williams, BG, Stadlin, S, Jaramillo , E & Dye, Ch (2008) . Alcohol use as a risk factor for tuberculosis - a systematic review. *BMC Public Health* 2008, 8:289 .

Meseret, M., Shibabaw, M. & Tsegaye, G. (2017). Determinants of Tuberculosis among Adults in Jabi Tehnan District, West Gojjam Zone, Northwest Ethiopia: A Case Control Study,. *International Journal of Public Health & Safety* 2017, 2:3,, Volume 2 • Issue 3 • 1000128.

MOH (2017) Guidance on nutritional care and support for patient with Tuberclosis of india, Newdehi,2017.

Nair, D. , Rajshekhar, N., Klinton, J.S., Watson, B., Velayutham, B., Tripathy, J.P., et al. (2016). Household Contact Screening and Yield of Tuberculosis Cases—A Clinic Based Study in Chennai, South India,. *Plos one | DOI:10.1371/journal.pone.0162090* September 1, 2016.

Olijira, H., Ifa, M. & Birhanu, A. (2016),Determinants of active tuberculosis among hiv-positive adults attending clinical care in ambo general hospital and gedo hospital, West Shoa zone, Oromia regional state, Central Ethiopia. J Pharm Altern Med 10..

Omotowo, B.I., Ekwueme, O.C. & Aghaji, M.N. (2012). Tuberculosis Control Mechanisms and Contact Tracing: Knowledge and Practice among TB Patients at Dots Centers in Southeast Nigeria,. *1:451. doi:10.4172/scientificreports.451*.

Otero, L., Shah, L., Verdonck, K., Battaglioli, T., Brewer, T., Gotuzzo, E., et al. (2016). A prospective longitudinal study of tuberculosis among household contacts of smear-positive tuberculosis cases in Lima, Peru,. *Oteroet al. BMC Infectious Diseases* (2016) 16:259 DOI 10.1186/s12879-016-1616-.

Paramasivam, S., Thomas, B., Thayyil, J., Rahim, A, Thavody, J., Lilabi , M. , et al. (2016). Knowledge and health seeking behaviour of tuberculosis patients in Kerala, India. *International Journal of Community Medicine and Public Health,* 2016 Sep;3(9):2464-247.

Saidu , I.S., Nasir, Z. & Goni, B.W. (2014). Social determinants of tuberculosis in sub-Saharan Africa: A systematic review ,Global Journal Of Medicen and Public Health,*GJMEDPH 2014; Vol. 3, issue 4,,* ISSN#- 2277-9604.

Shah, N.S., Yuen, C.M, Heo, M., Tolman, A.W. & Becerra, M.C. (2014).Yield of Contact Investigations in Households of Patients With Drug-Resistant Tuberculosis: Systematic Review and Meta-Analysis, *CID* 2014:58 (1 February)

Shah, S.A., Qayyum, S., Abro, R., Baig, S. & Creswell, J. (2013),Active contact investigation and treatment support: an integrated approach in rural and urban Sindh, Pakistan,. *Int J Tuberc Lung Dis* 17(12):1569–1574.

Shimeles E, Enquselassie F, Aseffa A, Tilahun M, Mekonen A & G, Wondimagegn (2019). Riskfactorsfortuberculosis:Acase–control study in AddisAbaba, Ethiopia, *PLoSONE 14(4): e 021 4235 . https://doi.org /10.1371/journal. pone.0214235*.

Sia , I.G., Orillaza, B.R., Sauver, JL.ST, QuelapioI, D., Lahr, B.D. , Alcañeses, R.S., et al. (2010). Tuberculosis attributed to household contacts in The Philippines, *Int J Tuberc Lung Dis* 14(1):122–125 ,2010 .

SiaI, G., Orillaza, B.R., Sauver, JL.ST, QuelapioI, D., Lahr, B.D. , Alcañeses, R.S., et al. (2010) Tuberculosis attributed to household contacts in The Philippines, *Int J Tuberc Lung Dis* 14(1):122–125 ,2010 .

Singh, J., Sankar, M.M., Kumar, S., Gopinath, K., Singh, N., Mani, K., et al. (2013). Incidence and Prevalence of Tuberculosis among Household Contacts of Pulmonary Tuberculosis Patients in a Peri-Urban Population of South Delhi, India, *Plos one 8(7): e69730. doi: 10.1371 /journal .pone. 0069730,* 8.

Srivastava, K, Kant, S & Verma, A (2015). Role of Environmental factors in Transmission of Tuberculosis. *Dynamics of Human Health;* 2015:2(4), *ISSN* 2382-1019.

