



THE BODY SYSTEM SUMMARY

Yisa Yu



1

SIGNS & SYMPTOMS

PATIENT'S SYMPTOMS



**Chills
and Fever**



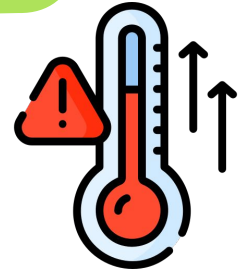
Night sweats



**Chronic
productive
cough**

PATIENT'S SIGNS

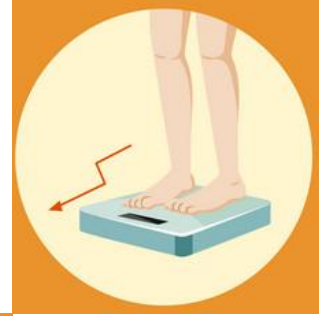
- **Fever of 38.5°C**
 - Fever: above 37.6°C (axillary or oral) and 38.1°C (in ear)
- **Crackles in the right lung**
 - clicking, rattling, or crackling noises emitted during inhalation
 - caused by exudates dislodged by the cough
- **Decreased breath sounds in the right lower lung**
 - caused by fluid(secretions) in the lungs



[1][2][3][4]

ADDITIONAL COMMON SYMPTOMS

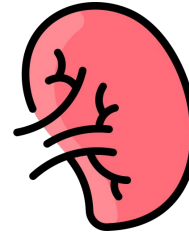
- Pleuritic chest pains
- Difficulty to sleep
- Unproductive coughs
- Loss of appetite
- Fatigue



[13]

ADDITIONAL COMMON SIGNS

- Tender or swollen lymph nodes
- Weight loss
- Hemoptysis due to erosion of blood vessels



[5]

HISTORY OF PRESENT ILLNESS (HPI)

DIAGNOSES

Generate different diagnoses

D

M

MEDICAL DECISION-MAKING

Guiding medical decision-making

I

A

Investigating the patient's condition

INVESTIGATION

Analyzing the patient's illness

ANALYSIS

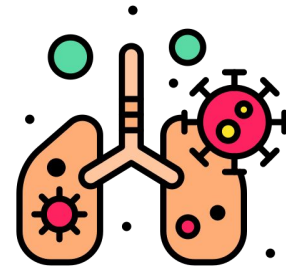
[6]

ROBERT'S CASE

MIGRATED FROM INDIA

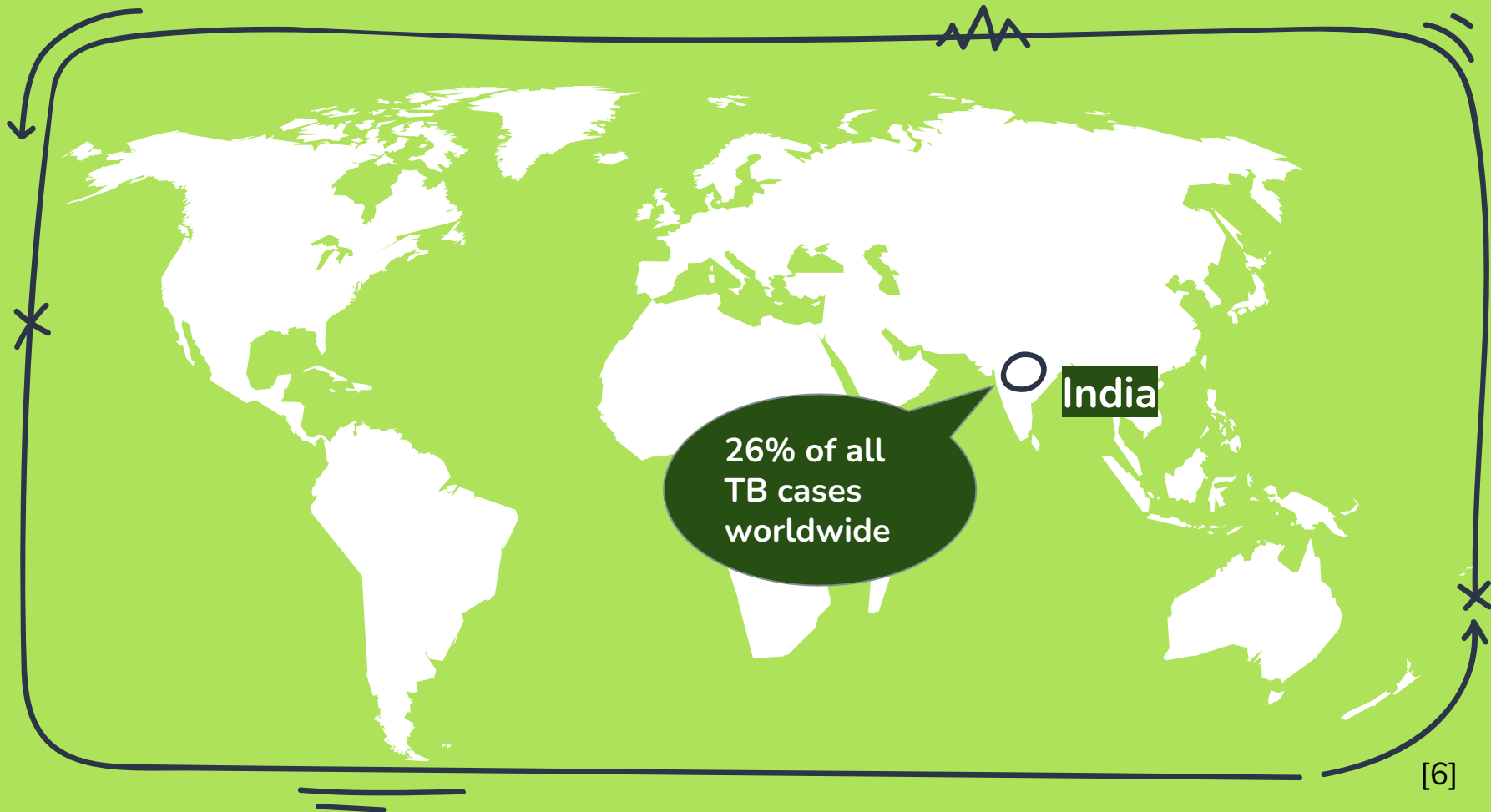
INCREASED
LEVELS OF STRESS

INCREASED
SUSCEPTIBILITY
TO TB



[7]







