

**“EVALUATION OF CONTACTS OF TUBERCULOSIS FOR ACTIVE OR LATENT
TUBERCULOSIS AND FACTORS ASSOCIATED WITH MANAGEMENT”**

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P.G. IN RESPIRATORY MEDICINE



Submitted to,

BLDE (DEEMED TO BE UNIVERSITY),

SHRI B.M. PATIL MEDICAL COLLEGE HOSPITAL & RESEARCH CENTRE,

VIJAYAPURA, KARNATAKA-586103

In partial fulfilment of the requirements for the degree of

DOCTOR OF MEDICINE

IN

RESPIRATORY MEDICINE

Under the guidance of

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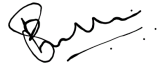
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ACKNOWLEDGEMENT

On completion of this scientific document, it gives me immense pleasure to acknowledge the guidance provided by my distinguished mentors.

I would like to express my sincere thanks to my guide, **DR. KEERTIVARDHAN D KULKARNI**, DNB, Professor and Head of the Department of Respiratory Medicine, whose supervision and invaluable guidance helped me learn the art of Respiratory Medicine. He has been a source of constant motivation and encouragement throughout the study with his expert and vigilant supervision. I am extremely grateful to him for guiding me throughout the study.

I am grateful to **DR. R. S. MUDHOL**, M.D, Professor and Vice Chancellor, BLDE (DU), Shri. B. M. Patil Medical College, Hospital and Research Centre, Vijayapura.

I humbly thank **DR. ARAVIND V PATIL**, M.S, Principal, for permitting me to utilize the resources in completion of my work.

I extend my heartfelt gratitude to **Dr. Ramesh S Babar** and **Dr. Shreeshail Anjutagi**, who stood as the guiding light throughout the course of my study, extending their kind support and providing me with endless opportunities to learn.

I am thankful to my colleague and my juniors, **Dr. Pothireddy Manisha Reddy**, **Dr. S Shyam**, **Dr. Saurav Suresh**, for their support throughout the study. I am also grateful to all the paramedical staffs for rendering timely help to complete my study.

I am eternally grateful to my beloved family; my parents **Mr. Suresh N R** and **Mrs. Kavitha C**, and my sister **Mrs. Honnika N Suresh**, who have nurtured me and supported me in all my endeavours; without their love and innumerable sacrifices, I would not be the person I am today.

Last but not the least, I am profoundly grateful to all the patients for their cooperation and participation in this study. They have been the principal source of knowledge which I have gained during the course of my clinical research.

Finally, I bow my head in a silent acknowledgement of all that **The Lord Almighty** has blessed me with.

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LIST OF ABBREVIATIONS

%	:	Percentage
TB	:	Tuberculosis
DSTB	:	Drug-sensitive tuberculosis
MDRTB	:	Multi-drug resistant tuberculosis
LTBI	:	Latent tuberculosis infection
TST	:	Tuberculin skin test
TPT	:	Tuberculosis preventive therapy
LMICs	:	Low- and middle-income countries
HICs	:	High-income countries
HHCs	:	Household contacts
BMI	:	Body mass index
CXR	:	Chest x-ray
mm	:	millimetre
ZN stain	:	Zeihl-Neelsen stain
US	:	United States
WHO	:	World Health Organization
TBI	:	Tuberculosis infection
ACF	:	Active case finding
HRGs	:	High-risk groups
NSP	:	National Strategic Plan
PA	:	Postero-anterior view
AFB	:	Acid fast bacilli

COVID-19	:	Coronavirus disease of 2019
HIV	:	Human immunodeficiency virus
RR-TB	:	Rifampicin-resistant tuberculosis
BC	:	Before Christ
BCG	:	Bacillus Calmette-Guérin
IGRA	:	Interferon-gamma release assay
INH/ H	:	Isoniazid
DTH	:	Delayed-type hypersensitivity
OT	:	Old tuberculin
PPD	:	Purified protein derivative
PPD-S	:	Purified protein derivative-standardized
PPD-RT	:	Purified protein derivative-research tuberculin
QFT	:	QuantiFERON-TB gold in-tube
CE	:	Conformité Européenne
T-SPOT.TB	:	T-cell ELISpot test for tuberculosis
FDA	:	U.S. Food and Drug Administration
RD1	:	Region of difference 1
ESAT-6	:	Early secreted antigenic target 6 kDa
CFP-10	:	Culture filtrate protein 10
MTB	:	Mycobacterium tuberculosis
NTM	:	Non-tuberculous mycobacteria
ELISA	:	Enzyme-linked immunosorbent assay
IU	:	International units

IFN- γ	:	Interferon-gamma
ELISPOT	:	Enzyme-linked immunosorbent spot
PBMCs	:	Peripheral blood mononuclear cells
PMTPT	:	Programmatic Management of Tuberculosis Preventive Treatment
TNF	:	Tumor necrosis factor
SFCs	:	Spot-forming cells
FQ	:	Flouroquinolone
R	:	Rifampicin
HP	:	Isoniazid plus rifapentine
MIC	:	Minimum inhibitory concentration
$\mu\text{g/mL}$	:	Micrograms per millilitre
mg	:	Milligram
kg	:	Kilogram
NAD	:	Nicotinamide adenine dinucleotide
NADH	:	Nicotinamide adenine dinucleotide + hydrogen
PLHIV	:	People living with HIV
ART	:	Antiretroviral therapy
CYP450	:	Cytochrome P450

CYP3A4	:	Cytochrome P450 3A4
CYP2C9	:	Cytochrome P450 2C9
CYP2E1	:	Cytochrome P450 2E1
SJS	:	Stevens-Johnson syndrome
TEN	:	Toxic epidermal necrolysis
RNA	:	Ribonucleic acid
DNA	:	Deoxyribonucleic acid
NAT2	:	N-acetyltransferase 2
GST	:	Glutathione S-transferase
CSF	:	Cerebrospinal fluid
IM	:	Intramuscular
GABA	:	Gamma-aminobutyric acid

ABSTRACT

BACKGROUND:

Tuberculosis is an infectious disease resulting from infection with the *Mycobacterium tuberculosis* (MTB) bacilli. Latent tuberculosis infection (LTBI) refers to a state in which individuals harbor a persistent immunological reaction to MTB antigens in the absence of symptoms of active tuberculosis. Household contacts, in particular, face the highest risk due to prolonged and repeated exposure within shared living spaces. It is estimated that approximately. Among individuals with latent tuberculosis infection, an estimated 5–10% will eventually transition to active tuberculosis over the span of their lifetime. Tuberculosis preventive therapy significantly reduces the likelihood of transitioning from tuberculosis infection to clinically active disease. While the early detection and management of active disease remain a central focus of the public health strategy, targeted identification and management of latent tuberculosis particularly among populations at elevated risk, notably household contacts of patients with active tuberculosis are essential components of tuberculosis elimination efforts.

AIMS AND OBJECTIVES:

To evaluate household contacts of tuberculosis for active or latent tuberculosis infection and to assess willingness for tuberculosis preventive treatment and the factors associated with management.

MATERIALS AND METHODS:

A cross-sectional analysis of 264 household contacts (HHCs) having history of prior exposure to active tuberculosis cases, was carried out in the Department of Respiratory Medicine, B.L.D.E. (Deemed to be) University's, Shri B. M. Patil Medical College, Hospital and

Research Centre, Vijayapura, Karnataka. Sputum for acid fast bacilli (AFB), chest x-ray postero-anterior view (CXR-PA view) and tuberculin skin test (TST) was done in each patient and evaluated for active TB and LTBI and patient's willingness to initiate therapy was assessed and tuberculosis preventive therapy (TPT) was offered accordingly. If the patient was unwilling for TPT, the reason for unwillingness was assessed.

RESULTS:

A total sample of 264 household contacts was included in the analysis. Among them, females constituted the majority of the study population. The average age of participants in the study was 34.55 ± 16.45 years, with a mean body mass index of 22.29 ± 4.16 kg/m². Among the study population, 2 individuals were diagnosed with active tuberculosis. Latent tuberculosis infection characterized by a positive tuberculin skin test, was diagnosed in 43 participants. Among eligible contacts, willingness to initiate TPT was high, with 81.3% expressing willingness for initiation of treatment. Among those who declined TPT, the most common reason cited was misconception, reported by 93.9%. Despite the high initial willingness, treatment completion rates were low, with only 37.2% of those who started TPT completing the full course.

CONCLUSION:

There is a significant burden of latent tuberculosis infection was observed among the contacts of active TB, particularly in individuals with diabetes mellitus. Although the majority of participants demonstrated a willingness to initiate TB preventive therapy, treatment completion rates were suboptimal. Misconceptions about LTBI and TPT emerged as a major barrier to treatment initiation. Comprehensive contact screening programs, improved patient education, and strategies to enhance adherence to TPT could significantly strengthen TB control

efforts, particularly in high-burden settings.

KEYWORDS: Tuberculosis, latent tuberculosis infection, tuberculosis preventive therapy, household contacts

INTRODUCTION

Tuberculosis (TB) is a chronic infectious disease caused by the bacillus *Mycobacterium tuberculosis*.¹ India carries the highest global burden of tuberculosis infection (TBI), with an estimated 35–40 crore individuals infected and approximately 26 lakhs new cases of tuberculosis (TB) disease diagnosed annually.²

Latent tuberculosis infection (LTBI) is characterized by a sustained immune response to *Mycobacterium tuberculosis* antigens in the absence of clinical evidence of active disease.³

Latent tuberculosis infection often results from close and prolonged exposure to individuals with active tuberculosis.⁴ The likelihood of acquiring infection is enhanced by greater exposure intensity and duration. Household contacts are particularly vulnerable, as they continuously share the same airspace with infectious TB patients over extended periods.⁵

It is projected that 5–10% of those with latent tuberculosis infection (LTBI) will develop active tuberculosis (TB) at some point during their lifetime.⁶

Although the early diagnosis and management of active tuberculosis (TB) continue to be critical priorities in India, TB prevention efforts—particularly through the identification and management of latent tuberculosis infection and the adoption of active case finding (ACF) approaches among high-risk groups (HRGs)—are becoming equally essential for achieving TB elimination goals. TPT has been shown to lower the risk of progression to active TB disease by approximately 60%.²

Management of TBI is recognized as a key strategy within India's National Strategic Plan (NSP) 2017–2025 for Ending Tuberculosis. The NSP outlines a "Detect-Treat-Prevent-Build" framework, emphasizing that the effective implementation of preventive therapy is crucial to accelerate the reduction in TB incidence from the current 2.5% to the targeted 10% annual reduction necessary to meet the 2025 goal.⁶

Since India is having an ambitious goal of ending tuberculosis by 2025 and contacts of active tuberculosis cases are the most vulnerable people for developing tuberculosis, screening and treating of tuberculosis contacts is an important step in early recognition and effective tuberculosis preventive measure.

This study aims to assess the prevalence of latent and active tuberculosis infections and to identify factors influencing their management among household contacts of patients with active TB.

AIMS AND OBJECTIVES OF THE STUDY

AIM:

The aim of the study is to evaluate contacts of tuberculosis for active or latent tuberculosis and to assess the factors associated with management.

OBJECTIVES:

1. To evaluate contacts of tuberculosis for active or latent tuberculosis with Chest X-ray (PA view), tuberculin skin testing and sputum for acid fast bacilli (AFB) for all the contacts of tuberculosis.
2. To determine willingness for tuberculosis preventive therapy among contacts of tuberculosis.
3. To assess willingness for treatment among contacts with latent tuberculosis infection.

REVIEW OF LITERATURE

INTRODUCTION:

Tuberculosis remains a major global public health challenge. Mycobacterium tuberculosis, the bacteria that causes tuberculosis, has plagued humanity for millennia.⁷ Before the pandemic of COVID-19, tuberculosis (TB) was one of the infectious causes leading to increased number of deaths worldwide.⁸ The World Health Organization (WHO) has set an ambitious target to reduce TB incidence by 90% between 2015 and 2035. However, significant challenges remain in the detection, management, and prevention of TB.⁹

BURDEN OF TUBERCULOSIS:

According to the WHO, an estimated 10.8 million people developed tuberculosis globally in 2023, corresponding to 134 incident cases per lakh population - the highest number reported since 1995.¹⁰

In 2023, the majority of tuberculosis cases were reported in the WHO regions of South-East Asia (45%), Africa (24%), and the Western Pacific (17%), with smaller percentages observed in the Eastern Mediterranean (8.6%), the Americas (3.2%), and Europe (2.1%).¹¹

Eight countries contributed to more than two-thirds of global tuberculosis cases in 2023: India (26%), Indonesia (10%), China (6.8%), the Philippines (6.8%), Pakistan (6.3%), Nigeria (4.6%), Bangladesh (3.5%), and the Democratic Republic of the Congo (3.1%). These countries experience a high TB burden due to factors such as high population density, limited healthcare access, and socioeconomic conditions that facilitate transmission and delays in treatment.¹²

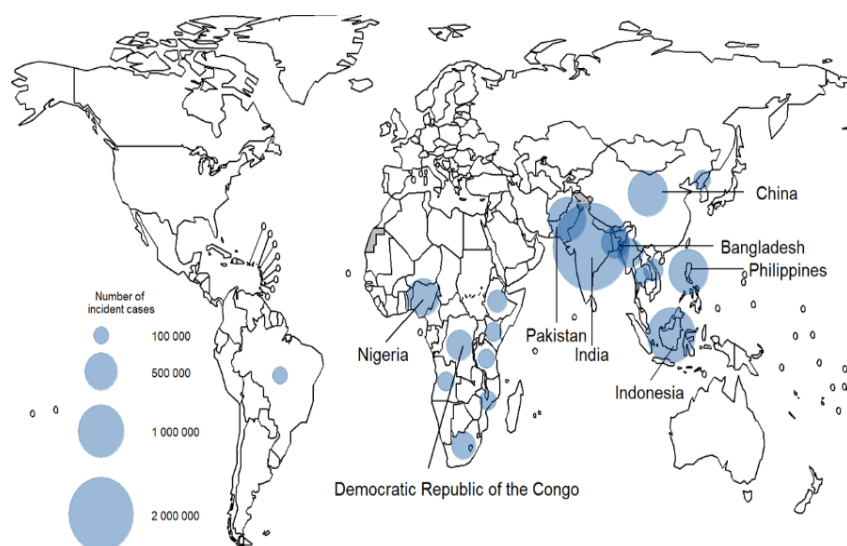


Figure-1: Estimated global incidence of tuberculosis cases in 2023.¹²

In 2023, individuals with HIV constituted for approximately 6.1% of the incident tuberculosis cases.¹² Around 1.09 million deaths related to TB occurred among individuals without HIV, while 161,000 deaths were reported among people living with HIV.¹³

In 2023, 5 countries represented more than one-half of the incident multidrug-resistant (MDR) and rifampicin-resistant tuberculosis (RR-TB) cases globally: 27% cases in India, the Russian Federation constituting 7.4%, 7.4% in Indonesia and 7.3% in China, and the Philippines (7.2%).¹²

The India TB report indicates a decline in both TB incidence and mortality rates.¹⁴ The tuberculosis incidence rate in India has declined by 17.7%, from 237 per 100,000 population in 2015 to 195 per 100,000 population in 2023. Similarly, TB-related deaths have decreased by 21.4%, from 28 per 100,000 population in 2015 to 22 per 100,000 population in 2023.¹⁵

HISTORY:

Tuberculosis is one of humanity's most ancient diseases, with evidence of its existence found in human remains dating back thousands of years.¹⁶ However, Latent Tuberculosis Infection was only formally recognized in the late 19th century as scientific understanding of TB evolved.¹⁷

Biological History of Tuberculosis:

Since time immemorial, tuberculosis (TB) has afflicted human beings. Evidence of TB in Neolithic humans has been confirmed through skeletal remains discovered in various parts of the world, with lesions characteristic of TB found in bones dating back thousands of years.¹⁸ One of the earliest clear indications of TB spine, also referred to as Pott's disease, comes from mummified bodies recovered from Egyptian tombs, dating back to approximately 5000 BC.¹⁹

In India, references to TB can be traced back to around 300 BC. The ancient Indian physician Sushruta, in his medical treatise *Sushruta Samhita*, described a disease resembling TB, referring to it as "Rajayakshma" and noting its severe and often incurable nature.²⁰ Similarly, the ancient Ayurvedic text *Charaka Samhita* (circa 200 BC) detailed symptoms of TB, emphasizing its contagious nature and the difficulty of treatment.²¹

These historical accounts and archaeological findings highlight TB's deep-rooted presence in human history, reinforcing the disease's long-standing challenge to medical science.

Tuberculosis (TB) has earned various names throughout history due to its devastating impact. In the 18th and 19th centuries, TB was commonly referred to as the "White Plague," a term derived from the extreme pallor observed in those affected.²² In Europe, the

tuberculosis epidemic was referred to as the "Great White Plague," which began in the 17th century and continued over the 200 years. During this period, TB was a leading cause of mortality, devastating populations across the continent. The disease was also known as "consumption," highlighting the severe weight loss and wasting experienced by patients.²³

The bacterium that causes tuberculosis, *Mycobacterium tuberculosis*, was discovered by the German scientist Robert Koch (1843–1910). He identified the bacterium in 1882 and presented his groundbreaking findings in his famous lecture, *Die Ätiologie der Tuberkulose* (The Etiology of Tuberculosis), on March 24, 1882, in Berlin.²⁴

For Tuberculosis, “Phthisis” is a Greek term. Phthisis has been identified by Hippocrates in around 460 BC as one of most prevailing disease of that time involving fever and coughing up blood that was almost disastrous. It was transmitted from individual to individual through the droplets from the lungs and throat of a person who has been suffering from active tuberculosis disease.²²

The first significant breakthrough in tuberculosis immunization was achieved in 1906 by French bacteriologists Albert Calmette and Camille Guérin. They developed a vaccine using an attenuated strain of the bovine form of tuberculosis, *Mycobacterium bovis*. This vaccine, named Bacillus Calmette-Guérin (BCG) in their honor, is the extensively used TB vaccine currently. It was first administered to humans in 1921.²⁵

Tuberculosis is a two- step process. The first stage is associated with attainment of infection and to the second stage is of development of disease. Infected persons are neither infectious nor ill even though they may progress to active TB. The infection is transmitted by the individuals infected with TB.²⁶

The understanding of tuberculosis infection has evolved significantly over time. Recent studies suggest that TB infection exists along a "continuum", spanning from the inhalation of micro-organism to the eventual establishment of clinically apparent TB disease. Rather than a simple latent-to-active progression, the progression of disease from LTBI to active disease is now recognized as a complex, dynamic process. This spectrum is influenced by a balance between the innate and adaptive immune responses in the host and the metabolic activity of *Mycobacterium tuberculosis*, including phases of dormancy, intermittent replication, and active replication.²⁶

The stages of TB can be broadly categorized as follows²⁶:

- Uninfected individual
- Tuberculosis infection
- Incipient tuberculosis
- Subclinical TB without recognized signs or symptoms
- Subclinical TB with unrecognized signs or symptoms
- Tuberculosis disease with clinical signs and symptoms

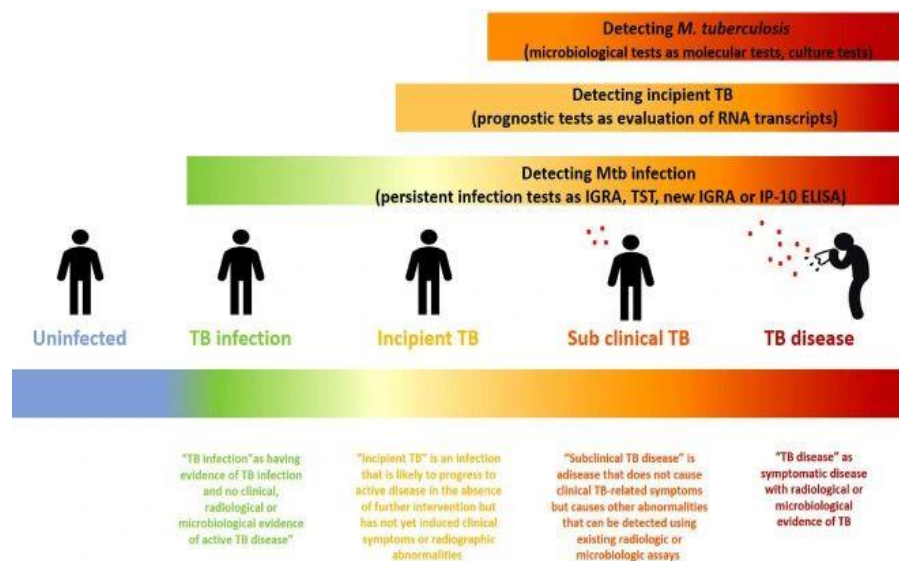


Figure – 2: Stages along the TB infection continuum.²⁷

LATENT TUBERCULOSIS INFECTION (LTBI):

Latent tuberculosis infection is characterized by a sustained immunological response to *M. tuberculosis* antigens in the absence of clinically apparent tuberculosis.²⁸

Mycobacterium tuberculosis (*M. tuberculosis*) employs various evasion mechanisms to circumvent the host immune system, enabling it to establish a latent infection. This latent state persists as long as the immune system effectively controls the bacteria. However, if immune function declines and bacterial replication surpasses immune defences, the infection can progress to active tuberculosis (TB), characterized by typical clinical symptoms. Notably, individuals with LTBI who are immunocompromised face a significantly higher risk of developing active infection during their lifetime.²⁹

Considering that *M. tuberculosis* can be isolated in humans only during the active phase of the disease, detecting LTBI relies solely on indirect immune response to antigenic challenge.³⁰

Diagnosing Latent Tuberculosis Infection:

The low bacterial burden in tissues, linked to LTBI undermines any diagnostic approach that aims to identify the bacteria or its constituent parts. LTBI is diagnosed indirectly, based on the presence of mycobacterial antigens that trigger the cellular immune system. The gold standard test for LTBI does not exist. For the diagnosis of LTBI, the intradermal tuberculin test (TST) and IGRA are the most often utilized tests.³¹

VON PIRQUET TEST:

The Von Pirquet test was one of the earliest tuberculin skin tests (TST) developed to detect latent or active tuberculosis (TB). This test, introduced in 1907 by Austrian paediatrician Clemens Von Pirquet, helped establish the concept of tuberculin hypersensitivity.³²

Method:³³

- Two variations of Koch's old tuberculin were used: a 25% diluted tuberculin solution (combined with carbolic acid and normal saline) and an undiluted tuberculin solution.
- A control solution (carbolic acid and normal saline without tuberculin) was applied to rule out non-specific reactions.
- Three separate areas on the forearm were superficially scarified (scratched), each approximately two inches apart. The skin was pricked or lightly scarified using a lancet to allow antigen penetration.
- After 48-72 hours, the site was examined for a delayed-type hypersensitivity (DTH) reaction, indicating prior TB exposure.

Interpretation:³⁴

- **Positive Reaction:** Red, raised, or ulcerated lesion, suggests prior exposure or TB infection.
- **Negative Reaction:** No reaction

Limitations:

- Low specificity due to the use of Old Tuberculin (OT), which contained impurities and cross-reactive antigens.
- Variability in skin absorption, leading to inconsistent results.

MORO PERCUTANEOUS TEST:

The Moro Percutaneous Test was a historical tuberculin skin test developed by Erich Moro in 1908 as an alternate method to the Von Pirquet test for diagnosing TBI. This test employed a simple percutaneous (through the skin) administration of tuberculin.³⁵

Method:

A small amount of Old Tuberculin (OT) was mixed with an ointment or petroleum jelly and rubbed onto the skin, typically on the abdomen or forearm. After 48-72 hours, the skin was examined for a delayed-type hypersensitivity (DTH) reaction.³⁶

Interpretation:³⁷

- **Positive Reaction:** Formation of papules, vesicles, or eczema-like lesions at the site.
- **Negative Reaction:** No visible skin changes.

Limitations:

- Lower sensitivity and specificity compared to the Mantoux test.
- Surface absorption was inconsistent, leading to false negative results.
- Replacement by intradermal tests (Mantoux test, Heaf test) by the mid-20th century.

SCARIFICATION TEST³⁸:

This method was derived from the Von Pirquet test (1907) and relied on creating small scratches (scarification) on the skin to introduce tuberculin.

Method:

A drop of Old Tuberculin (OT) or Purified Protein Derivative (PPD) was placed on the skin, usually on the forearm. The skin was superficially scratched or scarified using a sterile lancet or needle to facilitate tuberculin absorption. The test site was examined after 48-72 hours, for a delayed-type hypersensitivity (DTH) reaction.

Interpretation:

- **Positive Reaction:** A red, raised, or ulcerated lesion at the test site.
- **Negative Reaction:** No visible reaction.

Limitations:

- Less reliable as tuberculin absorption was inconsistent.
- Difficult to standardize, leading to variable interpretations of results.

- Potential risk of skin infections due to open scratches.

HEAF TEST:

The Heaf test is a tuberculin skin test that was developed in the 1950s and most commonly used in the United Kingdom as an alternative to the Mantoux test, primarily for use in mass screening programs. The test was phased out in the 2000s in favour of the Mantoux test and Interferon-Gamma Release Assays.³⁹

Method:

The test used a heaf gun, a spring-loaded device with six fine needles arranged in a circular pattern. PPD was applied to the skin, typically on the forearm and the heaf gun was pressed against the skin, creating small punctures to introduce the tuberculin. The test site was examined after 48-72 hours for any reaction.⁴⁰

Interpretation⁴¹:

- *Grade 0*: No reaction.
- *Grade 1*: Small punctate induration, borderline reactivity indicating a possible exposure.
- *Grade 2*: Discrete, raised papules suggests prior TB or BCG immunisation.
- *Grade 3*: Confluent papules are positive, indicating tuberculosis infection.
- *Grade 4*: Intense induration and ulceration indicates active tuberculosis.

