ADDIS ABABA UNIVERSITY

COLLEGE OF DEVELOPMENT STUDIES

CENTER FOR POPULATION STUDIES

ASSESSMENT OF TUBERCULOSIS-INDUCED RISK OF FERTILITY DELAY AMONG WOMEN OF REPRODUCTIVE AGE 15-49 AT SAINT PETER SPECIALIZED HOSPITAL, ADDIS ABABA.

BY

ADDISALEM LEMMA

COLLEGE OF DEVELOPMENTAL STUDIES
CENTER FOR POPULATION STUDIES

ASSESSMENT OF TUBERCULOSIS-INDUCED RISK OF FERTILITY DELAY AMONG WOMEN OF REPRODUCTIVE AGE 15-49 AT SAINT PETER SPECIALIZED HOSPITAL, ADDIS ABABA.

BY
ADDISALEM LEMMA

ADVISOR
MULUGETA BEZABIH (PHD)

A THESIS SUBMITTED TO COLLEGE OF DEVELOPMENT STUDIES CENTER FOR POPULATION STUDIES; IN PARTIAL FULFILLMENT OF THE REQUIREMENETS FOR THE DEGREE OF MASTER OF SCIENCE IN POPULATION STUDIES

JUN, 2024
ADDIS ABABA, ETHIOPIA

ADDIS ABABA UNIVERSITY

COLLEGE OF DEVELOPMENTAL STUDIES

CENTER FOR POPULATION STUDIES

This Thesis is my original work and has not been presented for a degree of masters in any other University and that all sources and materials used for the declared by:

Name: Addisalem Lemma

Signature: _____

Date: _____

Place: Addis Ababa University, Addis Ababa

ADDIS ABABA UNIVERSITY

COLLEGE OF DEVELOPMENTAL STUDIES

CENTER FOR POPULATION STUDIES

Declaration

As thesis research advisor, I hereby declare that I have read and evaluated this thesis prepared by under my supervision, by Addisalem Lemma: Tuberculosis-induced fertility delay among women of reproductive age 15-49 in S/t Peter specialized Hospital, Addis Ababa. I recommend that this thesis work can be submitted as fulfilling the requirement for the Degree of Masters of Science in population studies.

Mulugeta Bezabih (PHD) _____ _____

Advisor Signature Date

This is to certify that Thesis prepared by Addisalem lemma entitled: Tuberculosis-induced fertility delay among women of reproductive age 15-49 in S/t Peter Specialized Hospital, Addis Ababa and submitted in a partial fulfillment of the requirements for the Degree of Master of Science in Population studies and meets the accepted standards with respect to originality and quality.

Signed by the examining committee:

_____ _____ _____

Chairman Signature Date

_____ _____ _____

Internal examiner Signature Date

_____ _____ _____

External examiner Signature Date

_____

Chairperson of the Center or Graduate Program Coordinator

Acknowledgement

I owe my gratitude to the Almighty God in whom, and through whom all the work that went into this thesis was made possible. I therefore wish to acknowledge all the people who participated to make this thesis a reality. First of all, I would like to express my sincere thanks to my advisor Dr Mulugeta Bezabih, for his provision unending support and constrictive advice during the preparation of this study. My appreciation goes to the Management Team of S/t Peter Hospital, Addis Ababa and staffs. Also, I wish to acknowledge my research assistants for their availability and dedication during the entire period of data collection and analysis. Very exceptional thanks goes to, my husband Ato Aklilu Ketema for his support in a difficult life situation and my elder daughter Kalkidan Aklilu, I would have not been done without your unconditional support. Finally, I wish to thank all the respondents who agreed to participate in the study and all the people whose names I am not able to mention. God bless Ethiopia and all of us with his grace.

Table of Contents

List of tables

List of figures

Acronym

ATBI___Acute Tuberculosis Infection

FGTB __ Female genital tuberculosis

HIV____ Human immuno virus

LTBI ___Latent Tuberculosis Infection

MENA _ Middle East and North Africa

MDR ___Multi Drug Resistance

PCOS___polycystic ovarian syndrome

PID ___ pelvic inflammatory disease

PPP ____ preconception, pregnant, and postpartum

SDGs___ Sustainable Development Goals

SRH____ Reproductive Health and Research

SPSS____Statistical Package for the Social Sciences

SSA __ Sub-Saharan African SSA

TB __ Tuberculosis

WHO __ World Health Organization

Abstract

Title: Assessment of tuberculosis-induced risk of fertility delay among women of reproductive age 15-49 at saint peter specialized hospital, Addis Ababa: A Comparative Cross-Sectional Study

Background: *The global fertility landscape is shifting, with approximately 97% of countries projected to have fertility rates below the replacement level by 2100. Despite this overall decline, understanding, the impact of specific health conditions on fertility remains crucial. This study investigates the association between TB infection and fertility delay among women aged 15-49 at Saint Peter Hospital in Addis Ababa.* ***Methods:*** *We conducted a comparative cross-sectional study, comparing two distinct groups: women with TB and women without TB. Our quantitative approach emphasized numerical data, statistical analysis, and objective measurements.* ***Results:*** *Among TB-negative women, 68.5% experienced no fertility delay, while 31.5% did experience fertility delay. Among TB-positive women, only 20.8% experienced no fertility delay, while a significant 79.2% experienced fertility delay. There is a clear association between TB diagnosis and fertility delay, with TB-positive women being more likely to experience fertility delay compared to TB-negative women. Income >16,501 ETB significantly increases the odds of fertility delay, while income <5,500 ETB also raises the odds, possibly due to financial stressors. Addressing economic disparities is crucial for reproductive health outcomes. Other factors associated with fertility delay include fertility treatments, sexually transmitted infections, maternal health challenges, smoking, and TB transmission. TB treatment plays a crucial role in maintaining reproductive health. Additionally, TB treatment may influence menstrual irregularities in women of reproductive age, warranting further research to explore underlying mechanisms and potential interventions. Demographic factors such as age, income, occupational status, marital status, and maternal health care challenges also require investigation, considering confounding factors for a comprehensive understanding.* ***Conclusion:*** *Understanding the impact of TB infection on fertility delay is vital for informed reproductive health policies and interventions.*

*Keywords: Tuberculosis infection**,** Fertility delay**,** Reproductive health*

CHAPTER ONE: INTRODUCTION

1.1. Background of the study

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis. It can lead to chronic inflammation and the reproductive organs (Walles et al., 2021). Although TB primarily targets the lungs, it can also attack other parts of the body, such as the kidneys, spine, and brain. Not everyone infected with TB bacteria becomes symptomatic, but if left untreated, TB disease can be fatal (CDC, 2016).

The pathogenesis of tuberculosis occurs in two stages. Initially, there is an asymptomatic phase known as latent *TB*, which can persist for years. When the immune system weakens, the bacteria begin to replicate, leading to typical symptoms like cough, chest pain, fatigue, and unexplained weight loss (Egbuna et al, 2021). TB spreads primarily through airborne droplets. When infectious individuals cough, sneeze, talk, laugh, or spit, they release droplets containing Mycobacterium tuberculosis. People in close proximity may inhale these bacteria and become infected (Fawibe et al., 2013).

Globally, TB ranks as the 13th leading cause of death and is the second most infectious condition after COVID-19. Despite being treatable and curable, TB affected approximately 10 million people and caused 1.5 million deaths in 2020 (WHO, 2022).

In 2018, nearly 3.2 million women worldwide contracted TB, with almost 500,000 fatalities. While TB affects more men overall, it disproportionately endangers women of reproductive age, especially in areas with high rates of TB or drug-resistant TB (DR-TB) and HIV co-infection (Nguyen et al., 2022).

The World Health Organization (WHO) emphasizes the impact of social and economic development on TB incidence. Factors such as undernutrition, diabetes, HIV infection, alcohol use disorders, and smoking contribute to the TB burden. Achieving global targets requires addressing these determinants. Social determinants of health, including poverty, unequal access

to healthcare, lack of education, stigma, and racism, are linked to health disparities, including TB (Imtiaz et al 2017).

TB is an endemic problem for much of the sub-Saharan African region. High infection rates, caused by high population density and the infrastructure of the living environment, contribute to high infection rates, as well as compromised immune systems from diseases such as HIV/AIDS and health issues like malnutrition (Heaton., 2022).

TB imposes an economic burden on households, potentially pushing people below the poverty line, Who aims to eliminate catastrophic costs due to TB by 2020 (Baena, 2021). Barriers include geographical challenges, economic difficulties, communication issues, stigma, unregulated private healthcare practices, non-adherence to treatment, and gender biases. Addressing these challenges requires a multi-component approach (Pradipta, et al 2021).

Women of reproductive age are more likely to develop active TB, if they encounter TB bacteria, yet they are less likely to seek help for TB symptoms than men. This has an impact not just on their own health, but on the welfare of their family particularly their children.Global efforts to address TB must take account of factors specific to women, such as Language and literacy, Family responsibilities, Confidentiality, HIV (WHO, 2022).

In Africa, TB rates are up to 10 times higher in pregnant women living with HIV compared to pregnant women without HIV infection. Genital TB, which is challenging to diagnose, has been identified as an important cause of infertility in high TB-incidence settings (Paul et al., 2021). Detecting is especially difficult in women with fertility issues, as it mimics other more common causes. Unfortunately, delayed diagnosis of TB can lead to falopian tube and endomettial pathology, resulting in subfertility and pregnancy loss (Stroeken et al., 2023).

Some women may be infertile due to damage to the fallopian tubes, endometrium and ovaries caused by latent genital tuberculosis infection (LGTBI) Therefore, early diagnosis of TB is essential (Chu,Y, 2023).

1.2. Statement of the problem

The global fertility landscape is undergoing significant changes, with approximately 97% of countries projected to have fertility rates below the replacement level by 2100. Despite this overall decline, some low-income countries, particularly in sub-Saharan Africa (SSA), continue to experience high fertility rates. These demographic shifts have far-reaching implications for economies, food security, health, and geopolitical stability (Lancet:, 2024).

Infertility affects millions of people and has an impact on their families and communities. Estimates suggest that approximately one in every six people of reproductive age worldwide experience infertility in their lifetime (WHO , 2023.)While fertility decline has begun in some SSA countries, others—such as Chad, Mali, Niger, and the Democratic Republic of Congo—still maintain relatively high ideal family sizes. Accelerating demographic transition is crucial to harness the demographic dividend in these regions (APHRC Campus, 2018).

However, SSA countries have seen slower declines in the number of children per woman compared to other less developed countries, hindering their ability to fully benefit from the first demographic dividend (Bado,*et al,* 2022). Despite the lack of specific data on fertility delay in Ethiopia, addressing infertility remains critical. Understanding the factors contributing to fertility delay and promoting reproductive health is essential for Ethiopian women (Tilahun T, 2019).

Infertility is prevalent, affecting 27.6% of women attending gynecologic clinics in Addis Ababa, with 14.5% experiencing primary infertility and 13.2% facing secondary infertility (Akalewold, *et al*, 2022).

Barriers faced by women include limited access to finances and household-related obligations. Additionally, men—traditionally responsible for economically supporting the family—often postpone TB diagnosis. Stigma further affects healthcare-seeking behavior, particularly among women (Turusbekova, et al, 2022).

This study Despite advances in TB prevention and treatment, there remains limited understanding of how socio-demographic, socio-economic, health-related, and knowledge-related factors influence TB infection and its impact on fertility delay among women aged 15-49 attending Saint Peter Hospital. Therefore, this study aims to address this gap by investigating the specific risk factors associated with fertility delay in this group of women.

1.3. Objectives of the study

1.3 .1 General objective

The general objective of the study was to investigate the association between TB infection and risk of fertility delay among women of reproductive age in Saint Peter specialized hospital, in Addis Ababa.

1.3 .2 Specific objective

The specific objectives of the research were to:

- Examine whether active TB disease directly affects fertility dealay among women of reproductive age 15-49 in Saint Peter Hospital.
- Explore the association between irregular period related to TB infection and risk of fertility delay among women of reproductive age 15-49 in Saint Peter specialized hospital.
- Identify risk factors associated with fertility delay among women of reproductive age 15-49 in Saint Peter specialized hospital.