192 cases

per 100,000 people

34%

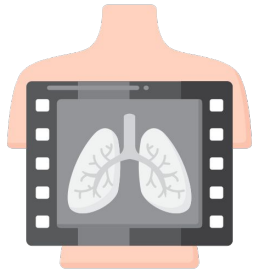
Worldwide TB mortality among HIV- persons

38%

Overall number of TB deaths among HIV+ and HIV- people

LABORATORY SAMPLES AND TESTS

Laboratory samples



Chest X-ray

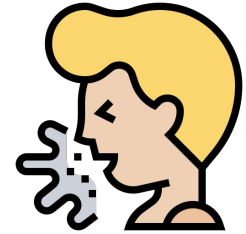
Understand
the extent of
TB

Further X-rays
to check organ
spread

3 deep sputum
samples

Acid-fast
bacilli smear

Culture



[9][10][11]

ACID-FAST BACILLI SMEAR

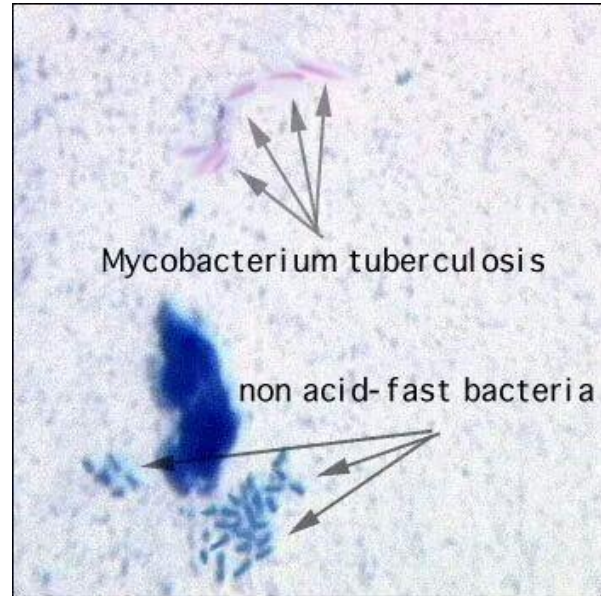
The sputum is smeared onto a glass slide



Use a specific dye to make Mtb visible under microscope



Count the acid-fast bacilli found in the smear



ACID-FAST BACILLI SMEAR (CONT.)

Smear Result (Number of AFB observed at 1000X magnification)	Smear Interpretation	Infectiousness of Patient
4+ (>9/field)	Strongly positive	Probably very infectious
3+ (1-9/field)	Strongly positive	Probably very infectious
2+ (1-9/10 fields)	Moderately positive	Probably infectious
1+ (1-9/100 fields)	Moderately positive	Probably infectious
+/- (1-2/300 fields)*	Weakly positive [†]	Probably infectious
No acid-fast bacilli seen	Negative	Probably not infectious**

* There are variations on labeling for this result, and include listing the number of AFB counted.

[†] Laboratories may report these smear results as "doubtful" or "inconclusive" based on CDC guidelines.

System for reporting the number of acid-fast bacilli

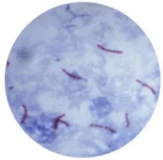
[12]

ACID-FAST BACILLI SPUTUM CULTURE

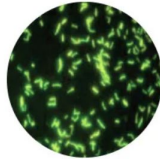
	Length of development	Drug susceptibility test	Expected results
Solid media	<u>Positive:</u> 4 weeks <u>Negative:</u> no development in 8 weeks	Employed	<u>Positive:</u> bacteria exists <u>Negative:</u> no bacteria
Liquid media	Positive: 2 weeks	Employed	<u>Positive:</u> bacteria exists <u>Negative:</u> no bacteria



DEFINITIVE DIAGNOSIS



Acid-fast bacilli

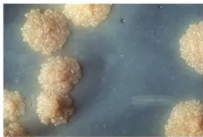


Mycobacteria stained with Fluorescent stain



Mantoux tuberculin skin test

Laboratory Diagnosis of *Mycobacterium tuberculosis* Infection



M. Tuberculosis colonies in LJ medium



GeneXpert MTB/RIF Assay

microbeatline

- Requires a **positive mycobacterial culture** or **nucleic acid amplification test (NAAT)**
- A single negative NAAT result **does not rule out TB**
- **Sputum culture** remains the **gold standard**

[12]

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2

BODY SYSTEMS AFFECTED

BODY SYSTEMS AFFECTED

Respiratory system

1

Liver

3

Gastrointestinal system

5

Skin

7

2

Lymphoreticular system

4

Musculoskeletal system

6

Reproductive system

[1]

AFFECTED COMPARTMENTS OF THE RESPIRATORY SYSTEM

- Lungs are mostly affected due to its gas exchange function
- Mtb infection occurs due to airborne dried mucous droplets