Tesema, C., Tadesse, T., Gebrehiwot, M., Tsegaw, A. & Weldegebreal, F. (2015). Environmental and host-related determinants of tuberculosis in Metema district, north-west Ethiopia,2015:7 Pages 87-95.

Thanh, Th.H.Th., Ngoc, S.D, Viet, N.N., Van, H.N., Horby, P., Cobelens, F.G.J., et al. (2014). A household survey on screening practices of household contacts of smear positive tuberculosis patients in Vietnam,. *Thanhet al. BMC Public Health* 2014,14:713 .

Tornee, S., Kaewkungwal, J., Fungladda, W., Silachamroon, U., Akarasewi, P. & Sunakorn, P. (2004). Risk factors for Tuberclosis infection among House hold contacts in Bakgkok ,Thailand. *,ASouth east asian J TropMED Public Health,* Vol 35 No. 2 June 2004.

USAID (2016). Committed to Ending TB: Tuberculosis Report to Congress, FY 2016,

WHO (2009). WHO Policy on TB Infection Control in Health-Care Facilities, Congregate Settings and Households, World Health Organization, Geneva, Switzerland.

WHO (2012). Recommendations for investigating contacts of persons with infectious tuberculosis in low- and middle-income counties, *ISBN* 978 92 4 1504492.

WHO (2013) . Guideline: Nutritional care and support for patients with tuberculosis. Geneva: World Health Organization; 2013.

WHO (2018). Global Tuberclosis report, 2018, .World Health Organization 2018 ,Geneva ,swizerland *ISBN* 978-92-4-156564-6.

Wordvision (2017). Technical Guideline for Tuberculosis (TB) and TB-HIV Program Implementation World,Vision , 2017.

Worku , M, Seyum , B & Kadir , H (2014). Assesment of goiter prevalence and associated factors among school age (7-12 years) children of rular primary school of bedeno woreda, East Hararghe zone, Ooromia Region, Ethiopia.

9. APPENDICES

Annex 1. Participant Information Sheet and Informed Consent Form

My name is----------. I am working as a data collector for the study being conducted in this kebele by **Abinet Adane** who is studying for his master degree at Haramaya University, the College of Medicine and Health science. I kindly request you to give me your attention to explain you about the study and being selected as study participant.

The study title

Prevalence of TB and associated factors among house hold contact of smear positive pulmonary Tuberculosis case in Haramaya district, Eastern Ethiopia, 2019.

Purpose of the study

The principal aim of this study is to write a thesis as a partial fulfillment for a Master's program in General Public health for the principal investigator. Moreover, the findings of this study will be used as an input for the district health managers and other stakeholders to identify and removing factors that facilitate TB transmission among study participants in Haramaya district in 2018.

Procedure and duration

I will be interviewing you, using a questionnaire to provide me with pertinent data that is helpful for the study. the interview and collection of sample if positive screening , will take around 30 minutes, so I kindly request you to spare me this time for the interview.

Risk and Benefit

The risks of being participating in this study are very minimal except taking few minutes from your time. There would not be any direct payment for participation in this study. However, the findings from this research may reveal important information for the local health planners.

Confidentiality

The information you will provide us will be kept confidential. There will be no any particular information that will identify your personality. There is no need to put your name or ID number on the format.

Right

Participation for the study is a voluntary. You have the right to participate or not. If you decide to participate, you have the full right to stop interview and this responses will not prevent you from seeking entitled services/benefits.

Contact address

If there are any questions or enquires any time about the study or the procedures, you can contact by using the following addresses.

Principal investigator: Abinet Adane

E-mail: abinetadane24@gmail.com

Mobile phone: +251-921373226,

Haramaya University College of Health and Medical Science Institutional Research Ethical review Committee:

Office phone: 0254660708 P.O.Box: 235, Harar

Declaration of informed voluntary consent

The participant information sheet was read for me. I have clearly understood the purpose of the study, the procedure, the risk and the benefit, issues of confidentiality, the right of the participating and contact address for any queries. I have been given the opportunity to ask the questions for things that may have been unclear. I was informed that I have the right to withdraw from the study at any time or not to answer any question that I do not want. Therefore, I declare my voluntary consent to participate in this study with my signature as indicated below.

Name of participant: _____Signature:_____date:_____

Name of the Interviewer_____Signature_____Date_____

Annex 2. English Version Questionnaire

Magnitude and associated factors of TB among adult house hold contact of smear positive pulmonary TB patient in Haramaya District, Eastern Hararge, Ethiopia, 2019.