1.4. Research questions

1. Does active TB disease have a direct impact on fertility delay among women aged 15-49 at Saint Peter Hospital?

2. Is there an association between irregular menstrual periods related to TB infection and the risk of fertility delay among women of reproductive age (15-49) at Saint Peter Specialized Hospital?

3. What factors are associated with the risk of fertility delay among women aged 15-49 at Saint Peter Specialized Hospital?

1.5. Scope of the study

This research focuses on women of reproductive age (15–44 years) who received care at Saint Peter Hospital in Addis Ababa. Understanding the impact of tuberculosis (TB) on the risk of fertility delay is crucial within this specific population. The study was conducted between March and June 2024, during which data collection and analysis occurred. When interpreting the findings, it is essential to consider this timeframe. The study population comprises two groups: Women without TB: These individuals did not have TB infection and serve as the comparison group.Women with TB: This group includes women with active TB infection. By comparing them to women without TB, your study aims to explore the effects of TB on fertility delay.

1.6. Significance of the Study

Understanding the association between TB infection and the risk of fertility delay is crucial for reproductive health programs. The findings from this study can serve as valuable guidance for various stakeholders: The study results can inform preventive strategies aimed at reducing the impact of TB on fertility delay.Early detection efforts can be enhanced by recognizing signs of fertility-related issues in TB-affected women. Clinicians can benefit from understanding the factors that impact fertility in both groups (women with and without TB).

Recognizing early signs of fertility delay allow healthcare providers to offer personalized advice and counseling to women with TB. Advocacy groups and policymakers can use this research to advocate for reproductive rights and improved access to family planning services. By highlighting the effects of TB on fertility, this study contributes to broader discussions about women's health and autonomy. Conducting this study in Ethiopia is particularly relevant due to the country's high TB burden.Findings can directly influence local policies related to TB management and reproductive health, leading to better resource allocation and improved maternal and child health outcomes.

1.7. Limitation of the study

The sample size used in this study may not be representative of the broader population of women aged 15-49 in Addis Ababa. Consequently, the generalizability of the study findings to the entire population may be limited. Cross-sectional studies provide a snapshot of data at a specific point in time. As a result, causal inferences or tracking changes over time are challenging within this design.Participants may not accurately report their TB status, fertility history, or other relevant information. Recall bias can affect data reliability. Defining and measuring fertility delay was complex. Subjective criteria or assumptions were involved, which can introduce variability. Participants may not accurately recall past events, such as TB exposure and fertility history.

1.8. Organization of the study

This study is organized as follows into five chapters. Chapter one covers introduction, this section provides an overview of the research question, objectives Statement of the problem, Scope of the study, Significance of the Study and Limitation of the study. Chapter two covers Literature review, which summarizes existing research on the topic. Chapter three covers Methods, this section describes the research design, sampling strategy, data collection methods, and data analysis techniques used in the study. Chapter four, is about analysis, discussions and findings of the study which constitutes the main body of the document. Conclusions and recommendations are presented in the final chapter five.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1. Theoretical framework

The Demographic Transition Theory explains the observed pattern of population growth in countries around the world. Developed by American demographer Warren Thompson in 1930, this theory explains population growth patterns by considering changes in mortality and fertility rates and it provides context for understanding fertility trends and societal shifts related to fertility delay (Roser, 2023).

Eva Beaujouan, an Associate Professor at the University of Vienna, has made significant contributions to understanding fertility trends and their consequences. Her work focuses on factors influencing later fertility and the implications of childbearing while delayed fertility represents a significant societal shift. However, the relationship between delayed fertility and completed fertility is complex. John Bongaarts, a Dutch demographer and researcher, has extensively studied fertility, population growth, and reproductive health. Understanding the interplay between fertility timing, constraints, and partnership dynamics helps us grasp the broader implications of this transformation on future fertility patterns. Fertility delay has probably had a causal effect on fertility decline because the delay implies that people are spending a shorter period trying to have children. Additionally, delayed fertility may accentuate inequalities associated with socioeconomic status and education. While delayed fertility is indeed a significant societal shift, its relationship with completed fertility remains intricate (Beaujouan E. , 2023).

Prominent demographer John Bongaarts is renowned for his contributions to the study of fertility, population dynamics, and reproductive behavior. His studies have concentrated on a variety of population and public health concerns, such as the influence of family planning initiatives and the factors that influence mortality and fertility. In determining reproduction patterns, Bongaarts' research frequently takes socioeconomic development, education, and contraception into account (Bongaarts, 2022).

Gender-sensitive medicine studies how healthcare-seeking behaviors are influenced by gender-related factors, financial limitations, household responsibilities, and stigma, especially when diagnosing tuberculosis. Addressing these issues is crucial for improving reproductive health outcomes in TB-affected populations. Research in Eastern Europe and Central Asia reveals women face obstacles due to family responsibilities, financial limitations, and stigma, hindering their healthcare seeking behavior (Turusbekova et al., 2022).

Observation aligns with the field of reproductive health and infectious diseases. Researchers and clinicians study the effects of TB on reproductive organs and emphasize the need for early diagnosis and management. TB of the female reproductive system can cause infertility, pain, and pelvic mass or menstrual disorders. Diagnosis requires a high index of suspicion for TB when a person from a country with endemic TB experiences genitourinary symptoms, including infertility (Kathryn et al, 2021).

2.2. Empirical literature

A systematic review conducted in Eastern Europe and Central Asia (EECA) found that gender-related factors contribute to delays in TB diagnosis. Women faced barriers due to financial constraints and household obligations, which led to de-prioritization of seeking diagnosis. In some countries, women experienced stigma more often than men, which acted as a deterrent to seeking healthcare. Gender norms and expectations influenced healthcare-seeking behavior addressing these factors is essential for improving reproductive health outcomes in TB-affected population (Turusbekova et al., 2022).

Female genital tuberculosis (FGTB) is a significant cause of morbidity and infertility worldwide. Mycobacterium tuberculosis commonly spreads to the genital tract from other body foci, affecting bilateral fallopian tubes and/or endometrium. Many patients with FGTB are diagnosed only after evaluation for infertility. Women may present with menstrual irregularities, lower abdominal or pelvic pain, or abnormal vaginal discharge (Christine Tzelios et al, 2022).

TB can also cause hormonal imbalances in women, leading to irregular menstrual cycles or even the absence of menstruation. In addition, TB can cause inflammation of the fallopian tubes,

uterus, and ovaries, which can lead to pelvic inflammatory disease (PID). PID can cause scarring and blockages in the fallopian tubes, which can prevent the egg from being fertilized by the sperm and can lead to infertility. TB can cause menstrual irregularities, such as amenorrhea (absence of periods) or oligomenorrhea (infrequent periods), which can make it difficult to conceive. TB can increase the risk of ectopic pregnancy, which occurs when the fertilized egg implants outside of the uterus, usually in the fallopian tube (N.specified, March 24, 2023).

In another study, researchers evaluated hormones in the menstrual cycle of women with pulmonary TB. They found that menstrual irregularities were present in 80% of cases, with secondary amenorrhea being the most common (55%). These irregularities were more prevalent in patients with far-advanced disease and those with an increased bacillary load. TB adversely affects ovarian function, leading to hormonal changes in the menstrual cycle and resulting in menstrual irregularities (Aswathy, 2018).

A qualitative study conducted in South Africa highlighted that pregnant woman diagnosed with TB infection lacked adequate knowledge about TB complications during pregnancy and the neonatal period Educating pregnant women about the negative effects of non-adherence to TB treatment during pregnancy and the neonatal period is crucial. Africa bears a substantial burden of TB, estimated at 2.5 million cases out of 9.9 million globally; addressing TB-induced pregnancy delay requires comprehensive education, timely treatment, and improved maternal and neonatal care in sub-Saharan countries (Khoza et al, 2023).

Common causes of infertility in developing countries are usually, women who are affected by Genital tuberculosis (GTB) where it affects the fallopian tubes, endometrium, and ovaries (Mir et al, 2023).

A research study conducted at Tikur Anbesa Specialized Hospital in Addis Ababa, Ethiopia, highlights that endometrial TB is fairly common among gynecologic patients visiting outpatient departments for various complaints. This research was sheds light on the prevalence of endometrial TB in Ethiopian women undergoing endometrial biopsy, emphasizing the importance of early detection and appropriate management (Abdissa,S., et al. 2018).

A cross-sectional Stud done in Ethiopia on both male and female-related factors are associated with infertility. Primary infertility was significantly higher among women whose partner chews chat and drinks alcohol. Secondary infertility was significantly associated with being underweight, obese, smoking, and young age at first birth. Hence, taking action on preventable factors is the most critical treatment approach and will improve the health status of the couples in other ways (Legese et al, 2023).

2.3. Conceptual framework

The conceptual framework illustrates a complex web of relationships. TB infection acts as a bridge between socio-demographic, socio-economic, and health-related variables, ultimately affecting fertility delay. Understanding these connections is crucial for designing effective interventions and promoting reproductive health.

Socio-Demographic and Socio-Economic Variables: These variables (such as age, marital status, family size, education, occupation, and income) indirectly influence TB infection which subsequently affects fertility delay.

Arrows to TB infection represent mediating factors, such as age: Refers to an individual's chronological age in years. It significantly influences fertility behavior. Younger women may have different fertility intentions than older women. For instance, teenage pregnancies and delayed childbearing are age-related factors affecting fertility. Older age may increase exposure risk to diseases, including tuberculosis (TB). Immune function changes with age, impacting susceptibility to infections. Age also affects family planning choices, as women may adjust their fertility goals based on their life stage (Singh,& P., Singh, K.K., 2024).

Marital status**:** Refers to an individual's legal and social relationship status (e.g., single, married, divorced, widowed). It directly influences family formation. Married individuals are more likely to plan for children, while single or divorced individuals may delay childbearing. Married couples often have built-in social support systems, which can impact fertility decisions.

Emotional and practical support from a partner can affect family planning choices (Giuntella, et al, 2022).

Family size: represents the number of family members living together in a household. Cultural norms and family traditions influence desired family size. Some societies value larger families while others prioritize smaller families (CDC, 2023).

Education refers to formal learning, including years of schooling and attainment of degrees. It increases awareness of family planning methods, reproductive health, and fertility-related risks. Educated individuals make informed choices. Additionally, education empowers women to delay childbearing for personal and career development, which correlates with delayed childbearing and smaller family sizes (Majewska, 2022).

Occupation refers to an individual's job or profession. Occupation affects work hours, stress levels, and flexibility. Demanding jobs may lead to delayed childbearing. Occupation influences income, financial stability, and access to healthcare. Stable employment enhances family planning options.

Income: represents the financial resources an individual or household receives. Adequate income enables access to reproductive healthcare services. Income influences social determinants of health, including education, employment, and lifestyle. These factors indirectly impact TB risk.

Health and Knowledge-Related Variables: These variables, including undernutrition, awareness of TB symptoms, and smoking, directly impact TB infection, which in turn influences fertility delay.

The arrows pointing to TB infection represent risk factors. Undernutrition refers to a deficiency of calories or essential nutrients due to inadequate food intake or absorption difficulties.It can affect reproductive health, potentially leading to delayed fertility. Malnutrition may disrupt hormonal balance and impair reproductive function. Weakened immune systems due to undernutrition make individuals more susceptible to infections, including TB. Awareness

involves recognizing the signs and symptoms of TB, such as prolonged cough, fever, and unexplained weight loss. Early detection is crucial for preventing disease progression and transmission. Educating the population about TB symptoms can lead to timely diagnosis and treatment, reducing the risk of complications.

Early detection involves identifying TB infection or disease at an early stage. Treatment involves administering appropriate medications. Early detection helps to prevent TB transmission to others. Timely treatment reduces the infectious period and curtails spread. Early treatment improves patient outcomes, prevents complications, and minimizes fertility-related risks associated with untreated TB.

Smoking involves inhaling and exhaling the fumes of burning tobacco leaves (commonly in cigarettes, cigars, or pipes). Smoking is a major risk factor for various diseases, including TB. Smokers are more susceptible to TB infection and have worse treatment outcomes. Nicotine and other tobacco components weaken the immune system, impairing the body's ability to fight infections like TB.

