Epidemiology of Tuberculosis

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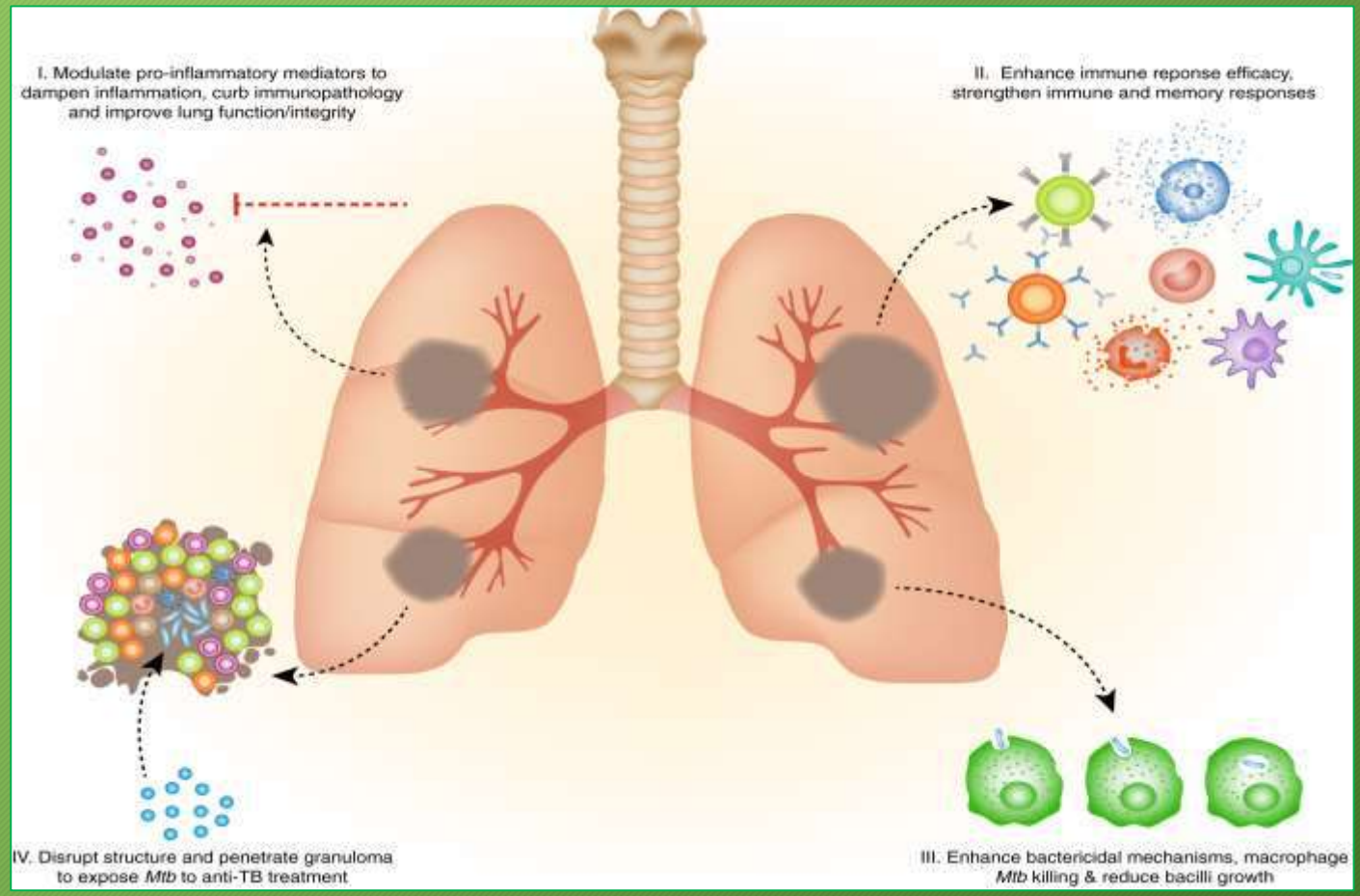
Agenda / Topics