Section 1._Questionnaires identification data

001. Questioner Identification number: _____
002. Regions: oromia
003 .Zone: East hararghe
004 .Woreda : Haramaya
005. Study area Kebele: _____
006. House Code: _____, Visit number: 1_____2_____3_____3+_____
007. Result codes: Completed=1, partially completed=2, Refused=3, others=4
Date of interview:___/___/____Time started__:_____Time finished:_____
Name of interviewer:_____Date of Interview: DD: ____MM:____YY:_____

PART I: SOCIO-DEMOGRAPHIC INFORMATION				
NO	QUESTIONS	Coding categories	skip	Remark
101	(Age (in years))	_____		
102	Sex	1. Male 2. Female		
103	Current Marital status	1. Single 2. Married 3. Separated 4. Divorced 5. Widowed		
104	Residence	**1.** Urban **2.** Rural		
105	What is your religion?	**1.** Muslim **2.** Orthodox Christian 96. Others (specify____)		
106	To which ethnic group do you belong? (Ethnicity)	**1.** Oromo **2.** Amhara 96. Others(specify____		
107	What is your relationship with TB index case	**1.** Husband **2.** Wife **3.** Son **4.** Daughter 96. Others-----		

NO	QUESTIONS	Coding categories	skip	Remark

PART II, SOCIO-ECONOMICN INFORMATION				
201	What is your occupation?	**1.** Farmer **2.** Employee (gov't) **3.** Housewife **4.** Merchants **5.** Daily lab or 96. Others (specify)_____		
202	What is your educational status?	1. Not read and write 2. Read and write. 3. Grade 1-8 4. Grade 9-12 5. Collage and above		
203	Does the house hold was overcrowded?	1. Yes 2. No		# of family - ----------
204	Average monthly income of contacts (ETB)	_____birr/month		
PART III. BEHAVIOURAL FACTOR INFORMATION				
301	Do you smoking cigarette?	1. Yes 2. No		
302	Do you drink Alcohol?	1. Yes 2. No		
303	Do you chewing kchat?	1. Yes 2. No		
304	Do you drinking raw milk?	1. Yes 2. No		
305	How many times do you eat meals per day?	**1.** ≥3 meals per day **2.** <3 meals per day		
IV :Environmental related factors				
401	Does the house hold was well ventilated?	**1.** Yes **2.** No		# of Window-------
402	Does the lighting status of house was good?	1. Yes 2. No		
403	What is size of living room of house hold contact?	_____(m2)		

NO	QUESTIONS	Coding categories	skip	Remark
404	Availability of separate kitchen room?	1. Yes **2.** No		
405	By what, do you cook your food?	1. Electric 2. Wood 96. Others		
406	Composition of houses floor	1. Mud 2. Cement & others		
407	Proximity to the Index case?	**1.** Sleep in the same bed **2.** Sleep in separated bed		
V. Tuberculosis Knowledge related information				
501	Causes of TB?	1. Germ/Bacillus 96. Others 88. Do not know		
502	Is TB transmissible?	1. Yes 2. No		
503	Mode of TB transmission?	1. Coughing or sneezing 2. Eating from the same plate 3. Sexual intercourse 88. Do not know		
504	Do you know TB symptoms?	1. Yes 2. No		
505	Is it possible to cure TB?	1. Yes 2. No		
506	Do you heard about TB treatment?	1. Yes 2. No		
507	Do you know that there is a vaccine to TB related?	1. Yes 2. No		
508	Does the contact have awareness about contact tracing?	1.yes 2. No		
VI. Host related factors				
601	Does the contact have sign and symptoms of Tuberculosis?	1. cough of ≥ 2 wks 2. Weight loss 3. Fever 4. Chest pain 5. Night sweat 6. None		
602	Have you been treated for TB previously within the last two year?	1. Yes 2. No		
603	Do you have family history of TB treatment in the house other than index case?	1. Yes 2. No		
604	What is treatment duration of TB index case?	1. < 6 month 2. ≥ 6 month		

510. AFB Laboratory result

1. Positive ☐

2. Negative ☐

Thank you

Name of the interviewer _____signature _____date_____

Name of the supervisor _____signature _____date_____

Annex 3. Afan oromo version of Participant informed sheet & consent format

Unka walii galtee gafatamtootaa

Seensa

Akkam oltan ,Maqaan Koo_____ jedhama. Yunivarsitii Hramaayaatti damee fayyaa hawaasaa waliigalteedhaan qorannoo barreeffamaan, **Obbo Abinet Adane** hojjechaan jira. Gaaffannon kunkan fayyaduu harcaatii fi rakkoolee tatamsa`ina **dhibe daranyoo sombaa maatii keessattii fidan** irratti hojjaamaa jiruu irrattii kan xiyyeefatee fi rakkolee addaan baafachuuf kan gargaaruudha. Kanaaf caraadhaan qoranoo kana keessatti akka hirmaataniif filatamtaniru.