After reviewing the literature, independent variables were grouped as socio-demographic, Socio-economic variables and Health and knowledge related variable. The effect of independent variables on outcome is shown below.

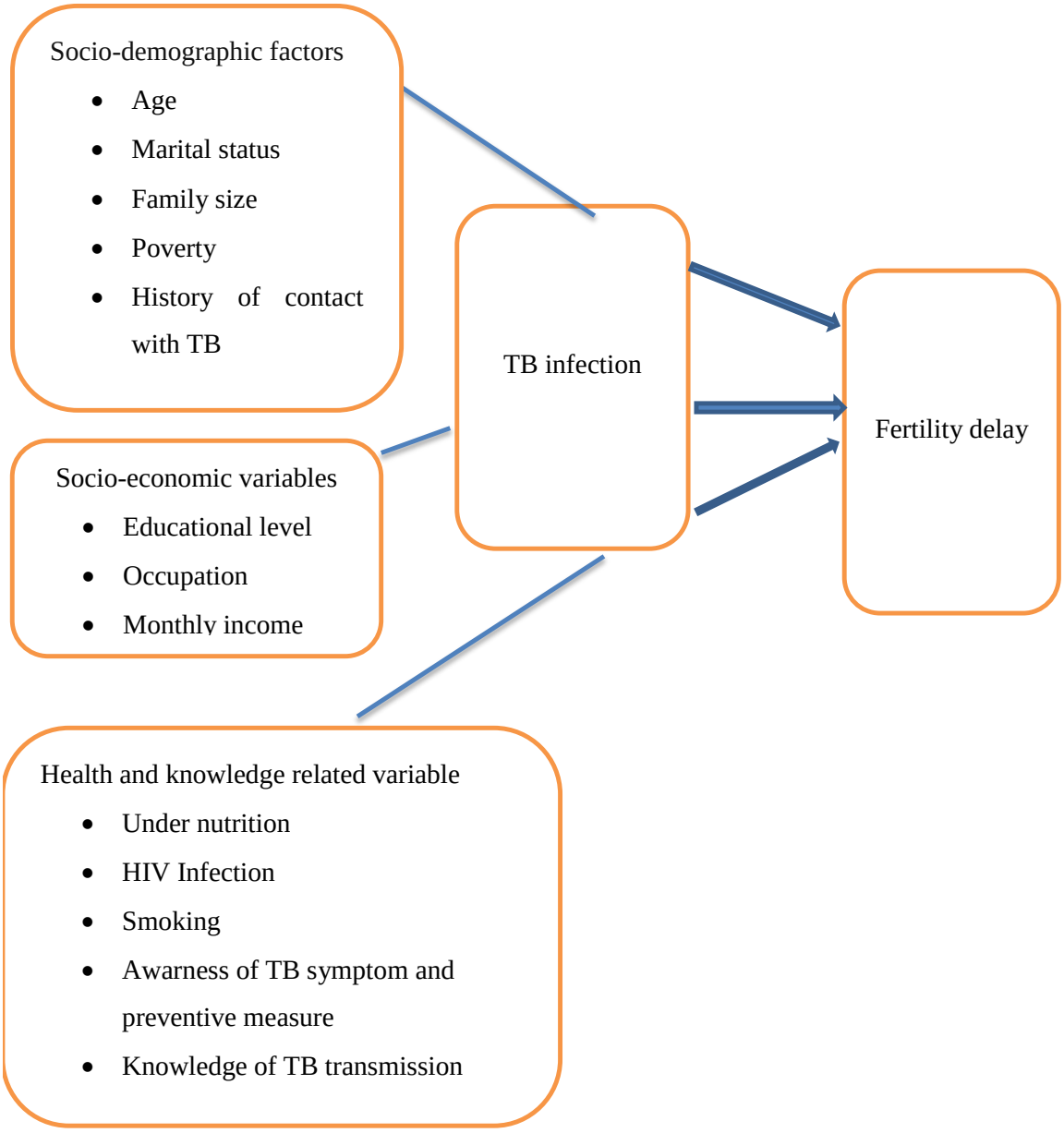

Figure 2.1: Conceptual framework on TB induced pregnancy delay on women age 15-49

The arrow from TB infection to fertility delay suggests a direct impact. In other words, TB infection affects fertility delay. Women with active TB infections may experience disruptions in their reproductive health. TB can lead to hormonal imbalances, irregular menstrual cycles, and impaired ovarian function, all of which contribute to fertility delay.

CHAPTER THREE: METHODOLOGY OF THE STUDY

3.1. Background of the study site

Sait Peter's Hospital is located in Addis Ababa, Ethiopia. The Hospital was established in 1953 and aims to become a center of excellence and a model TB general specialized Hospital in East Africa. The Hospital provides laboratory services and practical training on laboratory and nursing. The study was conducted in St. Peter specialized Hospital (SPSH) in Addis Ababa. Addis Ababa is the capital city of Ethiopia. The capital city holds one-fourth of Ethiopian live in urban areas. The Hospital was established in 1953.

It has been serving the nation as the only tuberculosis hospital for more than four decades. But for the previous few years, the hospital grew from a single disease hospital into a multi-services health institution. It is the first hospital to begin drug-resistant TB therapy in Ethiopia. It is also the country's center of excellence for the treatment of drug-resistant. According to the latest report from the hospital, it has treated 1,147 patients with DR-TB from 2009 to 2019, with a treatment success rate of 75.5% 3. The hospital has 120 beds, 10 isolation rooms, and 8 outpatient clinics for DR-TB patients 3. It also has a laboratory that can perform culture, drug susceptibility testing, and molecular testing for TB diagnosis 3. The hospital has a staff of 262, including 24 physicians, 88 nurses, 12 pharmacists, 10 laboratory technicians, and 128 support staff (MOH-Ethiopia, 2021).

3.2. Study design and approach

The objective of this study was to conduct a comparative cross-sectional study comparing two distinct groups: women with TB and women without TB. The comparative approach provides understanding the relationship between TB and fertility outcomes. It allows drawing meaningful conclusions and contributing valuable insights to the field. Investigation focused on a specific point in time. Applied a quantitative approach, this approach focuses on numerical data, statistical analysis, and objective measurements.

3.3. Data type and sources

Data for this study was collected through a structured questionnaire. Data gathered from two primary sources: Women who have history of Tb treatment or Taking Anti-TB Treatment and women who are not taking or no history of Tb treatment during data collection.

3.4. Target population and sampling procedures

The target population for this study included all women of reproductive age (15-49 years old) who are living in the area served by Saint Peter Specialized Hospital in Addis Ababa, Ethiopia. The sampling procedure involved selecting women of reproductive age (15-49) at Saint Peter Specialized Hospital in Addis Ababa. The sampling frame consists of only women within the target population. A structured questionnaire is administered to the selected participants to collect quantitative data Simple random sampling is employed to select participants from the sampling frame Using the Yamane formula, From expected sample size 661 collected 640 with 3% non-response so the total sample size was 640.

3.5. Study variables

3.5.1. Dependent Variable

- Fertility delay

3.5.2. Independent Variables are:

- Socio-Demographic and Socio-Economic Variables:

  Such as, age, marital status, family size, education, occupation, and income.
- Health and knowledge related variables: such as under nutrition, HIV infection, smoking awarnee of TB symptom and preventive measure, knowledge of TB transmission, awarnee of TB symptom and preventive measure.

3.6. Sampling Technique and Sample Size Determination

The study will apply simple random sampling technique; each member of the population has an equal chance of being selected for the sample. The sampling technique involves randomly selecting a subset of the population to participate in the study.

The sample size is determined using two sample size proportions. The below is a formula two calculate the sample size.

Were

N = Estimated sample Size

Zα/2 = is the value from the normal probability distribution corresponding to a confidence level 1-α

Z1-β = is the value from the normal probability distribution corresponding to a confidence level 1-β

P1= the sample proportion for group 1 (e.g. women with pregnancy delay)

P2= the sample proportion for group 2 (e.g., women without pregnancy delay).

$P = \frac{p_1=288}{640}$ 0.45

$P = \frac{p_2=352}{640}$ 0.55

Define Parameters:

- Confidence Level (α): a common confidence level of 95% (α = 0.05).
- Power (β): a power of 80% (β = 0.2).
- Expected Proportions:
  - Group 1 (TB-affected women): Proportion (p1 = 0.45)
  - Group 2 (Non-TB women): Proportion (p2 = 0.55)

Sample Size Calculation using the formula for the sample size

N= $[1.96]^2 \sqrt{2 * 0.5(1-0.5)} + 0.84\sqrt{0.45(1-0.45)+0.55(1-0.55)}\,]^2$ / 0.45-0.55

Therefore, i collected 640 with a 3% non-response rate, from expected 660 sample size for both group

Table 3. 1: Sample size determination

Required variable	Estimation value
$z_{\alpha/2}$	1.96
$z_{1-\beta}$	0.84
p_1	0.45
p_2	0.55
P	0.5
N1	296.91 ≈297-3%=288
N2	363.4 ≈364-3%=352
Non-response	3%
N	660

3.7. Inclusion and exclusion criteria:

This study focuses on reproductive women aged 15 to 49 years. For women with TB, the inclusion criteria encompass the following:

- Women diagnosed with active TB (pulmonary or extrapulmonary).
- Women with drug-resistant TB (DR-TB) or TB/HIV coinfection.
- Women attending antenatal care services.

As for women without TB, the inclusion criteria are as follows:

- Women without a history of TB.
- Women attending antenatal care services.

Exclusion criteria apply to both groups:

- Women younger than 15 years or older than 49 years.
- Women with severe psychiatric dysfunctions, infertility related to abnormal ovulation or endocrine issues, diabetes, malnutrition, or hypertension.
- Women unable to provide written informed consent.

3.8. Data collection instruments

Data was collected through the use of a structured questionnaire. The question types included dichotomous questions, which were generally “yes/no” questions, additionally; multiple-choice questions were employed by using Kobo Toolbox,

3.9. Data processing, analysis and interpretations

Once the questionnaire was finalized by reviewing different literature and used after pre-testing on 5% of the same source population. Data was collected through Kobo Toolbox and exported to micro-soft Excel sprees sheet then imported from Microsoft Excel spread to statically package for service (SPSS) software & Applied techniques of Crosstabulation for the association of two categorical variable and binary logistic regression model used for the association of different variables with the dependent variable.

3.10. Ethical consideration

The study was conducted after the approval of the proposal by the ethical review committee of the Department of Population Studies and subsequently by the ethical institutional review board of Addis Ababa University, College of Development Studies. The questionnaires administered to the respondents upon obtaining an informed written consent. Before consent was obtained, the researcher and the research assistants explained the purpose of the study and respondents were assured of confidentiality of the information they give then require their permission. To ensure privacy, names and other means of identity was not used during the data collection. The researcher ensured that all information obtained will be kept in strict confidence and will be used only for the purpose of the study.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1. Socio- demographic characteristics of respondents

The respondents' ages are grouped into specific categories to analyze the influence of age on TB diagnosis. Family members are categorized based on the number of individuals, reflecting household size and its impact on TB status. Primary education includes individuals who have completed education up to the primary level, covering basic literacy and numeracy skills. Secondary education represents respondents who have finished high school and provides a broader curriculum. Higher education encompasses individuals who have pursued education beyond the secondary level, including college, university, vocational training, and other post-secondary programs.

The number of rooms in the house is divided into categories to reflect housing conditions and potential exposure to TB. Marital status is examined as a factor in TB risk, with categories including single, married, divorced, and widowed. Average monthly income is segmented by income levels to explore the relationship between income and TB diagnosis.

The age of the respondent is a significant factor in TB diagnosis, with the highest diagnosis rate among those aged 35-39 (24.7%). And the lowest among those aged 15-19 (3.5%). The number of family members also influences TB diagnosis, with those having more than 4 family members having a higher diagnosis rate (52.8%).

Education level is also a factor, with individuals who have completed only primary education having a higher TB diagnosis rate (84.4%) compared to those with secondary (14.2%) or higher education (1.4%).The number of rooms in the house is linked to TB diagnosis, with individuals living in houses with 1-2 rooms having a higher diagnosis rate (96.9%).