Limitations:

- Less precise as results depended on the Heaf gun's calibration.
- Difficult to standardise, resulting in inconsistent results.
- Risk of cross-reactivity after BCG immunisation.

TUBERCULIN SKIN TEST (TST):

In tuberculin skin test, 0.1 ml of tuberculin-purified protein derivative (PPD) into the inner aspect of forearm using a tuberculin syringe with the needle bevel up. If done correctly, this intradermal injection creates a pale, raised wheal on the skin, measuring 6 to 10 mm in diameter.⁴²

PPD Derivatives⁴³ –

1. Old Tuberculin:

- Previously used but now replaced by PPD due to standardization and reliability.

2. PPD (Purified Protein Derivative):

- The most commonly used tuberculin.
- It is a standardized product derived from *M. tuberculosis* cultures, following the method described by Siebert.
- Known as PPD-S when referring specifically to the standardized version.

3. PPD-RT (Research Tuberculin) 23:

- Commonly used for research and diagnostic purposes.

Classification of tuberculin reaction⁴⁴:

CRITERIA FOR TUBERCULIN POSITIVITY, BY RISK GROUP

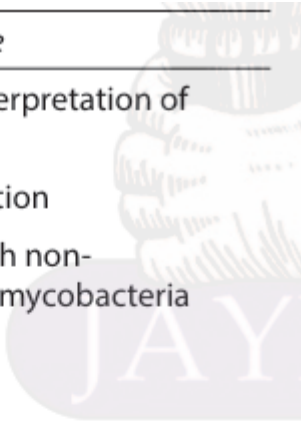
Reaction ≥ 5 mm of Induration	Reaction ≥ 10 mm of Induration	Reaction ≥ 15 mm of Induration
Human immunodeficiency virus (HIV)-positive persons	Recent immigrants (i.e., within the last 5 yr) from high prevalence countries	Persons with no risk factors for TB
Recent contacts of tuberculosis (TB) case patients	Injection drug users	
Fibrotic changes on chest radiograph consistent with prior TB	Residents and employees [†] of the following high-risk congregate settings: prisons and jails, nursing homes and other long-term facilities for the elderly, hospitals and other health care facilities, residential facilities for patients with acquired immunodeficiency syndrome (AIDS), and homeless shelters	
Patients with organ transplants and other immunosuppressed patients (receiving the equivalent of ≥ 15 mg/d of prednisone for 1 mo or more)*	Mycobacteriology laboratory personnel Persons with the following clinical conditions that place them at high risk: silicosis, diabetes mellitus, chronic renal failure, some hematologic disorders (e.g., leukemias and lymphomas), other specific malignancies (e.g., carcinoma of the head or neck and lung), weight loss of ≥ 10% of ideal body weight, gastrectomy, and jejunioileal bypass Children younger than 4 yr of age or infants, children, and adolescents exposed to adults at high-risk	

* Risk of TB in patients treated with corticosteroids increases with higher dose and longer duration.

[†]For persons who are otherwise at low risk and are tested at the start of employment, a reaction of ≥ 15 mm induration is considered positive.

Source: Adapted from Centers for Disease Control and Prevention. Screening for tuberculosis and tuberculosis infection in high-risk populations: recommendations of the Advisory Council for the Elimination of Tuberculosis. M.M.W.R. 1995;44(No. RR-11):19-34.

Figure-3: Classification of tuberculin reaction.⁴⁴

Causes of False-positive and False-negative TST⁴⁵:


<i>False-negative</i>	<i>False-positive</i>
Incorrect administration or interpretation of test	Incorrect interpretation of test
HIV infection	BCG vaccination
Improper storage of tuberculin	Infection with non-tuberculous mycobacteria
Viral infections (e.g., measles, varicella)	
Vaccinated with live viral vaccines (within 6 weeks)	
Malnutrition	
Bacterial infections (e.g. typhoid, leprosy, pertussis)	
Immunosuppressive medications (e.g. corticosteroids)	
Neonatal patient	
Primary immunodeficiencies	
Diseases of lymphoid tissue (e.g. Hodgkin disease, lymphoma, leukemia, sarcoidosis)	
Low protein states	
Severe TB	

Figure-4: Causes of false-positive and false-negative TST.⁴⁵**INTERFERON GAMMA RELEASE ASSAY (IGRA):**

The QuantiFERON-TB Gold In-Tube (QFT) assay (Cellestis/Qiagen, Carnegie, Australia) and the T-SPOT.TB assay (Oxford Immunotec, Abingdon, UK) are two commercially

available IGRAs.⁴⁶ Both tests are CE (Conformité Européenne) certified for use in Europe and have been approved by Health Canada and the U.S. Food and Drug Administration (FDA).⁴⁷

QUANTIFERON-TB GOLD IN-TUBE (QFT) ASSAY:

Peptides from the RD1 antigens ESAT-6 and CFP-10, as well as peptides from one other antigen (TB7.7 [Rv2654c], which is not an RD1 antigen but specific to *M. tuberculosis* complex), are used in the QFT assay, an enzyme-linked immunosorbent assay (ELISA)-based whole-blood test, in an in-tube format.⁴⁸ The addition of TB7.7 enhances the specificity of the QFT assay for detecting *Mycobacterium tuberculosis*.⁴⁹ These antigens activate T-cells that are specifically targeted against *M. tuberculosis*, leading to the release of interferon-gamma (IFN- γ) into the plasma, which is then quantified in international units (IU) per millilitre. Results are expressed quantitatively, providing flexibility for interpretation and monitoring.⁵⁰

The test is highly specific for *M. tuberculosis*, with minimal cross-reactivity to BCG or most NTMs and ideal for both high- and low-burden TB settings, especially for BCG-vaccinated populations.⁵¹

Interpretation of Results⁵² –

- **Positive Result:**
 - An IFN- γ response exceeding the defined cut-off, after adjustment for the negative control, is considered positive for TB antigens.
 - Indicates likely infection with *M. tuberculosis*.
- **Negative Result:**
 - An IFN- γ response to antigens against TB that falls below the cut-off or is similar to the negative control is considered negative.

- Suggests absence of infection or anergy (e.g., due to immunosuppression).
- **Indeterminate Result:**
 - An inadequate response in comparison to the positive control or an excessively elevated background response in the negative control indicates an indeterminate result.
 - Often due to technical issues, immunosuppression, or improper handling.

THE T-SPOT.TB ASSAY:

The T-SPOT.TB assay is a sophisticated diagnostic tool used to detect *Mycobacterium tuberculosis* infection. It belongs to the category of enzyme-linked immunospot (ELISPOT) assays and assesses the T-cell-mediated immune response.⁵³

Peripheral blood mononuclear cells (PBMCs) are isolated, counted, and then stimulated with *M. tuberculosis*-specific antigens, ESAT-6 and CFP-10.⁵⁴ The test measures the number of interferon-gamma (IFN- γ)-secreting T cells, reported as spot-forming cells (SFCs).⁵⁵

Interpretation of Results:

- **Positive Result:**
 - An individual is considered to have tuberculosis infection if the number of spots in the antigen wells exceeds the established threshold in comparison to the negative control wells.
- **Intermediate Result:**

Occur when:

- The positive control (mitogen) shows a low IFN- γ response, possibly indicating immunosuppression or insufficient cell viability.
- The negative control has a high background response, possibly reflecting non-specific activation or poor sample quality.

This assay provides a reliable tool for detecting latent or active tuberculosis infection but requires careful interpretation, particularly in cases of indeterminate results.

Preferred test	IGRA	TST	EITHER
Recommendation Indian ^[35]			HHCs >5 years of pulmonary TB patients after ruling out active disease; on immunosuppressants, anti-TNF alpha drugs, dialysis, silicosis patients, preparing for transplant
WHO ^[13]		Low- to middle-income countries with limited resources and a high TB burden, such as India, testing is recommended only in HIV and children <5 years of age. TST is preferred in view of the comparable performance and lower cost of TST	High- to upper-middle-income countries with a TB incidence of <100 per 100,000: HIV, contacts of active cases, patients on dialysis, antitumor necrosis factor (TNF) therapy, and immunosuppressed, patients with silicosis those living in close conditions include prisons and nursing homes
ATS, CDC, IDSA ^[36]	Low to intermediate risk of progression to active disease patients who are unlikely to return for TST read and a history of BCG vaccination		High risk of progression to active disease; A dual testing strategy can be performed, i.e., If one test comes negative, perform the other; any one of the positive tests is considered positive
NTCA ^[37]	Non-United States-born patients who had received BCG vaccination	For other individuals, depending on availability and cost, either a TST or IGRA may be used	Dual testing can be considered for patients who are at risk of severe forms of TB disease, and TB infection is strongly suspected and has a poor immune response

Figure – 5: Summary of guidelines for selecting between TST and IGRA.⁵⁶

SPUTUM COLLECTION:

Sputum specimens should be collected in clean, properly labeled containers. A commonly used container is a 50-ml screw-capped, plastic clear vessel, which ensures a tight

seal to prevent spillage or contamination. The transparency of the container will allow for visual assessment of the consistency and quality of the sputum sample. The container should be clearly labeled with the name of patient and the date of specimen collection. Once collected, specimen will have to be refrigerated at 2 to 8°C until it is sent to the laboratory for analysis.⁵⁷

American Centre for Disease Control and Prevention recommends collection of minimum of three consecutive samples, at around 8 to 24-hour intervals, and one sample being an early morning expectorate, is considered necessary for establishment of diagnosis.⁵⁸

SPUTUM FOR ACID-FAST BACILLI:

Acid-fast bacteria, also referred to as acid-fast bacilli (AFB), are a class of bacteria that share a physical characteristic known as "acid fastness" which allows a bacterium to withstand decolourisation by acids during staining.⁵⁹

Organisms demonstrating acid-fastness include⁵⁷:

- Mycobacterium species: including *M. leprae*, *M. tuberculosis*, and *Mycobacterium kansasii*, *M. smegmatis*, *Mycobacterium avium* complex.
- Nocardia species: including *N. brasiliensis*, *N. farcinica*, *N. cyriacigeorgica*, and *N. nova*.

Acid-fastness is also exhibited by various non-bacterial structures, which include⁵⁷:

- Bacterial endospores
- Spermatozoal heads
- Protozoan parasites such as *Cyclospora cayetanensis*, *Cryptosporidium parvum*, *Isospora belli*.

- Helminthic elements like eggs of *Taenia saginata* and hydatid cysts
- *Sarcocystis* species
- Inclusion bodies in the nucleus, particularly those associated with lead toxicity.

Sputum for AFB by immunofluorescence:

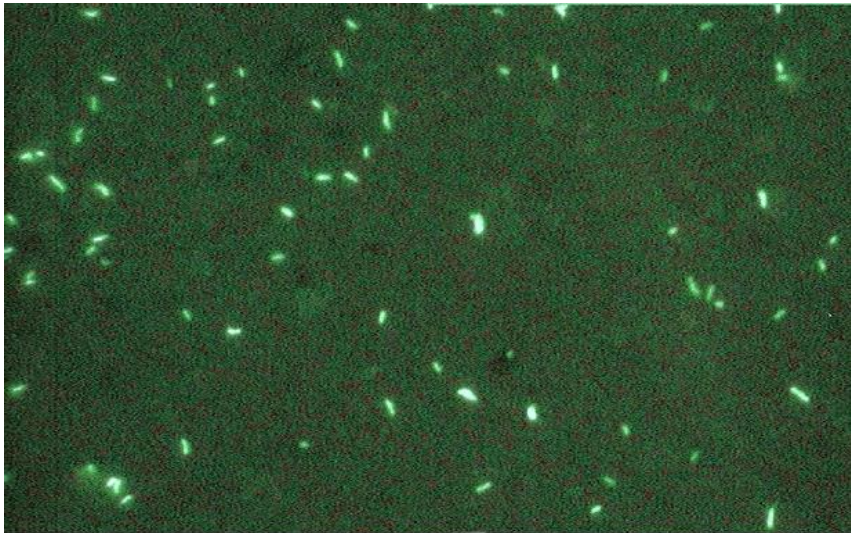


Figure-6: Microscopic Immunofluorescence image showing AFB.⁶⁰

Number of AFB seen	Result	Grading
More than 100 AFB per field in atleast 20 fields	Positive	3+
11–10 AFB per field in atleast 50 fields	Positive	2+
1–10 AFB per 100 fields	Positive	1+
1–3 AFB per 100 fields	Positive	Scanty
No AFB per 100 fields	Negative	-

Figure-7: Grading of immunofluorescence for AFB.⁶¹

Sputum for AFB by Ziehl-Neelsen staining:

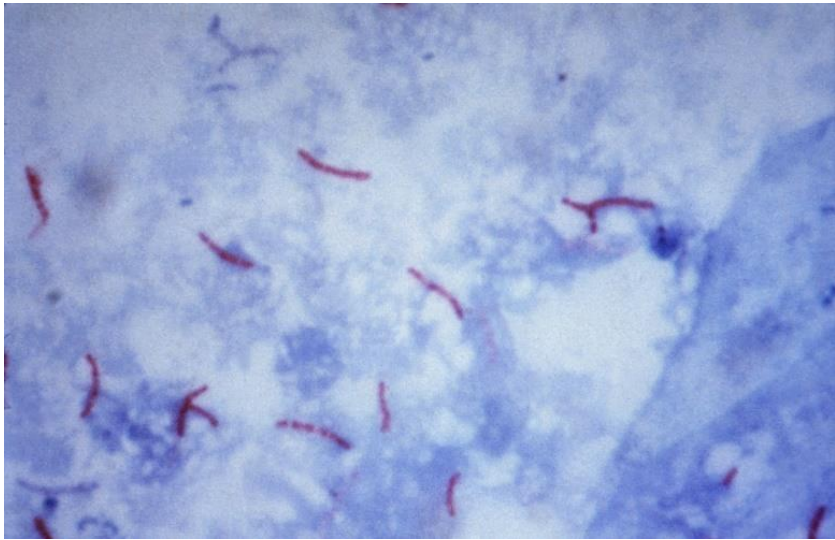


Figure-8: Microscopic image of Ziehl-Neelsen staining showing AFB.⁶²

NO. OF AFB	NO OF FIELD EXAMINED	REPORT
No AFB in 100 oil immersion fields	100	Negative
1-9 AFB per 100 oil immersion fields	100	scanty
10-99 AFB per 100 oil immersion fields	100	1+
1-10 AFB per oil immersion field	50	2+
>10 AFB per oil immersion field	20	3+

Figure-9: Grading of Ziehl-Neelsen staining for AFB.⁶³

HOUSEHOLD CONTACT:

A household contact refers to a person who, in the last three months prior to the start of the present treatment, has shared the indoor environment with the index case for minimum of one night or had frequent or extended interactions during daytime in that space.²

CONTACT INVESTIGATION:

Contact investigation is the process of systematically identifying previously undetected cases of active disease and TBI among those exposed to an index case, within settings where spread may have occurred, involves conducting clinical evaluations, testing, and administering the proper ATT (for individuals with confirmed disease) or TPT (for individuals without active disease).²

HIGH TUBERCULOSIS TRANSMISSION SETTING:

It describes an environment where the risk of TB transmission is increased, where undiagnosed or untreated TB cases are common, or where individuals with infectious TB are present. When TB patients are left untreated or receive insufficient treatment, they are most contagious. The presence of populations with increased vulnerability and activities that generate aerosols will boost transmission.²

TUBERCULOSIS PREVENTIVE THERAPY:

Preventive treatment aims to halt the development of active infection by targeting the latent *Mycobacterium tuberculosis* organisms that are sequestered in granulomas.⁶⁴

Usage of isoniazid for TB treatment began in the 1950s. In 1954, its potential as a

preventive therapy was first proposed. Subsequently, the initial trial assessing isoniazid's efficacy in preventing TB development among children was conducted.⁶⁵ The American Thoracic Society, by 1965 issued its inaugural expert recommendation, advocating for 12 to 18 months of isoniazid as preventive treatment for individuals with positive TST results and presence of certain risk factors, including history of exposure, age and pre-existing lung disease.⁶⁶

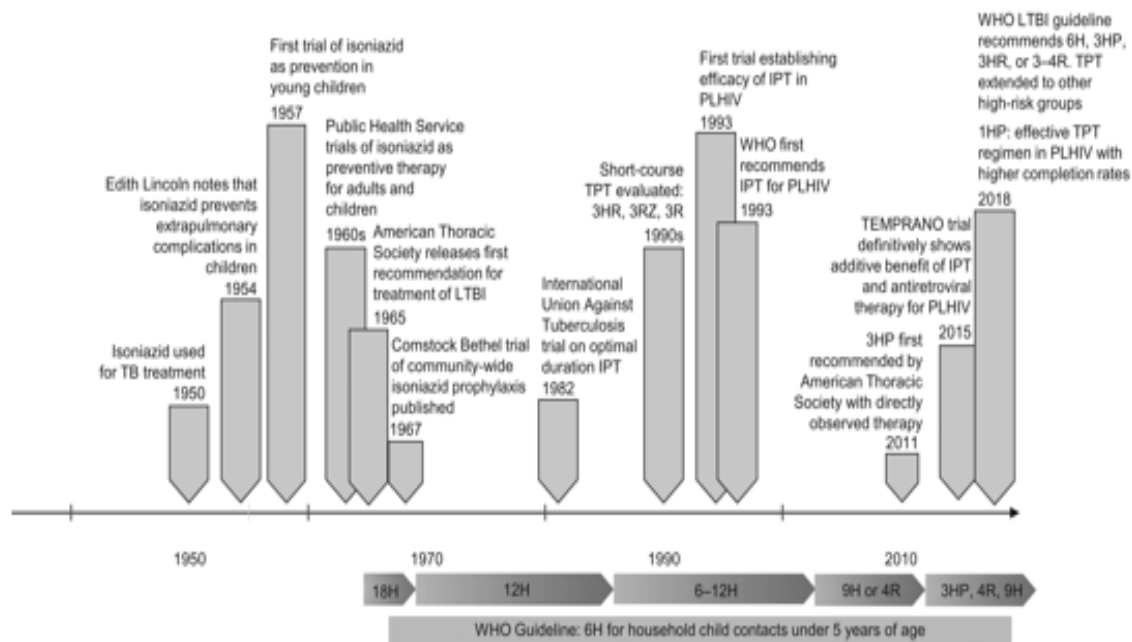


Figure – 10: Timeline of key milestones in the history of TPT.⁶⁴

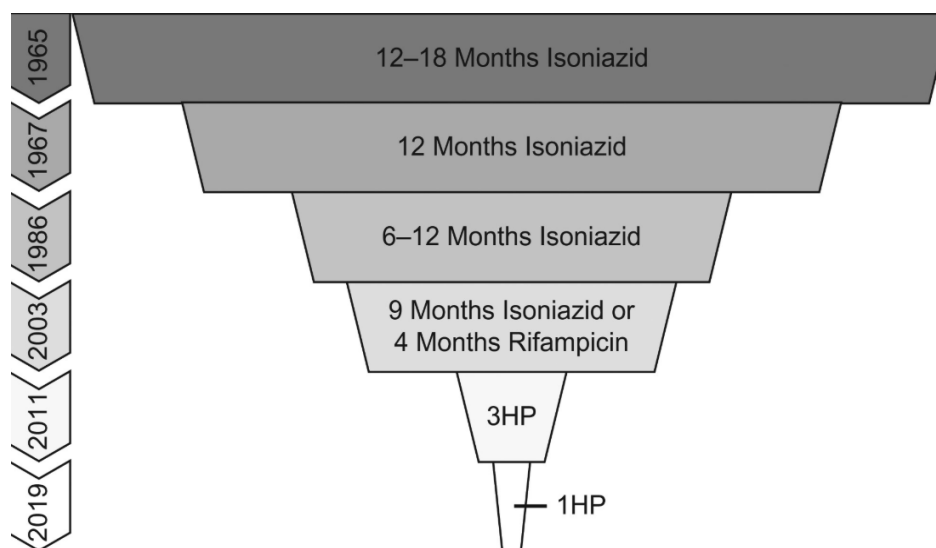


Figure-11: Evolution of the recommended duration for tuberculosis preventive therapy, as per the American Thoracic Society guidelines.⁶⁴

The End TB Strategy, by the World Health Organization targets a 90% decrease in tuberculosis incidence by 2030, compared to 2015.⁶⁷ India's tuberculosis elimination strategy sets an ambitious target of a 90% reduction in incidence of tuberculosis by 2025, necessitating a 10% annual decrease in cases for reaching this goal.⁶⁸ Achieving this would require coordinated efforts across all four pillars: prevention, early detection, effective treatment, and strengthening capacity.⁶⁹

Eliminating the reservoir of LTBI is essential for achieving elimination of tuberculosis. In 2015, the World Health Organization introduced the Programmatic Management of Tuberculosis Preventive Treatment (PMTPT) strategy, which encompasses a series of strategies: identifying target populations for testing and treatment, excluding active disease, testing for latent infection, administering preventive therapy, supervising treatment outcomes. Implementing these steps systematically is vital for reducing the incidence of active TB and moving towards global TB elimination goals.⁷⁰

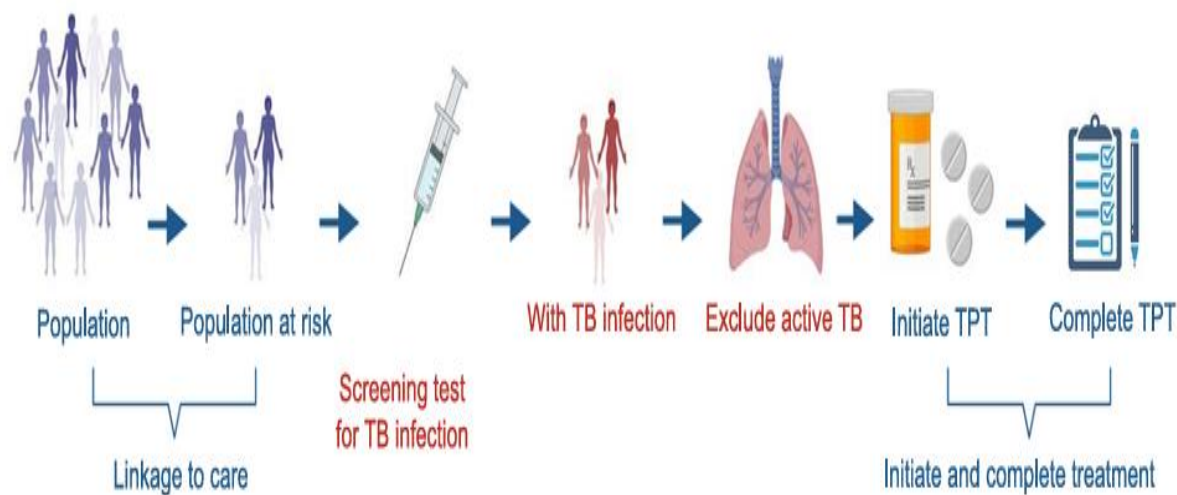


Figure - 12: The continuum of care in the structured management of LTBI.⁷¹

TARGET POPULATION FOR LTBI TESTING¹:

The purpose of testing is to detect population groups at elevated risk for developing active tuberculosis (TB) who would be benefitting from treatment of latent TB infection.