Mata duree qoronnichaa

Harcaatii fi rakkoolee tatamsa`ina dhibe daranyoo sombaa maatii keessattii fidan raawwatamu, Aanaa Haramaayaa keessatti, Bahaa Itoophiyaa.

Kaayyoo qorannoo kanaa

Haracaatii dhibee daranyoo sombaa sadarkaa maattii irrattii jiruu adda baasuu fi rakkoown dhibee kana akka babalatuuf sababa ta'uu danda'aan beekuuf garagaara. Kana malees digrii lammaffaa kan fayyaa hawaasummaa waligalaa barataa jiruuf xumuruuf kan na gargaaruudha.

Haala Adeemsa fi Yerroon Qoranon fudhatuu

Yeroo qoranichii itti gaggeeffamuu

Gurandhala1/2/2018 -30/2/2018 tahuu.

Tartiiba (adeemsa) Qorannichaa

Qoranoo kana keesaatii gaafiwan garagraa akksumaas waa`ee oddeffanoo keessanii singaafachuuf deema.kanaafuu deebii dhugaa fi quubsaa akkanuuf kenitan /deebiftan issin irraa egna.Unka gaafannoo kun daqiiqaa 20-30 keessatti dhuma. Tarrii gaaffiilee miira namaa tuqaan gaafaamuu dandeessuu. Odeeffanoon isiin irraa argamee yeroo kamittilee icittin isa ni eegama eenyuutti illee dabarfamee hin agarsiifamuu. Waantii hundinuu iccitiin isa kan sirritti eegamuu ni ta'aa. Maqaan keessan unka gaafannoo irratti hin barreefamuu. Qo'ataa qorrannoo kanaafi gaaataa gaaffii kana qofaatuu odeeffannoo kan arga.kanaaf obsaan akka nuwallin tatan issin gaafana .

Fayyidaa fi Miidhaa

Qo'aannaa kana irratti hirmachuu keessaniin fi odeeffanoo nu kennuu keessaniif kallattiin fayidaan argatan hin jiru. Haata'uu malee odeeffanon isin irra argamuu qo'aana kanaf wantoota rakkoolee tatamsaa`ina dhibbee daranyoo sombaa sadarkaa maattiti fiduu danda'aan aanaa kanaa hubannoon akka argamuu ni gargaara, akkasumas bu'aan qo'aanaa kanaa gara fulduratti sagantaa tajaajila Ittisaa fi to`annoo dhibee daranyoo sombaa irrattiihojjatuu keessatti nu gargara. Qo'annoo kana keessatti hirmaachuu keessaniin miidhaan isin irraa ga'uu yeroo keessan qabachuu ala miidhaan biraa isin irra ga'uu tokkolee hin jiru.

Iccittii

Sirritti kan isiin hubachiisuu barbaannu maqaa keessan unkaa gaafannoo kana irratti hin barreefamu. Akasumas odeffanoon nu kennitan sababa qo'anna kanaaf malee waan biraaf akka hin ollee fi hubachiisa iccittin isa sirritti ni eegama. Qo'ataa fi gaafata unka gaafannoo irraa kan hafee odeeffannoon keessan eenyumaafuu hin agarsifamuu.

Mirga

Qo'aanaa kana irratti hirmaachuun keessan fedhii keessan irratti kan hunda'ee dha. Yeroo kamitti illee isiin itti yoo hin tolee addaan kutanii deemu ni dandeessuu. Addaan kutuu keessaniif miidhaa tokko illeen gama tajaajila wal'dhaansaa argachaa jirtaanii fi fayidaa keessan kam illee kan isiin jalaa hin miinee ta'uu isaa isiin hubachifna.

Teessoo qo'ataa qoranichaa fi koree naamusaa Yunivarsitti Haramaayaa

Yeroo kamitti illee yoo odeeffannoo barbadaan teessoo armaan gadittin odeefanno argachuu ni dandeessuu.

Tessoo qo'ataa qoranichaa

Maqaa :-Abinet Adana

Lakk. Bil.0921373226, E-mail: abinetadane24@gmail.com

Teessoo koree naamusaa Yunivarsitti Haramaayaa

Lakk. Bil: 0254660708 P.O.Box: 235, Harar

Uunkaa walii galtee

Odeeffanoo armaan olitti naaf dubbifamee sirritti hubadheera.Carraa gaffii kam illee gaafachuu fi deebi argachuu qabaa. Qo'annaa kana irratti feedhii koon kan hirmaadhuufi dhiibbaan tokkolee kan