Upper respiratory tract

Nasal cavity

Pharynx

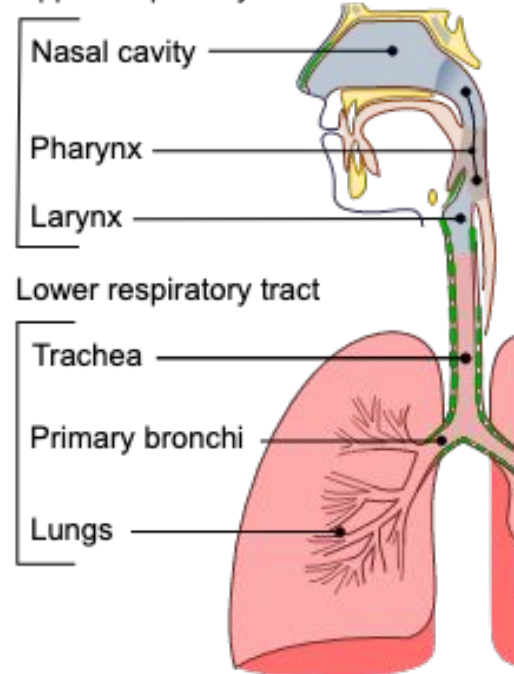
Larynx

Lower respiratory tract

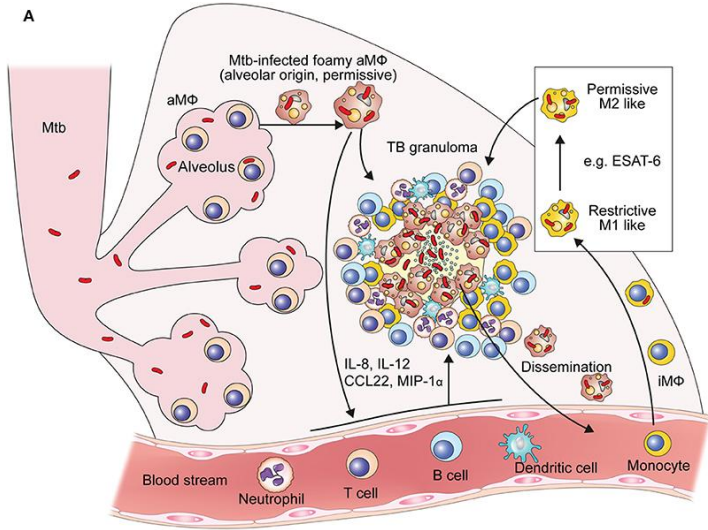
Trachea

Primary bronchi

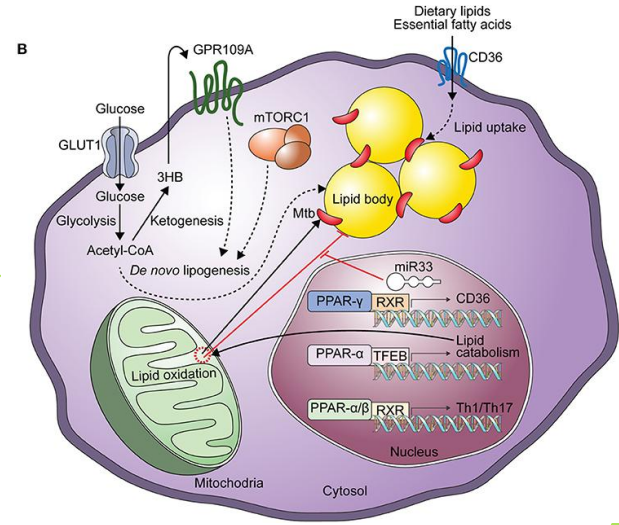
Lungs



EARLY STAGES OF TB INFECTIONS

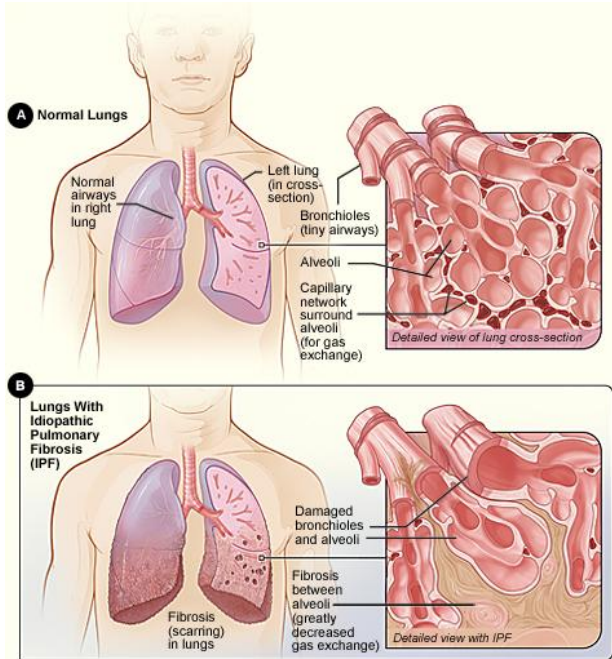


Alveolar macrophages initiate inflammatory response, leading to formation of granuloma.



Lipid pneumonia lesions lead to caseous necrosis formation, then coughed out by the patient, leaving a cavity

EARLY STAGES OF TB INFECTIONS (CONT.)



Extracellular matrix proteins deposit in lungs; normal lung tissue replaced with collagenous tissue



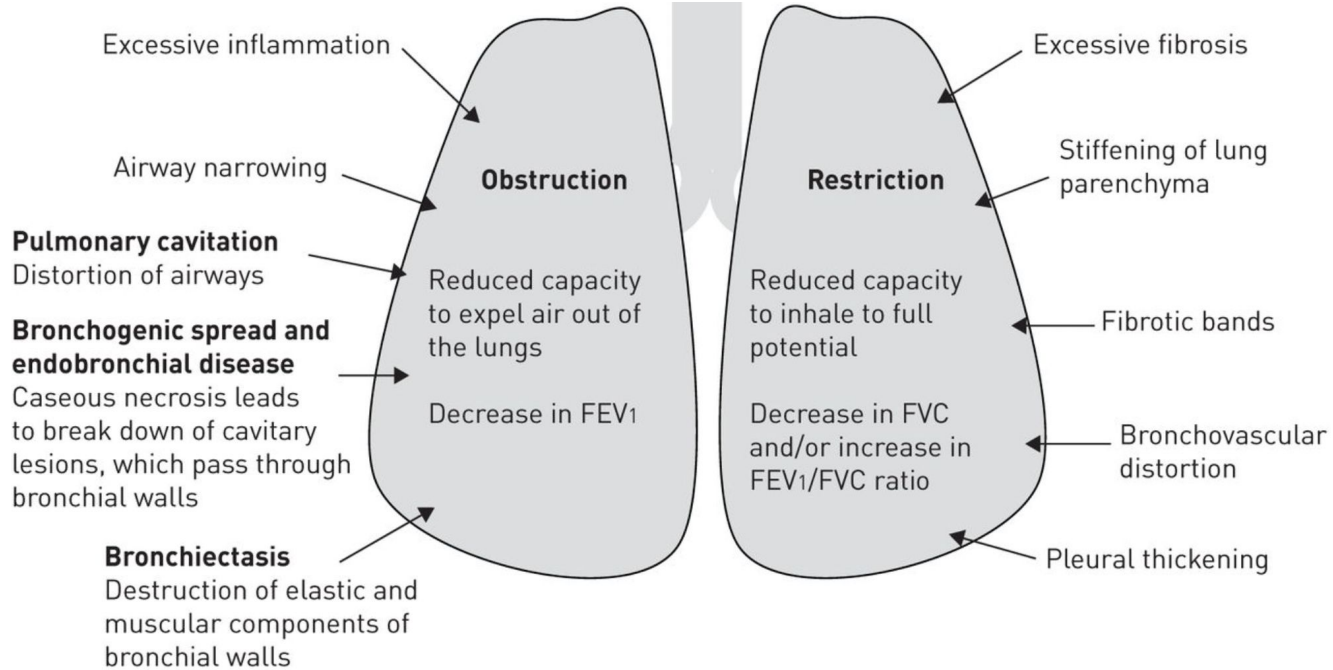
Lung walls become thick and stiff



Bronchiectasis may develop; bronchial walls lose elasticity and bronchi dilate

[4][7]