Target population	Strategy
• People living with HIV (+ ART) ▶ Adults and children >12 months ▶ Infants <12 months with HIV in contact with active TB • HHC below 5 years of pulmonary* TB patients	TPT to all after ruling out active TB disease
• HHC 5 years and above of pulmonary* TB patients#	TPT among TBI positive# after ruling out TB disease

#Chest X Ray (CXR) and TBI testing would be offered wherever available, but TPT must not be deferred in their absence

Figure - 13: Identification of populations eligible for latent tuberculosis infection (LTBI) screening.²

Target population	Strategy
Individuals who are: • on immunosuppressive therapy • having silicosis • on anti-TNF treatment • on dialysis • preparing for organ or hematologic transplantation	TPT after ruling out TB disease among TBI positive

Figure- 14: Risk groups targeted for latent tuberculosis infection screening.²

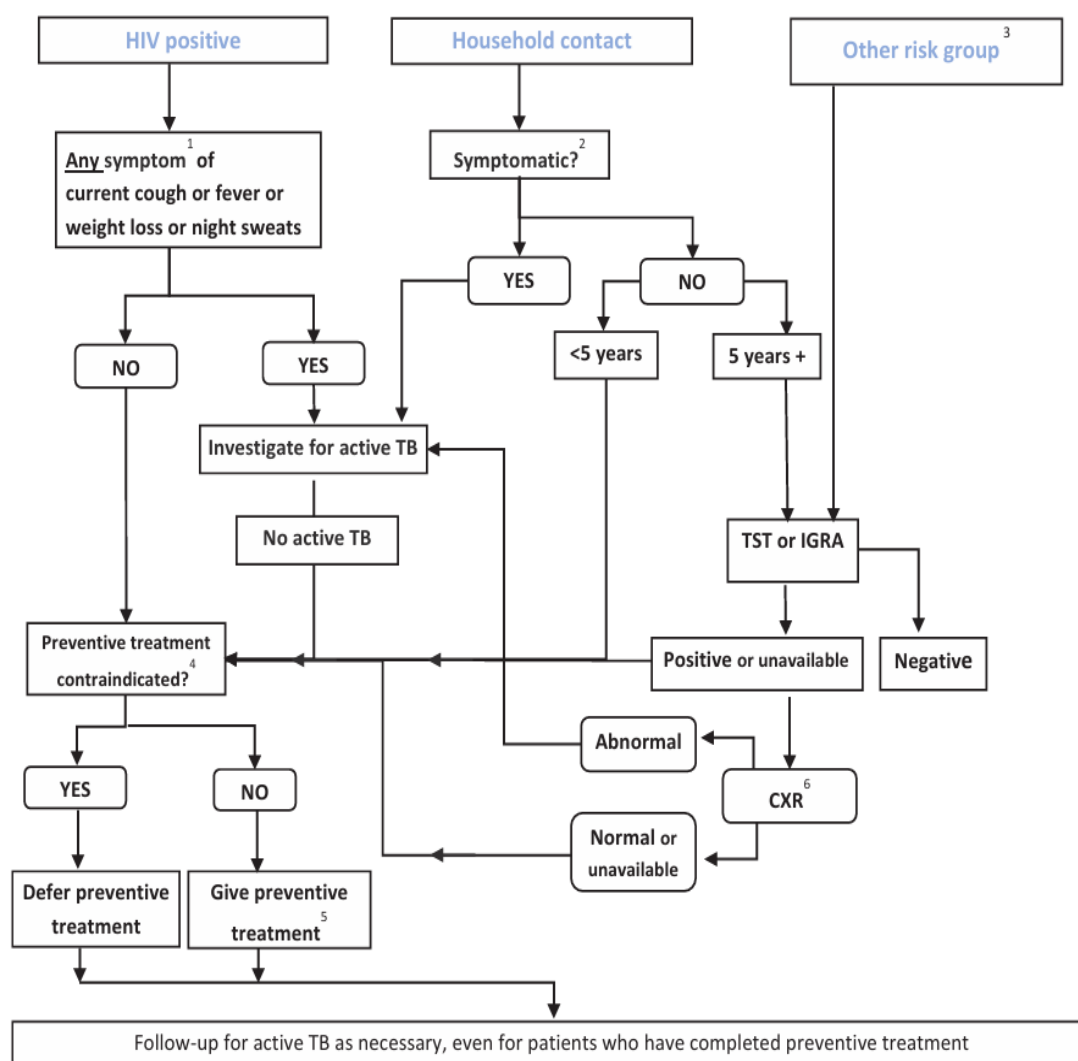


Figure –15: Flowchart for tuberculosis screening and preventive treatment in India.²

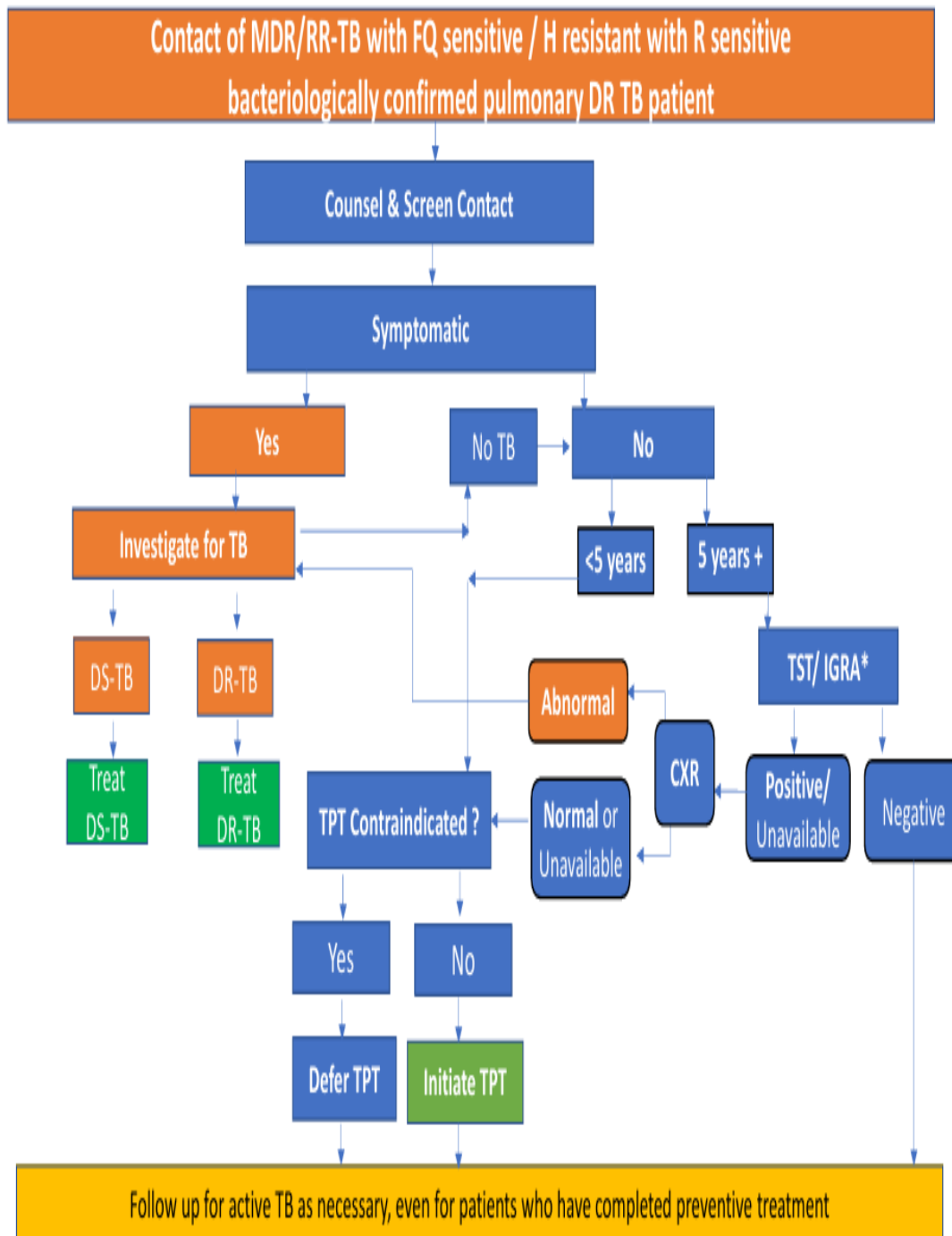


Figure – 16: Integrated algorithm for screening household contacts of DRTB.²

TPT TREATMENT REGIMEN²:

The proposed treatment guidelines for individuals with LTBI, regardless of HIV status of the individual, include:

- **Six months of daily isoniazid therapy (INH):** This traditional regimen has been widely used for LTBI treatment. The recommended dosing of isoniazid is 5 mg/kg in adult patients and 10 mg/kg for pediatric patients, not exceeding a maximum dose of 300 mg.
- **3-month regimen of once weekly isoniazid with rifapentine (3HP):** This shorter regimen has shown greater treatment completion rates and is effective irrespective of HIV-status.
- **4 months of daily rifampicin (4R):** An alternative regimen that is effective and associated with higher completion rates compared to longer isoniazid monotherapy.

According to WHO guidelines, contacts of active disease with known multidrug-resistant tuberculosis, who are fluoroquinolone sensitive should be given six months of levofloxacin, using a pediatric formulation for child contacts, provided it is well tolerated.

Contacts may receive 6H if RR-TB index patients have confirmed H susceptibility. Rifampicin is advised to be used for four months in contacts who have been exposed to people who have known H-resistant TB and are R sensitive.

Following initiation of Tuberculosis Preventive Treatment (TPT), it is essential to monitor individuals for both clinical symptoms and potential side effects to ensure treatment efficacy and safety. The following monitoring measures are recommended:

- **Clinical Assessment:**

- **Symptom Screening:** Regular evaluation for the presence of the “4S symptoms—cough, night sweats, fever and loss of weight”—which are indicative of active TB disease.
- **Side Effect Monitoring:** Observe and document any adverse reactions to the medication, such as hepatotoxicity or hypersensitivity reactions.
- **Emergence of TB Signs/Symptoms:** If new symptoms suggestive of TB develop during TPT, a comprehensive clinical assessment to be done to rule out active disease.

- **Laboratory Monitoring:**

- Prior to starting TPT, baseline tests, including complete blood counts and assessment of liver function, are to be carried out to assess for any pre-existing conditions that may influence treatment.
- Periodically laboratory tests to be repeated to detect potential drug-related toxicities, especially in individuals at higher risk for adverse effects.

Target population	Treatment option
- People living with HIV (adults and children >12 months) - Infants <12 months in contact with active TB - HHC below 5 years of pulmonary* TB patients	6-months daily isoniazid (6H) 3-month weekly Isoniazid and Rifapentine (3HP) in persons older than 2 years
HHC 5 years and above of pulmonary* TB patients (testing would be offered whenever available)	3-month weekly Isoniazid and Rifapentine (3HP) 6-months daily isoniazid (6H)
b. Other risk groups expansion	
Children/adult on immunosuppressive therapy, silicosis, anti-TNF treatment, dialysis, transplantation	3-month weekly Isoniazid and Rifapentine (3HP) 6-months daily isoniazid (6H)

Figure -17: Target population and TPT regimen options.²

Regimen	Dose by age and weight band					
6 months of daily isoniazid monotherapy (6H)	Age 10 years & older: 5 mg/kg/day ^d Age <10 years: 10 mg/kg/day (range, 7–15 mg)					
Three months of weekly rifapentine plus isoniazid (12 doses) (3HP)	Age 2–14 years^c					
	Medicine, formulation	10–15 kg	16–23 kg	24–30 kg	31–34 kg	>34 kg
	Isoniazid, 100 mg ^a	3	5	6	7	7
	Rifapentine, 150 mg	2	3	4	5	5
	Isoniazid + rifapentine FDC (150 mg/150 mg) ^b	2	3	4	5	5
	Age > 14 years^c					
	Medicine, formulation	30–35 kg	36–45 kg	46–55 kg	56–70 kg	>70 kg
	Isoniazid, 300 mg	3	3	3	3	3
	Rifapentine, 150 mg	6	6	6	6	6
	Isoniazid + rifapentine FDC (300 mg/300 mg) ^b	3	3	3	3	3

Figure -18: Regimen options for TB preventive therapy with recommended dosages of medicines.²

Regimen	Dose by age and weight band
Six months of daily levofloxacin (6Lfx) for contacts of R resistant FQ sensitive patients [#]	Age > 14 years, by body weight: < 45 kg, 750 mg/day; ≥ 45 kg, 1g/day Age < 15 years (range approx. 15–20 mg/kg/day), by body weight: 5–9 kg: 150 mg/day 10–15 kg: 200–300mg/day 16–23 kg: 300–400mg/day 24–34 kg: 500–750mg/day
Four months of rifampicin daily (4R) for contacts of H resistant R sensitive patients [*]	Age 10 years & older: 10 mg/kg/day[@] Age <10 years: 15 mg/kg/day (range, 10–20 mg)

Figure - 19: Recommended TPT regimens and dosages for contacts of DR-TB index cases.²

CONTRAINDICATIONS²:

1. **Active TB Disease:** Individuals with confirmed or suspected active TB should receive anti-tubercular therapy rather than preventive therapy.
2. **Severe Liver Disease:** Conditions such as acute hepatitis or cirrhosis with liver failure contraindicate TPT due to the hepatotoxic potential of medications like isoniazid and rifampicin.
3. **Known Drug Hypersensitivity:** A history of severe allergic reactions to components of the TPT regimen (e.g., isoniazid, rifampicin, rifapentine) precludes their use.

4. **Severe Peripheral Neuropathy:** Isoniazid can exacerbate neuropathy, making it unsuitable for those with significant peripheral nerve disorders (presence of symptoms like persistent tingling, numbness and burning sensation).
5. **Frequent and excessive consumption of alcohol.**

ISONIAZID:

Isoniazid, also referred to as, isonicotinic acid hydrazide (INH), a nicotinic acid derivative was the first antibiotics used to treat tuberculosis (TB).⁷² INH was first biosynthesized at the German University in Prague in 1912 by Hans Meyer and Josef Mally, but its antitubercular properties were not explored for decades.⁷³ In the early 1950s, researchers including Walsh McDermott, Irving Selikoff, and Edward Robitzek, Carl Muschenheim, systematically studied INH's effectiveness in tuberculosis patients.⁷⁴ Their work led to the widespread adoption of INH in standard TB regimens. By the late 1950s, INH became a cornerstone of tuberculosis treatment worldwide.⁷⁵

Isoniazid is effective against both intracellular and extracellular *Mycobacterium tuberculosis*. Its bactericidal activity is most pronounced during the bacterium's active replication phase. The minimum inhibitory concentration (MIC) for INH-susceptible MTB isolates is typically ranging from 0.03 to 0.125 µg/mL.⁷⁵

Mechanism of action:

Isoniazid (INH), acts as a pro-drug requiring activation by *Mycobacterium tuberculosis* enzyme catalase-peroxidase (KatG) to exert its bactericidal effect.⁷⁶ KatG functions

by catalyzing the isonicotinic acyl radical formation, subsequently coupling with NADH leading to formation of the nicotinoyl-NAD adduct. The adduct subsequently binds with high affinity to enoyl-acyl carrier protein reductase (InhA), obstructing the interaction between the natural enoyl-AcpM substrate and fatty acid synthase. This inhibition disrupts the biosynthesis of mycolic acids, crucial constituents of the mycobacterial cell wall, ultimately resulting in bacterial cell death.⁷⁷

Pharmacokinetics⁷⁸:

- **Absorption:** Following oral or intramuscular (IM) administration, INH is quickly and efficiently absorbed, attaining peak plasma levels within 1 to 2 hours. Absorption primarily occurs in the intestine, and the drug is transported to the liver via the portal system.
- **Distribution:** It distributes widely across all body tissues, including penetration into the cerebrospinal fluid (CSF). Plasma protein binding is low (10%–15%), allowing for efficient tissue distribution.
- **Metabolism:** INH undergoes hepatic inactivation via N-acetylation by N-acetyltransferase 2 (NAT2) in the liver and intestines. The acetylated metabolite, acetylhydrazine, is further oxidized by CYP2E1, producing hepatotoxic metabolites.
 - Individuals with rapid NAT2 metabolism may generate hepatotoxins more quickly, increasing the risk of INH-induced hepatotoxicity.

- Glutathione S-transferase (GST) plays a protective role by detoxifying hepatotoxic metabolites, converting them into water-soluble and less toxic compounds for excretion.
- **Elimination:** The majority (75%–95%) of INH and its metabolites are eliminated in urine, with smaller quantities being eliminated via faeces and saliva.

INH resistance is primarily due to *katG* and *inhA* genes mutations. The *katG* gene codes for a catalase-peroxidase enzyme essential for activating INH; mutations here can lead to high-level resistance. Conversely, alterations in *inhA* gene or its promoter region frequently lead to the development of resistance to INH (low-level). Evidence from studies have suggested that high-dose INH therapy (10–15 mg/kg daily) retains bactericidal activity against strains with *inhA* mutations, analogous to the standard 5 mg/kg dosage against drug-sensitive strains. However, high-dose INH lacks early bactericidal activity against strains with *katG* mutation.⁷⁶

Adverse Effects of Isoniazid (INH):

Isoniazid (INH) is usually well tolerated. Despite its efficacy, it is associated with both dose-dependent and idiosyncratic adverse effects, primarily affecting the liver, nervous system, and gastrointestinal tract.

1. Hepatotoxicity –

- Most serious and common adverse effect; can range from asymptomatic liver enzyme elevation to fulminant hepatitis.⁷⁹
- Risk factors: Older age group (>35 years), alcoholism, pre-existing liver disease, genetic polymorphisms (NAT2 slow acetylators).⁸⁰

2. Peripheral Neuropathy –

- Occurs due to pyridoxine (vitamin B6) depletion, leading to sensory nerve dysfunction.
There is a relative lack of biologically active pyridoxine as INH and pyridoxine combine to generate a hydrazone that is eliminated in the urine.⁸¹
- Symptoms: Numbness, tingling, burning sensations in hands and feet.⁸²
- Risk factors: Malnutrition, diabetes, alcohol use, pregnancy, HIV infection, and slow acetylators.⁸¹
- Prevention: Vitamin B6 supplementation (25–50 mg/day) is advised in high-risk population.⁸³

3. Neuropsychiatric Effects –

- Rare but serious effects include seizures, psychosis, depression, and suicidal ideation, likely related to GABA depletion due to pyridoxine deficiency.⁸⁴

4. Gastrointestinal Effects –

- Nausea, vomiting, epigastric pain, and diarrhoea are common but mild and self-limiting.⁷⁹

5. Hypersensitivity Reactions –

- Fever, rash, eosinophilia, and drug-induced lupus.⁸⁵
- Rare reactions: Stevens-Johnson syndrome (SJS) and toxic epidermal necrolysis (TEN).⁸⁶

6. Hematologic Effects –

- Aplastic anaemia, agranulocytosis, and thrombocytopenia.⁸⁵

7. Endocrine Effects –

- Gynecomastia and metabolic acidosis.⁸⁷

RIFAMPICIN:

Rifampicin (also referred to as rifampin), is a semi-synthetic, broad-spectrum antimicrobial, obtained from rifamycin B, being produced by *Amycolatopsis rifamycinica*.⁸⁴ It has potent bactericidal activity, especially against *Mycobacterium tuberculosis*, making it a cornerstone in tuberculosis (TB) treatment.⁸⁵ It is also used to treat leprosy, bacterial infections, and as a prophylactic agent for meningococcal and staphylococcal infections.⁸⁶

Mechanism of Action:

Rifampicin belongs to the rifamycin class of antibiotics and exerts its effect by inhibiting bacterial RNA synthesis. It binds to the beta subunit of bacterial DNA-dependent RNA polymerase, thereby obstructing transcription and ultimately causing bacterial cell death. This mechanism makes rifampicin a potent bactericidal agent against *Mycobacterium tuberculosis* as well as a range of Gram-positive and Gram-negative bacteria. It is effective against both actively dividing bacteria and those in a dormant state.⁸⁸

Pharmacokinetics:

- **Absorption:** It is rapidly absorbed into the blood stream from the gastrointestinal tract and bioavailability is reduced with food.⁸⁹
- **Distribution:** Wide distribution, including intracellular penetration. It crosses the blood-brain barrier.⁹⁰

- **Metabolism:** Primarily metabolized in the liver via deacetylation.⁹¹
- **Excretion:** Excreted mainly in bile (65%) and to some extent in urine.⁸⁸

Adverse Effects⁹²:

- Hepatotoxicity (risk increases with pre-existing liver disease)
- Occurrence of red-orange discoloration in bodily fluids, notably urine, sweat, and tears
- Gastrointestinal disturbances (nausea, vomiting, diarrhoea)
- Hypersensitivity reactions (rash, fever)
- Haematologic such as thrombocytopenia, haemolysis (rare)
- Renal – acute kidney injury

Drug Interactions⁹³:

Rifampicin is a strong inducer of cytochrome P450 enzymes (CYP3A4, CYP2C9), which affects the metabolism of several drugs, including:

- **Oral contraceptives** - Reduced effectiveness and increases risk of pregnancy.
- **Warfarin** - Increased clearance, reducing anticoagulation effects.
- **Protease inhibitors (HIV treatment)** - Reduced plasma concentrations.
- **Antiepileptic drugs (e.g., phenytoin, carbamazepine)** – Increased metabolism and decreased effectiveness.

- **Immunosuppressants (Cyclosporine, Tacrolimus)** – Reduced plasma levels, risk of rejection.

RIFAPENTINE:

Rifapentine is a rifamycin antibiotic that is structurally similar to rifampin, with a key difference being the substitution of a cyclopentyl group at the C-3 position. This modification improves its lipophilicity and extends its half-life, which makes it suitable for less frequent dosing.⁹⁴

Mechanism of Action:

Rifapentine targets the beta-subunit of bacterial RNA polymerase, effectively inhibiting RNA synthesis. This prevents transcription of genes of the bacteria, resulting in bacterial cell death.⁹⁵ It demonstrates antimicrobial effect against a diverse array of gram-positive and gram-negative pathogens, particularly *Mycobacterium tuberculosis*.⁹⁶

Pharmacokinetics:

- **Long half-life:** Rifapentine has a half-life of 13-14 hours, facilitating less frequent administration compared to rifampin. This contributes to its potential use in once-weekly regimens.⁹⁷
- **Absorption:** Well-absorbed orally, though it should be taken with food to enhance absorption.⁹⁸
- **Metabolism:** Metabolized in the liver, predominantly by the CYP450 enzyme system.⁹⁹

- **Drug interactions:** Rifapentine, like rifampin, induces the CYP450 enzymes, leading to potential interactions with other medications metabolized by these pathways (e.g., antiretrovirals, oral contraceptives).⁹⁹

Adverse Effects¹⁰⁰:

- Hepatotoxicity
- Orange discoloration of body fluids
- Gastrointestinal effects – nausea, vomiting.

BARRIERS FOR TPT:

Tuberculosis Preventive Treatment (TPT) is a critical strategy for minimizing the likelihood of latent infection progressing to active tuberculosis, especially within high-risk population, such as people living with HIV (PLHIV) and household members of tuberculosis patients. Despite its benefits, several barriers hinder the widespread implementation and uptake of TPT.

1. Limited Awareness and Knowledge:

- Many healthcare providers and at-risk populations lack sufficient awareness about TPT, its benefits, and eligibility criteria.⁶⁷
- Misconceptions and fear of TB drug side effects contribute to low adherence rates.¹⁰¹

2. Health System Challenges¹⁰²:

- Weak diagnostic and reporting systems hinder the identification of eligible individuals for TPT.
- Inadequate training for healthcare workers results in inconsistent prescription practices.
- Stockouts of TPT medications disrupt continuity of care, particularly in areas with low-resources.

3. Stigma and Fear of TB Association:

- Some individuals avoid TPT due to the stigma associated with TB, fearing discrimination in their communities.¹⁰³
- PLHIV may be reluctant to take TPT due to concerns about additional pill burden alongside antiretroviral therapy (ART).¹⁰²

4. Adverse Drug Reactions and Adherence Issues¹⁰⁴:

- Concerns about side effects (e.g., liver toxicity with isoniazid) deter patients from completing TPT regimens.
- Longer treatment regimens (e.g., isoniazid preventive therapy for 6-9 months) reduce adherence, though newer regimens like 3HP (rifapentine weekly-once dosing and isoniazid for 3 months) show promise.

5. Policy and Funding Gaps⁶⁷:

- Many high-burden TB countries lack strong national TPT policies and funding for implementation.

- Insufficient integration of TPT into primary healthcare systems limits access.

Recommendations to Overcome Barriers¹⁰⁵:

- Expanding access to shorter regimens (e.g., 3HP and 1HP) to improve adherence.
- Strengthening healthcare provider training to ensure proper TPT prescription and patient counselling.
- Addressing stigma through community education and advocacy programs.
- Ensuring continuous supply chains to prevent medication shortages.

OTHER SIMILAR STUDIES:

In a study done by Mary R. Reichler et al., to determine factors for development tuberculosis and the impact of prophylactic treatment in close contacts of individuals with tuberculosis, they concluded that treatment for latent TB infection was highly effective in preventing active infection as active infection developed in 49(9.8%) of 446 patient who did not receive prophylaxis compared to 1(0.2%) of 517 patient who completed the treatment.⁶

A study conducted by Dina Nair et al., among 683 HHCs of 280 index cases, 71(13%) patients had abnormal findings on chest x-ray and 70% of them had symptoms. 29 were diagnosed to have sputum smear positive TB among the contacts. They concluded that screening of HHCs is an efficient method to identify new cases among contacts.⁷

Karbito K et al., used the TST to detect latent tuberculosis infection in household contacts with active tuberculosis patients and concluded that there was a high incidence of latent tuberculosis infection in household members of active patients. Out of the 138 subjects selected from 241 family contacts of 112 active cases, 88 subjects were found to have latent tuberculosis

infection based on TST.⁸

A study was conducted by Yuvaraj et al., to evaluate the burden and factors influencing latent tuberculosis infection in household contacts of individuals with active tuberculosis. They included 1523 household contacts, out of which 801(52.6%) had latent tuberculosis infection and 6(0.4%) developed active tuberculosis infection in the follow up period of 1 year. 4 out of these 6 individuals had latent tuberculosis infection during baseline evaluation.⁹

Adam Cohen et al., undertook a study to estimate the global distribution of latent tuberculosis infection based on both interferon-gamma release assays (IGRA) and tuberculin skin test. A total of 3280 subjects were screened from 36 countries and the global prevalence was found to be 24.8 % and 21.2%, based on IGRA and 10mm TST cut-off respectively. It was concluded that the estimated prevalence correlated well with the WHO incidence rates.¹⁰

A study conducted by Rajpal S. Kashyap et al. aimed to evaluate the diagnostic utility of QuantiFERON TB Gold and the tuberculin skin test for detecting latent tuberculosis infection in the high tuberculosis endemic region of Nagpur, India. The study estimated a prevalence of 42% with TST and 48% with QFT-G and an overall prevalence of around 69%. The study concluded a presence of greater number of latent tuberculosis infection in high TB endemic areas.¹¹

A retrospective study comprising of 278 HHCs of 27 pulmonary tuberculosis cases was conducted in Oman, a country with low tuberculosis incidence, by Jeffrey Singh et al., to identify the number of individuals with latent tuberculosis infection and to compare the rates of infection based on exposure characteristics. Latent tuberculosis infection was detected in 22.8% of people exposed to active cases and they received counselling and given the option of

chemoprophylaxis following national treatment protocols.¹²

A study conducted by Kavindhran Velen et al., aimed at estimating the prevalence of LTBI among HHCs of TB patients and to evaluate the efficacy of contact investigation in contrast to passive case detection methods. The study found that contact investigation played a crucial role in enhancing TB case detection and notification, leading to a decrease in mortality rates and a reduction in the prevalence of TB within the population. Among contacts, the combined prevalence of LTBI was 42.4%.¹³

In another cross-sectional study done by Aneliese Domingues Wysocki et al., for diagnosis and treatment of tuberculosis infection among 336 contacts; 140 were symptomatic, 9 had active infection and 106 (48%) had positive tuberculin skin test result. 64 patients were started on treatment for latent tuberculosis infection. They concluded that contact investigation is required for TB control.¹⁴

Kyaw Ko Ko Htet et al., in their study conducted in Myanmar, observed that 14(12.2%) patients had active TB infection and 10 patients presented with clinical features suggestive of TB with an abnormal chest radiograph, among the 115 contacts. They concluded that an integrated approach is required for TB contact tracing using Chest x-ray, sputum microscopy and Gene Xpert which resulted in a high rate of TB identification among exposed.¹⁵

Mary R Reichler et al., conducted a study to assess the risks and time frame for development tuberculosis in contacts of patients with active infection. Of the 4490 contacts, 158 developed tuberculosis in 5 consecutive years following the diagnosis of index patient. They concluded that close contacts to active tuberculosis patients have higher risk of developing infection within 3 months and hence contact screening is required to detect and treat latent infection and prevent the disease.¹⁶

MATERIALS AND METHODS

SOURCE OF DATA:

This prospective study was carried out in the Department of Respiratory Medicine, Shri B. M. Patil Medical College, Hospital and Research Centre, BLDE (Deemed to be) University, Vijayapura, Karnataka, from April 2023 to January 2025 on 264 household contacts of active tuberculosis patients attending the out-patient and in-patient department. This study was conducted after receiving approval from the Institutional Ethical Committee. The procedure of the study was explained to all participants and written informed consent was taken prior to enrollment.