na irraa hin genyee ta'uu isaa hubadheera akkasumas yeroo kamitti illee addaan kutee deemu kan danda'uu fi sababa addan kutuu kootiif miidhaan na irra ga'uu akka hin jiree sirritti hubadheera. Qorannoo kana keessatti hirmaachuu kootiif kallattidhaan akka fayidaa hin arganee hubadheera garuu odeeffannoon anii kennuu hubannaa tatamsa`ina dhibe daranyo sombaa cimsuuf ni gargaara. Yeroo koo gubuun ala irraa kan hafee miidhaan biraa na irraa hin ga'uu. Akkan hubadheetti maqaan koo fi sadarkaa maalummaa koo kan ibsaan akka gaafanoo irratti hin caqaffamne hubadheera. Iccitiin odeeffannoo ani kennuu qorannoo kana alaatti dhimmaa biraaf akka hin olee hubadheera. Yoo naaf hintollee illee yeroon jaaladhee addaan kutuuf mirga qabaachuu koo hubachuun waligalee mallateesseera.

Maqaa gaafatamaa _____Mallattoo :_____Guyyaa _____

Jacha ragaa sassaabaa

Hirmaataan kun yeroo fudhatee odeefannoo waa'ee qorannoo kanaa sirritti dhaggeefachuunifii waan hingaleef erga gaafatee hubatee booda qorannoo irratti hirmaachuuf murteesee mallatteessu isaa mirkaneesseetiin jira. Hirmaataan kun waa'ee kaayyoo, bu'aa fi midhaa, icitii fi mirga qorannoo kanaan waliin wal-qabatee sirriitti hubatee gaafii deebii irratti fedhinaan hirmaachuuf waligalee gaafilee gaaftame deebisuu isaa ibsa.

Maqaa gaafaaa _____mallattoo:_____ guyyaa _____

Annex 4. Afan ororrmo version questioner

Gaaffiiwwaan hundi gaaffii afaanicharrattii hundaa'amee gaafatamuu qaba.Namni gaafatamuu gaafichii yoo isaaf hin galiin irraa caalaa sirritti akka hubataniif ykn ibsamuuf gaafachu ni danda'u.

Hubachiisaa

Gaaffiiwwaniin alaa ajajnii barreffaman nama gaaffii afaanii taasisuuf waan ta'aniif nama gaafatamuuf dubbifamuu hin qabu. Gaaffileen irraa caalaan filannoo tarreefaman ni qabu. Haata'u malee filannoota tarreessuurraan gaafatamtuun yoo dubbattu mallattoo godhaa.

Maqaa gaafataa:_____Guyyaa:_____Aradaa :_____Lakk.Eenyummaa gaafatamaa :_____Umrii :_____Salaa :_____

Gaaffii Afaan Oromo

Qaamaa Ragaa Funaanun kan guutamuu

001. Lakkoofsa gaafii (Questionier):_____

002. Iddoo qoranoon itti gaggeefamuu: Araddaa_____Ganda_____

003. Kodii manaa_____marsaa dawwii 1_____2_____3_____

004. Kodii gutinsaa:1=Kan xumuramee,2=muraasni Kan gutamee, 3=Kan hin gutamin, 4=Kan biro

Guyyaa gaafiin itti gaafatamee_____sa'a itti jalqabe_____sa'a itti xumurame_____

Maqaa Gaafataa_____

Kutaa 1^{ffaa}: Odeeffannoo waligalaa

Lakk	Gaaffii	Deebii	Filanno	Yaada
101	Umrii keessan meeqa (waggaan)?	_____		
102	Saalaa?	Dhiiraa Dhalaa	1 2	
103	Haala fudhaa fi heerumaa?	Hin Heerumne Heerumtee Kan irraa du'e Kan walhikan	1 2 3 4	
104	Iddoon jirenyaa essa ?	Baadiyaa Magaalaa	1 2	
105	Amantiin hordoftuu maalii?	Muslima Orthodox Kan biroo yoo Jiraate ibsi_____)	1 2 96	