CONSEQUENCES OF TB INFECTIONS

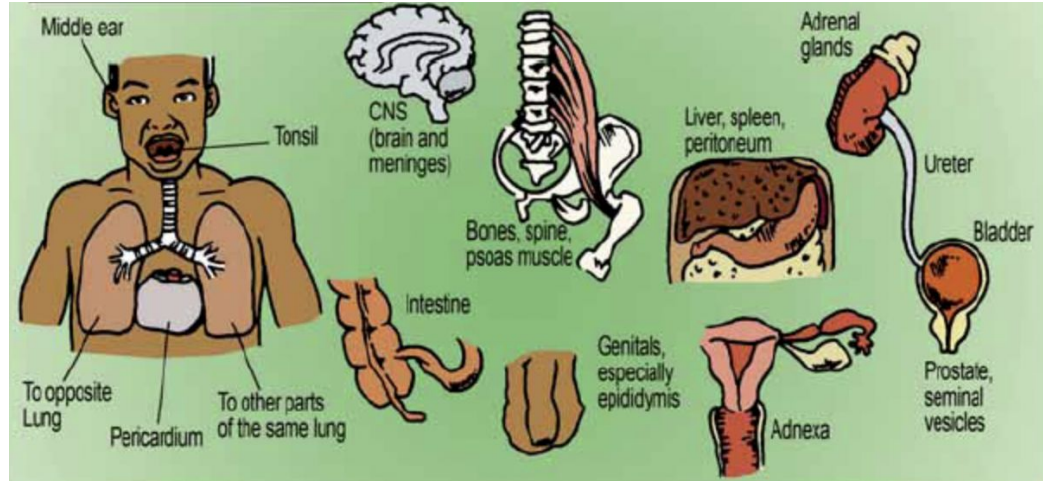


[2][7][8]

WHAT IF LEFT UNTREATED?

May spread via:

1. Hematogenous route
2. Lymphatic route
3. Descending direct spread
4. Sexual transmission



[9]

TB LYMPHADENITIS

**SWELLING of
LYMPH NODES
in the NECK**



Locations:

1. Anterior and posterior triangles of the neck
2. supraclavicular and axillary regions
3. a sinus tract or ulceration of the surrounding skin (aka Scrofula)

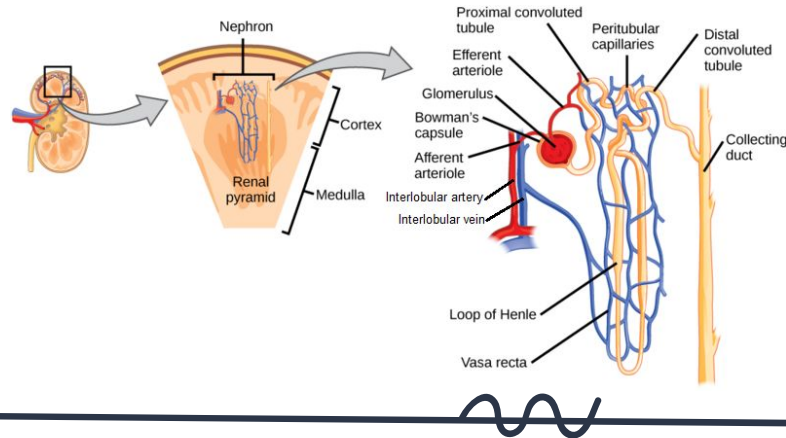
[10]

EFFECTS ON THE KIDNEY

Granulomatous lesion in the glomeruli burst into renal tubule

Become caught up in the Loop of Henle

Cause Granulomatous progression, necrosis, cavitation



[10]



EFFECTS ON THE CENTRAL NERVOUS SYSTEM

TB can cross the blood-brain barrier and the blood-cerebrospinal fluid barrier

Can also enter by hijacking neutrophils and macrophages



TB stimulates an immune response, leading to inflammation and brain damage



Exudate forms and leads to edema and perivascular infiltration, resulting in encephalitis

[11][12][13][14][15]

BONE AND JOINT TB

Infection begins in the anterior-inferior portion of a vertebral body

Spreads beneath the anterior longitudinal ligament

Spreads to neighboring vertebral bodies, causing illness



[10]



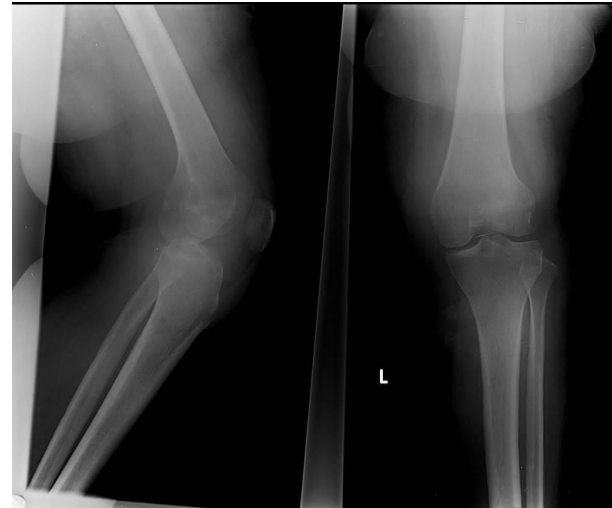
BONE AND JOINT TB (CONT.)