METHOD OF COLLECTION OF DATA:

Study design: Cross-sectional study.

Study Period: Twenty-two months.

Sample size:

With the anticipated Proportion of latent tuberculosis infection 22.8% ¹², the study would require a sample size of 264 patients with 95% level of confidence and 5% absolute precision.

Formula used:

$$n = \frac{z^2 p * q}{d^2}$$

Where Z= Z statistic at α level of significance

d^2 = Absolute error

P= Proportion rate

$$q = 100 - p$$

Statistical Analysis:

Data entry was performed using Microsoft Excel 2019, followed by analysis with SPSS version 20. Descriptive statistics summarized sociodemographic and clinical variables. For continuous data, results are presented as mean $\pm$ SD or median (IQR), while categorical data are represented as frequencies and percentages. Appropriate statistical tests were used based on data type. Variables with $p < 0.05$ were considered significant.

INCLUSION CRITERIA:

- All contacts of TB patients more than 5 years of age.
- Individuals ready to give informed consent for inclusion in the study.

EXCLUSION CRITERIA:

- Patients already diagnosed as having tuberculosis.
- Those already on chemoprophylaxis for tuberculosis.
- Pregnant and lactating women.
- Children less than 5 years of age.
- Individuals not willing to take part in the study or to give informed consent for the study.

METHODOLOGY:

All household contacts of pulmonary tuberculosis and extrapulmonary tuberculosis with history of exposure to individuals with active tuberculosis, attending the outpatient and in-patient department at Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura, from April 2023 to January 2025, were enrolled in the study. Data were collected using a structured questionnaire, which comprised demographic details, contact history, and relevant personal history (e.g., smoking, alcohol use, comorbidities).

All participants underwent the following investigations:

- Chest X-ray (posteroanterior view)
- Tuberculin Skin Test: The Mantoux test was administered using 0.1 mL (5 TU) of purified protein derivative injected intradermally on the volar aspect of the forearm. The test result was read after 48 to 72 hours. An induration of ≥ 10 mm was considered positive.
- Sputum examination for AFB: An early morning sample of sputum (3–10 mL) was collected from each participant under proper sterile conditions. The specimen was subjected to smear microscopy using either Auramine-O fluorescent staining or ZN staining. For Auramine-O staining, smears were examined under a fluorescent microscope, whereas Ziehl-Neelsen-stained smears were examined under light microscopy using oil immersion fields. The presence of acid-fast bacilli was recorded and graded according to standard guidelines provided by the Revised National Tuberculosis Control Programme (RNTCP)/National TB Elimination Programme (NTEP).

Diagnostic Categorization:

- Active Tuberculosis: Participants with positive sputum smear microscopy for AFB were diagnosed with active TB and started on standard anti-tubercular therapy in accordance with national guidelines.
- Latent Tuberculosis Infection (LTBI): Participants who tested positive for TST but had negative sputum AFB were diagnosed with LTBI. These individuals were offered TB preventive therapy (TPT), and their willingness to initiate treatment was recorded.
- No Evidence of TB Infection: Participants with negative results on all three tests (TST, sputum AFB, and chest X-ray) were considered uninfected but were still offered TPT. Their willingness to initiate treatment was similarly documented.

Assessment of TPT Uptake and Adherence:

For all participants eligible for TPT, willingness to accept therapy was assessed. Among those who declined treatment, the reasons for unwillingness were recorded. In participants who initiated TPT, treatment completion rates were monitored and documented.

RESULTS

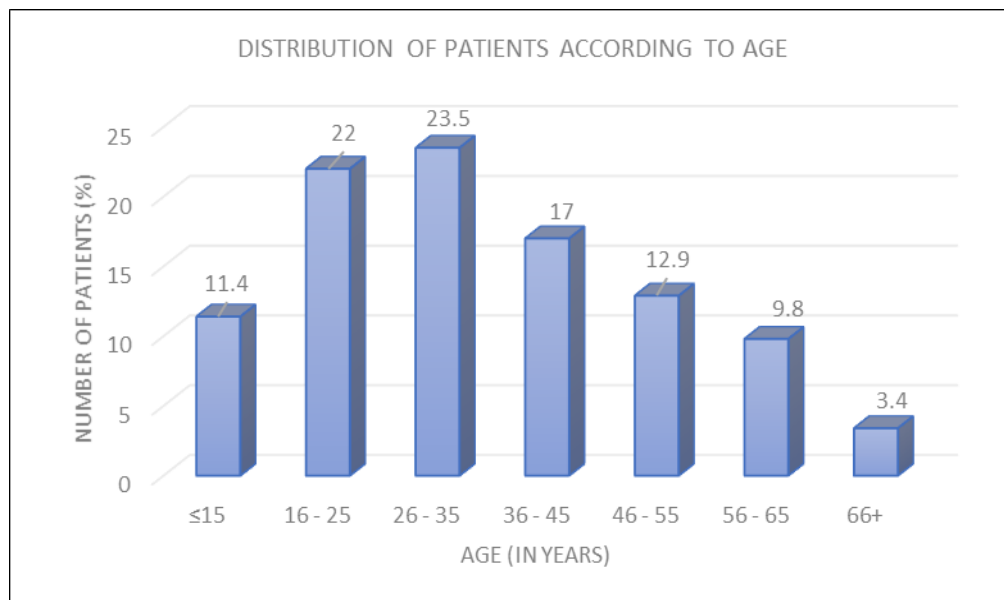
Distribution of patients according to age:

The distribution of patients according to different age groups is depicted in graph-1, with majority of patients being in the age group of 16-35 years. The mean age was 34.55 ± 16.45 .

Table-1: Distribution of patients according to age

Age (in years)	Number of patients	Percentage (%)
≤15	30	11.4
16 – 25	58	22.0
26 – 35	62	23.5
36 – 45	45	17.0
46 – 55	34	12.9
56 – 65	26	9.8
66+	9	3.4
Total	264	100.0

Graph-1: Distribution of patients according to age



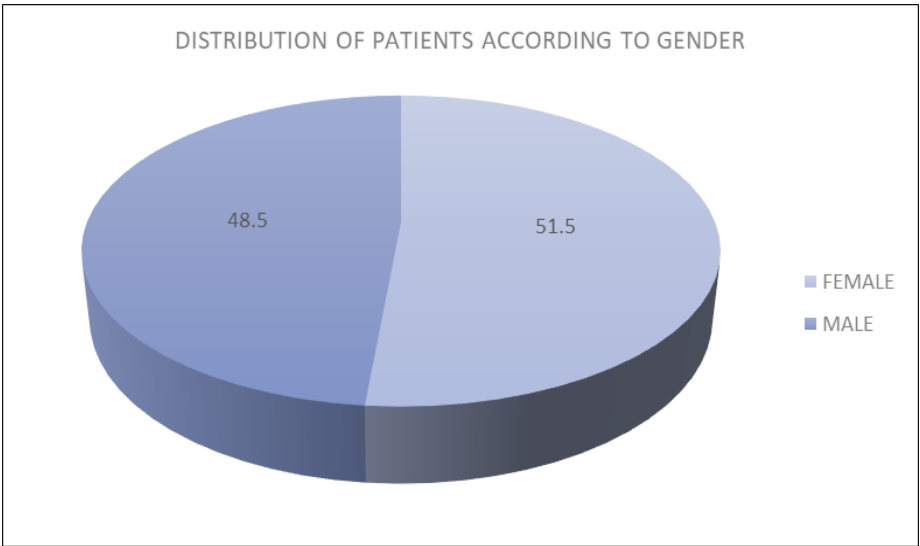
Distribution of patients according to gender:

It was observed that the gender inclination was slightly towards females, constituting 51.5% of study population (136 in number), while 48.5% of patients were males (128 in number), as represented in Graph-2.

Table-2: Distribution of patients according to gender

Gender	Number of patients	Percentage (%)
Female	136	51.5
Male	128	48.5
Total	264	100.0

Graph-2: Distribution of patients according to gender



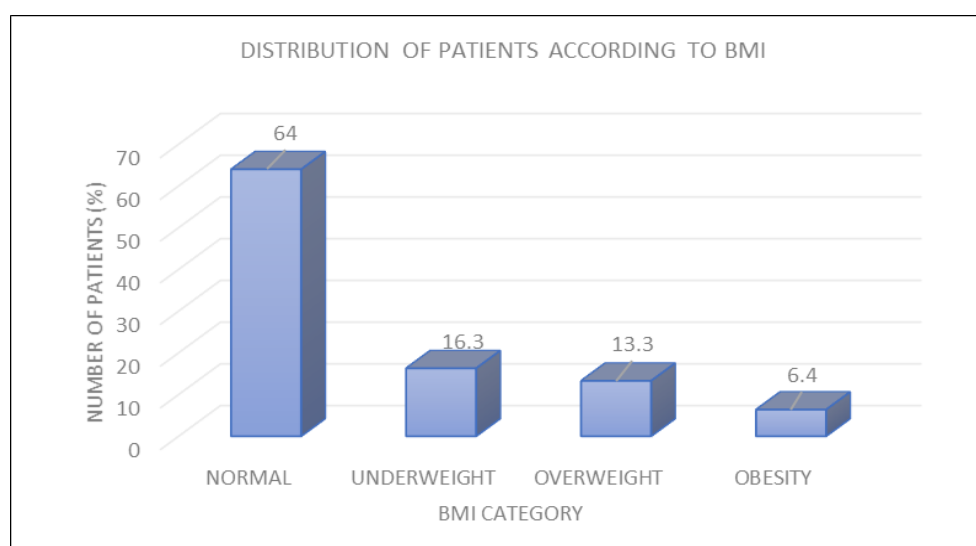
Distribution of patients according to BMI:

Of the 264 patients, 64% were of ideal body weight (169 in number), whereas 16.3% (43 patients) were underweight. 35 (13.3%) and 13 (6.4%) patients belonged to the overweight and obese category respectively. The mean body mass of index of the study population was 22.29 ± 4.16 .

Table-3: Distribution of patients according to BMI

BMI category	Number of patients	Percentage (%)
Normal	169	64.0
Underweight	43	16.3
Overweight	35	13.3
Obesity	17	6.4
Total	264	100.0

Graph-3: Distribution of patients according to BMI



Distribution of patients based on comorbidities:

The distribution of patients based on comorbidities is represented in Graph-4. Diabetes mellitus (8.7%) was the most common comorbidity observed.

Table-4: Distribution of patients based on comorbidities

Comorbidities	Number of patients	Percentage (%)
Diabetes	23	8.7
Diabetes and hypertension	7	2.7
Hypertension	20	7.6
Hypothyroidism	6	2.3
None	208	78.8
Total	264	100.0

Graph-4: Distribution of patients based on comorbidities

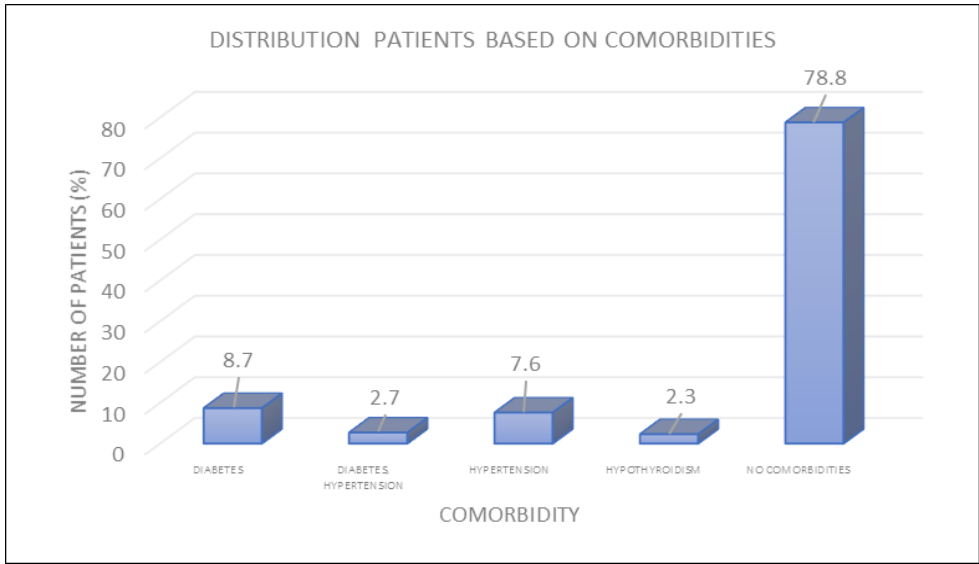


Table-5: Distribution of patients based on diabetes mellitus and its association with LTBI

			Diagnosis		Total	Chi-square Value	p-value
			LTBI	Normal			
Diabetes Mellitus	Yes	Number of patients	9	21	30	4.559	0.032*
		Percentage	30.0%	70.0%	100.0%		
	No	Number of patients	34	198	232		
		Percentage	14.7%	85.3%	100.0%		
Total		Number of patients	43	219	262		
		Percentage	16.4%	83.6%	100.0%		
*Statistically significant							

Table-6: Distribution of patients based on hypertension and its association with LTBI

			Diagnosis		Total	Chi-square Value	p-value
			LTBI	Normal			
Alcohol Use	Yes	Number of patients	5	22	27	0.097	0.755
		Percentage	18.5%	81.5%	100.0%		
	No	Number of patients	38	197	235		
		Percentage	16.2%	83.8%	100.0%		
Total		Number of patients	43	219	262		
		Percentage	16.4%	83.6%	100.0%		
Statistically not significant							

Distribution of patients based on smoking habits:

The distribution of smoking habits among the study population is depicted in Graph-5.

Table-7: Distribution of patients based on smoking habits

Smoking habits	Number of patients	Percentage (%)
None	191	72.3
Smoker	35	13.3
Smoker, tobacco chewer	9	3.4
Tobacco chewer	29	11.0
Total	264	100.0

Graph-5: Distribution of patients based on smoking habits

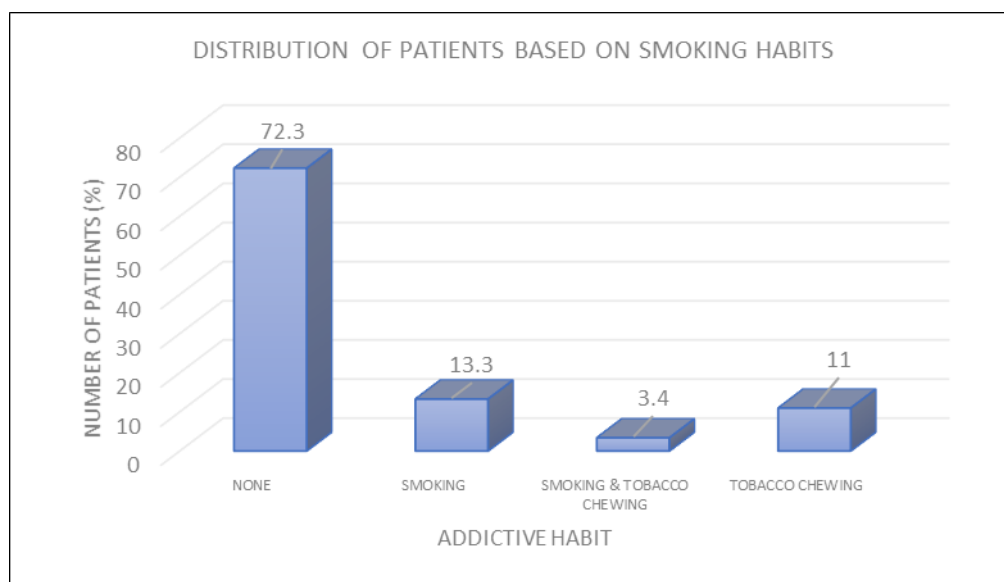


Table-8: Distribution of patients based on tobacco use and its association with LTBI

			Diagnosis		Total	Chi-square Value	p-value
			LTBI	Normal			
Tobacco Use	Yes	Number of patients	11	62	73	0.461	0.497
		Percentage	15.1%	84.9%	100.0%		
	No	Number of patients	32	157	189		
		Percentage	16.9%	83.1%	100.0%		
Total		Number of patients	43	219	262		
		Percentage	16.4%	83.6%	100.0%		
Statistically not significant							

Distribution of patients based on alcoholism:

Out of the 264 patients enrolled in the study, 39 patients (14.8%) had history of alcohol consumption while 85.2% were non-alcoholics, the distribution depicted in Graph-6.

Table-9: Distribution of patients based on alcohol use

Alcohol use	Number of patients	Percentage (%)
Present	39	14.8
No	225	85.2
Total	264	100.0

Graph-6: Distribution of patients based on alcohol use

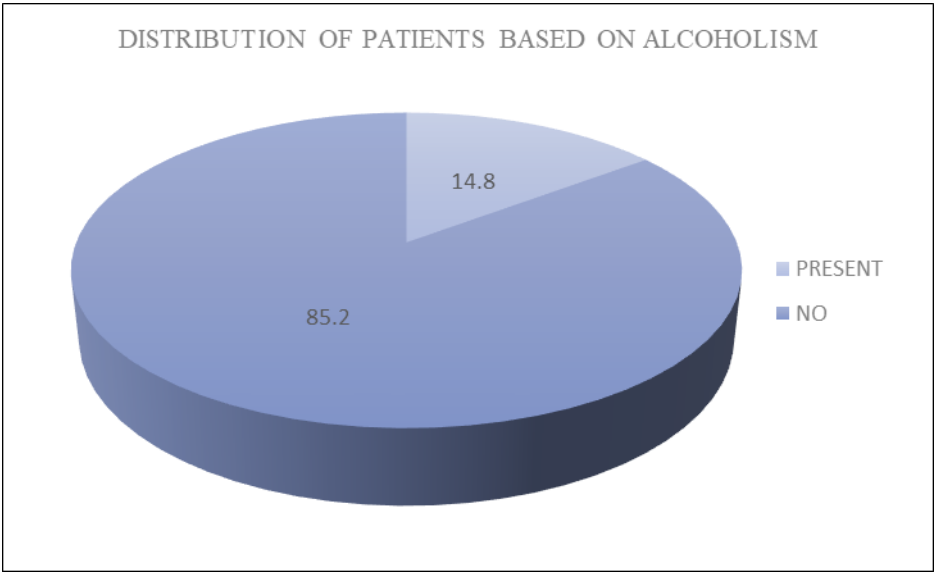


Table-10: Distribution of patients based on alcohol use and its association with LTBI

			Diagnosis		Total	Chi-square Value	p-value
			LTBI	Normal			
Alcohol Use	Yes	Number of patients	7	32	39	0.343	0.558
		Percentage	17.9%	82.1%	100.0%		
	No	Number of patients	36	187	223		
		Percentage	16.1%	83.9%	100.0%		
Total		Number of patients	43	219	262		
		Percentage	16.4%	83.6%	100.0%		
Statistically not significant							

Distribution of patients based on chest radiograph findings:

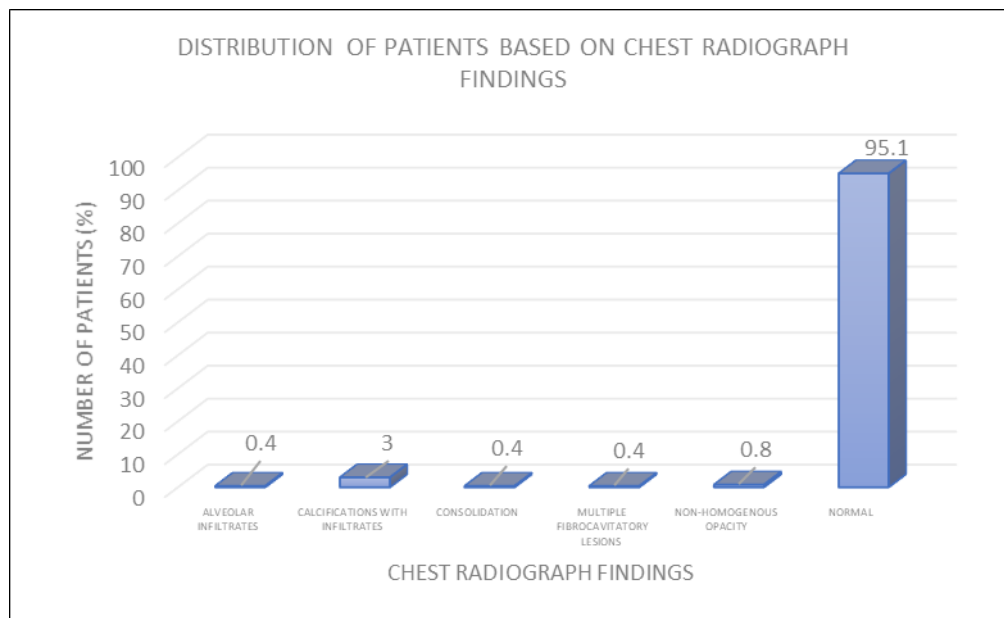
Majority of patients (95.1%) had normal chest radiograph. Among the 13 patients with abnormalities on chest radiograph, maximum number of patients (3.0%) had calcifications with

infiltrates, the distribution of patients based on chest radiograph findings is depicted in Graph-7.

Table-11: Distribution of patients based on chest radiograph findings

Chest radiograph findings	Number of patients	Percentage (%)
Alveolar infiltrates	1	0.4
Calcifications with infiltrates	8	3.0
Consolidation	1	0.4
Multiple fibrocavitatory lesions	1	0.4
Non-homogenous opacity	2	0.8
Normal	251	95.1
Total	264	100.0

Graph-7: Distribution of patients based on chest radiograph findings



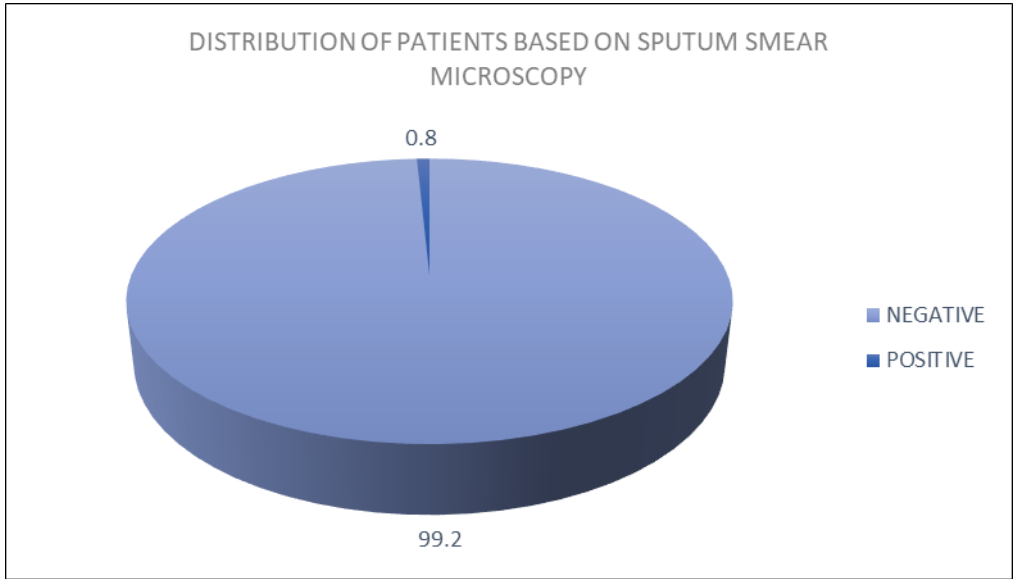
Distribution of patients based on sputum smear microscopy:

Sputum smear microscopy positivity for acid fast bacilli was observed in 2 patients (0.8%), the distribution is represented in Graph-8.