106	Sabaa?	Oromo Amhara Kan biro ibsi: _____	1 2 96	
107	Firoomni dhukkubsataa walin qabdu malli?	Abbaa Mana Haadha mana Ilmo dhira Intala dubartii Kan biro ibsi:_____	1 2 3 4 96	
	Kutaa 2ffaa Haala Haasumaa fi Dinagdee			
201	Hojiin kee maalii?	Qonnan bulaa Hojjetuu(mootumma/ dhunfaa) Haadhaa manaa Daldaltuu Hojjetaa guyyaa Kan biro yoo jiraate Ibsa:_____	1 2 3 4 5 96	
202	Sadarkaa barnoota	Hin barannee Dubbisuu fi ykn barreessuu kutaa (1-8) kutaa (9-12) kollejii fi sanaa olii	1 2 3 4 5	
203	Namonii baayeen mana kana keessa wallin jiraatuu ?	Eeyee Lakki	1 2	Lakk.ma atii____
204	Gidduu galeessaan galiin ji`aan argatan(ETB)?	_____qarshii/ji`aan		
	Kutaa 3ffaa : Haala Jiruu fi Jirenya (Amala qabdu/bu)			
301	Cigaaraa/tamboo ni arsitaa/dhugdaa?	Eeyee Lakki	1 2	
302	Dhugaattii ni dhugdaa ?	Eeyee Lakki	1 2	
303	Jimaa ni qamaataa/?	Eeyee Lakki	1 2	
304	Anan ossoo hin danfisin dhugdee beektuu?	Eeyee Lakki	1 2	
305	Guyyattii si`a meeqa nyaata nyaata?	Yerroo sadii fi sanaa ol (>3) Yerroo sadii gadii (<3)	1 2	
Kutaa 4ffaa : Haala Naannoo jirenya keessanii				
401	Manii jireenyaa kunii qillensa gahaa ni argatuu ?	Eeyee Lakki	1 2	Lakk.fod aa--------
402	Manii jireenyaa kunii ifa adduu gahaa ni argatuu ?	Eeyee Lakki	1 2	
403	Balinii kutaa jireenyaa kunii meeqa ?	_____(m^2)		

404	Manii jireenyaa fi mana nyaanii tii qophaa`uu (kushunaa) adda bahee jiraa ?	Eeyee Lakki	1 2	
405	Mana keessattii nyaata maalin bilcheesita?	Elektrikaan Muka Gaaza kan biro	1 2 3 96	
406	Manii jirenyaa keessii isaa maal irraa hojjetamee?	Biyoo Simintoo Kan biro.....	1 2 3	
407	Haalii cisichaa keessan dhukkubsataa wallin maal fakkaata?	Sire tokkoo irratti cisna Sire adda addaa irrattii cisna	1 2	
Kutaa 5ffaa Hubanoo Dhibee TB ilaalchise				
501	Dhukkubni dhibee daranyoo sombaa maaliin dhufa ?	Germii/Baakteriyaa Kan biro Hin beeku	1 96 88	
502	Dhukkubni dhibee daranyoo sombaa nama irrraa namattii ni darbu?	Eeyee Lakki	1 2	
503	Dhukkubnii daranyoo sombaa akkamitii dadarbaa ?	Qufaan ykn haxifachuun Nyaata walin nyaachuun Qunamtii saalaattin Hin bektu/u	1 2 3 88	
504	Mallatton dhibee daranyoo sombaa ni beektuu ?	Eeyee Lakki	1 2	
505	Namnii Dhukkuba dhibee daranyoo sombaa qabuu yoo walaanama ni feyuu?	Eeyee Lakki	1 2	
506	Talaalii ittisa fi toa`nnoo dhibee daranyoo sombaa keessaattii bu`aa qabu jiraachuu isaa ni beektu ?	Eyyee Lakkii	1 2	
507	Barbaachisumaa calalii dhibee TB namota walitti dhihenya dhukkubsata TB wallin qabaniif bektuu ?	Eyyee Lkkii	1 2	
VI. Ragaa adda addaa dhimma nama gaafatamuu ilalchise				
601	Mallattoo dhiibee daranyoo sombaa ni qabu /qabdii?	Qufaa torbaan lammaa oli Ulfatin hi`risuu o`aa guddaa Dafaqa halkanii Dhukkubi laphee Hin qabu	1 2 3 4 5 6	
602	Dhukkuba daranyoo somabaattif waggota lammen darban kana keessattii walaanamatee beektuu?	Eyyee Lkkii	1 2	
603	Namni dhibee daranyoo sombaan ammaan dura maattii keesssan kessa qabamee turee jira?	Eyyee Lkkii	1 2	
604	Dhukkubsataan kunii erga qoricha jalqabee hangam turee jira?	ji`a jahaa gadii Ji`a jahaa olii	1 2	

510. Bu`aa qorannoo AFB

1. Smear positive ☐

2. Smear Negative ☐

Galatomaa

Maqaa gaafataa _____Mallattoo _____Guyyaa _____

Maqaa supervizoraa _____Mallattoo _____Guyyaa _____

Annex 5. Detailed procedure of sputum sample collection and processing

Procedure for specimen collection, handling and transportation

Principle

Specimen collection, handling and transport has a great effect on result collection site or special diagnostic facilities like microscopy site, conditions of specimen management ,have to be considered from collection to arrival in laboratory .