Tuberculous arthritis:

- Affects major, weight-bearing joints
- Symptoms: swelling, discomfort and loss of function

Advanced illness:

- Paraspinous fluid collections
- Compression of the spinal cord or peripheral nerves



[10]

GASTROINTESTINAL TB LOCATIONS

Ileocecal areas
Jejunioileal areas
anorectal areas

} Most common

Hepatosplenic
biliary tract
pancreatic

} Quite uncommon

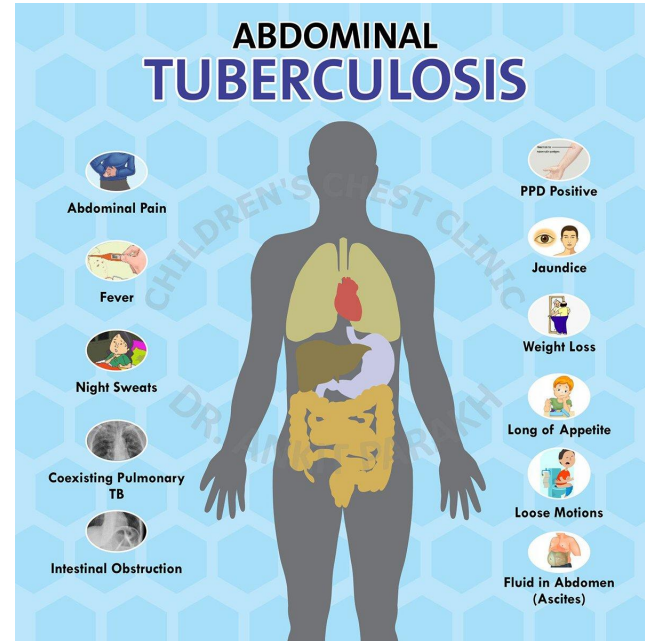
Esophagus
Stomach
Duodenum

} Have been reported

[10]

GASTROINTESTINAL TB SYMPTOMS

- Persistent abdominal pain
- Constitutional symptoms
- Right lower quadrant mass
- Ascites



[10]

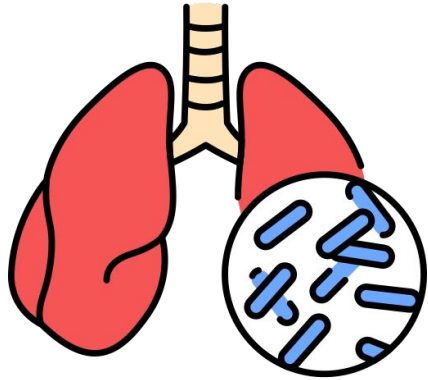
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3

TREATMENTS





85%

Treatment success rate

60%

Mortality rate due to inappropriate treatment and multidrug resistant strains of TB

[1]

TREATMENT PERIOD FOR TB

Completely susceptible
illness

Extrapulmonary
TB

TB meningitis and TB
pericarditis

Treatment
duration

**6 months for
rifampin-based regimens**

up to 9 months

**corticosteroids
administered for the
first 1 to 2 months**

[3][4][5]