Table-12: Distribution of patients based on sputum smear microscopy

Sputum smear microscopy	Number of patients	Percentage (%)
Negative	262	99.2
Positive	2	0.8
Total	264	100.0

Graph-8: Distribution of patients based on sputum smear microscopy



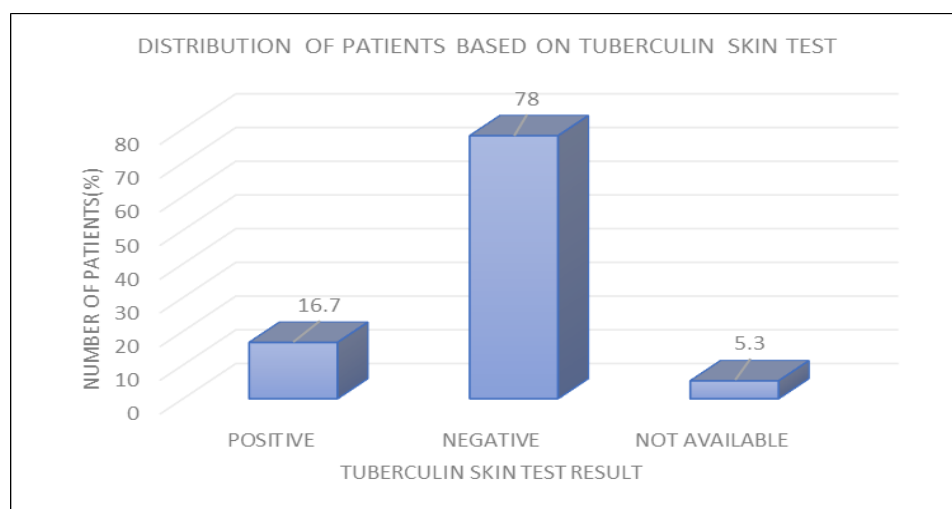
Distribution of patients based on tuberculin skin test:

Tuberculin skin test was positive in 16.7% of the contacts, and was negative in 78.0%.

Distribution of contacts with respect to tuberculin skin test is shown in Graph-9.

Table-13: Distribution of patients based on tuberculin skin test

Tuberculin skin test	Number of patients	Percentage (%)
Positive	44	16.7
Negative	206	78.0
Not available	14	5.3
Total	264	100.0

Graph-9: Distribution of patients based on tuberculin skin test

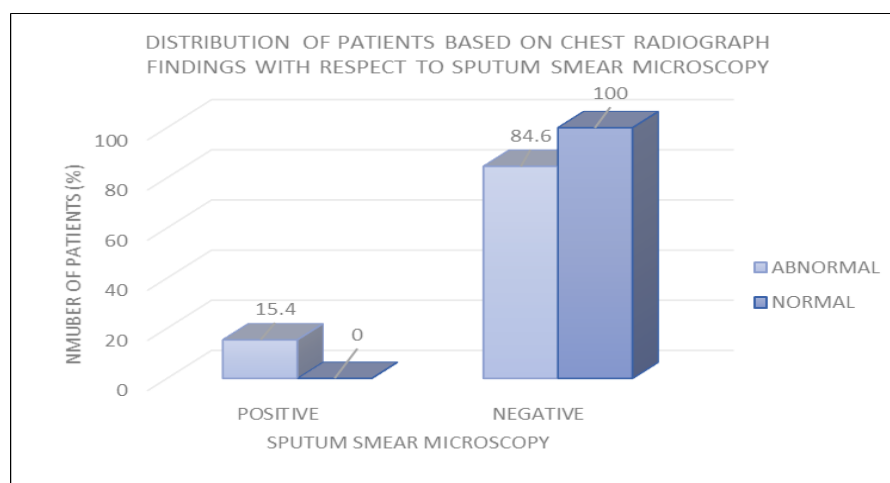
Distribution of patients based on chest radiograph findings with respect to sputum smear microscopy

Sputum smear microscopy was positive in 15.4% and negative in 84.6% contacts with abnormal chest radiograph findings, as depicted in Graph-10. There was a statistically significant association between sputum smear microscopy and chest radiograph findings ($p < 0.05$) (Table-14).

Table-14: Distribution of patients based on chest radiograph findings with respect to sputum smear microscopy

			Sputum Microscopy		Total	Chi-square Value	p-value
			Positive	Negative			
Chest X-ray	Abnormal	Number of patients	2	11	13	197.539	0.000*
		Percentage	15.4%	84.6%	100.0%		
	Normal	Number of patients	0	251	251		
		Percentage	0.0%	100.0%	100.0%		
		Total	Number of patients	2	262		
Percentage	0.8%		99.2%	100.0%			
*Statistically significant							

Graph-10: Distribution of patients based on chest radiograph findings with respect to sputum smear microscopy



Distribution of patients based on chest radiograph findings with respect to tuberculin skin test

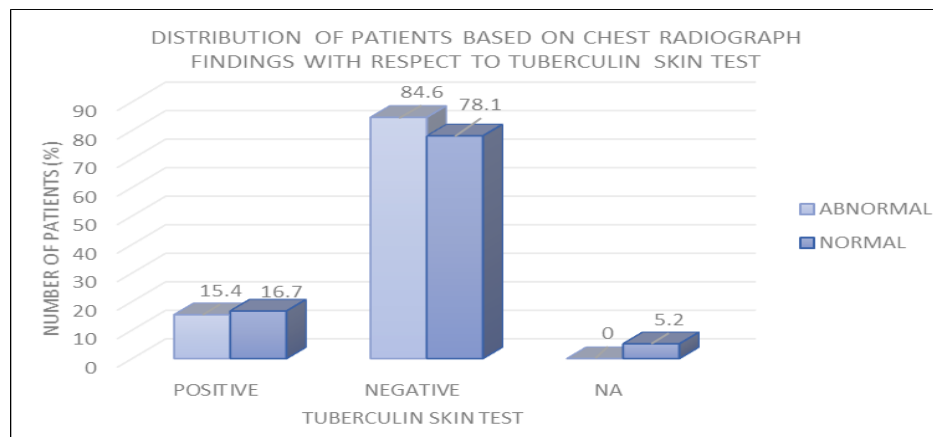
Out of the 13 household contacts with abnormal chest radiograph findings, 2 patients (15.4%) had positive tuberculin skin test while 84.6% had negative results, the distribution depicted in

Graph-11. The association was not statistically significant ($p>0.05$) (Table-15).

Table-15: Distribution of patients based on chest radiograph findings with respect to tuberculin skin test

			Tuberculin skin test			Total	Chi-square Value	p-value
			Positive	Negative	NA			
Chest X-ray	Abnormal	Number of patients	2	11	0	13	13.066	0.220*
		Percentage	15.4%	84.6%	0.0%	100.0%		
	Normal	Number of patients	42	196	13	251		
		Percentage	16.7%	78.1%	5.2%	100.0%		
	Total	Number of patients	44	207	13	264		
		Percentage	16.7%	78.4%	4.9%	100.0%		
*Statistically not significant								

Graph-11: Distribution of patients based on chest radiograph findings with respect to tuberculin skin test



Distribution of patients based on diagnosis:

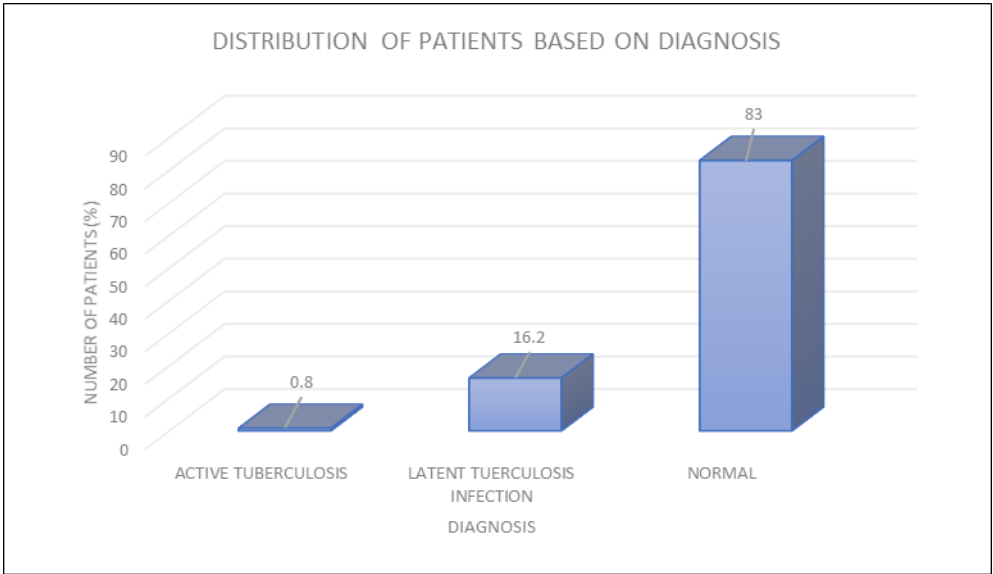
Maximum number of patients were normal (83.0%), with negative tuberculin skin test and sputum smear microscopy. Active tuberculosis and latent tuberculosis infection were diagnosed in 0.8% and 16.2% of the contacts respectively. The distribution of cases according to diagnosis

is represented in Graph-12.

Table-16: Distribution of patients based on diagnosis

Contact diagnosis	Number of patients	Percentage (%)
Active tuberculosis	2	0.8
Latent tuberculosis infection	43	16.2
Normal	219	83.0
Total	264	100.0

Graph-12: Distribution of patients based on diagnosis

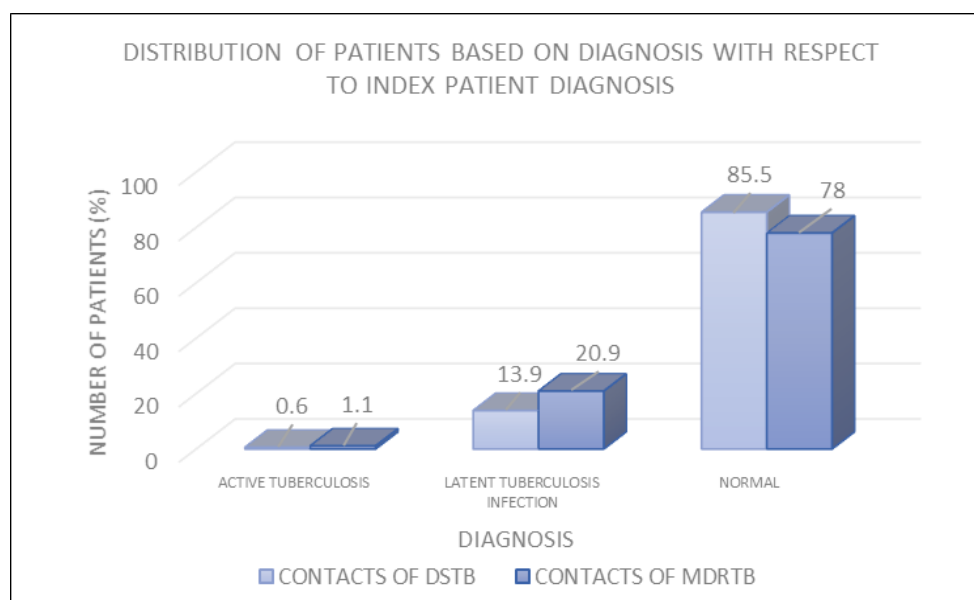


Distribution of patients based on diagnosis with respect to index patient diagnosis:

The distribution of cases based of diagnosis with respect to diagnosis of index case is represented in Graph-13. The association was found to be not statistically significant ($p>0.05$) as depicted in Table-17.

Table-17: Distribution of patients based on diagnosis with respect to index patient diagnosis

			Diagnosis			Total	Chi-square value	p-value
			Active TB	LTBI	Normal			
Index Patient Diagnosis	DSTB	Number of patients	1	24	148	173	2.418	0.298*
		Percentage	0.6%	13.9%	85.5%	100.0%		
	MDRTB	Number of patients	1	19	71	91		
		Percentage	1.1%	20.9%	78.0%	100.0%		
Total		Number of patients	2	43	219	264		
		Percentage	0.8%	16.2%	83.0%	100.0%		
*Statistically not significant								

Graph-13: Distribution of patients based on diagnosis with respect to index patient diagnosis

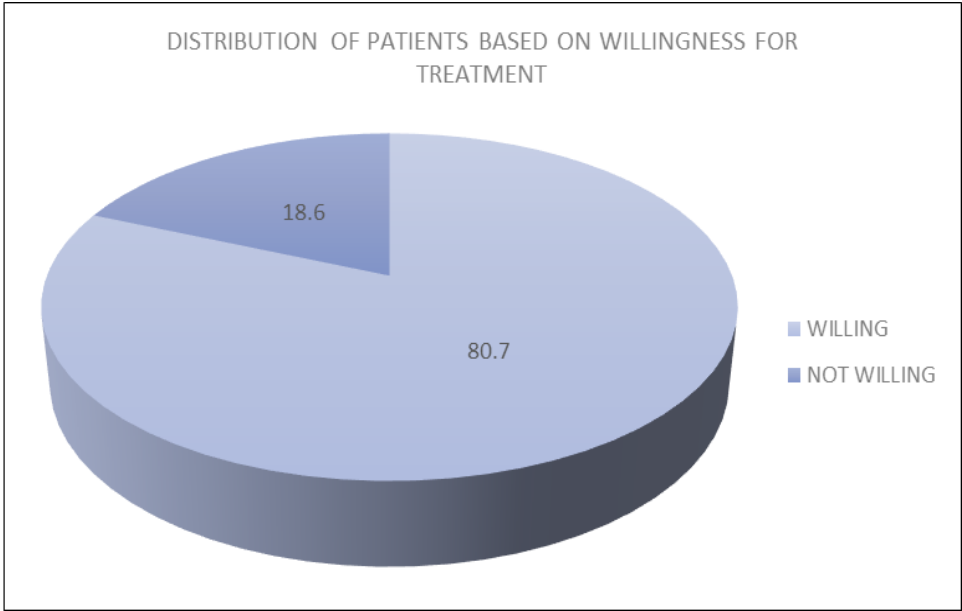
Distribution of patients based on willingness for tuberculosis preventive treatment:

Out of the 262 patients without active tuberculosis eligible for tuberculosis preventive treatment, 213 patients (81.3%) were willing for tuberculosis preventive treatment whereas 49 patients (18.7%) were unwilling (Graph-14).

Table-18: Distribution of patients based on willingness for tuberculosis preventive treatment

Willingness for TPT	Number of patients	Percentage (%)
Yes	213	81.3
No	49	18.7
Total	262	100.0

Graph-14: Distribution of patients based on willingness for tuberculosis preventive treatment



Distribution of patients based on willingness for tuberculosis preventive treatment with respect to diagnosis (latent tuberculosis infection):

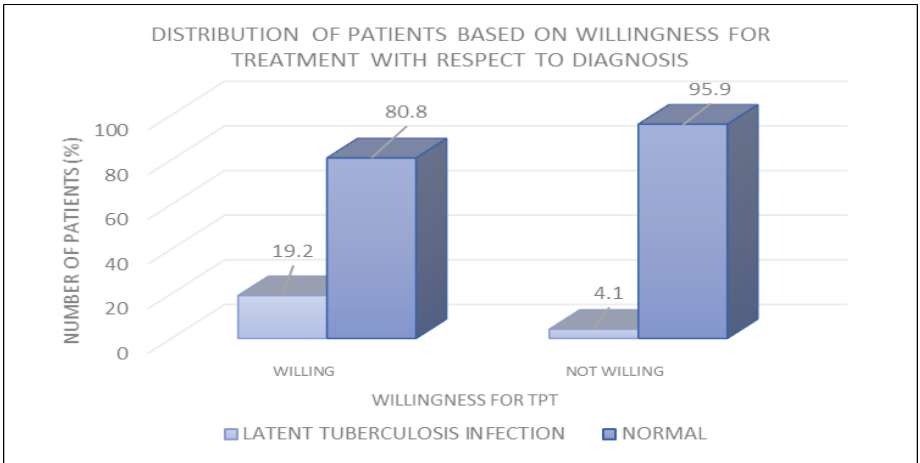
Willingness to initiate tuberculosis preventive therapy (TPT) was observed in 95.3% of patients diagnosed with latent tuberculosis infection, compared to 78% among those without tuberculosis

infection, as shown in Graph-15. There was a statistically significant association between latent tuberculosis infection and willingness for tuberculosis preventive treatment.

Table-19: Distribution of patients based on willingness for tuberculosis preventive treatment with respect to diagnosis

			Willingness for TPT		Total	Chi-square value	p-value
			Willing	Not willing			
Diagnosis	LTBI	Number of patients	41	2	43	270.731	0.000*
		Percentage	95.3%	4.7%	100.0%		
	Normal	Number of patients	172	47	219		
		Percentage	78.5%	21.5%	100.0%		
Total		Number of patients	213	49	262		
		Percentage	81.3%	18.7%	100.0%		
*Statistically significant							

Graph-15: Distribution of patients based on willingness for tuberculosis preventive treatment with respect to diagnosis



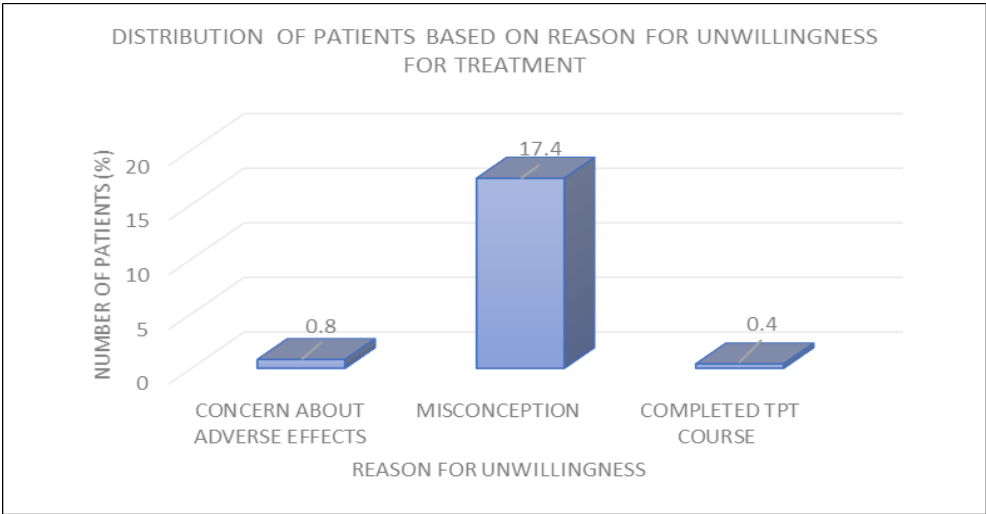
Distribution of patients based on reason for unwillingness for tuberculosis preventive treatment:

The distribution of cases based on reason for unwillingness for initiation of tuberculosis preventive treatment is represented in Graph-16, misconception being the most common (93.9%).

Table-20: Distribution of patients based on reason for unwillingness for tuberculosis preventive treatment

Reason for unwillingness	Number of patients	Percentage (%)
Concern about adverse effects	2	4.1
Misconception	46	93.9
Completed course of TPT	1	2.0
Total	49	100.0

Graph-16: Distribution of patients based on reason for unwillingness for tuberculosis preventive treatment



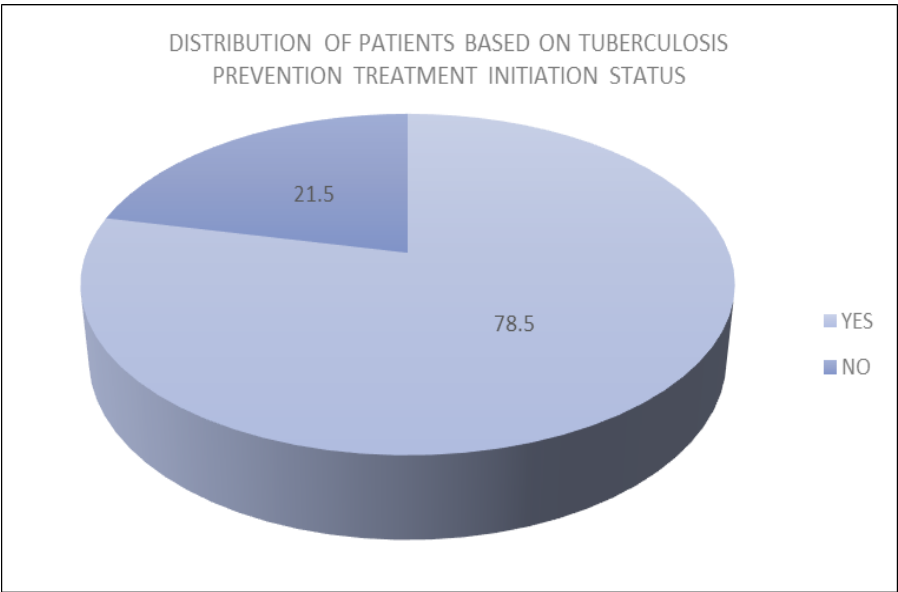
Distribution of patients based on tuberculosis preventive treatment initiation status:

207 household contacts (79.0%) were started on tuberculosis prevention treatment. The distribution of patients based on treatment initiation status in those eligible for tuberculosis prevention treatment is represented in Graph-13.

Table-21: Distribution of patients based on tuberculosis preventive treatment initiation status

TPT initiated	Number of patients	Percentage (%)
Yes	207	79.0
No	55	21.0
Total	262	100.0

Graph-17: Distribution of patients based on tuberculosis preventive treatment initiation status



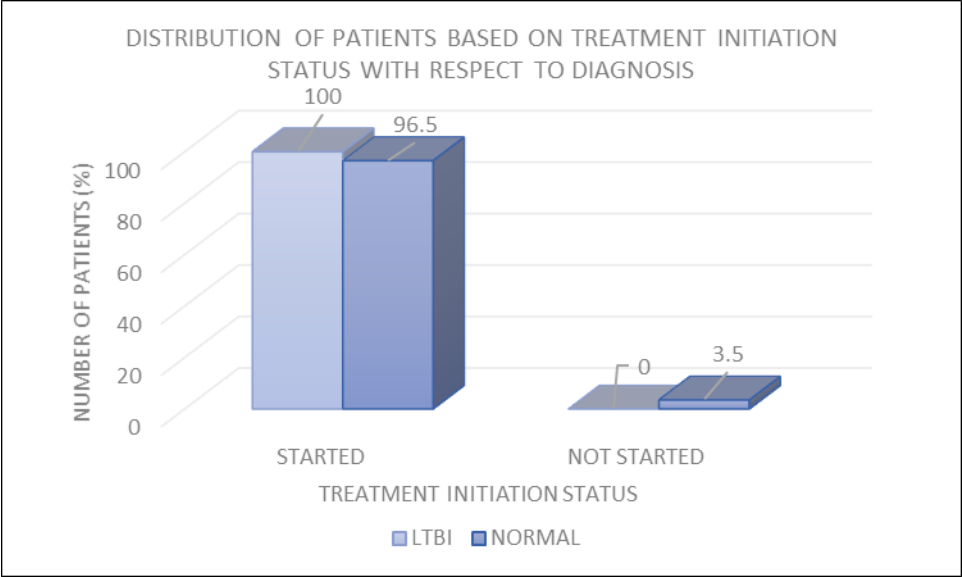
Distribution of patients based on tuberculosis preventive treatment initiation status with respect to diagnosis (latent tuberculosis infection):

41 patients (100%) with and 166 patients (96.5%) without latent tuberculosis infection were initiated on tuberculosis preventive treatment, as represented in Graph-18. The association between initiation of tuberculosis prevention treatment and latent tuberculosis infection, as depicted in Table-18, was found to be statistically significant ($p < 0.05$).

Table-22: Distribution of patients based on tuberculosis preventive treatment initiation status with respect to diagnosis

			TPT Initiation	Status	Total	Chi-square value	p-value
			Started	Not started			
Diagnosis	LTBI	Number of patients	41	0	41	509.265	0.000*
		Percentage	100.0%	0.0%	100.0%		
	Normal	Number of patients	166	6	172		
		Percentage	96.5%	3.5%	100.0%		
	Total	Number of patients	207	6	213		
		Percentage	97.2%	2.8%	100.0%		
*Statistically significant							

Graph-18: Distribution of patients based on tuberculosis preventive treatment initiation status with respect to diagnosis



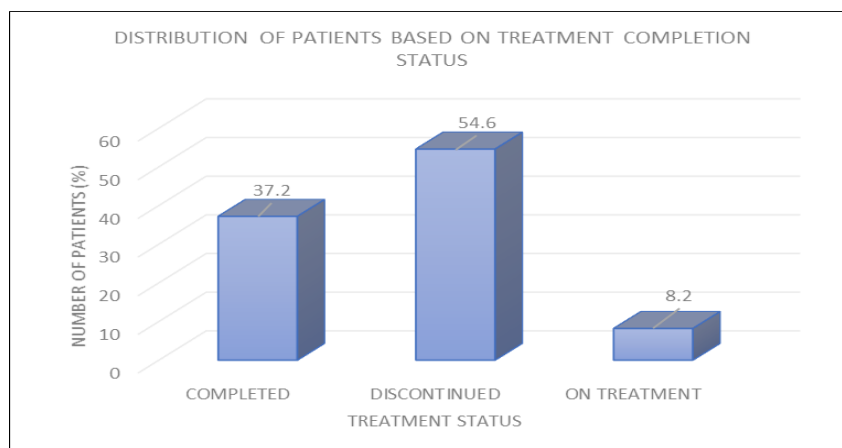
Distribution of patients based on tuberculosis preventive treatment completion status:

The distribution of cases according to treatment completion status is represented in Graph-19. Majority of the patients (54.6%) discontinued the treatment.