Reagent and supplies

Distilled water/Tape water, Aura mine 0.1g, 95% ethanol, Phenol crystals, Potassium permanganate (KMnO4), concentrated hydrochloric acid 0.5 ml, Glove powder free, 50ml, sputum cup, Permanent marker, Equipment, Sample and container type and Sample: sputum

Pre-specimen collection procedure

Patient present to sample reception unit

Lab test request review on the test availability, appropriate of collection of time

Patient data entered into log books

Properly label specimen with patient name, identification number, types of test, date and time of collection

Sample collection for sputum

Instruct the patient

To collect in a separate, ventilated room or preferably outdoors/ produce sputum in sputum coughing designation area/

To keep both hands on hips, cough forcibly and collect sputum in the mouth

To spit the sputum carefully into a wide-mouthed, unbreakable, leak proof container and close the lid tightly. Example sputum cup

To collect 2–4ml in volume, although smaller quantities are acceptable if the quality is satisfactory.

To collect sample, consider the following for collection

Sample containers are pre-labeled before sample collection, and the labels are protected from the sample matrix by using water proof labels or by covering with clear tape

Laboratory personnel should label each specimen container with the unique identification number and date of collection

Give labeled sputum cup to the patient

Check the quantity, quality and cross check the number with the request form when receive

Inform contacts how to collect sputum, if necessary instruct the individual

Compare label with individual's data on the request form

Sample type, volume and condition of transportation

Sputum specimen should have a volume of 2-4 ml, although smaller quantities a are acceptable if the quality of sample will good.

Storage: Store the sputum specimen at 2 to 8oC up to 5 days

Transport: Use triple packaging and the sample must reach to the testing site within 5 days after collection

Stability: Cold chain must be maintained using Ice pack and the Ice pack must be changed at the transit site after 12 hours

Fluor chrome staining method

 Prepare and heat fix smears.

 Place the numbered smears on a staining rack in batches (maximum 12).

 Flood the slides with aura mine O stain and allow them to stain for 15 minutes.

 be sure that the stain stays on the smear. Do not heat and do not use paper strips.

 Rinse the slide with water. Aim the flow of water at the edge of the slide and slowly peel the stain from the slide.

 Flood the slides with 0.5% acid alcohol and allow them to decolorize for three minutes.

 Ensure that the slides are flooded thoroughly with acid alcohol.

 Rinse off the 0.5% acid alcohol with water, drain the excess water from the slide.

 Flood each slide with potassium permanganate and allow it to quench for two minutes.

Note: It is critical that the potassium permanganate remains on the slides for no longer than two minutes as over-quenching of fluorescence can occur.

 Wash off the potassium permanganate. Drain the excess water from the slide.

 Allow smears to air dry. Do not blot. Read as soon as possible after staining.

Annex 6. TB screening questions

1. Has the individual had cough for >2 weeks?

2. Has the individual had fever for > 2 weeks?

3. Has the individual had weight loss >3kg in the last 4 weeks?

4. Has the individual had night sweats for > 2 weeks?

5. History of TB contacts in the past one year?

INTERPRETATION OF THE RESULT

If YES to Question # 1

Or

If NO to question # 1 but YES to 2 or more of other questions = **Positive TB screen [P]** => Evaluate for TB

If NO to all questions = **Negative TB screen [N]**

- START INH PREVENTIVE THERAPY (IPT), if House Hold contact is HIV +ve individual and children < 5years of age (FMOH, 2016)

Annex 7. Curriculum Vitae (C.V)

1. Personal Information

Full Name: Abinet Adane Gedamu

Gender: Male

Date of Birth: January 10, 1984 G.C.

Place of Birth: Deder

Marital Status: Married

Address: Harar, Ethiopia

Phone Number: 0921373226

Email Adress: abinetadane24@gmail.com

Contact Person: - Mesrak assegid Assefa (Tell;-0915106957)
- Address:-Harar kebele 17

2. Educational Back ground and Qualification

Primary School

1-8: Karamekela Elementary school, Deder (1992-2000 GC)

Secondary and Preparatory School

9-12: Deder Senior Secondary school, Deder (2001-2004 GC)

Higher Education

Haramaya University, Collage of Health and Medical Science, BSC in public Health nurse (Graduated Grade 3.79) 2005-2007.

Undergraduate Research Title: Knowledge and Altitude of mother on the mal nutrition among under 5yr children in Harar ,Ethiopia .