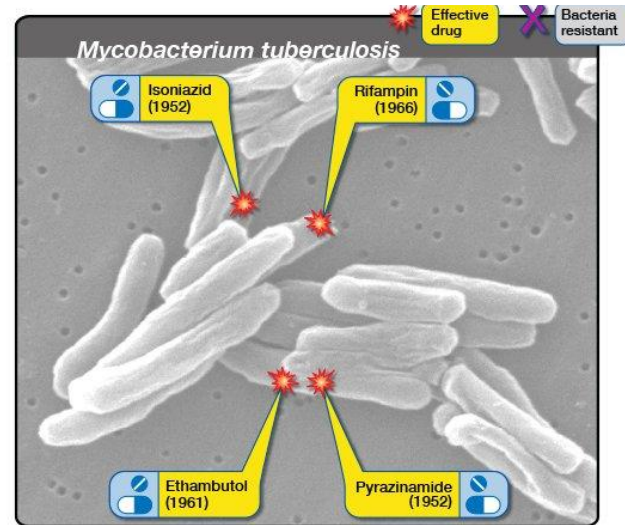
STANDARD TREATMENT REGIMEN

1. Isoniazid
2. Rifampin
3. Pyrazinamide
4. Ethambutol

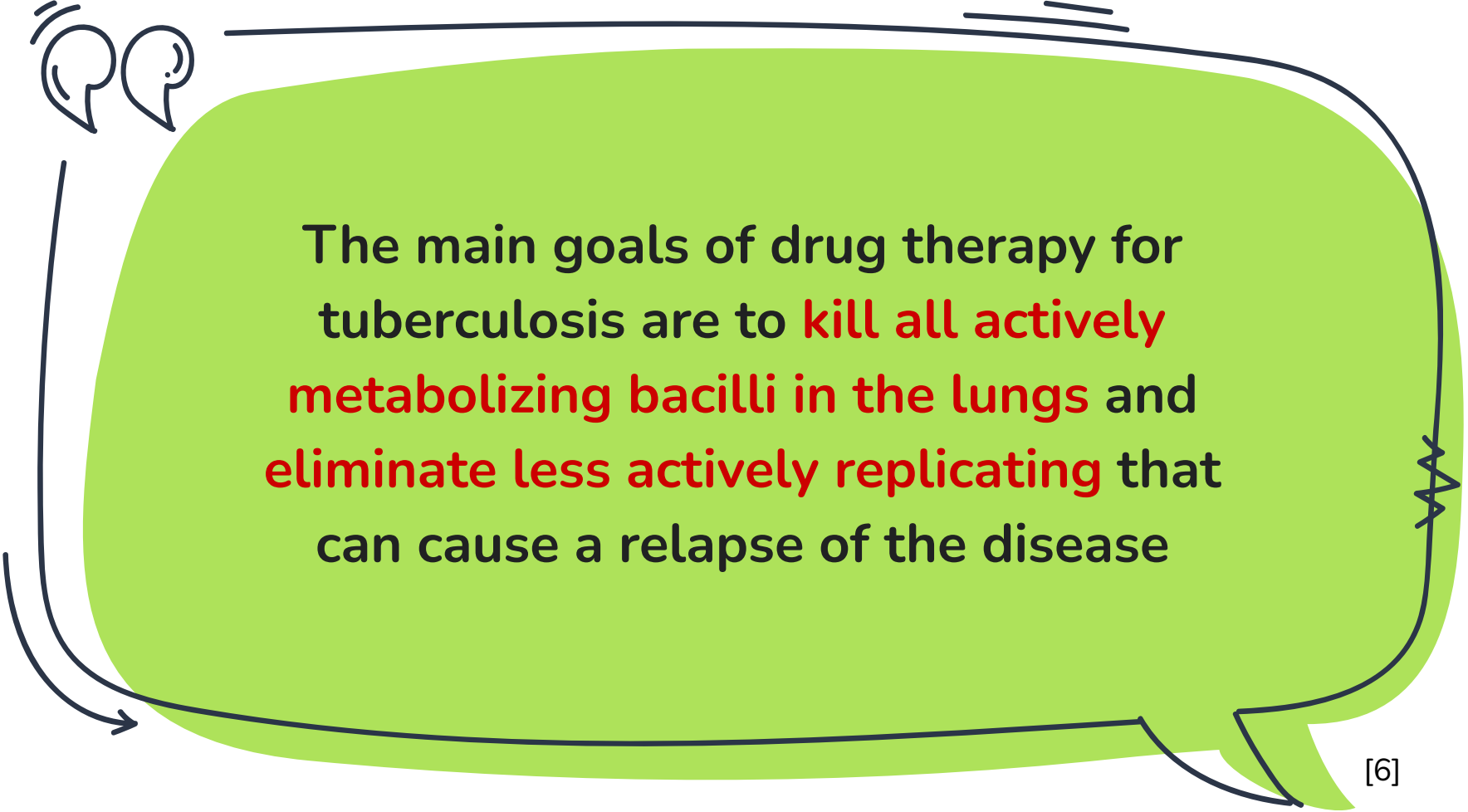
First 2 months

Following 4 months

May be discontinued if bacteria are susceptible to the other 3 drugs



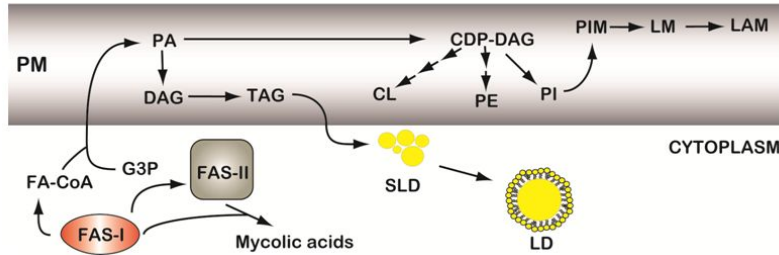
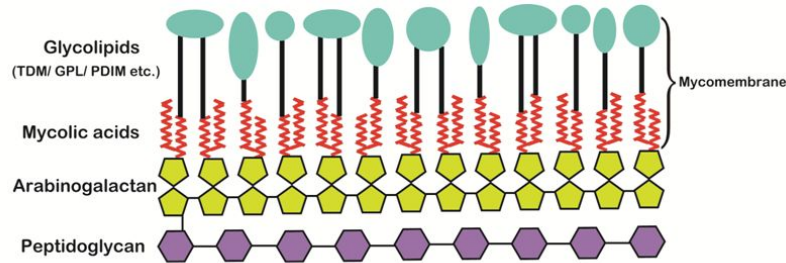
[2][6]



The main goals of drug therapy for tuberculosis are to **kill all actively metabolizing bacilli in the lungs** and **eliminate less actively replicating** that can cause a relapse of the disease

[6]

MYCOLIC ACID - STRONG TARGET FOR DRUGS



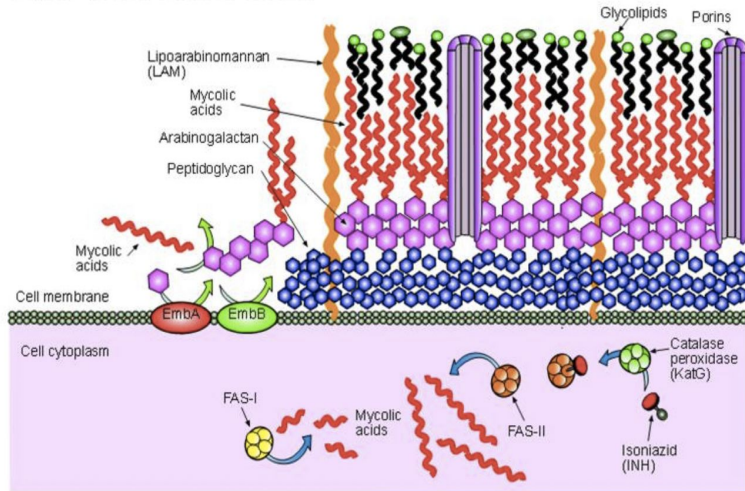
- X A component of Mtb cell wall
- X Prevent chemical damage and dehydration of cell wall
- X Prevent hydrophobic antibiotics from penetrating cell wall
- X Allow bacteria to grow within macrophages

[6][7]



ISONIAZID MECHANISM OF ACTION

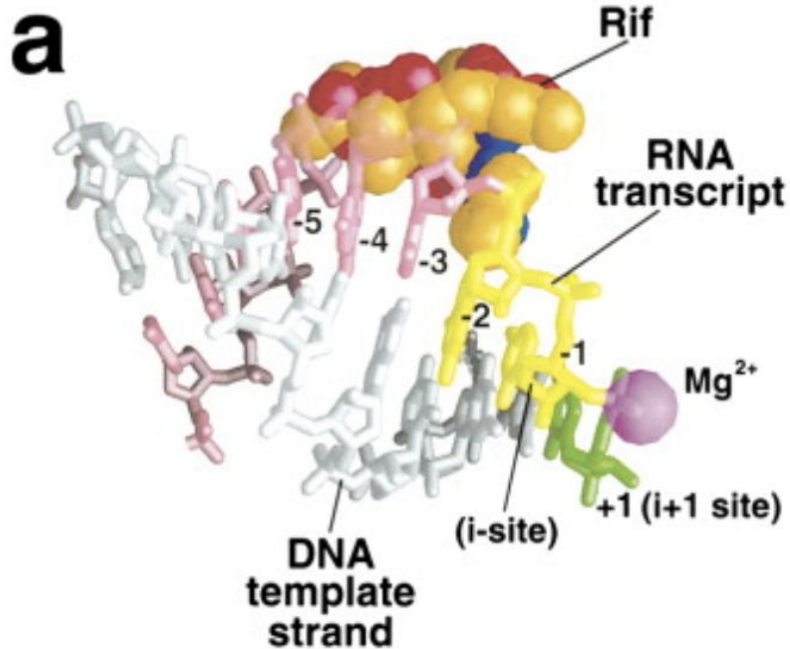
Drug action: Isoniazid (INH)