Table-23: Distribution of patients based on tuberculosis preventive treatment completion status

Treatment status	Number of patients	Percentage (%)
Completed	77	37.2
Discontinued	113	54.6
On treatment	17	8.2
Total	207	100.0

Graph-19: Distribution of patients based on tuberculosis preventive treatment completion status



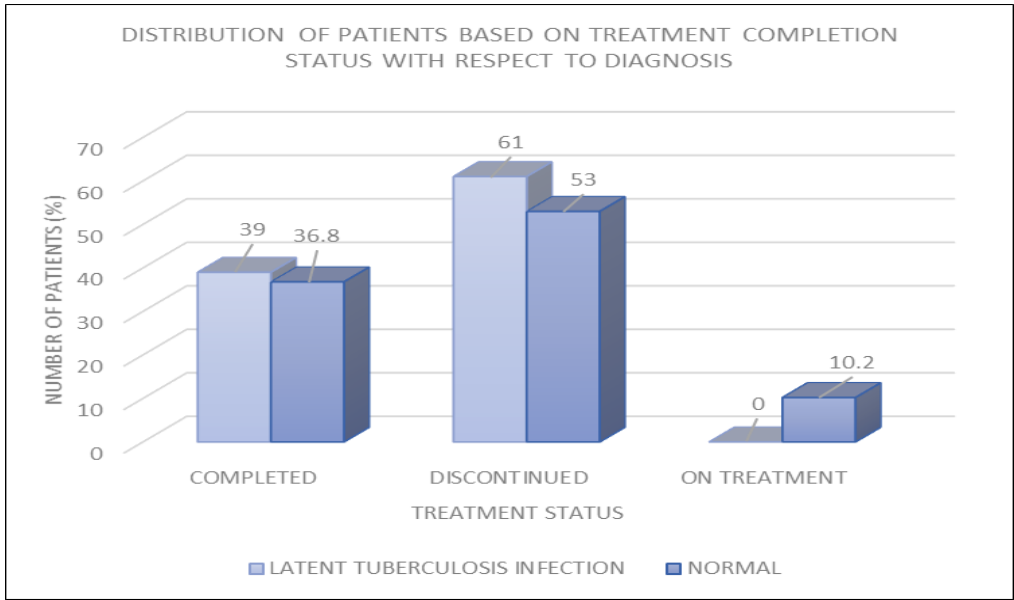
Distribution of patients based on tuberculosis preventive treatment completion status with respect to diagnosis (latent tuberculosis infection):

Based on the diagnosis, the distribution of patients according to treatment completion status is shown in Graph-20. The association between latent tuberculosis infection and treatment completion was statistically significant ($p < 0.05$) (Table-24).

Table-24: Distribution of patients based on tuberculosis preventive treatment completion status with respect to diagnosis

			TPT Completion		Status	Total	Chi-square Value	p-value
			Completed	Discontinued	On treatment			
Diagnosis	LTBI	Number of patients	16	25	0	41	19.963	0.003*
		Percentage	39.0%	61.0%	0.0%	100.0%		
	Normal	Number of patients	61	88	17	166		
		Percentage	36.8%	53.0%	10.2%	100.0%		
Total		Number of patients	77	113	17	207		
		Percentage	37.2%	54.6%	8.2%	100.0%		
*Statistically significant								

Graph-20: Distribution of patients based on tuberculosis preventive treatment completion status with respect to diagnosis



DISCUSSION

Close contacts within the household setting represent a key population at risk for both LTBI and its development to active tuberculosis. Systematic screening of the household contacts plays a pivotal role in active case finding and has been examined in multiple studies undertaken in various parts of the world. Early identification of latent infection among HHCs, coupled with the assessment of factors leading to progression of disease, and preventive treatment is critical for reducing incidence of TB is a cornerstone of global control strategies. In the present study, 264 household members were examined for latent infection and active tuberculosis and willingness for tuberculosis preventive treatment was assessed.

Out of the 264 household contacts enrolled, 62 patients (23.5%) were within the age group of 26-35 years, 58(22.0%) and 45(17.0%) patients, in the age groups of 16-25 years and 36-45 years respectively. The average age of the study group being 34.55 ± 16.45 years. This observation aligns with the findings of the study carried out by K Joza et al.,¹ in which 344 contacts were screened and the mean age being 35 ± 16 years. A study by Aman AM et al.,² in Sudan, the average age of household contacts of smear-positive tuberculosis was 33.07 ± 14.87 years, while for smear-negative cases, it was 32.35 ± 14.87 years.

In the current study, it was found that the gender inclination was towards females with 51.5% of household contacts (136 in number), while 48.5% were males (128 in number) which corroborates the results of the study carried out in Sao Paulo, Brazil by Wysocki AD et al.,³ which also consisted majorly of female population (50.7%). Studies from South Indian states by Munisankar S et al.,⁴ and Krishnamoorthy et al.,⁵ also showed female preponderance.

DISTRIBUTION OF BMI AND ITS ASSOCIATION WITH LATENT TUBERCULOSIS INFECTION

One established factor that raises the burden of active infection is low body weight. The impact of weight on the likelihood of LTBI, however, is the subject of conflicting research. Though the real association between obesity and tuberculosis infection is unclear, there is evidence that obesity and overweight are linked with latent tuberculosis infection probably because of the decreased production of T-helper-1 cytokines in response to infection, which also increases cardiometabolic indicators that hinder the burst of respiratory secretions necessary to expel the pathogenic micro-organisms.

Out of the 264 patients in study, most of the patients i.e. 64% (169 patients) had ideal body weight, whereas 13.3% and 6.4% were overweight and obese respectively, while 16.3% of the patients were underweight. In our study, the mean BMI was $22.29 \pm 4.16 \text{ kg/m}^2$, which is in the normal range.

There are few studies conducted to identify the association of BMI with latent infection. Cubilla-Batista I et al.,⁶ conducted a study in Panama, to identify the relationship between overweight, obesity and latent infection in household contacts, and results revealed a significant positive association between higher BMI and risk of latent infection. Furthermore, it is unclear if obesity causes a pro-inflammatory response that could lead to LTBI and halt the progression of the disease or an increased immune response to a mycobacterial challenge and, consequently, the clearance of MTB which prevents advancement to clinically active disease.

PREVALENCE OF DIABETES MELLITUS AND ITS ASSOCIATION WITH LATENT TUBERCULOSIS INFECTION

In our study, 11.4% household contacts had diabetes mellitus at baseline. Out of the 30 known diabetics, 9 individuals were tuberculin skin test positive, with a prevalence of diabetes of 20.9% in contacts with tuberculosis infection. The study identified a statistically significant positive association ($p < 0.05$) between latent tuberculosis infection and diabetes. The association of diabetes and LTBI has been identified in several studies, with a high prevalence rates among contacts with latent infection. This is in agreement to a study by Djibougou DA et al.,⁷ in which 11.88% of the participants had diabetes mellitus, and the association was also statistically significant. Krishnamoorthy Y et al.,⁵ conducted a study to evaluate the determinants associated with LTBI among the contacts. Their findings indicated that 63% of the contacts had diabetes mellitus, but no statistically significant association was identified between diabetes and latent tuberculosis infection. Our findings showed a higher yield compared to that reported from Indonesia (4.0%)⁸, Iraq (2.1%)⁹ and Chandigarh (2.4%)¹⁰.

PREVALENCE OF HYPERTENSION AND ITS ASSOCIATION WITH LATENT TUBERCULOSIS INFECTION

Hypertension could be a potential risk factor for latent tuberculosis (LTBI), primarily due to shared underlying mechanisms such as chronic low-grade inflammation and immune system dysregulation. Hypertension is associated with alterations in cytokine profiles and vascular damage, which may impair the body's ability to contain *Mycobacterium tuberculosis*.

Of the household contacts in this study, 27 (10.2%) had hypertension and 5 were

diagnosed as latent tuberculosis infection (18.5%). No statistically significant association was found between latent tuberculosis infection (LTBI) and hypertension. A study by Huaman MA et al.,¹¹ showed a higher prevalence of hypertension among the study population (65%). Although, the percentage of hypertensive patients tested positive for LTBI was 63%, much higher than our study, there was no significant association between history of hypertension and LTBI status, which correlates to the results of our study. In contrast, a cross-sectional study by Munisankar S et al.,⁴ found that 15% of individuals with LTBI had hypertension, similar to our results, but they identified a significant association between hypertension and latent tuberculosis infection.

In contrary, in a study by Salindri AD et al.,¹² prevalence of hypertension was 49.8% with a high prevalence among those with LTBI (48.3%). However, a study conducted by Aravindhan et al., in South India found a significantly greater proportion of hypertensive individuals among household contacts, with a strong association observed between latent tuberculosis infection (LTBI) and hypertension. Some observational studies, have shown an increased prevalence of LTBI among hypertensive individuals, suggesting a possible bidirectional relationship. However, confounding factors may complicate this association.

SMOKING AND ITS ASSOCIATION WITH LATENT TUBERCULOSIS INFECTION

Tobacco smoking has been linked to an increased susceptibility to LTBI, likely due to its deleterious effects on respiratory and immune function. Cigarette smoke compromises mucociliary clearance and impairs the activity of alveolar macrophages, facilitating the initial establishment of *Mycobacterium tuberculosis* following exposure. Additionally, chronic inflammation and immune modulation caused by smoking may contribute to both increased infection risk and progression from latent to active disease.

Tobacco use was prevalent among 27.7% of individuals enrolled in our study, encompassing both cigarette smoking and tobacco chewing. Out of 73 individuals who reported tobacco use, 35 were cigarette smokers, 29 were tobacco chewers, and 9 reported using both forms. However, among individuals with LTBI, 11 reported consuming tobacco products. The role of smoking as a risk factor for LTBI and its transition to active disease has been well-established in the literature. The association between smoking and LTBI was not statistically significant ($p>0.05$) in our study.

These results are in accordance to the study conducted by Sangma VSC et al.,¹⁰ conducted in Chandigarh, with 35.6% and 17% prevalence of smoking in the study population and among individuals with LTBI respectively, and the association was also not statistically significant. Djibougou DA et al.,⁷ reported smoking in 22.35% LTBI positive individuals, although the association of smoking with LTBI was not statistically significant. In a study conducted by Abdulkareem FN et al.,⁹ the prevalence of smoking was lower in both the study group and LTBI group in comparison to our study, but there was a statistically significant association in their study. These observations emphasize the potential impact of integrating tobacco cessation support into LTBI management strategies.

ALCOHOL CONSUMPTION AND ITS ASSOCIATION WITH LATENT TUBERCULOSIS INFECTION

In our study, 39 participants consumed alcohol, accounting for 14.8% of the study population. Out of the 43 cases with LTBI, only 7 patients consumed alcohol (16.2%). The association between alcohol use and LTBI was not statistically significant ($p>0.05$) Supporting the results of our study, a study by Krishnamoorthy Y et al.,⁵ showed that 10.4% of the patients

consumed alcohol and there was no significant association between alcohol consumption and LTBI.

In addition, the predominance of female participants in our study may have introduced confounding effects, particularly in the analysis of behavioural risk factors such as alcohol consumption and smoking, which are more commonly reported among males in many settings. As a result, the potential associations between these factors and LTBI may have been attenuated or obscured. Previous research has demonstrated that both alcohol use and smoking are independently associated with increased risk of TB infection and disease progression, underscoring the importance of accounting for these behaviours in risk assessments. Future studies with more balanced gender representation are warranted to gain a more comprehensive understanding of their impact on LTBI.

CHEST RADIOGRAPH AND ITS ASSOCIATION WITH ACTIVE AND LATENT TUBERCULOSIS INFECTION

Chest radiograph was performed in all 264 household contacts, among whom an abnormal chest x-ray was observed in 4.9% (13 in number). No abnormality in chest x-ray was observed in 95.1% of contacts. Out of the 13 patients with abnormal chest radiograph, two cases (15.4%) were microbiologically – confirmed tuberculosis. The results of our study are consistent with the study conducted by Nababan B et al.,⁸ in Indonesia, with radiological evidence on chest X-ray suggestive of tuberculosis observed in 2.4% cases (68 of 2857 screened). Another study by Mudoola D et al.,¹⁴ in Uganda reported similar results as our study with 3.1% patients showing abnormal chest x-ray findings.

A recent systematic review and meta-analysis by Velen K et al.,¹⁵ found that 1893

out of 88103 contacts screened for active tuberculosis with chest radiographs in 25 studies had radiological changes suggestive of active tuberculosis, accounting for a pooled prevalence of 3.6%. These findings suggest that chest radiography may help identify pathological changes prior to the onset of TB symptoms. On the contrary, in a study from Chennai by Ananthakrishnan R et al.,¹⁶ chest radiograph abnormalities were observed in 531 cases of 5553 evaluated, accounting to 9.56%. Mendelsohn SC et al.,¹⁷ in their study, reported a high incidence of chest radiograph abnormalities (14.7%) in the study population, compared to our study.

TUBERCULIN SKIN TEST

Among the household contacts tested for latent tuberculosis infection, positive reaction (cut-off >10mm) was observed in 44 household contacts. The current study revealed that among HHCs with pulmonary TB, the prevalence of latent TB was 16.7%, which is less than the global estimate. Given that these lower numbers only reflect statistics from a limited geographic area and do not reflect the prevalence of a nation, they must be evaluated with caution.

In agreement to our study, studies conducted by Martinson NA et al.,¹⁸ in South Africa, A L Innes et al.,¹⁹ in Vietnam and MacPherson P et al.,²⁰ in South African provinces have shown similar results with a tuberculin skin test positivity rate of 13%, 13.1% and 13.1% respectively among the contacts.

Several studies in various countries across the world have showed varied results with a very high incidence of tuberculin test positivity in contrast to our study. A study conducted by Karbito et al.,²¹ in Indonesia showed a positive TST result in 63.8% of contacts. In a longitudinal observational study with prospective data collection conducted in Delhi, by Sharma N et al.,²² 61.5% cases showed a positive response to tuberculin test.

Immune response to tubercular protein in the host is a major determinant of Mantoux positivity. Therefore, immunocompromised conditions such as diabetes, HIV, malnourishment, and individuals receiving immunosuppressants will have an impact on the Mantoux induration. Selection bias may have also been introduced by the inclusion of participants from index patient's household contacts in this study. However, the impact of seroconversion which results from exposure to new TB patients on the incidence of latent TB is called into question by the comparatively lower prevalence of latent TB among HHCs in the current study.

Characteristics and TST positivity in similar studies:

Author and Year	Country	Study Period	Study Design	Method Used with Cut-off	TST Positivity Rate
MacPherson P et al. ²⁰ 2020	South Africa	2015-2016	Cluster randomised trial	Tuberculin skin test ≥10mm ≥5mm	13.1% 16.8%
Paradkar M et al. ²³ 2020	India	August 2014 – December 2017	Cohort study	Tuberculin skin test ≥10mm	26%
Abdulkareem FN et al. ⁹ 2020	Iraq	May – October 2018	Cross - sectional	Tuberculin skin test ≥5mm	24.05%
Corbett C et al. ²⁴ 2020	Kyrgyz Republic	November 2018 – March 2019	Cross - sectional	Tuberculin skin test	36.8%

Aman A M et al. ² 2017	Sudan	November 2015 – April 2016	Cross - sectional	Tuberculin skin test	11.6%
Martinson NA et al. ¹⁸ 2022	South Africa	December 2016 – March 2019	Randomised control trial	Tuberculin skin test ≥10mm	13%
Krishnamoorthy et al. ⁷ 2021	South India	2014 – 2019	Cohort study	Tuberculin skin test	52.6%
Gutierrez J et al. ²⁵ 2024	Uganda	June 2016 - March 2020	Cross - sectional	Tuberculin skin test ≥10mm	27.7%
Ghanaiee RM et al. ²⁶ 2022	Iran	July 2017 – August 2019	Cohort	Tuberculin skin test ≥5mm	46.4%
A L Innes et al. ¹⁹ 2023	Vietnam	2020 – 2021	Cross - sectional	Tuberculin skin test ≥10mm ≥5mm	13.1% 37.4%
Sangma VSC et al. ¹⁰ 2024	Chandigarh, India	January 2020 – July 2021	Cross - sectional	Tuberculin skin test ≥10mm	26.36%
K Warria et al. ²⁷ 2020	Kenya	March 2014 – June 2016	Prospective cohort	Tuberculin skin test	34.1%
Singh J et al. ²⁸ 2020	Oman	2018 – 2019	Cross - sectional	Tuberculin skin test ≥10mm	22.8%

Cohen A et al. ²⁹ 2019	Global	January 2005 – July 2018	Systematic review and meta-analysis	Tuberculin skin test $\geq 10\text{mm}$	21.2%
Nababan B et al. ⁸ 2024	Indonesia	June 2020 – December 2022	Prospective cohort study	Tuberculin skin test $\geq 10\text{mm}$	40.4%
Our study	Karnataka, India	March 2023 – January 2025	Cross – sectional	Tuberculin skin test $\geq 10\text{mm}$	16.7%

SPUTUM SMEAR MICROSCOPY

Overall, in our study, sputum smear positivity was observed in 2 household contacts (0.8%), indicating active tuberculosis. These results are comparable to a study from Rajasthan by Gupta M et al.,³⁰ to determine the TB prevalence among household contacts of newly diagnosed sputum smear TB index cases which reported similar results, with a prevalence of 1.15% (5 patients) among 521 contacts. A study by Krishnamoorthy Y et al.,⁵ in which prevalence of active TB disease was reported in 6 (0.4%) of the 1523 HHCs screened, which was much lower than that observed in our study.

Of the 2 HHCs diagnosed with sputum smear positivity, the prevalence of active tuberculosis was 0.6% (1 of 173 HHCs) and 1.1% (1 of 91 HHCs) among HHCs of DS-TB and MDR-TB index cases. These results are similar to a study by Seid G et al.,³¹ 11 (1.48%) of 765 HHCs and 2 (1.24%) of 161 HHCs of the DS-TB and MDR-TB index case groups were diagnosed with active disease, respectively. Furthermore, it was observed that, the overall prevalence of TB among the enrolled HHCs was 1.44% (13 in number).

The percentage of active TB recorded from HHC screening has varied between previous studies. Our findings align with those reported in previous studies conducted by

Ghanaiee RM et al.,²⁶ in Iran and Ohene SA et al., in Ghana³² with a prevalence of 1.1% and 0.65% respectively.

In another study in sub-Saharan African countries by Seid G et al.,³¹ reported that the overall pooled prevalence rate of tuberculosis among household contacts stood at 3.29%. Notable among them are studies by Daniel W et al.³³ and Adane A et al.³⁴ in Ethiopia which reported a prevalence of 6.9% and 7.8%, which was much higher than our study.

Characteristics and prevalence of active tuberculosis in similar studies:

Author and Year	Country	Study Period	Study Design	Method Used	Prevalence among HHC
Jude S et al. ³⁵ 2025	Uttar Pradesh, India	October 2021 – March 2022	Cross - sectional	Sputum smear microscopy	2.72%
Ananthakrishnan R et al. ¹⁶ 2020	Chennai, India	January 2015 – March 2016	Cross - sectional	Sputum smear microscopy and Xpert	1.33%
Seid G et al. ³¹ 2025	Central Ethiopia	January – December 2023	Cross - sectional	Sputum smear microscopy, Xpert and culture	1.44%
Nair D et al. ³⁶ 2016	Chennai, India	2007 - 2014	Retrospective	Sputum smear microscopy	4.2%
Ohene SA et al. ³² 2018	Ghana	June 2010 – December 2014	Retrospective	Sputum smear microscopy	0.65%

Gupta V et al. ³⁷ 2020	Haryana, India	January – June 2019	Cross - sectional	Sputum smear microscopy	1.97%
Krishnamoorthy Y et al. ⁵ 2021	South India	2014-2019	Cohort study	Sputum smear microscopy	0.4%
Moosazadeh M et al. ³⁸ 2015	North of Iran	2010-2011	Cross - sectional	Sputum smear microscopy, culture	0.9%
Ghanaiee RM et al. ²⁶ 2022	Iran	July 2017 – August 2019	Cohort	Sputum smear microscopy, culture	1.1%
Gupta M et al. ³⁰ 2016	Rajasthan, India	July 2013 – February 2014	Cohort	Sputum smear microscopy	1.15%
Sangma VSC et al. ¹⁰ 2024	Chandigarh, India	January 2020 – July 2021	Cross - sectional	Sputum smear microscopy	3.03%
K Warria et al. ²⁷ 2020	Kenya	March 2014 – June 2016	Prospective cohort	Sputum smear microscopy, Xpert and culture	3.5%
Beyanga et al. ³⁹ 2018	Tanzania	August – December 2016	Retrospective cohort	Sputum smear microscopy	0.9%
Our study	Karnataka, India	March 2023 – January 2025	Cross - sectional	Sputum smear microscopy	0.8%

This discrepancy may be explained by variations in the study populations, study environments, such as the prevalence of tuberculosis, community living practices, differences in the infectiousness of index cases, susceptibility of household contacts, and study methodologies—including disparities in sample size, screening protocols, and diagnostic precision—may account for variability in findings across studies.

TUBERCULOSIS PREVENTION TREATMENT

There is variability in the implementation of TPT across studies, particularly regarding eligibility criteria. Some studies offered TPT exclusively to individuals with confirmed LTBI, typically based on TST or IGRA. In contrast, other studies have adopted a broader approach by providing TPT to all HHCs, regardless of LTBI test results. This universal approach aims to overcome barriers related to LTBI testing access, reduce transmission risk, and streamline preventive care—especially in high-burden settings or in young children where testing may be less reliable. In our study, TPT was offered to all HHCs of individuals with active tuberculosis, irrespective of their LTBI status. A comparative analysis was conducted to assess differences in willingness, treatment initiation, and completion rates between HHCs with and without confirmed LTBI.

In our study, 83% of the HHCs were normal, with no active or latent tuberculosis infection, while 16.2% of the contacts had latent tuberculosis infection and 0.8% had active TB. Among the patients eligible for TPT, 213 patients (81.3%) were willing for TPT and 18.7% declined treatment. When stratified by LTBI status, willingness to initiate TPT was higher among household contacts with LTBI compared to those without. Specifically, 95.3% of LTBI-positive contacts were willing to start TPT, whereas only 78.5% of LTBI-negative contacts

expressed willingness. This suggests that a confirmed diagnosis of LTBI may strengthen patient acceptance of TPT. The willingness for TPT among household contacts in another study by Sharma et al., conducted in Delhi, was found to be 73.5%, which is comparable to our study. A study by Matias GL et al.⁴⁰ showed 26.1% of HHCs diagnosed with tuberculosis infection were willing for initiation of treatment, which is lower compared to our study group.

Among LTBI-negative household contacts who expressed willingness to initiate TPT, treatment was not started in 6 individuals due to non-provision of drugs. This highlights the impact of logistical and supply-side challenges on the implementation of preventive therapy, even when patient acceptance is present. Hence, TPT was initiated in a total of 207 household contacts, including 41 individuals with confirmed LTBI and 166 without LTBI.

Of the 207 household contacts who were initiated on TPT, 77 (37.2%) completed the full course, 113 (54.6%) discontinued treatment before completion, and 17 (8.2%) were still on treatment at the time of analysis. Treatment completion rates were similar between those with LTBI and those without. 39% of contacts with LTBI completed treatment compared to 36.8% of normal contacts, indicating no statistically significant difference ($p > 0.05$) in adherence between the two groups. A study by Kumar A et al.⁴¹ showed 22% of patients completed the full course of treatment, which is comparable to our study, whilst studies by Shah D et al.⁴² and Mahajan P et al.⁴³ showed treatment completion rates of 90% and 90.6% respectively, which is higher when compared to our study.

Prevalence of tuberculosis preventive treatment (TPT) initiation and completion among contacts across studies:

Author and Year	Country	Study Period	Study Design	TPT Initiation Rate	TPT Completion Rate
Vo LNQ et al. ⁴⁴ 2023	Vietnam	May 2019 – September 2022	Cohort study	63.3%	80.6%
Shah et al. ⁴² 2024	Mumbai, India	September – December 2021	Cross - sectional study	85%	90%
Park SH et al. ⁴⁵ 2016	Korea	October 2009 – August 2013	Randomized control trial	48.9%	58.1%
Mundoola D et al. ¹⁴ 2025	Uganda	November 2023 – September 2024	Pilot study	82.8%	95.1%
Felisia F et al. ⁴⁶ 2023	Indonesia	January 2020 – August 2022	Cross - sectional study	78.8%	91.5%
Rahman MT et al. ⁴⁷ 2024	Bangladesh	February 2018 – March 2019	Community-based implementation study	73%	97%
Sagili KD et al. ⁴⁸ 2022	Global	2010 – 2021	Systematic review and meta-analysis	91%	65%
Mahajan P et al. ⁴³ 2023	Maharashtra, India	October 2021 – March 2022	Cohort study	91.7%	90.6%
Samudyatha UC et al. ⁴⁹ 2023	Karnataka, India	April – December 2022	Cohort + Descriptive study	98%	77%
Mukherjee O	West Bengal,	September –	Cross - sectional	74.8%	69.3%

et al. ⁵⁰ 2024	India	November 2023	study		
Kumar A et al. ⁴¹ 2025	India	January – March 2022.	Cross - sectional study	34%	22%
Hussain H et al. ⁵¹ 2023	Pakistan	2018 – 2021	Cross - sectional study	12.8%	75.4%
Malik AA et al. ⁵² 2021	Pakistan	-	Cohort study	80%	70.3%
Abdulkareem FN et al. ⁹ 2023	Iraq	April – September 2021	Cross - sectional study	74.0%	100%
Acuña- Villaorduña C et al. ⁵³ 2022	Brazil	2008 – 2015	Retrospective	24%	71.9%
Our study	Karnataka, India	March 2023 – January 2025	Cross - sectional study	81.3%	37.2%

BARRIERS FOR TUBERCULOSIS PREVENTIVE THERAPY

There are several key barriers to the successful introduction and scale-up of tuberculosis preventive treatment, particularly among household contacts. At the health system level, challenges such as limited resources, drug supply interruptions, and weak service integration hinder consistent delivery of TPT. Healthcare provider-related issues, including insufficient training, high workloads, and diagnostic uncertainty, further contribute to suboptimal

implementation. Patient-level factors such as fear of adverse effects, low perceived risk due to the asymptomatic nature of latent TB, and stigma limit both initiation and adherence. Moreover, community-level barriers, including misinformation, cultural beliefs, and socioeconomic constraints, can significantly reduce access and implementation.