Marital status is also a factor, with widowed individuals having the highest TB diagnosis rate (21.2%). Income level is associated with TB diagnosis, with the majority of individuals (73.9%) with TB diagnosis having an income below 5500.

Table 4.1: Demographic and socioeconomic characteristics of respondents by tuberculosis diagnosis status

Socio-Demographic Characteristic	**Negative TB Diagnosis (Count)**	**Negative TB Diagnosis (%)**	**Positive TB Diagnosis (Count)**	**Positive TB Diagnosis (%)**
Respondent Age				
15-19	58	16.5%	10	3.5%
20-24	48	13.6%	23	8.0%
25-29	70	19.9%	42	14.6%
30-34	53	15.1%	45	15.6%
35-39	49	13.9%	71	24.7%
40-44	35	9.9%	53	18.4%
45-49	39	11.1%	44	15.3%
Family Members				
One up to 2	59	16.8%	36	12.5%
Three to four	132	37.5%	100	34.7%
More than 4	161	45.7%	152	52.8%
Educational Status				
Primary	128	36.4%	243	84.4
Secondary	110	31.3%	41	14.2%
Higher	114	32.4%	4	1.4%
Number of Rooms in House				
1-2 rooms	239	67.9%	279	96.9%
3-4	94	26.7%	2	0.7%
More than 4	19	5.4%	7	2.4%
Marital Status				
Single (Never Married)	134	38.1%	115	39.9%

Cotinu… Demographic and socioeconomic characteristics of respondents by tuberculosis diagnosis status

Married	182	51.7%	86	29.9%
Divorced	22	6.3%	26	9.0%
Widowed	14	4.0%	61	21.2%
Average Monthly Income				
<5500	260	73.9%	286	99.3%
5501– 16500	84	23.9%	2	0.7%
>16501	8	2.3%	0	0.0%
Total	352	100.0%	288	100.0%

Source: Own Survey (2024).

4.2. Tuberculosis infection and difficulty fertility delay

TB can affect fertility, especially when it involves the genital organs. Genital TB may lead to infertility due to adhesions in the pelvis, which can cause blockages in the fallopian tubes or affect the uterus and ovaries. Symptoms of genital TB may include menstrual disorders, pelvic pain, and difficulty conceiving. TB infection, whether pulmonary or genital, can contribute to poor reproductive health outcomes.

Among women diagnosed with TB (TB-negative), 68.5% experienced no fertility delay, while 31.5% experienced fertility delay. Among women with TB (TB-positive), 20.8% experienced no fertility delay, while 79.2% experienced fertility delay. There appears to be a significant association between TB diagnosis and fertility delay. TB-positive women are more likely to experience fertility delay compared to TB-negative women. Within the TB-positive group, 80.1% had no fertility delay, and 32.7% had fertility delay. Within the TB-negative group, 19.9% had no fertility delay, and 67.3% had fertility delay. Overall, 47.0% of the participants were TB-positive and had no fertility delay, while 53.0% were TB-positive and experienced fertility delay.

Table 4.2: The crosstabulation table based on TB status and fertility delay among women of reproductive age 15-49 in Saint Peter specialized Hospital, Addis Ababa

TB Diagnosis	Fertility Delay: NO	Fertility Delay: Yes	Total
No	241 (68.5%)	111 (31.5%)	352
	(80.1% within no)	(32.7% within yes)	(55.0% of Total)
Yes	60 (20.8%)	228 (79.2%)	288
	(19.9% within yes)	(67.3% within yes)	(45.0% of Total)
Total	301 (47.0%)	339 (53.0%)	640
	(100.0% within Total)	(100.0% within Total)	(100.0% of Total)

Source: Own Survey (2024).

4.2.1. Chi-square test results for fertility delay and tuberculosis infection

The Pearson Chi-Square Test yielded a value of 144.264 with 1 degree of freedom (df) and a two-sided asymptotic significance of .000 (highly significant). Based on this test, there is a statistically significant association between TB status and fertility delay.

Additionally, the continuity correction method resulted in a value of 142.358 with 1 df and a two-sided asymptotic significance of .000 (also highly significant). Similar to Pearson's test, it indicates a significant association between TB status and the variable being tested.

The Likelihood Ratio Test produced a value of 151.400 with 1 df and a two-sided asymptotic significance of .000 (again, highly significant). The interpretation remains consistent, showing strong evidence of an association between TB status and the tested variable.

Furthermore, the Linear-by-Linear Association test yielded a value of 144.038c with 1 df and a two-sided asymptotic significance of .000 (once more, highly significant). This test also supports the association between TB status and the variable.

To validate findings across different methods or address various assumptions, I employed multiple statistical tests. Each test has its strengths and limitations: Pearson's test assumes larger sample sizes; Likelihood ratio tests can be more powerful when data don't meet certain assumptions, and Linear-by-linear association assesses trends across ordered categories. By incorporating multiple models, i ensure robustness and consistency in results. All these models confirm a significant association between TB status (those who have TB) and the tested variable (fertility delay), providing a comprehensive understanding of the relationship.

Table 4.3: Chi-square test results and the tested variable

Test	Value	Degrees of Freedom (df)	Significance (p-value)
Pearson Chi-Square	144.264	1	p < .001 (highly significant)
Continuity Correction	142.358	1	p < .001 (highly significant)
Likelihood Ratio	151.400	1	p < .001 (highly significant)
Linear-by-Linear Assoc.	144.038	1	p < .001 (highly significant)

Source: Own Survey (2024)

4.3. The association between irregular period to TB infection and risk of fertility delay

Those Individuals who are not diagnosed with TB have a lower mean association with menstrual irregularity leading to fertility delay, Mean: 0.3153, Sample size (N): 352, Standard Deviation: 0.46531. Individuals with specified TB have a stronger mean association with menstrual irregularity leading to fertility delay, Mean: 0.7917, Sample size (N): 288, Standard Deviation: 0.40682. Across all participants: Mean: 0.5297 (moderate association), Total sample size: 640, Standard Deviation: 0.49951.

Table 4.4: The association between irregular periods related to TB infection

TB Status*fertility delay	**Mean (Menstrual Irregularity)**	**Sample Size (N)**	**Standard Deviation**
No	0.3153	352	0.46531
Yes	0.7917	288	0.40682
Total	0.5297	640	0.49951

4.3.1 TB status and menstrual irregularity in relation to fertility delay

There is a statistically significant difference between groups when considering fertility delay in relation to having been diagnosed with TB and menstrual irregularity. The high F-ratio suggests a strong association. Between Groups (Combined): Sum of Squares: 35.939, Degrees of Freedom (df): 1, Mean Square: 35.939, F-ratio (F): 185.664, Significance Level (Sig.): .000 (very low). Within Groups: Sum of Squares: 123.497, Degrees of Freedom (df): 638, Mean Square: 0.194. This represents variability within each group. Sum of Squares: 159.436, Degrees of Freedom (df): 639

Table 4.5: The ANOVA results based on TB status and menstrual irregularity

Fertility delay and TB diagnosed	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups(Combined)	35.939	1	35.939	185.664	.000
Within Groups	123.497	638	.194		
Total	159.436	639			

Source: Own Survey (2024)

4.4. Risk factors associated with fertility delay

Women diagnosed with tuberculosis (TB) have higher odds of experiencing fertility delay compared to those without TB. Among different age groups, ages 15-19 show a lower risk, ages 20-24 still have a lower risk, and ages 25-29 exhibit a similar trend. Ages 30-34 continue to have a lower risk, while ages 35-39 show a slightly higher risk. However, there is no significant effect on fertility delay for ages 40-45. It's important to recognize that fertility naturally declines with age.

Having 1-3 family members increases the odds of fertility delay (Odds ratio = 2.770). This association may be due to additional responsibilities or stressors in larger families. However, having more than 4 family members does not significantly impact fertility delay. Having 1-3 rooms in the house increases the odds of fertility delay (Odds ratio = 2.494). This association may be related to socioeconomic factors or living conditions. However, having more than 4 rooms does not significantly affect fertility delay.

There is no significant association with fertility delay for primary, secondary, or higher education. No significant association with fertility delay for housewives, government employees, self-employed, daily laborers, or unemployed individuals. Income >16501 significantly increases

the odds of fertility delay (Odds ratio = 13.898). Economic stability may influence family planning decisions. Income <5500 also raises the odds (Odds ratio = 3.016). Lower income also raises the odds, possibly due to stressors associated with financial constraints. Fertility treatments, sexually transmitted infections, challenges of maternal health care, smoking and TB transmission are all associated with increased odds of fertility delay.

Table 4.6: Binary logistic regression results of risk factors associated with fertility delay

TB diagnosis status	.347	5.142	1	.023	2.195	1.113	4.332
Respondent age		7.765	6	.256			
Respondent age(15-19)	.655	5.528	1	.019	.214	.059	.774
Respondent age(20-24)	.615	3.018	1	.082	.344	.103	1.147
Respondent age(25-29)	.451	3.287	1	.070	.442	.183	1.069
Respondent age(30-34)	.424	.876	1	.349	.672	.292	1.544
Respondent age(35-39)	.379	.318	1	.573	.807	.384	1.697
Rspondent age(40-45)	.422	.005	1	.942	1.031	.451	2.360
Number of respondant family members		9.028	2	.011			

Conti…: Binary logistic regression results of risk factors associated with

fertility delay

Number of respondant family members (1-3)	.344	8.757	1	.003	2.770	1.411	5.438
Number of respondant family members(more than 4)	.247	2.529	1	.112	1.482	.913	2.405
Number of rooms in the respondant house		2.678	2	.262			
Number of rooms in the respondant house (1-3)	.660	1.919	1	.166	2.494	.684	9.088
Number of rooms in the respondant house (more than 4)	.712	2.666	1	.103	3.196	.792	12.889
Educational status		.709	3	.871			
Educational status (primary)	.412	.009	1	.926	1.039	.463	2.332
Educational status(secondy)	.365	.273	1	.601	.826	.404	1.690

Conti…

Educational status (Higher)	.357	.575	1	.448	.763	.379	1.536
Occupational status		10.200	5	.070			
Occupational status (Housewife)	.632	.182	1	.670	.764	.222	2.634
Occupational status (Government employee)	.638	.033	1	.855	.890	.255	3.106
Occupational status (Self-employed)	.542	1.901	1	.168	2.111	.730	6.105
Occupational status (Daily laborer)	.548	2.628	1	.105	2.433	.830	7.127
Occupational status (Unemployed)	.611	.521	1	.470	.643	.194	2.131
Average monthly income		30.409	3	.000			
Average monthly income <5500	.548	4.061	1	.044	3.016	1.031	8.823
Income (5501–16500)	.999	.026	1	.873	.852	.120	6.044

Conti…

Average monthly income >16501	.500	27.690	1	.000	13.898	5.215	37.038
Fertility treatments	.281	12.045	1	.001	2.652	1.529	4.600
Sexually transmitted infections	.321	5.037	1	.025	2.054	1.095	3.852
Challenges of maternal health care	.252	22.688	1	.000	.301	.184	.493
smoking cigarettes or use other tobacco products	.341	.279	1	.597	.835	.428	1.630
Transmission of TB	.674	6.724	1	.010	.174	.047	.653
Constant	2.559	.127	1	.721	2.493		

Source: Own Survey (2024)

4.4.1. Regression statistics of crude odds ratios on fertility delay

The crude odds ratio is 8.250, which means that individuals diagnosed with TB have approximately 8.25 times higher odds of experiencing fertility delay compared to those individuals who were not diagnosed with TB The 95% confidence interval (CI) for these crude odds ratio ranges from 5.742 to 11.855.

The crude odds ratio is 3.286. Individuals who responded fertility delay = no have approximately 3.29 times higher odds of fertility delay compared to those individuals who were not diagnosed with TB. The 95% CI for this crude odds ratio ranges from 2.595 to 4.161.

The crude odds ratio is 0.398. Individuals Individuals who responded fertility delay = yes) have significantly lower odds of fertility delay compared to those individuals who were not diagnosed with TB. The 95% CI for this crude odds ratio ranges from 0.338 to 0.470.