1. Prodrug of isoniazid activated into its acyl radical form via **catalase-peroxidase enzyme**
2. Catalyze the formation of the activated isoniazid intermediate from the prodrug and bind to the **InhA protein**
3. Inhibit fatty acid synthesis by catalyzing the reduction of **long-chain trans-2-enoyl-ACP** in the **type II fatty acid biosynthesis pathway** of the bacteria
4. Inhibition of InhA disrupts the biosynthesis of the **mycolic acid**, leaving the bacterium vulnerable to destruction by the immune system

[6][8]

RIFAMPIN MECHANISM OF ACTION

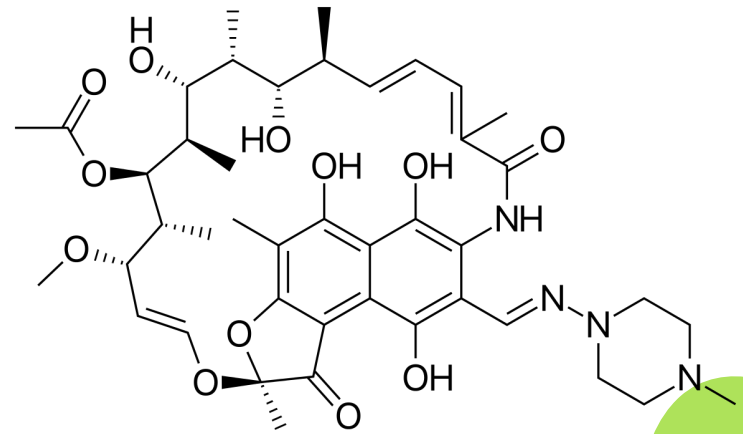


- Bind to the B subunit of the DNA-dependent RNA polymerase
- Block RNA transcription (RNA elongation at the 5' end)
- Block bacterial RNA synthesis

[9]

DOWNSIDES OF RIFAMPIN

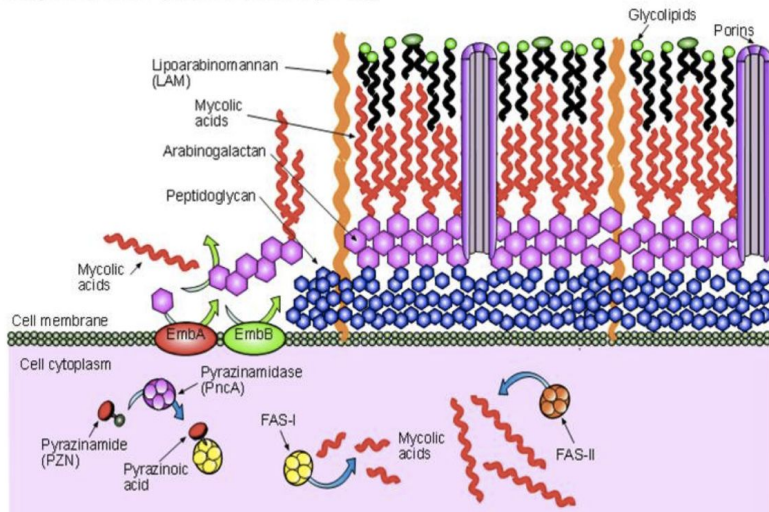
- ✗ Does not interfere with substrate binding/catalytic activity
- ✗ If the RNA polymerase has already synthesized a transcript that has entered the elongation phase, it is completely resistant to the drug
- ✗ Must be used with isoniazid due to short-lived improvements and increased drug resistance



[10]

PYRAZINAMIDE MECHANISM OF ACTION

Drug action: Pyrazinamide (PZN)



- Targets **non-growing bacilli**
- converted to **pyrazinoic acid** via **nicotinamidase** encoded by the **pncA** gene
 - acidification of the bacteria leading to inhibition of crucial enzymes
 - inhibiting fatty acid synthesis and disrupting bacteria growth and replication
 - de-energize the membrane, inhibiting protein and RNA synthesis
 - inhibit ribosomal protein S1, preventing trans-translation

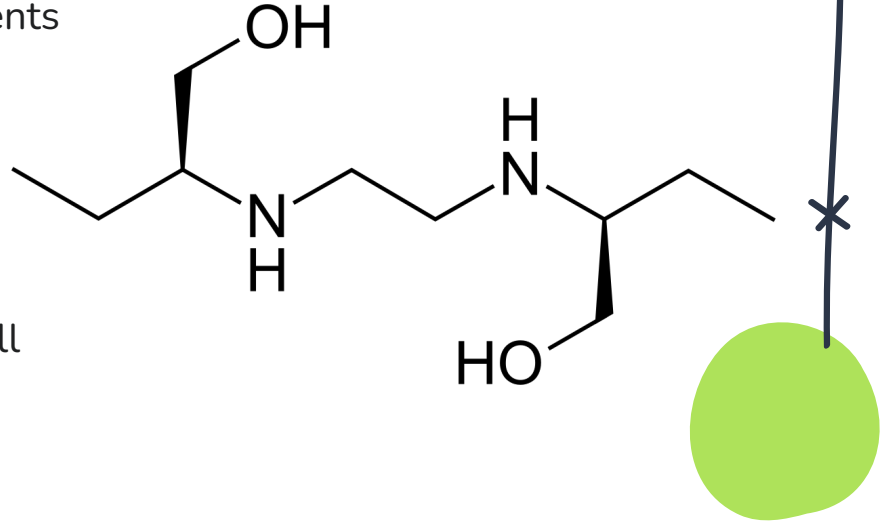
[11][12]

ETHAMBUTOL MECHANISM OF ACTION

Reducing the production of lipoarabinomannan and arabinogalactan which are cell wall components



Prevents bacterial replication as it needs cell walls to divide



[13]