Of the 262 patients eligible for tuberculosis preventive therapy in whom active tuberculosis had been ruled out, willingness for TPT was observed in 213 contacts (81.3%). 49 participants were unwilling for therapy, accounting to 18.7% of the eligible population. Majority of the patients (93.9%) were reluctant for TPT due to lack of knowledge about preventive therapy and misconception about the necessity of TPT in healthy states. The fear of drug-related side effects emerged as a barrier to initiating tuberculosis preventive treatment (TPT) in 2 individuals (4.1%) as they perceived that the risks of TPT may outweigh the benefits. One patient declined tuberculosis preventive treatment due to completion of the full course of therapy. Out of the 219 normal individuals, 21.5% refused TPT (47 patients). Latent tuberculosis infection was perceived as an asymptomatic or 'healthy' state by 2 patients, leading to low perceived need for treatment and served as a barrier for TPT initiation in 4.7% of LTBI positive cases. In a study conducted by Sharma N et al.⁵⁴ in Delhi, the key reasons for lack of willingness to initiate TPT were absence of overt clinical symptoms (33.1%), perception of being in good health (42.9%), and concerns over potential adverse effects of the drugs (27.5%). Comparable to our study, J Ren et al.⁵⁵ in Delhi, also reported misconceptions about efficacy as the most common barrier, with 57.8% (517 out of 894) of participants expressing doubts regarding its uncertain effects on prevention. Additionally, concerns about potential side effects were reported by 32.7% (292/894) of participants.

LIMITATIONS

1. The study included 264 household contacts; a larger sample size may have provided stronger conclusions and more robust significance of associations.
2. The study population included household contacts who presented voluntarily for screening, introducing potential selection bias.
3. The study was carried out in a single-institution setting, which may limit the generalizability of the findings to larger population or other settings with different healthcare infrastructure or tuberculosis burden.
4. Latent tuberculosis infection in this study was diagnosed using the TST, which has limited sensitivity and specificity, potentially affecting diagnostic accuracy.
5. It was not possible to determine whether tuberculin skin test positivity reflected recent household exposure or prior infection, limiting causal interpretation.
6. The study relied on sputum smear microscopy and chest radiography without routine use of more sensitive diagnostics like GeneXpert MTB/RIF or culture, which could affect the accuracy of diagnosis of tuberculosis.

SUMMARY

A cross-sectional study was carried out on 264 household contacts of individuals with active tuberculosis, in the Department of Respiratory Medicine, Shri B. M. Patil Medical College, Hospital and Research Centre, BLDE (Deemed to be) University, Vijayapura. The household contacts were screened for active or latent tuberculosis through sputum smear microscopy for acid-fast bacilli, chest radiography, and the tuberculin skin test their willingness to initiate tuberculosis preventive treatment was assessed.

1. The most common age group was 26-35 years with 23.5%, followed by 16-25 years with 22%. The mean age of the study population was 34.55 ± 16.45 years.
2. In this study, female preponderance (51.5%) was observed.
3. 64% of the patients were of ideal body weight, whereas 16.3% were underweight. 13.3% and 6.4% patients belonged to the overweight and obese category respectively. The mean body mass of index of the study population was 22.29 ± 4.16 kg/m².
4. Diabetes mellitus was present in 8.7% of the study population, hypertension in 7.6%, and both in 2.7%. A statistically significant association was identified between diabetes and latent tuberculosis infection. However, no significant association was found between hypertension and latent infection.
5. A total of 27.7% of the study population reported a history of smoking or tobacco chewing, while 14.8% reported alcohol use.
6. Chest radiograph abnormalities was present in 4.9% of the study population. The most common abnormality was presence of calcifications with alveolar infiltrates in 3.0% of the contacts.

7. Of the total participants screened, sputum positivity for acid-fast bacilli was identified in 0.8% of participants, suggesting active tuberculosis.
8. A positive tuberculin skin test, defined by an induration greater than 10 mm, was observed in 16.7% of the study population.
9. A substantial proportion of the study population (83%) were classified as normal, as indicated by negative results on both sputum microscopy and tuberculin skin testing. While 0.8% of contacts were diagnosed with active tuberculosis, 16.3% were identified as having latent tuberculosis infection.
10. Sputum smear microscopy was positive in 15.4% and negative in 84.6% contacts with abnormal chest radiograph findings. There was a statistically significant association between sputum smear microscopy and chest radiograph findings.
11. Out of the 13 household contacts with abnormal chest radiograph findings, 2 patients (15.4%) had positive tuberculin skin test while 84.6% had negative results and the association was not statistically significant ($p > 0.05$).
12. One contact each of a patient with multi-drug resistant tuberculosis and drug-sensitive tuberculosis developed active tuberculosis. The prevalence of latent tuberculosis infection was found to be 13.9% among drug-sensitive tuberculosis contacts and 20.9% among multi-drug resistant tuberculosis contacts.
13. Among contacts without active tuberculosis, overall, willingness to tuberculosis preventive treatment was observed in 81.3%. Among those with tuberculosis infection and normal individuals, 95.3% and 78.5% were willing for treatment respectively.
14. There was a positive and statistically significant association between willingness for tuberculosis prevention treatment and latent tuberculosis infection.

15. The most common reason for unwillingness for treatment was misconception (93.9%).
16. Overall, 79% of patients were started on tuberculosis preventive treatment. There was a statistically significant association between latent tuberculosis infection and initiation of treatment, with all contacts diagnosed with latent infection being started on preventive therapy.
17. In this study, the overall treatment completion rate among contacts initiated on tuberculosis preventive treatment (TPT) was 37.2%.
18. The treatment completion rates were 39.0% among contacts diagnosed with latent tuberculosis infection and 36.8% among those without, while discontinuation rates were 61.0% and 53.2%, respectively. This study revealed a statistically significant association between latent tuberculosis infection status and treatment completion rates.

CONCLUSION

In the present study, the age distribution of the study population was skewed toward individuals aged 16–35 years, with female predominance. The study group predominantly constituted of contacts with ideal body weight. A large proportion of the patients included in the study, were found to be household contacts of drug-sensitive tuberculosis.

A substantial proportion of the study population had a history of diabetes mellitus, and a statistically significant association was found between diabetes and latent tuberculosis infection. However, no such association was observed between latent tuberculosis infection and other risk factors such as hypertension, smoking, or alcohol use.

The findings of this study provide insight into the prevalence of latent tuberculosis infection and active tuberculosis among household contacts of index tuberculosis cases, highlighting key epidemiological trends. There was a significant burden of latent tuberculosis infection among household contacts of both drug-sensitive and multidrug-resistant tuberculosis patients, with a higher prevalence observed in contacts of multi-drug resistant tuberculosis cases.

The actual initiation rates of tuberculosis preventive treatment were lower, emphasizing the need for improved counselling and follow-up. Importantly, all individuals diagnosed with tuberculosis infection were initiated on treatment, indicating good adherence to targeted prevention protocols. A statistically significant association between latent tuberculosis infection and treatment initiation underscores the value of targeted testing in contact investigations. A major factor contributing to non-initiation was patient unwillingness, predominantly driven by misconceptions about the necessity and safety of tuberculosis prevention treatment. These findings emphasize that strengthening health education can play a

pivotal role in addressing misinformation, improving treatment acceptance, and enhancing overall adherence.

This study highlights that while TPT remains a vital strategy in mitigating the conversion of latent tuberculosis infection into clinically active tuberculosis, treatment completion rates are still suboptimal. The findings support the integration of systematic screening, testing for LTBI, and preventive therapy into routine tuberculosis contact management to curb the transition from an asymptomatic latent infection to symptomatic active tuberculosis and accelerate progress toward tuberculosis elimination goals. This could help us mitigate the social and economic impact of infection as well as its increasing tide.

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ANNEXURE – I



BLDE

(DEEMED TO BE UNIVERSITY)

Declared as Deemed to be University u/s 3 of UGC Act, 1956

Accredited with 'A' Grade by NAAC (Cycle-2)

The Constituent College

SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA

BLDE (DU)/IEC/ 873/2022-23

1/4/2023

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this University met on **Saturday, 18th March, 2023 at 11.30 a.m. in the CAL Laboratory, Dept. of Pharmacology**, scrutinizes the Synopsis/ Research Projects of Post Graduate Student / Under Graduate Student /Faculty members of this University /Ph.D. Student College from ethical clearance point of view. After scrutiny, the following original/ corrected and revised version synopsis of the thesis/ research projects has been accorded ethical clearance.

TITLE: "EVALUATION OF CONTACTS OF TUBERCULOSIS FOR ACTIVE OR LATENT TUBERCULOSIS INFECTION AND FACTORS ASSOCIATED WITH MANAGEMENT".

NAME OF THE STUDENT/PRINCIPAL INVESTIGATOR: Dr SAGARIKA N SURESH

NAME OF THE GUIDE: DR RAMESH S.BARBAR, PROFESSOR AND HOD,DEPT. OF RESPIRATORY MEDICINE.

Dr. Santoshkumar Jeevangi
Chairperson
IEC, BLDE (DU),
VIJAYAPURA

Chairman,
Institutional Ethical Committee,
BLDE (Deemed to be University)
Vijayapura

Dr. Akram A. Naikwadi
Member Secretary
IEC, BLDE (DU),
VIJAYAPURA

MEMBER SECRETARY
Institutional Ethics Committee
BLDE (Deemed to be University)
Vijayapura-586103, Karnataka

Following documents were placed before Ethical Committee for Scrutiny

- Copy of Synopsis/Research Projects
- Copy of inform consent form
- Any other relevant document

Smt. Bangaramma Sajjan Campus, B. M. Patil Road (Sholapur Road), Vijayapura - 586103, Karnataka, India.

BLDE (DU): Phone: +918352-262770, Fax: +918352-263303, Website: www.blddedu.ac.in, E-mail: office@blddedu.ac.in
College: Phone: +918352-262770, Fax: +918352-263019, E-mail: bmprmc_principal@blddedu.ac.in

ANNEXURE – II

INFORMED CONSENT FORM

B.L.D.E(DEEMED TO BE UNIVERSITY), SHRI B.M. PATIL MEDICAL COLLEGE
HOSPITAL AND RESEARCH CENTRE, VIJAYAPURA, KARNATAKA – 586103

TITLE OF THE PROJECT: EVALUATION OF CONTACTS OF TUBERCULOSIS
FOR ACTIVE OR LATENT TUBERCULOSIS AND
FACTORS ASSOCIATED WITH MANAGEMENT

PRINCIPAL INVESTIGATOR: Dr. SAGARIKA N SURESH
Department of Respiratory Medicine

PG GUIDE: Dr. RAMESH S. BABAR,
Professor and HOD,
Department of Respiratory Medicine,
BLDE (Deemed to be University),
Shri B.M. Patil Medical College Hospital and
Research Centre, Vijayapura,
Karnataka- 586103

PURPOSE OF RESEARCH:

I have been informed that the purpose of this study is to "EVALUATE CONTACTS OF

TUBERCULOSIS FOR ACTIVE OR LATENT TUBERCULOSIS AND FACTORS
ASSOCIATED WITH MANAGEMENT”

I have been explained about the reason for conducting this study and selecting me/my ward as a subject for this study. I have also been given free choice for either being included or not in the study.

PROCEDURE:

I understand that I will undergo detailed history and clinical examination and investigations.

BENEFITS:

I understand that I/my ward’s participation in this study will help to evaluate
CONTACTS OF TUBERCULOSIS FOR ACTIVE OR LATENT TUBERCULOSIS AND
FACTORS ASSOCIATED WITH MANAGEMENT.

CONFIDENTIALITY:

I understand that medical information produced by this study will become a part of this hospital records and will be subjected to the confidentiality and privacy regulation of this hospital. Information of a sensitive, personal nature will not be a part of the medical records, but will be stored in the investigator’s research file and identified only by a code number. The code key connecting name to numbers will be kept in a separate secure location.

If the data are used for publication in the medical literature or for teaching purpose, no names will be used and other identifiers such as photographs and audio or video tapes will be used only with my special written permission. I understand that I may see the photograph and videotapes and hear audiotapes before giving this permission.

REQUEST FOR MORE INFORMATION:

I understand that, I may request for more questions about the study at any time. Dr. SAGARIKA N SURESH is available to answer my questions or concerns. I understand that, I will be informed of any significant new findings discovered during the course of this study, which might influence my continued participation.

If during this study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me. And that a copy of this consent form will be given to me for keep for careful reading.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care.

I also understand that Dr. SAGARIKA N SURESH will terminate my participation in this study at any time after she has explained the reasons for doing so and has helped arrange for my continued care.

INJURY STATEMENT:

I understand that in the unlikely event of injury to me/my ward, resulting directly to my participation in this study, if such injury were reported promptly, then medical treatment would be available to me, but no further compensation will be provided.

I understand that by my agreement to participate in this study, I am not waiving

any of my legal rights.

I have explained to _____, the purpose of this research, the procedures required and the possible risks and benefits, to the best of my ability in patient's own language.

Date:

Dr. RAMESH. S. BABAR

(Guide)

Dr. SAGARIKA N SURESH

(Investigator)

STUDY SUBJECT CONSENT STATEMENT:

I confirm that Dr. SAGARIKA N SURESH has explained to me the purpose of this research, the study procedure that I will undergo and the possible discomforts and benefits that I may experience, in my own language.

I have been explained all the above in detail in my own language and I understand the same. Therefore, I agree to give my consent to participate as a subject in this research project.

(Participant)

Date

(Witness to above signature)

Date

ANNEXURE -III

PROFORMA

Name:

Age/Sex:

Address:

O.P No:

Occupation:

Complaints:

Contact history:

Past history:

Personal history:

1. Diet:

2. Appetite:

3. Sleep:

4. Bowel and bladder habits:

5. Tobacco chewing:

6. Smoking:

7. Alcoholism:

Family history:

GENERAL PHYSICAL EXAMINATION:

Built:

Nourishment:

Height (cm):

Weight (kg):

BMI:

Pallor

Icterus

Clubbing

Cyanosis

Lymphadenopathy

Edema

6. Vital parameters:

a. Pulse:

b. BP:

c. Respiratory rate:

d. Temperature:

SYSTEMIC EXAMINATION:

RESPIRATORY SYSTEM

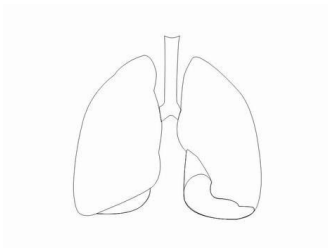
CARDIOVASCULAR SYSTEM

GASTROINTESTINAL SYSTEM

CENTRAL NERVOUS SYSTEM

INVESTIGATIONS:

Chest X-ray (PA View):



Tuberculin skin test:

Sputum for AFB:

FINAL DIAGNOSIS:

Willingness for treatment:

If no, Reason for Unwillingness for treatment:

DATE

SIGNATURE

ANNEXURE – IV



Page 2 of 129 - Integrity Overview

Submission ID trn:oid::3618-93483000

9% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

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- Quoted Text
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Exclusions

- 2 Excluded Websites

Match Groups

**101**Not Cited or Quoted 9%
Matches with neither in-text citation nor quotation marks

**0** Missing Quotations 0%
Matches that are still very similar to source material

**0** Missing Citation 0%
Matches that have quotation marks, but no in-text citation

**0** Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

6% Internet sources

6% Publications

0% Submitted works (Student Papers)

Integrity Flags

0 Integrity Flags for Review

No suspicious text manipulations found.

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

ANNEXURE – V

S.L.NO.	NAME	INDEX PATIENT NAME	INDEX PATIENT DIAGNOSIS	HEIGHT ID	CONTACT NUMBER	DATE	AGE (IN YEARS)	SEX	HEIGHT (in cm)	WEIGHT (in kg)	BM (kg/m ²)	CATEGORY	COMORBIDITIES	SMOKING	TOBACCO HISTORY	ALCOHOL HISTORY	CONDUCT HISTORY	CHEST XRAY FINDINGS	SPUTUM ZIEHL NEILSEN	TUBERCULIN SKIN TEST	DIAGNOSIS	WILLINGNESS FOR TPT	REASON FOR UNWILLINGNESS	TPT INITIATED	TREATMENT COMPLETION STATUS	
1	SATISH MONMADU	DEEPA MONMADU	DTB	80536110	901179448	10/29/2024	35	F	161	43.1	16.78	UNDERWEIGHT	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
2	HEMANTH MONMADU	DEEPA MONMADU	DTB	80536110	901179448	10/29/2024	40	M	169	80.6	21.22	NORMAL	NONE	SMOKER	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
3	ABHISHEK MONMADU	DEEPA MONMADU	DTB	80536110	901179448	10/29/2024	18	M	165	51	18.73	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
4	NIITHA MONMADU	DEEPA MONMADU	DTB	80536110	901179448	10/29/2024	12	F	142	33.4	16.56	UNDERWEIGHT	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
5	VIDYAREE BACHABAI	BHIMAPPA BACHABAI	DTB	4489350	832540481	12/15/2023	26	F	152	47.2	24.49	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	LTBI	YES	NA	YES	INCOMPLETE	
6	RAVI BACHABAI	BHIMAPPA BACHABAI	DTB	4489350	832540481	12/15/2023	31	M	160	51.6	20.55	NORMAL	NONE	NONE	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
7	ASHWINI BACHABAI	BHIMAPPA BACHABAI	DTB	4489350	832566484	12/15/2023	26	F	157	51.6	20.59	NORMAL	NONE	NONE	NO	YES	YES	CALCIFICATIONS	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
8	VIJAYASHAM BHADRO	SHIVAPPA BHADRO	DTB	6014801	741120151	2/5/2024	35	F	160	51.4	21.42	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
9	RAJ KONGARHAGAG	SULTKA KONGARHAGAG	DTB	6320559	702251557	10/28/2023	19	M	155	58.9	24.52	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
10	SODHAPATHI KONGARHAGAG	SULTKA KONGARHAGAG	DTB	6320559	702251557	10/28/2023	35	M	163	61.1	23.75	NORMAL	NONE	TOBACCO CHEWER	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
11	SAREGBODDA KONGARHAGAG	SULTKA KONGARHAGAG	DTB	6320559	702251557	10/28/2023	43	M	171	89.7	30.68	DIESTY	NONE	SMOKER,TOBACCO CHEWER	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	LTBI	YES	NA	YES	COMPLETED	
12	BAJAVAN INDI	UMESH INDI	DTB	9306764	821364704	11/28/2024	50	F	156	48.7	20.01	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
13	JAGADESH NOKI	UMESH INDI	DTB	9306764	821364704	11/28/2024	37	M	168	76.9	27.35	OVERWEIGHT	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
14	REKSHA PATIL	RAAJ JAGADESHETTI	DTB	3666953	636326767	6/8/2023	49	F	153	51.6	24.61	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
15	BAJAVANTHAY PATIL	RAAJ JAGADESHETTI	DTB	3666953	636326767	6/8/2023	61	M	162	61.3	24.88	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
16	MUTAPPA TUMBAGI	BAGIANA TUMBAGI	DTB	6876907	832584148	2/14/2024	36	M	172	77.6	26.23	OVERWEIGHT	NONE	SMOKER	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
17	SHAMUNA TUMBAGI	BAGIANA TUMBAGI	DTB	6876907	832584148	2/14/2024	55	F	154	51.5	21.59	NORMAL	DIABETES	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	LTBI	YES	NA	YES	COMPLETED	
18	BAGIANA TUMBAGI	BAGIANA TUMBAGI	DTB	6876907	832584148	2/14/2024	28	F	158	51.1	22.67	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
19	SAMANTH TUMBAGI	BAGIANA TUMBAGI	DTB	6876907	832584148	2/14/2024	6	M	105	21.6	19.59	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
20	SANJEEV TUMBAGI	BAGIANA TUMBAGI	DTB	6876907	832584148	2/14/2024	5	M	97	38.7	20.54	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
21	BAGIAMAN BADGER	SHIVANANT BADGER	MTB TB	6127229	636275946	11/17/2023	35	F	156	46.1	19.94	HYPOPHOSPHOS	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
22	BAGIAMAN BADGER	SHIVANANT BADGER	MTB TB	6127229	636275946	11/17/2023	8	M	116	23.3	18.80	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
23	BAINDANA TAGI	SANJAYANA TAGI	MTB TB	1755957	97531346	808557378	11/15/2024	58	M	172	57.3	19.37	NORMAL	NONE	SMOKER	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA
24	CHANDRAPPA MONMADU	MULANNA MONMADU	DTB	9464695	832585381	12/31/2024	58	M	166	69.9	25.19	NORMAL	NONE	SMOKER,TOBACCO CHEWER	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
25	SODHAPATHI FLUR	GOLLAJAPPA FLUR	DTB	962397	778520548	1/2/2025	21	M	159	51.6	20.61	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
26	ASHWINI KULLETHA	ASHWINI KULLETHA	DTB	6072514	814723552	11/4/2023	21	M	165	73.5	27.00	OVERWEIGHT	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
27	ABHINAV KULLETHA	ASHWINI KULLETHA	DTB	6072514	814723552	11/4/2023	27	M	174	75.1	24.07	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
28	ASHWINI KULLETHA	ASHWINI KULLETHA	DTB	6072514	814723552	11/4/2023	23	F	157	30.7	26.57	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
29	STATHI KULLETHA	ASHWINI KULLETHA	DTB	6072514	814723552	11/4/2023	50	F	160	56.4	21.09	NORMAL	NONE	TOBACCO CHEWER	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	LTBI	YES	NA	YES	COMPLETED	
30	BABY KULLETHA	ASHWINI KULLETHA	DTB	6072514	814723552	11/4/2023	28	M	172	75.8	25.62	OVERWEIGHT	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
31	SUDASHINI KULLETHA	ASHWINI KULLETHA	DTB	6072514	814723552	11/4/2023	69	F	156	47.8	19.64	NORMAL	DIABETES	TOBACCO CHEWER	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
32	SNASH KULLETHA	ASHWINI KULLETHA	DTB	6072514	814723552	11/4/2023	5	F	97	11.4	12.12	UNDERWEIGHT	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
33	MAJALAPPA MUGAL	MAJALAPPA MUGAL	MTB TB	7348801	950307133	5/2/2024	18	M	171	88.3	30.38	DIESTY	NONE	NONE	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NA	NO TB	MISCONCEPTION	NO	NA	
34	ASHWINI BADGAR	MITHAN THIRREDDY	DTB	6727253	988571402	1/24/2024	28	F	153	46.7	19.95	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	LTBI	YES	NA	YES	INCOMPLETE	
35	KAVITA CHIDAMANI	73848728	MTB TB	930801246	6713/2024	35	M	169	58.3	24.13	NORMAL	NONE	SMOKER	PRESENT	YES	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NA	NO TB	YES	NA	COMPLETED	
36	TASNU RAJENDRA MANSAB	RAJENDRA MANSAB	MTB TB	66334767	62080133	761391548	2/9/2024	37	F	156	48.8	17.99	UNDERWEIGHT	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	NO	NON-PROGRESS
37	SADASHI BHAI	DARWAD BHAI	MTB TB	9132550	782575236	11/7/2024	50	F	154	38.2	24.54	NORMAL	NONE	TOBACCO CHEWER	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
38	VASANTHA BHAI	DARWAD BHAI	MTB TB	9132550	782575236	11/7/2024	28	F	165	49.7	18.26	UNDERWEIGHT	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
39	ASHWIN K	BEEBAPPA NARAHODI	DTB	6963651	930801247	2/28/2024	55	M	161	71.9	28.51	OVERWEIGHT	HYPERTENSION	SMOKER	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	LTBI	YES	NA	YES	COMPLETED	
40	SHEEDIN A	BEEBAPPA NARAHODI	DTB	6963651	930801247	2/28/2024	48	F	152	54.2	23.48	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
41	SHARAPPA BHAIKATTI	MALLANNA BHAIKATTI	MTB TB	4736955	930632189	6/4/2023	46	M	169	62.5	21.66	NORMAL	NONE	SMOKER	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
42	MALLANA PANGI	LAKSHMIPATI PANGI	DTB	8013967	825697016	7/30/2024	25	M	160	59.3	21.39	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
43	BHIMANNA FLURI	LUNALA FLURI	MTB TB	6423638	801297075	12/30/2023	36	M	167	78.3	28.08	OVERWEIGHT	HYPERTENSION	SMOKER	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
44	SANDESH SHAILI	SHIVANNA SHAILI	DTB	3045584	952401044	1/20/2025	24	M	173	61.7	20.95	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
45	MALLAPPA GANTEPAGOL	SHIVAPPA GANTEPAGOL	DTB	9793695	725523812	1/3/2025	50	M	166	71.5	25.95	OVERWEIGHT	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
46	MALLAPPA WATHA	SODHANA WATHA	DTB	62801118	897166369	12/20/2023	60	F	151	38.2	25.53	OVERWEIGHT	DIABETES, HYPERTENSION	TOBACCO CHEWER	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
47	BHUVARESHWARI WATHA	SODHANA WATHA	DTB	62801118	897166369	12/20/2023	30	F	158	51.6	21.47	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	LTBI	YES	NA	YES	INCOMPLETE	
48	MALLANNA WATHA	SODHANA WATHA	DTB	62801118	897166369	12/20/2023	35	M	163	64.1	24.13	NORMAL	HYPERTENSION	SMOKER	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
49	ANJANATH CHODARI	BHARANNANA CHODARI	DTB	73381365	988007183	3/30/2024	56	F	149	52.9	23.63	NORMAL	DIABETES	TOBACCO CHEWER	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
50	AKKAPPA CHODARI	BHARANNANA CHODARI	DTB	73381365	988007183	3/30/2024	25	M	157	67.8	27.51	OVERWEIGHT	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
51	SEETHA SHIVASTAV	GOPAL SHIVASTAV	DTB	70381196	53428112	3/10/2024	27	F	151	48.7	21.36	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	LTBI	YES	NA	YES	COMPLETED	
52	APARAJITHA PODAGALAGI	APARAJITHA PODAGALAGI	DTB	63237472	741123829	11/6/2023	60	M	166	89.3	25.15	OVERWEIGHT	NONE	SMOKER	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
53	MINAKSHI PODAGALAGI	APARAJITHA PODAGALAGI	DTB	63237472	741123829	11/6/2023	55	F	154	70.1	23.93	DIESTY	HYPERTENSION	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED
54	APARAJITHA PODAGALAGI	APARAJITHA PODAGALAGI	DTB	63237472	741123829	11/6/2023	29	M	171	84.5	28.90	OVERWEIGHT	NONE	NONE	PRESENT	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
55	MALLANA KERNAL	CHANNAPPA KERNAL	MTB TB	6325980	932525748	11/17/2023	24	F	158	56.5	23.63	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	LTBI	YES	NA	YES	INCOMPLETE	
56	ANJANNA KERNAL	CHANNAPPA KERNAL	MTB TB	6325980	932525748	11/17/2023	5	M	104	20.7	19.14	NORMAL	NONE	NONE	NO	YES	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
57	MAHILA HACHOHIL	HUSARBODDA HACHOHIL	MTB TB	4016294	897181479	6/4/2023																				