Table 4.7: Crude odds ratios for fertility delay

R isk Estimate	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for TB diagnosed with (TB positive)	8.250	5.742	11.855
For cohort fertility delay = no	3.286	2.595	4.161
For cohort fertility delay = yes	.398	.338	.470
N of Valid Cases	640		

4.4.2. Logistic regression of predictions and observation

False Negatives: These are cases where the model incorrectly predicted that a woman does not have fertility delay, but in reality, she does have fertility delay.

False Positives**:** These are cases where the model incorrectly predicted that a woman has fertility delay, but in reality, she does not have fertility delay.

True Positives**:** These are cases where the model correctly predicted that a woman has fertility delay, and in reality, she does have fertility delay.

True Negatives**:** These are cases where the model correctly predicted that a woman does not have fertility delay, and in reality, she does not have fertility delay.

The overall percentage of correct predictions is the sum of true positives and true negatives divided by the total number of cases.

Table 4.8: Classification table from logistic regression of predictions and observation

Observed	**Predicted fertility delay**	**Percentage correct**
	No	**Yes**
No	**230**	**71**
Yes	**53**	**286**
Overall Percentage	**80.6%**	

Source: Own Survey (2024)

4.5. Discussion

In this study a total of 640 samples were included and followed by Descriptive statistics and statistical model analysis presents the analysis and discussion of the data obtained from the study using structured questionnaire. Descriptive statistics and statistical model analysis were applied to describe the association between TB infection and fertility delay among women of reproductive age and timely diagnosis, proper management, and addressing associated factors are essential for promoting reproductive health.

Our findings contribute to valuable insights into the association between tuberculosis (TB) infection and fertility delay among women. TB of the female reproductive system can cause infertility, pain, a pelvic mass or menstrual disorder. Diagnosis requires a high index of suspicion for TB when a person from a country with endemic TB experiences genitourinary symptoms, including infertility (Miele,K., 2023).

Our findings align with existing research, emphasizing that women diagnosed with TB (TB-positive) face significantly higher odds of fertility delay compared to those without TB (TB-negative). Here are the key percentages, Among TB-negative women: 68.5% experienced no fertility delay. 31.5% experienced fertility delay. Among TB-positive women: Only 20.8% experienced no fertility delay. A substantial 79.2% faced fertility delay. Overall, 47.0% of participants were TB-positive and had no fertility delay, while 53.0% were TB-positive and experienced fertility delay. The data provides clear percentages for both TB-negative and TB-positive groups, highlighting the stark contrast in fertility delay rates. The specific breakdown within each group (e.g., 80.1% of TB-positive women with no fertility delay) reinforces the association.

Both this study and previous research recognize the association between TB diagnosis and fertility delay. The overall trend of TB-positive women experiencing more fertility delay aligns with existing literature. This study specifically focuses on primary data collected from a specific population, while previous studies may have used secondary data or broader samples. This study provides detailed percentages within each group, offering a nuanced view of fertility delay and

directly collected data, ensuring relevance and freshness and focused on TB diagnosis and fertility delay, providing targeted insights.

The current evidence of TB associated fertility delay provides recommendations to improve care and outcomes during TB disease essentially, the researchers sought to understand how TB affects fertility in women and explore the role of family planning in preventing adverse outcomes. Despite well-established adverse effects of TB on fertility, little attention has been paid to family planning for women with TB or drug-resistant TB (DR-TB). Integrating family planning services within TB treatment programs is crucial to reduce fertility delay and improve reproductive health outcomes. The study highlights the need for better practices and emphasizes the importance of addressing family planning during TB treatment.

The study provides evidence on fertility complications for women (e.g., menstrual disorders, pelvic pain) and potential impact on conception. It also discusses the value of offering family planning services to prevent fertility delay. Future research could explore effective strategies for integrating family planning into TB care and improving outcomes for women with TB. In summary, this study sheds light on the intersection of TB, fertility, and family planning, emphasizing the need for comprehensive care to enhance reproductive health outcomes.

The results of the study show a strong correlation between the diagnosis of tuberculosis, irregular menstruation, and delayed fertility. The mean connection between monthly irregularities and delayed fertility is higher in women with TB diagnosis (mean: 0.7917). The mean association is smaller (mean: 0.3153) in those without tuberculosis. Consistency within groups is indicated by the low standard deviations (0.40682 and 0.46531). The association's strength is further supported by the strong F-ratio (185.664) and extremely low significance level (Sig. =.000). The findings are further supported by the diversity within and between groups (Turusbekova, N et al, 2022). This is consistent with the results from S/t Peter Hospital, where TB infection was associated with menstrual irregularities.

While ages 15-19 and 20-24 show lower risks, ages 25-29 exhibit a similar trend. Ages 30-34 continue to have a lower risk, while ages 35-39 show a slightly higher risk.

Existing literature emphasizes that fertility naturally declines with age. These patterns may reflect biological realities and societal factors influencing family planning decisions. Income plays a crucial role. Both high income (>16501) and low income (<5500) raise fertility delay odds. Economic stability and stressors associated with financial constraints likely influence family planning decisions. This aligns with existing evidence Income indirectly influences body weight and nutrition. People with higher income tend to have better access to nutritious food, healthcare, and lifestyle choices. Being significantly underweight or overweight can indeed impact ovulation and menstrual cycles.

Adequate nutrition and a healthy weight are essential for reproductive health. Income can affect access to healthcare and preventive measures. Individuals with lower income may face barriers to regular check-ups and timely treatment. Untreated infections like, chlamydia and gonorrhea can lead to pelvic inflammatory disease (PID), affecting fertility. Early diagnosis and treatment are crucial. Income disparities can influence tobacco use patterns. Lower-income individuals may be more exposed to smoking due to stress, limited resources, or social factors. Smoking is indeed linked to lower fertility and premature ovarian aging. It affects egg quality and overall reproductive health (Staff, 2024).

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The aim of our study was to investigate the association between TB infection and fertility delay among women of reproductive age at Saint Peter Specialized Hospital in Addis Ababa. TB, especially when it affects the genital organs, can lead to infertility due to adhesions in the pelvis. These adhesions may cause blockages in the fallopian tubes or affect the uterus and ovaries. Symptoms of genital TB include menstrual disorders, pelvic pain, and difficulty conceiving. Both pulmonary and genital TB contributes to poor reproductive health outcomes.

Among TB-negative women, 68.5% experienced no fertility delay, while 31.5% did experience fertility delay. Among TB-positive women, only 20.8% experienced no fertility delay, while a significant 79.2% experienced fertility delay. Overall, there is a clear association between TB diagnosis and fertility delay, with TB-positive women being more likely to experience fertility delay compared to TB-negative women. Our study confirms that TB diagnosis significantly affects fertility delay among women. TB-positive individuals exhibit a stronger association with menstrual irregularity leading to fertility delay compared to TB-negative individuals.

Income and economic factors, such as income >$16,501, significantly increase the odds of fertility delay, while income <$5,500 also raises the odds, possibly due to financial stressors. Fertility treatments, sexually transmitted infections, maternal health challenges, smoking, and TB transmission are associated with increased odds of fertility delay. Therefore, addressing TB-related fertility delay through screening, family planning discussions, and awareness campaigns can improve reproductive health outcomes for women.

The sample provides valuable insights into the demographics, family size, education, occupation, marital status, and income of women in the study. Further analysis could explore associations between these factors and fertility delay or other health outcomes. The study emphasizes that TB treatment plays a crucial role in maintaining reproductive health. When TB affects the genital organs, it can lead to infertility due to adhesions and blockages. Monitoring and managing TB infections are essential to prevent adverse effects on fertility.

Additionally, our findings suggest that TB treatment may influence menstrual irregularities in women of reproductive age. Further research could explore the underlying mechanisms and potential interventions to mitigate the impact of TB on menstrual health. Factors associated with fertility delay, such as age, income, occupational status, marital status, and maternal health care challenges, warrant further investigation. Considering confounding factors is essential to fully understand these relationships.

In summary, our study model shows reasonable performance in predicting fertility delay. By addressing TB-related fertility delay, we can enhance reproductive health outcomes for women.

5.2. Recommendation

- Targeted Screening and Follow-Up:
  - Implement routine TB screening for women presenting with menstrual irregularities, pelvic pain, or fertility concerns.
  - Identifying high-risk individuals allows efficient resource allocation.
  - Prioritize follow-up assessments for TB-positive individuals to monitor their reproductive health.
- Education and Awareness:
  - Develop educational materials for healthcare providers and patients:
    - Highlight the impact of TB on fertility.
    - Emphasize the need for early diagnosis and treatment. Conduct awareness campaigns in the community to reduce stigma and encourage timely healthcare seeking.
- Integrated Care:
  - Collaborate with gynecologists, infectious disease specialists, and reproductive health experts.
  - Establish multidisciplinary clinics where TB treatment and reproductive health services intersect. Co-located services streamline care and improve accessibility.
- Family Planning Counseling:
  - Offer personalized family planning advice to TB-positive women:
    - Address potential challenges related to conception and pregnancy.
  - Addressing fertility concerns is crucial for these patients.
- Socioeconomic Support:
  - Recognize the influence of income on fertility decisions.

- Provide counseling on managing financial stressors during fertility planning.
  - Financial stability impacts family planning choices.
- Longitudinal Studies:
  - Conduct long-term studies to assess the impact of TB treatment on menstrual health and fertility.
- Explore factors affecting fertility delay beyond the immediate post-diagnosis period. Understanding long-term effects informs targeted interventions.

References

Abdissa, S., Abebe, T., Ameni, G. et al. (2018). Endometrial tuberculosis among patients undergoing endometrial biopsy at Tikur Anbesa specialized hospital, Addis Ababa, Ethiopia. *BMC Infect Dis 18, 304*, https://doi.org/10.1186/s12879-018-3202-x.

Ahmad K, K. E. (2021). Maternal health and health-related behaviours and their associations with child health: Evidence from an Australian birth cohort. *PLoS*.

Akalewold, M., Yohannes, G.W., Abdo, Z.A. et al. (2022). Magnitude of infertility and associated factors among women attending selected public hospitals in Addis Ababa, Ethiopia: a cross-sectional study. *BMC Women's Health*, 22, 11 .

Akalewold, M., Yohannes, G.W., Abdo, Z.A. et al. (2022). Magnitude of infertility and associated factors among women attending selected public hospitals in Addis Ababa, Ethiopia: a cross-sectional study. *BMC Women's Health 22, 11*, https://doi.org/10.1186/s12905-022-01601-8.

Alene, K.A., Wangdi, K., Colquhoun, S. et al. (2021). Tuberculosis related disability: a systematic review and meta-analysis. . *BMC Med 19, 203* , https://doi.org/10.1186/s12916-021-02063-9.

Alene, M., Assemie, M.A., Yismaw, L. et al. (2020). Patient delay in the diagnosis of tuberculosis in Ethiopia: a systematic review and meta-analysis. *BMC Infect Dis 20, 797*.

APHRC Campus, K. (2018). Lagging fertility transition in sub-Saharan Africa: Trends and patterns in selected countries. *Fact sheet*.

Arck, Anke Diemert & Petra Clara. (2020). Preterm birth: pathogenesis and clinical consequences revisited. *seminares in immunology*, 42, 375–376.

Azizi, M., Ebrahimi, E., Moghadam, Z. B., Z., & Modarres, M.Shahhossein. (2023). Pregnancy rate, maternal and neonatal outcomes among breast cancer survivors: A systematic review. *Nursing open*, 10(10),.

Bado, A.R., Guengant, JP., Maga, H.I. (2022). *Sub-Saharan Africa: Slow Fertility Transitions Despite Policy Efforts.* Springer, Cham.

Baena, I.G., Floyd, K., Cunnama, L. (2021). The Global and Individual Economics of Tuberculosis. In: Migliori, G.B., Raviglione, M.C. (eds) Essential Tuberculosis. *Springer, Cham*.

Bain, L.E., Aboagye, R.G., Dowou, R.K. et al. (2022). Prevalence and determinants of maternal healthcare utilisation among young women in sub-Saharan Africa: cross-sectional analyses of demographic and health survey data. *BMC Public Health*.