3. Language Skill

Local:-Afan oromo and Amharic

Foreign:-English

No	Language	Speaking	Reading	Writing
1	Amharic	Excellent	Excellent	Excellent
2	Afan Oromo	Excellent	Excellent	Excellent
3	English	V. Good	Excellent	Excellent

4. Special Skill

Good Computer Skill:-Ms word ,Ms Excel, Word power point

5. Certificated/Training

- Training On **TBL,TB/HIV,MDR-TB and TB infection control training** organized by oromia regional Health Bureau in collaboration with WHO Ethiopia from july 18th-24th ,2009,Adama pan –Africa
- Training On training of trainers (TOT) on the **Compressive Tuberculosis to train HEW** on the woreda level ,organized by oromia regional health Bureau from October 13th -15th ,2010 Harar Ethiopia .
- Training On training of trainers (TOT) on the`` **Integrated Refresher training** of Tuberculosis for Health Extetion Workers and Sputum AFB smear Preparation , organized by oromia regional health Bureau in collaboration with Heal TB from October 15th-18th ,2011 Ruwoda Hotel ,Harar ,Ethiopia.
- Training On Training of trainers (TOT) on the Compressive TBL, TB/HIV training organized by all Africa leprosy ,TB rehabilitation ,Research and training center (ALERT) in collaboration with management science for health (Beyanga et al) from Nov.7th to Nov. 12th ,2011 Addiss Ababa ,Ethiopia .
- Training On **Ethiopia Contraceptive logistic system (ECLS)** organized by Oromia regional health bureau and USAID /Delivery project ,Ethiopia from Feb. 25th -27th ,2008 in Harar ,Abadir Hotel .
- Training On **management of acute sever mal nutrition** in the context of community based therapeutic care (CTC) organized by oromia regional Health bureau and IMC ,Ethiopia from December 31th -2007 to4th of January 2008
- Training On the **Expanded program of immunization (EPI)** organized by East Hararghe Zone Health office in collaboration with IFHP Ethiopia from January 23th -26th 2009 in Harar .
- Training On Training of trainers (TOT) on **Integrated Refresherment training(IRT)** of HEW (ON HEP Program) organized by oromia Health Bureau in collaboration with IFHP and UNICEF from February 3th -13th ,2012 Ras Hotel ,Dire Dawa ,Ethiopia .
- Training On **Health management and Information system (HMIS)** organized by oromia health bureau(ORHB) in collaboration with Tulane University from January 28th – February 2nd ,2012 Red across center ,Harar .
- Training on Basic programmatic Management of **Drug resistance TB** (PMDT) (MDRTB) organized by ORHB November 10-15,2014 Gete Hotel adama

- Training on **health information used** organized by Tulane University in collaboration with ORHB from june 1-5,2015 Tokuma Hotel ,adama
- Training on **Woreda based plan (one Health tools)** organized by ORHB from august 3-7 Geda Resort ,adama
- Training On **Master Regional Training of trainers (Master TOT**) on the ***Programmatic Management of Drug Resistant TB*** organized by oromia Regional Health Beurou (ORHB) in collaboration with management science for health (Beyanga et al)/Heal TB from Nov.21th to Nov. 25th ,2015 Rift Vally Hotel , Adama ,Ethiopia
- Training On Master National Training of trainers (Master TOT) on *Revised Integrated Refresherment training(IRT)* on *TB, Leprosy, HIV/AIDS and MDR TB* of HEW organized by Federal Minister of Health(FMOH) in collaboration with Challenges TB organization from Dec.30th /2015 – Jan.5th /2016,Ayu International Hotel ,Adama ,Ethiopia .
- Training On Master National Training of trainers (master TOT) on the Revised Compressive TBL, TB/HIV and MDR TB training organized by Federal Minster of Health (FMOH) in collaboration with ICAP Ethiopia and Challenge TB from April.17th to Nov. 22th ,2016 Fenet Hotel , Adama ,Ethiopia .

6. Job description and Work Experience

Health Center Level (HC)

- Worked at adult OPD,TB and Leprosy clinic and as PHCU director

Woreda Health Office level (WHO)

- CDC process owner and TBL focal person
- As vice head of Cinaksen WHOs

Zonal Health office Level (EHZHO)

- as ***zonal TBL coordinator*** (TBL focal person) (currently)

7. Post Graduate

Haramaya University, collage of Health and Medical Science, School of Graduate Studies, General public Health track candidate

Research title: prevalence of tuberculosis and associated factors among adult household contacts of smear positive pulmonary tuberculosis patients treated in public health facilities of haramaya district, oromia region, eastern ethiopia.

8. Interest and Hobbies

Reading Books, Watching Movies and Listening Radio

References

Lelisa : FMOH ,National TB/HIV core process coordinators (Tele:-0922914132)

Hangatu Mohamed: PHCU director of directorate of Federal Ministry of Health (FMOH) (Tele:-0913332649)

Mengistu kena: TB officer of Global staff at ORHB (tele: 0911302568)

Dr.amano: TB and Leprosy prevention officer of UNICEF staff at ORHB (tele: 0911406710)

Mr. Tariku Tesema: TB officer of Global staff at ORHB (tele: 0911031304)