91	ARAND KAMATAGI	SHARANAPPA KAMATAGI	DOB	67401522	8712248831	1/20/2004	27	M	165	66.5	24.4	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
92	STON KAMATAGI	SHARANAPPA KAMATAGI	DOB	67401522	8712248831	1/20/2004	25	M	159	53.2	21.4	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
93	PREMA KAMATAGI	SHARANAPPA KAMATAGI	DOB	67401522	8712248831	1/20/2004	20	F	153	42.2	18.9	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	LBN	YES	NA	YES	COMPLETED	
94	SAVITA KAMATAGI	SHARANAPPA KAMATAGI	DOB	67401522	8712248831	1/20/2004	21	F	157	50.8	20.61	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	NO TB	YES	NA	YES	COMPLETED	
95	NELAMA KAMATAGI	SHARANAPPA KAMATAGI	DOB	67401522	8712248831	1/20/2004	55	F	154	57.3	24.16	NORMAL	DIABETES	TOBACCO CHEWER	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	COMPLETED
96	VEDANT KAMATAGI	SHARANAPPA KAMATAGI	DOB	67401522	8712248831	1/20/2004	6	M	99	18.7	19.98	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
97	UNNAI DALUVA	FATIMA DALUVA	NORTB	40163013	49713940	8/19/2003	25	M	174	68.8	22.72	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
98	CHANDREPA GOUNSANG	CHAREPPA GOUNSANG	DOB	68895718	634561369	27/12/2004	73	F	156	45.3	18.61	NORMAL	DIABETES	TOBACCO CHEWER	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA
99	MUTHUPPA GOUNSANG	CHAREPPA GOUNSANG	DOB	68895718	634561369	27/12/2004	36	M	163	48.1	18.10	UNDERWEIGHT	NONE	NONE	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
100	NAGAPPA GOUNSANG	MAJALAMUNA TAGI	DOB	61071021	5148351763	10/18/2003	55	M	168	61.9	22.28	NORMAL	DIABETES	SHOKEE, TOBACCO CHEWER	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE
101	PODANVA GADAPATI	BAHEVA GADAPATI	DOB	73784066	825691708	4/25/2004	30	F	157	56.5	23.73	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
102	KANAKSHA PUNJI	PARANESHWAR PUNJI	DOB	63079163	7895132902	11/16/2004	54	F	152	85.6	37.05	OBESITY	HYPERTENSION	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	PT COMPLETED	NO	NA
103	BAJI HATTI	SIRAGODI HATTI	DOB	73681707	988545143	11/12/2004	37	M	161	59.3	22.87	NORMAL	NONE	SHOKEE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED
104	PARAGI HATTI	SIRAGODI HATTI	DOB	73681707	988545143	11/12/2004	32	M	165	71.8	36.37	OVERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
105	SIRAGODI HATTI	SIRAGODI HATTI	DOB	73681707	988545143	11/12/2004	33	F	154	61.4	26.21	OVERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
106	SHYAM KAMBLE	BAJUNGA KAMBLE	NORTB	81707348	8871596675	9/13/2004	29	M	159	50.7	20.05	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
107	PANOTI GANDE	PANOTI GANDE	DOB	68862161	808854122	2/15/2004	40	F	163	48.9	18.4	UNDERWEIGHT	HYPERTENSION	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA
108	SURUNTHI BELLATTI	KANALUVA BELLATTI	NORTB	75384066	8971772384	6/23/2004	53	M	170	65.8	22.77	NORMAL	NONE	NONE	PRESENT	YES	NORMAL	NEGATIVE	NA	NO TB	YES	NA	YES	INCOMPLETE	
109	YESHODA MASHAL	CHANDRASHANT MASHAL	DOB	67962149	630263839	6/9/2003	34	F	155	58.1	23.95	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
110	YASHU MASHAL	CHANDRASHANT MASHAL	DOB	67962149	630263839	6/9/2003	10	M	126	22.4	14.11	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
111	ACHANA MASHAL	CHANDRASHANT MASHAL	DOB	67962149	630263839	6/9/2003	8	F	117	18.5	15.51	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
112	POORNIMA MASHAL	CHANDRASHANT MASHAL	DOB	67962149	630263839	6/9/2003	7	F	110	15.9	13.14	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
113	MOULALI AMENGAS LATI	AMENGAS LATI	NORTB	38636692	15745715	6/19/2003	13	M	134	29.6	16.48	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
114	GOUNDA AMENGAS LATI	AMENGAS LATI	NORTB	38636692	15745715	6/19/2003	37	F	152	51.4	22.25	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
115	MENKA AMENGAS LATI	AMENGAS LATI	NORTB	38636692	15745715	6/19/2003	16	F	122	22.7	13.84	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE	
116	MOINI AMENGAS LATI	AMENGAS LATI	NORTB	38636692	15745715	6/19/2003	20	M	148	42.5	15.40	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
117	JASHNA SALTAGA	TAPPANNA SALTAGA	NORTB	82023284	785445255	9/12/2004	21	F	159	48.7	19.26	NORMAL	HYPERTENSION	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED
118	JAKHNA SALTAGA	TAPPANNA SALTAGA	NORTB	82023284	785445255	9/12/2004	23	M	167	51.6	19.50	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
119	ADITHA RATHOD	KASI MANU RATHOD	DOB	61895356	848636672	10/31/2003	5	M	52	21.3	25.17	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
120	LACCHU RATHOD	KASI MANU RATHOD	DOB	61895356	848636672	10/31/2003	65	F	158	52.1	20.87	NORMAL	DIABETES	TOBACCO CHEWER	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE
121	MANU RATHOD	KASI MANU RATHOD	DOB	61895356	848636672	10/31/2003	34	M	172	70.8	25.93	NORMAL	NONE	SHOKEE	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
122	MANU RATHOD	KASI MANU RATHOD	DOB	61895356	848636672	10/31/2003	30	F	163	63.3	24.58	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE	
123	PAVAL RATHOD	KASI MANU RATHOD	DOB	61895356	848636672	10/31/2003	7	F	134	33.2	30.70	OBESITY	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE	
124	SATYU MORGAR	NAHABANDA MORGAR	DOB	91126992	998232748	11/5/2004	23	M	165	66.5	24.43	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	ON TREATMENT	
125	BHEEM SINGALUVA	TAGESH SINGALUVA	NORTB	75381741	871287846	5/31/2004	45	F	161	54.4	20.98	NORMAL	DIABETES	TOBACCO CHEWER	NONE	NO	YES	NORMAL	NEGATIVE	NA	NO TB	YES	NA	YES	INCOMPLETE
126	ARESHA SINGALUVA	TAGESH SINGALUVA	NORTB	75381741	871287846	5/31/2004	8	F	121	23.9	16.13	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NA	NO TB	YES	NA	YES	INCOMPLETE	
127	BAHEVA GADAPATI	BAHEVA GADAPATI	DOB	73784066	825691708	4/25/2004	58	F	166	61	22.14	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
128	ANIL SINGER	ARJUNDEWA SINGER	NORTB	67623126	997123589	6/9/2004	30	F	159	50.7	20.05	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NA	NO TB	NO	MISCONCEPTION	NO	NA	
129	REKHA GUNU	ARJUNDEWA SINGER	NORTB	67623126	997123589	6/13/2004	46	F	156	47.2	19.40	NORMAL	HYPERTENSION	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NA	NO TB	NO	MISCONCEPTION	NO	NA
130	SHAYEN MAMADAPPER	SAMENKA MAMADAPPER	DOB	49593660	998677959	10/6/2003	40	F	169	59.7	22.46	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
131	ARESHA MAMADAPPER	SAMENKA MAMADAPPER	DOB	49593660	998677959	10/6/2003	15	F	137	27.5	14.65	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
132	MESHERU MAMADAPPER	SAMENKA MAMADAPPER	DOB	49593660	998677959	10/6/2003	32	M	174	61.3	20.25	NORMAL	NONE	SHOKEE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	COMPLETED
133	MAIDA MAMADAPPER	SAMENKA MAMADAPPER	DOB	49593660	998677959	10/6/2003	48	F	160	68.9	26.91	OVERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
134	LATHABA GOG	CHANDRASEKHAR GOG	DOB	62025985	966293521	11/19/2003	61	F	152	58.8	24.15	NORMAL	DIABETES, HYPERTENSION	TOBACCO CHEWER	NONE	NO	YES	NON-HOMOGENEOUS OPACITY	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA
135	BAJUNGA GOG	CHANDRASEKHAR GOG	DOB	62025985	966293521	11/19/2003	42	M	165	71.1	26.48	OVERWEIGHT	NONE	SHOKEE, TOBACCO CHEWER	NONE	NO	YES	CALCIFICATIONS	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA
136	JALAM PANDITH	GAJANANAN PANDITH	DOB	89983034	7481185469	10/22/2004	49	F	153	73.8	31.53	OBESITY	HYPERTENSION	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE
137	PRATHEN PANDITH	GAJANANAN PANDITH	DOB	89983034	7481185469	10/22/2004	42	M	170	63.6	28.93	OVERWEIGHT	NONE	SHOKEE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE
138	KANCHOVA UNESH	GAJANANAN UNESH	DOB	89983034	7481185469	10/22/2004	39	F	148	63.6	30.17	OBESITY	HYPERTENSION	NONE	NONE	NO	YES	CALCIFICATIONS	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE
139	SHANMUGA GOUR	BAJANATHAPPA GOUR	DOB	89519523	7317663857	10/18/2004	26	M	175	48.2	15.74	UNDERWEIGHT	NONE	SHOKEE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	INCOMPLETE
140	PRATHISA HALUAPPA	HALUAPPA MUGALUNNA	NORTB	53627355	5740415378	11/25/2004	9	F	112	21.5	17.14	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
141	PREETHA HALUAPPA	HALUAPPA MUGALUNNA	NORTB	53627355	5740415378	11/25/2004	13	M	136	23.9	20.72	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
142	PRIN HALUAPPA	HALUAPPA MUGALUNNA	NORTB	53627355	5740415378	11/25/2004	10	F	118	26	18.67	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
143	SHRASHVI MUGALUNNA	HALUAPPA MUGALUNNA	NORTB	53627355	5740415378	11/25/2004	31	F	155	53.1	22.1	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	NO	MISCONCEPTION	NO	NA	
144	SHACHIN REE BRADAR	PRANJALI BRADAR	DOB	36274858	9980326081	4/27/2003	27	F	161	58.5	22.57	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
145	VIJAYALAKSHI BRADAR	PRANJALI BRADAR	DOB	36274858	9980326081	4/27/2003	51	F	156	55.9	22.97	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
146	SHYRAGAD BRADAR	PRANJALI BRADAR	DOB	36274858	9980326081	4/27/2003	56	M	164	65.1	24.20	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
147	SIVANNA SHINDE	ANILKUSH SHINDE	NORTB	20365790	26434956	6/19/2003	36	F	147	43.7	20.22	NORMAL	HYPERTENSION	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	COMPLETED
148	DEEPIKA SHINDE	ANILKUSH SHINDE	NORTB	20365790	26434956	6/19/2003	9	F	112	21.5	17.14	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES	NA	YES	COMPLETED	
149	MANJAPPA SHINDE	ANILKUSH SHINDE	NORTB	20365790	26434956	6/19/2003	10	M	128	26	18.67	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO TB	YES				

187	SHAJA ADDONAGI	CHAPPAL ADDONAGI	NOBTE	3676289	984581008	3/14/2023	40	F	153	61.3	26.19	OVERWEIGHT	HYPERTENSION	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE
188	CHANDAPPA PUARI	SHREE PUARI	NOBTE	7041110	984530336	3/14/2024	40	M	168	71.3	25.26	OVERWEIGHT	NONE	NONE	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
189	MAHESHA PUARI	SHREE PUARI	NOBTE	7041110	984530336	3/14/2024	35	F	160	56.1	21.95	NORMAL	NONE	NONE	NO	YES	ALUSLAR INFILTRATES	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
190	DUDAPPA KOLLI	SHADABAN MANTAGO	NOBTE	48911251	914024045	11/15/2025	19	M	156	50.9	20.91	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
191	APPANNA KOLLI	SHADABAN MANTAGO	NOBTE	48911251	914024045	11/15/2025	53	M	157	53.6	20.93	NORMAL	NONE	SHOCKER	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
192	SUNITA KOLLI	SHADABAN MANTAGO	NOBTE	48911251	914024045	11/15/2025	31	F	157	38.7	15.70	UNDERWEIGHT	HYPERTENSION	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
193	GANGANNA HULUBAHAI	WINGAPPA HULUBAHAI	NOBTE	5339908	008551451	11/21/2024	30	M	169	69.1	24.19	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
194	SHARAT SHIVANAND VABDE	RIGHT VABDE	NOBTE	38887021	954056902	5/23/2023	39	F	154	57.3	24.16	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
195	SANT SHIVANAND VABDE	RIGHT VABDE	NOBTE	38887021	954056902	5/23/2023	19	M	146	38.5	14.31	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	COMPLETED
196	ADITH VABDE	RIGHT VABDE	NOBTE	38887021	170376159	5/23/2023	12	F	128	32.4	19.70	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	COMPLETED
197	HARAPPA VABDE	RIGHT VABDE	NOBTE	38887021	170376159	5/23/2023	56	M	167	69.6	24.96	NORMAL	DIABETES	NONE	PRESENT	YES	CONSOLIDATION	NEGATIVE	POSITIVE	LBN	YES	NA	YES	COMPLETED
198	RAHEL VADHANAI	RIGHT VABDE	NOBTE	38887021	170376159	5/23/2023	31	M	176	53.8	18.01	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
199	HARAPPA VADHANAI	RIGHT VABDE	NOBTE	38887021	170376159	5/23/2023	67	M	168	70.1	24.84	NORMAL	DIABETES	SHOCKER	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	COMPLETED
200	REHA VABDE	RIGHT VABDE	NOBTE	38887021	170376159	5/23/2023	45	F	160	53.3	21.60	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	COMPLETED
201	SHANTULU VAGHARWAR	RIGHT VABDE	NOBTE	38887021	985555025	5/23/2023	57	F	156	68.0	26.22	OVERWEIGHT	HYPERTENSION	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
202	SIVITA VOGDEWAR	RIGHT VABDE	NOBTE	38887021	911320957	5/23/2023	22	F	155	36.2	15.07	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
203	BARU VOGDEWAR	RIGHT VABDE	NOBTE	38887021	911320957	5/23/2023	33	M	159	59.7	23.61	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
204	PAUSAGHAR PATRO	RIGHT VABDE	NOBTE	38887021	985555025	5/23/2023	50	M	163	67	32.74	OBESITY	NONE	SHOCKER	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
205	SADASHI VAGHARE	AVUL VAGHARE	NOBTE	6087949	014003982	11/18/2023	33	M	165	78.2	29.72	OVERWEIGHT	NONE	SHOCKER	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
206	SHYAM VAGHARE	AVUL VAGHARE	NOBTE	6087949	014003982	11/18/2023	41	F	159	63.5	25.12	OVERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE
207	SHIVAPPA VADAR	SHIVAPPA VADAR	NOBTE	7552187	086151700	6/18/2024	45	M	170	72.6	23.91	NORMAL	DIABETES	SHOCKER	NO	YES	NORMAL	NEGATIVE	NA	NO7B	YES	NA	YES	INCOMPLETE
208	VALLUHA PHAR	BHIMARAO PHAR	NOBTE	7574579	961007693	7/20/2024	35	F	156	60.3	24.78	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE
209	YOGHA PHAR	BHIMARAO PHAR	NOBTE	7574579	961007693	7/20/2024	11	F	121	28.1	19.08	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
210	DIPSHA PHAR	BHIMARAO PHAR	NOBTE	7574579	961007693	7/20/2024	9	F	108	22.5	10.94	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
211	HANNA PATTAR	GANGASHAR PATTAR	NOBTE	7102044	986623634	3/25/2024	28	M	159	67.9	26.86	OVERWEIGHT	NONE	SHOCKER	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
212	KANAKASH PATTAR	GANGASHAR PATTAR	NOBTE	7102044	986623634	3/25/2024	45	F	148	52.3	23.00	NORMAL	DIABETES	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE
213	SHANAJA PATTAR	GANGASHAR PATTAR	NOBTE	7102044	986623634	3/25/2024	25	M	157	61	24.75	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
214	SHESHULA TALASGAR	SUGHLANT TALASGAR	NOBTE	7217610	991638031	4/17/2024	44	F	152	56.2	24.32	NORMAL	NONE	TORACIC OVERH	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
215	GURU TALASGAR	SUGHLANT TALASGAR	NOBTE	7217610	991638031	4/17/2024	50	M	170	70.7	24.46	NORMAL	HYPERTENSION	SHOCKER	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
216	YOGHANATH TALASGAR	SUGHLANT TALASGAR	NOBTE	7217610	991638031	4/17/2024	21	M	157	53.6	18.14	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
217	YOGHANATH TALASGAR	SUGHLANT TALASGAR	NOBTE	7217610	991638031	4/17/2024	18	F	153	47.8	20.41	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
218	MALLIKARJUN TALASGAR	SUGHLANT TALASGAR	NOBTE	7217610	991638031	4/17/2024	12	M	146	42.1	19.75	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
219	GANGASHA PREHATH	SUGLA SARANGAMATH	NOBTE	1289466	014591123	1/21/2025	72	M	163	75.7	28.48	OVERWEIGHT	DIABETES, HYPERTENSION	SHOCKER	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
220	PRASHANTH BANSODE	SHAMANTH BANSODE	NOBTE	8111458	729191302	8/14/2024	34	M	171	58.3	19.94	NORMAL	NONE	NONE	PRESENT	YES	NORMAL	NEGATIVE	POSITIVE	LBN	NO	MISCONCEPTION	NO	NA
221	KOMAL BANSODE	SHAMANTH BANSODE	NOBTE	8111458	729191302	8/14/2024	26	F	151	39.3	15.16	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
222	DANISHA BANSODE	SHAMANTH BANSODE	NOBTE	8111458	729191302	8/14/2024	48	F	162	59.6	19.28	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
223	HESHA BANSODE	SHAMANTH BANSODE	NOBTE	8111458	729191302	8/14/2024	24	M	169	52.7	19.45	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
224	PARAGSHAM MURAL	MUCHAPPA MURAL	NOBTE	4591556	026800002	10/4/2023	25	M	164	69.3	25.77	OVERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE
225	CHANNIMA MURAL	MUCHAPPA MURAL	NOBTE	4591556	026800002	10/4/2023	45	F	156	48.6	19.97	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE
226	LACHIMA MURAL	MUCHAPPA MURAL	NOBTE	4591556	026800002	10/4/2023	60	F	160	62.8	24.53	NORMAL	DIABETES	TORACIC OVERH	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
227	NAGESH GUNAPUR	SHANTIVA MUDAR	NOBTE	5629744	95407765	1/8/2025	32	M	167	61.5	22.25	NORMAL	NONE	SHOCKER	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
228	MAHARAJA ANAGH	DEBODIPPA ANAGH	NOBTE	4489344	986594517	9/22/2023	40	F	161	47.3	18.95	UNDERWEIGHT	HYPERTENSION	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
229	MANAPPA ANAGH	DEBODIPPA ANAGH	NOBTE	4489344	986594517	9/22/2023	26	M	169	52.8	18.48	UNDERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
230	ALUPPA ANAGH	DEBODIPPA ANAGH	NOBTE	4489344	986594517	9/25/2023	25	M	167	63.9	22.91	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
231	LAKHMA NAWAZI	REKSHAPPA NAWAZI	NOBTE	6715797	914217167	1/14/2024	57	F	158	45.9	18.38	UNDERWEIGHT	NONE	TORACIC OVERH	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
232	KASHBA GANGAGODA	ANAPPA GANGAGODA	NOBTE	6193016	740553380	1/29/2024	66	F	154	51.5	21.72	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	NO	MISCONCEPTION	NO	NA
233	BASPA BAPAZO	REHA BAPAZO	NOBTE	6192104	948711761	8/21/2024	59	M	172	78.1	26.74	OVERWEIGHT	DIABETES	TORACIC OVERH	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
234	SHANTU BAPAZO	REHA BAPAZO	NOBTE	6192104	948711761	8/21/2024	45	F	165	63.3	36.60	OBESITY	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
235	CHANDRANATH BASPA	TIREN KULANGI	NOBTE	6329302	107414025	1/14/2025	29	M	161	59.3	19.41	NORMAL	HYPOTHYROIDISM	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	NO	NON-PRESEN
236	INDRA BASNAL	MAHESHITA BASNAL	NOBTE	6240186	991397189	11/15/2023	50	F	149	52.9	20.83	NORMAL	DIABETES, HYPERTENSION	TORACIC OVERH	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE
237	KAMUJA KULKAR	BALAPPA KULKAR	NOBTE	7594495	009095700	6/5/2024	53	F	157	59.1	23.98	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NA	NO7B	NO	MISCONCEPTION	NO	NA
238	BASUNNA KACHAMTHI	WINGANNA KACHAMTHI	NOBTE	9559939	914078025	1/8/2025	42	M	177	57.3	18.29	UNDERWEIGHT	NONE	SHOCKER, TORACIC OVERH	PRESENT	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
239	ABHINAV	VIDHARRE BOKER	NOBTE	59120146	958551493	12/30/2024	35	M	165	62.7	23.63	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
240	KELANNA JAMBHAL	SODAPPA JAMBHAL	NOBTE	9427959	914049159	12/17/2024	36	F	150	49.3	21.91	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
241	PAULU MULLA	PAULU MULLA	NOBTE	9565256	919459339	1/8/2025	32	M	159	68.4	27.06	OVERWEIGHT	NONE	NONE	NO	YES	NORMAL	NEGATIVE	POSITIVE	LBN	YES	NA	YES	INCOMPLETE
242	MAHESH GANAGARI	SHIVAM GANAGARI	NOBTE	7017520	992171401	5/13/2024	46	M	173	76.5	25.56	OVERWEIGHT	NONE	SHOCKER	PRESENT	YES	NORMAL	NEGATIVE	NA	NO7B	NO	MISCONCEPTION	NO	NA
243	SHANTIVA BLAGI	BAGANTAPPA BLAGI	NOBTE	11453083	196388572	2/19/2025	68	F	148	49.2	22.48	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	NO	MISCONCEPTION	NO	NA
244	BHAGHAT BHADAR	BHAGHAT BHADAR	NOBTE	7981378	010513839	7/14/2024	19	M	155	59.1	24.40	NORMAL	NONE	NONE	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	INCOMPLETE
245	SHANAJA SUDARE	MANCHER SUDARE	NOBTE	6194135	014790340	10/31/2023	56	F	161	62.3	24.08	NORMAL	DIABETES	TORACIC OVERH	NO	YES	NORMAL	NEGATIVE	NEGATIVE	NO7B	YES	NA	YES	COMPLETED
246	SANTOSH SUDARE	MANCHER SUDARE	NOBTE	6194135	014790340	10/31/2023																		