Ban, M., Sun, Y., Chen, X., Zhou, X., Zhang, Y., & Cui, L. (2024). Association between maternal polycystic ovarian syndrome undergoing assisted reproductive technology and pregnancy complications and neonatal outcomes: a systematic review and meta-analysis. *Journal of ovarian research*.

Beaujouan, E. (2023). Delayed Fertility as a Driver of Fertility Decline. *The Springer Series on Demographic Methods and Population Analysis (Vol. 56).*

Beaujouan, E. (2023). Delayed Fertility as a Driver of Fertility Decline?. In: Schoen, R. (eds) The Demography of Transforming Families. *Springer, Cham*.

Biadgo, A., Legesse, A., Estifanos, A. S., Singh, K., Mulissa, Z., Kiflie, A., Magge, H., Bitewulign, B., Abate, M., & Alemu, H. (2021). Quality of maternal and newborn health care in Ethiopia: a cross-sectional study. *BMC health services research*, 21(1), 679.

Bongaarts, J., Hodgson, D. (2022). The Developing World's Fertility Transition: 2000–2020. In: Fertility Transition in the Developing World. SpringerBriefs in Population Studies. *Springer, Cham.*

Bricker, D. (2021). "Bye, bye, baby? Birthrates are declining globally – here's why it matters. *the Global CEO of Public Affairs at Ipsos*.

Bricker, D. (2021). Birthrates are declining globally here's why it matters. *World economic forum*.

CDC. (2016). Basic TB fact division of tuberclosis elimination national center for HIV viral hepatites STD and tuberclosis prevention. *Center for disease control and prevention*.

CDC. (2020). Treatment for TB During Pregnancy. *CDC*.

CDC. (2023). about active tuberculosis disease. *CDC*.

Chala, B. a. (2020). Prevalence of Multidrug Resistant Mycobacterium tuberculosis among Tuberculosis Patients Admitted to Adama Hospital Medical College, Adama, Ethiopia: A Retrospective Stud. *journal of tuberclosis research*.

Cheng, M., Yuan, T. & Liu ,Y. (2021). A woman with disseminated tuberculosis experienced preterm delivery, fallopian tube pregnancy, and delivered successfully following in vitro fertilization: a case report. *BMC Pregnancy Childbirth 21, 27 . https://doi.org/10.1186/s12884-020-03487-6*.

Cheng, M., Yuan, T. & Liu, Y. (2021). A woman with disseminated tuberculosis experienced preterm delivery, fallopian tube pregnancy, and delivered successfully following in vitro fertilization: a case report. *BMC Pregnancy Childbirth 21, 27* .

Cheong, K. C., Ghazali, S. M., Md Zamri, A. S. S., Cheong, Y. L., Md. Iderus, N. H., Nagalingam, T., Ruslan, Q., Omar, M. A., & Yusoff, A. F. (2022). Gender Differences in Factors Associated with the Total Delay in Treatment of Pulmonary Tuberculosis Patients: A Cross-Sectional Study in Selangor, Malaysia. *International Journal of Environmental Research and Public Health.*

Christine Tzelios, Werner M Neuhausser, David Ryley, Nhi Vo, Rocio M Hurtado, Ruvandhi R Nathavitharana. (2022). Female Genital Tuberculosis,. *Open Forum Infectious Diseases, Volume 9, Issue 11*.

Christine Tzelios, Werner M Neuhausser, David Ryley, Nhi Vo, Rocio M Hurtado, Ruvandhi R Nathavitharana,. (2022). Female Genital Tuberculosis. *Open Forum Infectious Diseases*, Volume 9, ofac543, https://doi.org/10.1093/ofid/ofac543.

Christine Tzelios, Werner M Neuhausser, David Ryley, Nhi Vo, Rocio M Hurtado, Ruvandhi R Nathavitharana,. (2022,). Female Genital Tuberculosis. *Open Forum Infectious Diseases*, Volume 9, Issue 11,.

Chu, Y.; Chen, Y.; Yao, W.; Wang, L.; Zhang, B.; Jin, L.; Yue, J. (2023). The Effect of Latent Tuberculosis Infection on Ovarian Reserve and Pregnancy Outcomes among Infertile Women Undergoing Intrauterine Insemination: A Retrospective Cohort Study with Propensity Score Matching. *J. Clin. Med*.

Dian Tjahyadi, Bejo Ropii, Kevin Dominique Tjandraprawira, Ida Parwati, Tono Djuwantono, Wiryawan Permadi, Tinchiu Li,. (2022.). Female Genital Tuberculosis: Clinical Presentation, Current Diagnosis, and Treatment. *Infectious Diseases in Obstetrics and Gynecology*, vol. 2022, Article ID 3548190, 6 pages,.

Egbuna, Muhammad Akram and Umme Laila and Benson Chukwunweike Ephraim-Emmanuel and Chukwuebuka. (2021). Roll of nutraceutical in the treatment of tubercloisis. *ScienceDirect.*

Ekezie, W., Hopwood, E., Czyznikowska, B., Weidman, S., Mackintosh, N., & Curtis, F. (2023). Perinatal health outcomes of women from Gypsy, Roma and Traveller communities: A systematic review. *Midwifery*.

Fawibe, Desalu OO, Adeoti AO, Fadeyi A, Salami AK, Fawibe. (2013). Awareness of the Warning Signs, Risk Factors, and Treatment for Tuberculosis among Urban Nigerians. *PMID*.

Fazle Rabbi, A.M., Kabir, M. (2015). Explaining fertility transition of a developing country: an analysis of quantum and tempo effect. *Fertil Res and Pract 1, 4*.

Fetensa, G., Wirtu, D., Etana, B. et al. (2020). Magnitude and determinants of delay in diagnosis of tuberculosis patients in Ethiopia: a systematic review and meta-analysis. *Arch Public Health*.

Fetensa, G., Wirtu, D., Etana, B. et al. (2022). Certainly! Let's delve into the findings from the study titled "Magnitude and Determinants of Delay in Diagnosis of Tuberculosis Patients in Ethiopia: A Systematic Review and Meta-Analysis. *Arch Public Health 80, 78*.

Fetensa, G., Wirtu, D., Etana, B. et al. (2022). Magnitude and determinants of delay in diagnosis of tuberculosis patients in Ethiopia: a systematic review and meta-analysis:. *Arch Public Health 80, 78*, https://doi.org/10.1186/s13690-022-00837-y.

Fetensa, G., Wirtu, D., Etana, B. et al. (2022). Magnitude and determinants of delay in diagnosis of tuberculosis patients in Ethiopia: a systematic review and meta-analysis: 2020. *Arch Public Health 80, 78*.

FMOH. (2017). *Guideline for managment of TB.* Federal democratic republic of ethiopia.

FMOH. (2017). *Guidelines for management of TB, DR-TB and leprosy in Ethiopia sixth edition.* Addis Ababa: FDREMOH.

FMOH. (2017). *Nationalguideline for Tb and leprosy in Ethiopia.* Addis Ababa: Nationa guideline for management.

Gebremariam, R.B., Wolde, M. & Beyene, A. (2021). Determinants of adherence to anti-TB treatment and associated factors among adult TB patients in Gondar city administration, Northwest, Ethiopia: based on health belief model perspective. *Journal of Health, Population and Nutrition*.

Grace GA, Devaleenal DB, Natrajan M. (2017). *Genital tuberculosis in females.* Indian J Med Res.

Heaton,& Brooke . (2022). Prevalence of Tuberculosis in Sub-Saharan Africa. *Ballard Brief*.

Heaton., B. (2022). Prevalence of Tuberculosis in Sub-Saharan Africa. *Ballard Brief are not necessarily endorsed by BYU or The Church of Jesus Christ of Latter-day Saints*.

Hile/grbremariam. (2020). St Peter TB specialized Hospital. AA.

Hochbaum, Rosenstock and others,. (developed in the 1950's). Main Constructs.

Hong, X., Yin, J., Wang, W. et al. (2022). The current situation and future directions for the study on time-to-pregnancy: a scoping review. *Reprod Health 19, 150*.

Hui, S. Y. (2022). Tuberculosis in pregnancy. *Clinical obstetrics & gynaecology*,.

ilahun T., Wado Y. D., Bangha M., and Izugbara, C.O. (. (2019). LAGGING FERTILITY TRANSITION IN SUB-SAHARAN AFRICA: . *African Population and Health Research* .

Imtiaz S et al. Eur Resp Jour (2017); Hayashi S et al. Trop Med Int Health (2018); Lönnroth K et al. Lancet (2010);. (2017). World Bank Sustainable Development Goals Database and WHO Global TB Programme. *WHO*.

Jhone Walles, Fregenet Tesfaye, Marianne Jansson, Taye Tolera Balcha, Erik Sturegård, Mestawet Kefeni, Gadissa Merga, Stefan R Hansson, Niclas Winqvist, Per Björkman. (2021). Tuberculosis Infection in Women of Reproductive Age: A Cross-sectional Study at Antenatal Care Clinics in an Ethiopian City,. *Clinical Infectious Diseases, Volume 73, Issue*.

John Walles, Fregenet Tesfaye, Marianne Jansson, Taye Tolera Balcha, Erik Sturegård, Mestawet Kefeni, Gadissa Merga, Stefan R Hansson, Niclas Winqvist, Per Björkman. (15 July 2021). Tuberculosis Infection in Women of Reproductive Age: A Cross-sectional Study at Antenatal Care Clinics in an Ethiopian City,. *Clinical Infectious Diseases, Volume 73*, Pages 203–210.

John Walles, Fregenet Tesfaye, Marianne Jansson, Taye Tolera Balcha, Erik Sturegård, Mestawet Kefeni, Gadissa Merga, Stefan R Hansson, Niclas Winqvist, Per Björkman,. (2021). Tuberculosis Infection in Women of Reproductive Age: A Cross-sectional Study at Antenatal Care Clinics in an Ethiopian City. *Clinical Infectious Diseases, Volume 73, Issue 2,*.

John Walles, Fregenet Tesfaye, Marianne Jansson, Taye Tolera Balcha, Erik Sturegård, Mestawet Kefeni, Gadissa Merga, Stefan R Hansson, Niclas Winqvist, Per Björkman,. (2021). Tuberculosis Infection in Women of Reproductive Age: A Cross-sectional Study at Antenatal Care Clinics in an Ethiopian City,. *Clinical Infectious Diseases,* , Pages 203–210, https://doi.org/10.1093/cid/ciaa561.

Kathryn Miele, MD; R. Bryan Rock, MD; Sylvia M. LaCourse, MD; David Ashkin, MD; Lisa Y. Armitige, MD; William Pomputius, MD; Neela D. Goswami, MD. (2023). Undiagnosed Tuberculosis During Pregnancy Resulting in a Neonatal Death — United States, 2021. *MMWR Morbidity and Mortality Weekly Report*.

Kathryn Miele, MD1; R. Bryan Rock, MD2; Sylvia M. LaCourse, MD3; David Ashkin, MD4; Lisa Y. Armitige, MD5; William Pomputius, MD6; Neela D. Goswami, MD. (2021). *Notes from the Field: Undiagnosed Tuberculosis During Pregnancy Resulting in a Neonatal Death.* United States,: CDC.

Khoza, L., Mulondo, S. & Lebese, R. (2023). Perspectives on pregnant women's educational needs to prevent TB complications during pregnancy and the neonatal period. A qualitative study. *BMC Public Health 23, 1997*.

Laelago, T., Habtu, Y. & Yohannes, S. (2019). Proximate determinants of fertility in Ethiopia; an application of revised Bongaarts model. *Reprod Health 16, 13*.

Lancet. (2024). Dramatic declines in global fertility rates set to transform global population patterns by 2100.

Lancet:, T. (2024). Dramatic declines in global fertility rates set to transform global population patterns by 2100. *The Lancet:*.

Legese, N., Tura, A. K., Roba, K. T., & Demeke, H. (2023). The prevalence of infertility and factors associated with infertility in Ethiopia: Analysis of Ethiopian Demographic and Health Survey (EDHS). *PloS one*, 18(10), e0291912. https://doi.org/10.1371/journal.pone.0291912.