TREATMENT PRECAUTIONS

- Incorrect usage of medication could lead to:
 - ineffective treatment
 - a higher chance for future complications
 - Resistant forms of TB
- Treatment of TB will take longer than other bacterial infections



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4

PUBLIC HEALTH UNIT
INTERVENTION



> 3,000,000

People get killed by TB each year

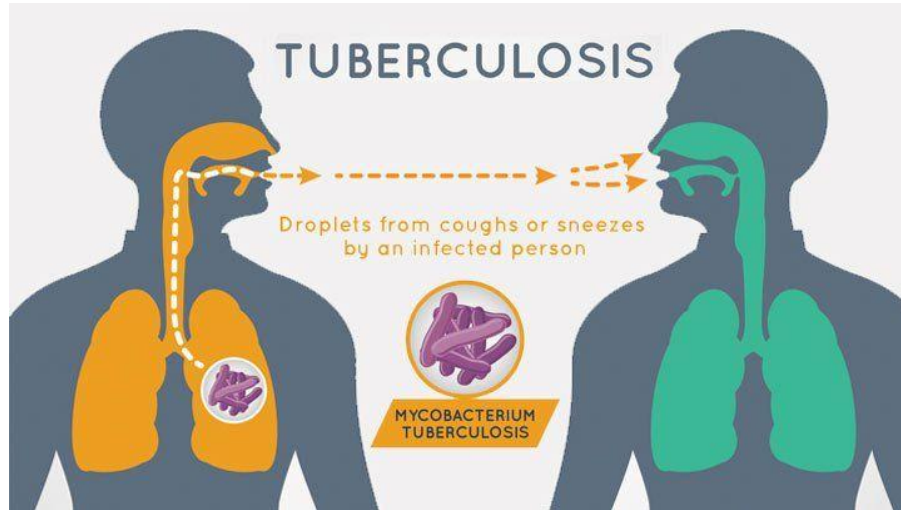


33%

World's population infected with latent TB

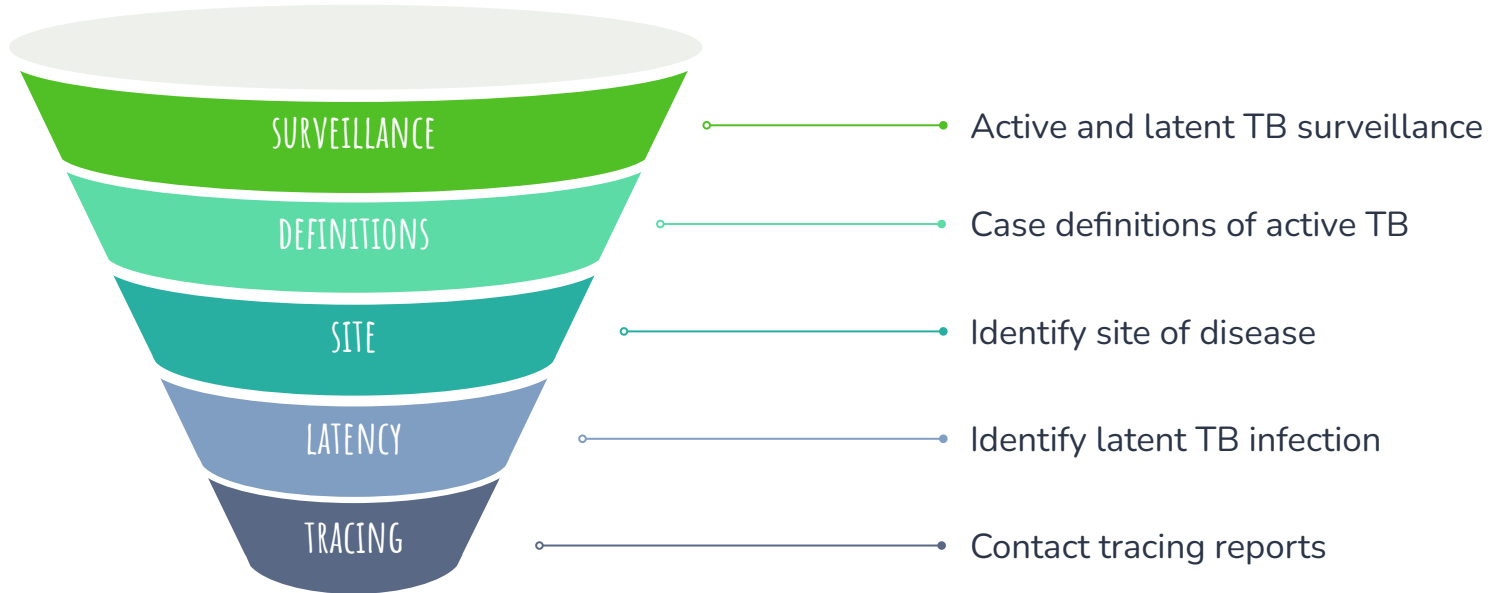
TRANSMISSIBILITY OF TB

- X Highly transmissible via spread in the air
- X Public Health unit should be notified within 24 hours to prevent disease outbreaks



[2][3]

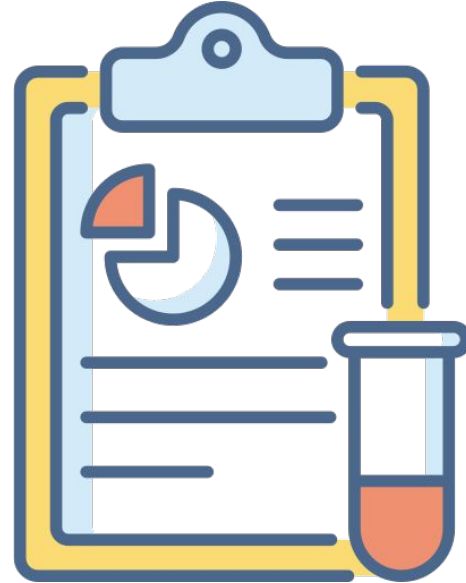
DETECTION OF POTENTIAL CASES



[4][5]

LABORATORIES

- Should report suspected or confirmed cases of TB, including:
 - **Date**
 - **Results of tests**
 - **Name of physician**
 - **Address of physician**
- Failure to submit reports will result in citations and fines



References

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THANKS!