Legesse T, Abdulahi M, Dirar A. (2017). rends and causes of maternal mortality in Jimma University Specialized Hospital, southwest Ethiopia: a matched case-control study. *Int J Womens Health.*

Madden, S. K., Ahuja, K. D. K., Blewitt, C., Hill, B., Hills, A. P., & Skouteris, H. (2023). Understanding the pathway between work and health outcomes for women during the preconception, pregnancy, and postpartum periods through the framing of maternal obesity. *an official journal of the International Association for the Study o*.

Majewska, M. J. (2022). Formal, non-formal, and informal learning: What are they, and how can we research them? *uiversity press and assesment*.

Malik, S. (2020). Genital Tuberculosis and its Impact on Male and Female Infertility. *S Endocrinology, 16(2), 97-103*.

Mir, N., & Pal, L. (2023). Genital tuberculosis, infertility and assisted reproduction. *Current opinion in obstetrics & gynecology*.

MOH-Ethiopia. (2021). St. Peter's TB Specialized Hospital. *MOH-Ethiopia*.

N.specified. (March 24, 2023). *The Impact of TB on Fertility: How Does it Affect Your Chances of Conceiving?* Juhi Fertility.

Nguyen, H.T., Pandolfini, C., Chiodini, P. et al. (2014). Tuberculosis care for pregnant women: a systematic review. *BMC Infect Dis 14, 617*.

Nguyen, Y., McNabb, K. C., Farley, J. E., & Warren, N. (2022). Examining family planning and adverse pregnancy outcomes for women with active tuberculosis disease: a systematic review. *BMJ open*, 12(3).

Nguyen, Y., McNabb, K. C., Farley, J. E., & Warren, N. (2022). Examining family planning and adverse pregnancy outcomes for women with active tuberculosis disease: a systematic review. *BMJ open, 12(3), e054833. https://doi.org/10.1136/bmjopen-2021-054833*.

Nguyen, Y., McNabb, K. C., Farley, J. E., & Warren, N. (2022). Examining family planning and adverse pregnancy outcomes for women with active tuberculosis disease: a systematic review. . *BMJ Open, 12(3),*.

Nunn, P.P., Hovhannesyan, A., Rashid, A. (2021). Tuberclosis in women. *Essential Tuberculosis. Springer, Cham*.

Osea Giuntella, Lorenzo Rotunno, and Luca Stella. (2022). Globalization, Fertility, and Marital Behavior in a Lowest-Low Fertility Setting. *National Bureau of Economic Research*.

Paul P. Nunn, Araksya Hovhannesyan, and Aamna Rashid. (2021). Tuberculosis in Women. *SpringerLink.*

Pradipta, I.S., Idrus, L.R., Probandari, A. et al. (2021). Barriers and strategies to successful tuberculosis treatment in a high-burden tuberculosis setting: a qualitative study from the patient's perspective. *BMC Public Health 21*.

Roser, M. (2023). Demographic transition: Why is rapid population growth a temporary . *Our World in Data*.

Samantha Artiga and Elizabeth HintonNakweya, G. (2018). Beyond Health Care: The Role of Social Determinants in Promoting Health and Health Equity. *Kaiser Family FoundationNature*.

Sang, Y., Zhang, L., Song, B. et al. (2023). Global Stability for an Endogenous-Reactivated Tuberculosis Model with Beddington–DeAngelis Incidence, Distributed Delay and Relapse. *Qual. Theory Dyn. Syst. 22, 89.*

Shao, Y., Hageman, J. R., & Shulman, S. T. (2021). Congenital and Perinatal Tuberculosis. *NeoReviews*, 22(9).

Singh, P., Singh, K.K. (2024). Trends, patterns and predictors of high-risk fertility behaviour among Indian women: evidence from National Family Health Survey. *BMC Public Health 24, 626*.

Sofia Tsiapakidou,Tahir Mahmood,Charles Savona-Ventura. ((2023). The potential impact of tobacco use on female fertility and pregnancy outcomes: An invited scientific review by EBCOG. *European journal of obstetrics, gynecology, and reproductive biology*, 85–87.

Staff, M. C. (2024). Female Fertility: Why Lifestyle Choices Count. *Augusta Health*.

Stroeken, Y., Broekhuijsen, K., Leyten, E. et al. (2023). Case Report: Subfertility and Pregnancy Loss due to Genital Tuberculosis. *SN Compr. Clin. Med*, 5, 164.

Stroeken, Y., Broekhuijsen, K., Leyten, E. et al. Case Report. ((2023). Case Report: Subfertility and Pregnancy Loss due to Genital TuberculosisLoss due to Genital Tuberculosis. *SN Compr. Clin. Med.* .

Sylvia M. LaCourse, Sharon A. Greene, Elizabeth. (2016). Risk of Adverse Infant Outcomes Associated with Maternal Tuberculosis in a Low Burden Setting:A Population-Based Retrospective Cohort Study. *Infectious Diseases in Obstetrics and Gynecology*, 2.

T.A. Aswathy, Gopal Purohit, Sunil Vyas. (2018). Evaluation of Hormones in the Menstrual Cycle of Women with Pulmonary Tuberculosis. *European Respiratory Society*.

Tambe, R. (2024). What are the impacts of Tuberculosis on fertility? Know from expert. *India TV News.*

Tiwari, M., & Menon, B. (2020). Menstrual Disorders in Non-genital Tuberculosis – an Ignored Entity. *European Respiratory Journal, 56(Suppl 64), 1561.* .

Tjahyadi, D., Ropii, B., Tjandraprawira, K. D., Parwati, I., Djuwantono, T., Permadi, W., & Li, T. (2022). Female Genital Tuberculosis: Clinical Presentation, Current Diagnosis, and Treatment. *infectious diseases in obstetrics and gynecology*.

Tsegaye Negash, B. (2023). Fertility intention among married women in Ethiopia: a multilevel analysis of Ethiopian demographic health survey 2016. . *Contracept Reprod Med*, 8, 6.

Turusbekova, N., Celan, C., Caraulan, L. et al. (2022). Gender-related factors associated with delayed diagnosis of tuberculosis in Eastern Europe and Central Asia. *BMC Public Health 22, 1999*.

Turusbekova, N., Celan, C., Caraulan, L. et al. (2022). Gender-related factors associated with delayed diagnosis of tuberculosis in Eastern Europe and Central Asia. *BMC Public Health 22*.

Turusbekova, N., Celan, C., Caraulan, L. et al. (2022). Gender-related factors associated with delayed diagnosis of tuberculosis in Eastern Europe and Central Asia. . *BMC Public Health 22,* , https://doi.org/10.1186/s12889-022-14419-8.

USAID. (2022). ETHIOPIA TUBERCULOSIS ROADMAP OVERVIEW, FISCAL YEAR 2022. *USAID*.

Walles, J., Otero, L. G., Tesfaye, F., Abera, A., Jansson, M., Balcha, T. T., Sturegård, E., Winqvist, N., Hansson, S. R., & Björkman, P.; "et al'. (2022). Tuberculosis infection and stillbirth in Ethiopia-A prospective cohort study. *PloS one*, *17(4)*, *e0261972*.

Walles, J., Tesfaye, F., Jansson, M., Balcha, T. T., Sturegård, E., Kefeni, M., Merga, G., Hansson, S. R., Winqvist, N., & Björkman, PWalles. (2021). uberculosis Infection in Women of Reproductive Age: A Cross-sectional Study at Antenatal Care Clinics in an Ethiopian City. *Infectious Diseases Society of America*,.

waterr, B.J., Brooks, M.B., Huang, CC. et al. (2020). Tuberculosis clinical presentation and treatment outcomes in pregnancy: a prospective cohort study. *BMC Infect Dis 20*.

WHO . (2023.). *Sexual and Reproductive Health and Research (SRH).Infertility.* WHO.

WHO. (2016). *Ethiopia: On the road to ending tuberculosis.* WHO.

WHO. (2017). *WHO recommendations on maternal health.* WHO.

WHO. (2019). *Tuberclosis in women.* WHO.

WHO. (2019). *Tuberclosis in women.* WHO.

WHO. (2019). Tuberculosis in women. *CDC/WHO*.

WHO. (2021). *National TB prevalence surveys.* WHO.

WHO. (2021). *Tb desease burdon.*

WHO. (2021). *TB determinants.*

WHO. (2021). Tuberclosis. *WHO*.

WHO. (2022). global tb challenge. *WHO*.

WHO. (2022). *Global tuberclosis.* WHO.

WHO. (2022). *Global Tuberculosis Report.* WHO.

WHO. (2022). *Who global TB report* . WHO.

WHO. (2023). *Global tuberculosis report.* WHO.

WHO. (2023). Tuberculosis. *WHO*.

7. Budget and time break down

Table 7.1 : Budget breakdown for research entitled with (TB) induced fertility delay on reproductive women the age of 15-49 in S/t Peter Hospital, Addis Ababa, 2024

Tasks to be performed	Responsible persons	January and Feb.	March	April	May	June
Training and Research Proposal Preparation	Researchers					
Final research proposal submission	Researchers					
Period for approval process						
Pretest	Researchers					
Training of data collectors	Researchers					
Data collection	Researchers& data collectors					
Data processing and analysis	Researchers					
Report writing	Researchers					
Final research report submission	Researchers					

Gantt chart showing the work plan of study on tuberculosis (TB) induced fertility delay on reproductive women the age of 15-49 in S/t Peter Hospital, Addis Ababa, 2024

Lists of Items	Unit	Quantity	Unit Price(ETB)		Total
Stencils	Pcs	3	130	00	390.00
Duplicating paper	Ram	2	130	00	260.00
Pen	No.	10	5	00	50.00
Pencil	No.	20	2	00	40.00
Eraser	No.	4	5	00	20.00
Ruler	No.	4	10	00	40.00
Duplicating Inc.	No.	1	600	00	600.00
Sub-total **1400.00**					

Personal cost				
Description of the activities	Unit	Quantity	Total	
Periderm for the data collectors(2)	Questionnaire filled	450	20	9000
Periderm for supervisors		1	3000.00	3000
Secretarial payment (Printing, Photo copy)	Total		1000.00	1000
Laboratory payment	Per patient	60	400.00	24000
Transport				**1500**
38,500.00				

Addis Ababa University

College of Development Studies

Center for Population Studies

8. Questionnaire

Dear Esteemed Participants,

My name is Addisalem Lemma and I am a researcher at St. Peter TB Hospital. I am conducting a study focused on TB induced fertility delay among women aged 15 to 49 years. The study aims to investigate how TB affects fertility, in women. By comparing women with TB to those without TB, we hope to identify patterns and potential delays related to conception and pregnancy. Your participation is invaluable. By contributing to this research, you can help us improve our understanding of TB induced fertility delay. Ultimately, our findings may inform better prevention strategies, and early detection. Rest assured that all information provided will remain strictly confidential. Participation is entirely voluntary, and you have the right to withdraw at any time without consequences. If you are a woman aged 15 to 49 years and have been diagnosed with TB or have never had TB, we invite you to participate in our study. Your insights will contribute significantly to advancing our knowledge in this critical area. Thank you for participating on our study. Together, we can make a difference in understanding and addressing TB-related fertility challenges.

Are you willing to participate?

Yes	No (*If No Please Skip to the next respondent*)

S.N	Questions	Responses	Rem.
101	Age	A. 15- 19☐ B. 20- 24☐ C. 25- 29 ☐ D. 30-34 ☐ E,35-39 ☐ F.40-44 ☐ G.45-49 ☐	
102	What is the number of your family members (including yourself)?	A. 1 – 2 B. 3-4 C. More than 4	
	Questionary table contin…		
103	What is the number of rooms in your house?	A. 1 – 2 rooms B. 3-4 C. More than 4	
104	Educational status	B. Primary ☐ C. Secondary ☐ D. Higher ☐	
105	Occupational status	A. Housewife B. Government employee C. Self-employed D. Daily laborer E. Unemployed	
106	Marital status of respondents	A. Single C, Married C. Divorced D. Widowed	
107	Average monthly income	A) Less than $100☐ B) $101 – $300☐ C) >$301 ☐	
Part II: Health-Related			
201	Have you ever received any fertility treatments?	A) Yes B) No	
202	Have you ever had any sexually transmitted infections?	A) YES B) No	

Questionary table contin…

203	Have you ever taken the tuberculosis treatment?	A. Yes B. No	
204	Have you cope with the challenges of maternal health care?	A. Yes B. No	
205	Have you been pregnant or given birth during or after TB treatment?	A. Yes B. No	
206	Have you ever had any difficulty getting pregnant?	A. Yes B. No	
207	Have you ever had any gynecological surgeries?	A. Yes B. No	
208	Do you have any concerns about fertility delay due to TB?	A. Yes B. No	
209	Do you smoke cigarettes or use other tobacco products?	A. Yes B. No	
210	Have you received any counseling or support related to TB and reproductive health?	A. Yes B. No	
211	Have you tested HIV?	A. Yes B. No	
212	How long have you been trying to conceive?	A. one times B. two times and more C. Don't know	
213	Do you have any chronic health conditions (besides TB)?	A. Yes B. No	
Part III: Knowledge and Awareness related variables			
301	How many types of TB have you heard?	A. One type B. Two types	

		C. More than two	
302	How can a person get TB?	A. Through handshakes B. Through the air when a person with TB coughs or sneezes C. Through sharing dishes D. Through eating from the same plate E. Through touching items in public places (doorknobs, handles in transportation) F. I do not know	
303	How can a person prevent getting TB?	A. Avoid shaking hands B. Covering mouth and nose when coughing or sneezing C. Avoid sharing dishes D. Washing hands after touching items in public places E. Closing windows at home F. Through good nutrition G. Do not know H. Other (please explain	
304	Can TB be cured?	A. Yes B. No	
305	Have you ever been diagnosed with TB?	A. Yes B. No	
306	Have you noticed any changes in your menstrual cycle since TB diagnosis?	A. Yes B. No	
307	Do you experience irregular periods or abnormal bleeding related to TB infection?	A. Yes B. No	
308	Did you receive counseling on family	A. Yes	

	planning to prevent adverse pregnancy outcomes?	B. No	

አዲስ አበባ ዩኒቨርሲት የልማት ጥናቶች ኮሌጅ የህዝብ ብዛት ጥናት ማዕከል መጠይቅ

ውድ የተከበራችሁ ተሳታፊዎች፣

አዲስአለም ለማ እባላለሁ የቅዱስ ጴጥሮስ ቲቢ ሆስፒታል ተመራማሪ ነኝ። ከ15 እስከ 49 ዓመት የሆናቸው ሴቶች በቲቢ ምክንያት የመውለድ መዘግየት ላይ ያተኮረ ጥናት እያካሄድኩ ነው። ጥናቱ ቲቢ በሴቶች ላይ የወሊድ መዘግየት እንዴት እንደሚያመጣ ለመመርመር ያለመ ነው። ቲቢ ያለባቸውን ሴቶች ቲቢ ከሌላቸው ጋር በማነፃፀር፣ ከእርግዝና እና እርግዝና ጋር የተያያዙ ንድፎችን እና ሊከሰቱ የሚችሉ መዘግየቶችን ለመለየት ነዉ። የእርስዎ ተሳትፎ በዋጋ ሊተመን የማይችል ነው። ለዚህ ምርምር አስተዋጽዖ በማድረግ፣ በቲቢ ምክንያት የሚመጣ የወሊድ መዘግየት ያለንን ግንዛቤ እንድናሻሽል ሊረዱን ይችላሉ። በመጨረሻም፣ ግኝቶቻችን የተሻሉ የመከላከያ ስልቶችን እና ቀድሞ ማግኘትን ያሳውቁ ይሆናል። ሁሉም የቀረቡት መረጃዎች በጥብቅ ሚስጥራዊ እንደሚሆኑ እርግጠኛ ይሁኑ። ተሳትፎ ሙሉ በሙሉ በፈቃደኝነት ነው, እና በማንኛውም ጊዜ በጥናቱ ያለመሳተፍ መብት አለዎት. ከ15 እስከ 49 ዓመት የሆናችሁ ሴት ከሆናችሁ እና በቲቢ ከተረጋገጠ ወይም ቲቢ ታክመዉ የማታውቁ ከሆነ በጥናታችን እንድትሳተፉ እንጋብዝዎታለን። በዚህ ወሳኝ ቦታ ላይ ያለንን እውቀት ለማሳደግ የእርስዎ ግንዛቤዎች ጉልህ አስተዋፅኦ ያደርጋሉ። በጥናታችን ስለተሳተፉ እናመሰግናለን። በጋራ፣ ከቲቢ ጋር የተያያዙ የወሊድ ችግሮችን በመረዳት እና በመፍታት ላይ ለውጥ ማምጣት እንችላለን።

እባክዎ ምርጫውን ምልክት ያድርጉበት ወይም ይግለጹ

ክፍል I: ማህበራዊ-ስነ-ሕዝብ ባህሪያት			
ተ.ቁ	ጥያቄዎች	ምላሾች	አስተያየት
101	ዕድሜ	ሀ.15- 24 ለ. 25- 34 ሐ. 35- 45 መ. 45-49	
102	የትምህርት ደረጃ	ሀ)ትምህርት የለም ለ.የመጀመሪያ ደረጃ ሐ)ሁለተኛ ደረጃ መ.ከሁለተኛ ዯረጃ በላይ)	
103	የአሁኑ የሙያ ደረጃ	ሀ. የቤት እመቤት ለ. የመንግስት ሰራተኛ ሐ.በግሌ ተዳዳሪ መ. ዕለታዊ ሠራተኛ ሠ.ሥራ አጥነት ረ. ሎሎች	
104	የጋብቻ ሁኔታ	ሀ. በጭራሽ አላገባም ለ. ያገባች ሐ. የተፋታች መ. መበለት	
105	በቤትዎ ውስጥ ያሉት ክፍሎች ብዛት ስንት ነው?	ሀ. 1 - 2 ክፍሎች ለ. 3-4 ሐ. ከ 4 በላይ	
106	የቤተሰብዎ አባላት ቁጥር (ራስዎን ጨምሮ) ስንት ነው?	ሀ 1 — 2 ለ .3-4 ሐ. ከ 4 በላይ	
107	ጠቅላላ ወርሃዊ ገቢ	ሀ) ከ$100 በታች ለ) $100 — $300 ሐ) $300 — $600 መ) ከ600 ዶላር በላይ	

ክፍል II: ከጤና ጋር የተገናኙ ተለዋዋጮች			
201	የወሊድ ህክምና ወስደሽ ታውቂያለሽ?	ሀ) አዎ ለ) አይ ሐ) አላውቅም	
202	በግብረ ሥጋ ግንኙነት የሚተላለፉ ኢንፌክሽኖች አጋጥመውሽ ያውቃሉ?	ሀ) አዎ ለ) አይ ሐ) አላውቅም	
203	የሳንባ ነቀርሳ ሕክምናን ወስደሽ ታውቃለሽ?	ሀ. አዎ ለ. አይ ሐ)አላውቅም	
204	የእናቶች ጤና አጠባበቅ ችግሮችን ተቋቁመሻል?	ሀ. አዎ ለ. አይ አዎ ከሆነ በምን? ሀ. መገለል፣ ለ. መድልዎ፣ ሐ. ማግለል፣ መ. ወጪ፣ መጓጓዣ።	
205	በቲቢ ሕክምና ወቅት ወይም በኋላ ነፍሰ ጡር ሆነሻል ወይም ልጅ ተወልዱዋል?	ሀ. አዎ ለ. አይ ሐ. አላውቅም	
206	እርግዝና ችግር አጋጥሞሽ ያውቃል?	ሀ. አዎ ለ. አይ ሐ. አላውቅም	
207	እርግዝናዎ ምን ውጤቶች ነበሩ?	ሀ. ቀጥታ መወለድ ለ. በሞት መወለድ ሐ. የፅንስ መጨንገፍ መ. ፅንስ ማስወረድ	
208	የማህፀን ቀዶ ጥገና አጋጥመውዎት ያውቃል?	ሀ. አዎ ለ. አይ ሐ. አላውቅም	
209	በቲቢ ምክንያት የወሊድ መዘግየትን በተመለከተ የሚያሳስብዎት ነገር አለ?	ሀ. አዎ ለ. አይደለም ሐ. አላውቅም	
210	ሲጋራ ታጨሺያለሽ ወይስ ሌላ የትምባሆ ምርቶችን ትጠቀሚያለሽ?	ሀ. አዎ ለ. አይደለም ሐ. አላውቅም	

211	ከቲቢ እና ከሥነ ተዋልዶ ጤና ጋር የተያያዘ ምክር ወይም ድጋፍ አግኝተዋል?	ሀ. አዎ ☐ ለ. አይደለም☐ ሐ. አላውቅም☐	
212	ኤችአይቪን ተመርምረዋል?	ሀ. አዎ ☐ ለ. አይ ☐ ሐ. አላውቅም☐ አዎ ከሆነ የኤችአይቪ ውጤትዎ ምንድነዉ ነው? ሀ.አሉታዊ ለ.አዎንታዊ ሐ.ያልታወቀ	
213	ለመፀነስ ምን ያህል ጊዜ እየሞከሩ ነው?	ሀ. አንድ ጊዜ ☐ ለ. ሁለት ጊዜ እና ተጨማሪ☐ ሐ. አላውቅም☐	
214	ሥር የሰደዱ የጤና እክሎች አሉዎት (ከቲቢ በተጨማሪ)?	ሀ. አዎ☐ ለ. አይ ☐ ሐ. አላውቅም☐	
ክፍልIII: ከእውቀት እና ግንዛቤ ጋር የተያያዙ ተለዋዋጮች			
301	ቲቢ ሊድን ይችላል?	ሀ. አዎ☐ ለ. አይ☐ ሐ. አላውቅም☐	
302	ስንት የቲቢ አይነት ሰምተዋል?	ሀ. አንድ ዓይነት (መግለጽ) ለ. ሁለት ዓይነት (መግለጽ) ሐ. ከሁለት በላይ (መግለጽ)	
303	አንድ ሰው እንዴት ቲቢ ይይዛል?	ሀ. በመጨባበጥ ለ. ቲቢ ያለበት ሰው ሲያስል ወይም ሲያስነጥስ በአየር ውስጥ ሐ. ምግቦችን በማጋራት መ. ከተመሳሳይ ሰሃን በመብላት ሠ. ዕቃዎችን በሕዝብ ቦታዎች በመንካት (የበር እጀታዎች ፣ በመጓጓዣ ውስጥ ያሉ እጀታዎች)	

		ረ. አላውቅም	
304	አንድ ሰው የቲቢ በሽታን እንዴት መከላከል ይችላል?	ሀ. እጅን ከመጨባበጥ በመቆጠብ ለ. በሚያስሉበት እና በሚያስነጥሱበት ጊዜ አፍ እና አፍንጫን መሸፈን ሐ. ምግብን ከመጋራት በመቆጠብ መ. በሕዝብ ቦታዎች ፅቃዎችን ከነኩ በኋላ እጅን መታጠብ ሠ. በቤት ውስጥ መስኮቶችን መዝጋት ረ. በጥሩ አመጋገብ ሰ. አላውቅም ረ. ሌላ (እባክዎ ያብራሩ	
305	ቲቢ ተመርምረው ያውቃሉ?	ሀ. አዎ ለ. አይ ሐ. አላውቅም አዎ ከሆነ፣ በፅንስ መዘግየቶች አጋጥሞዎታል? ሀ. አዎ ለ. አይ ሐ. አላውቅም	
306	የቲቢ ምርመራ ከተደረገ በኋላ በወር አበባዎ ዑደት ላይ ለውጦች አስተውለዋል?	ሀ. አዎ ለ. አይ ሐ. አላውቅም	
307	ከቲቢ ኢንፌክሽን ጋር በተዛመደ መደበኛ ያልሆነ የወር አበባ ወይም ያልተለመደ ደም መፍሰስ አጋጥሞዎታል?	ሀ. አዎ ለ. አይ ሐ. አላውቅም	
308	አደገኛ የእርግዝና ውጤቶችን	ሀ. አዎ ለ. አይ ሐ.	

	ለመከላከል በቤተሰብ ምጣኔ ላይ ምክር ተቀብለዋል?	አላውቅም	