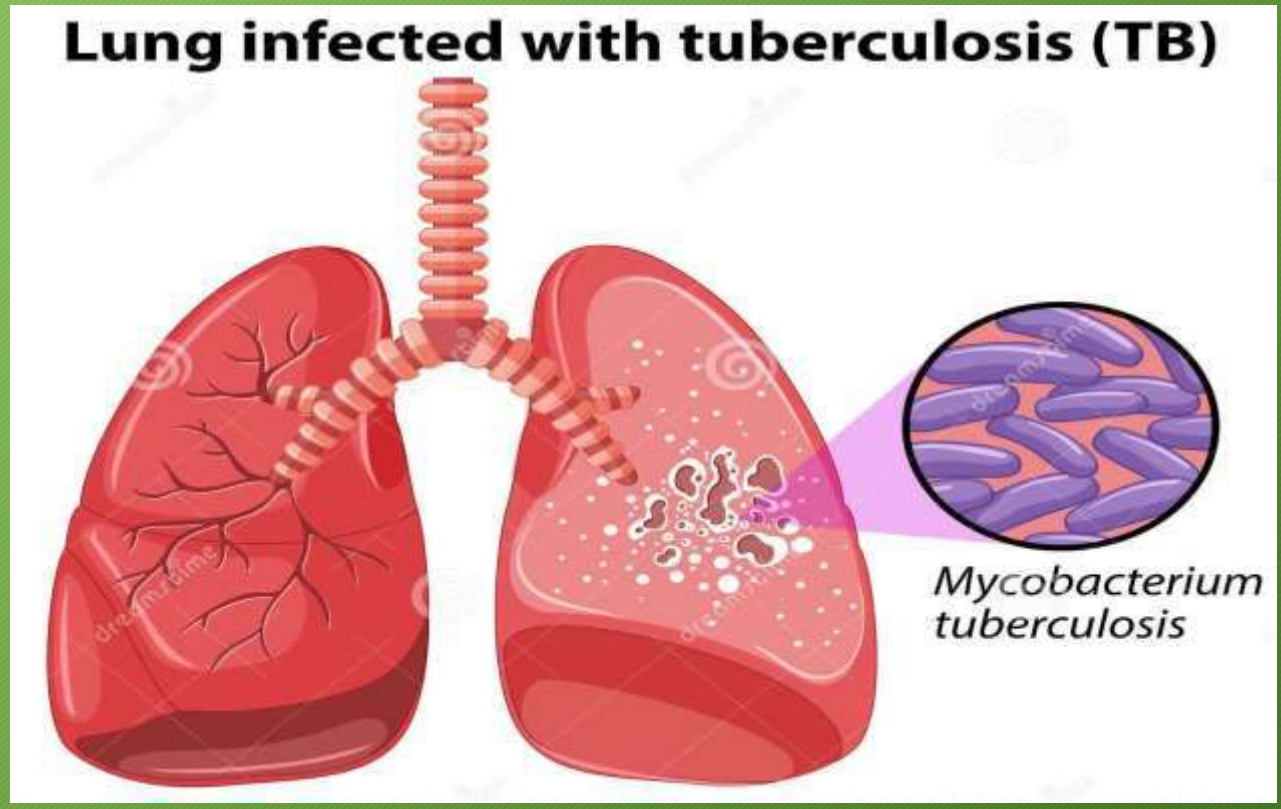
- Introduction
- Problem Statement
- Epidemiological Triad of TB
- Clinical Features
- Complications
- Diagnosis
- Treatment & Control
- Prevention



Tuberculosis: Introduction

Tuberculosis is highly communicable disease caused by Mycobacterium Tuberculosis.

- It Primarily Affects lungs causing Pulmonary Tuberculosis.
- It also affects GIT, Meninges, Bones, Skin, Lymph glands and other parts of the body.



Tuberculosis: Problem Statement

Tuberculosis is Worldwide public health problem. But preventable and curable.

- Due to non-specific determinants as QoL, Improved standard & healthy resources. Rather than due to effective drugs.

Year	Death (per 1 lac)
1900	199
1980	0.5

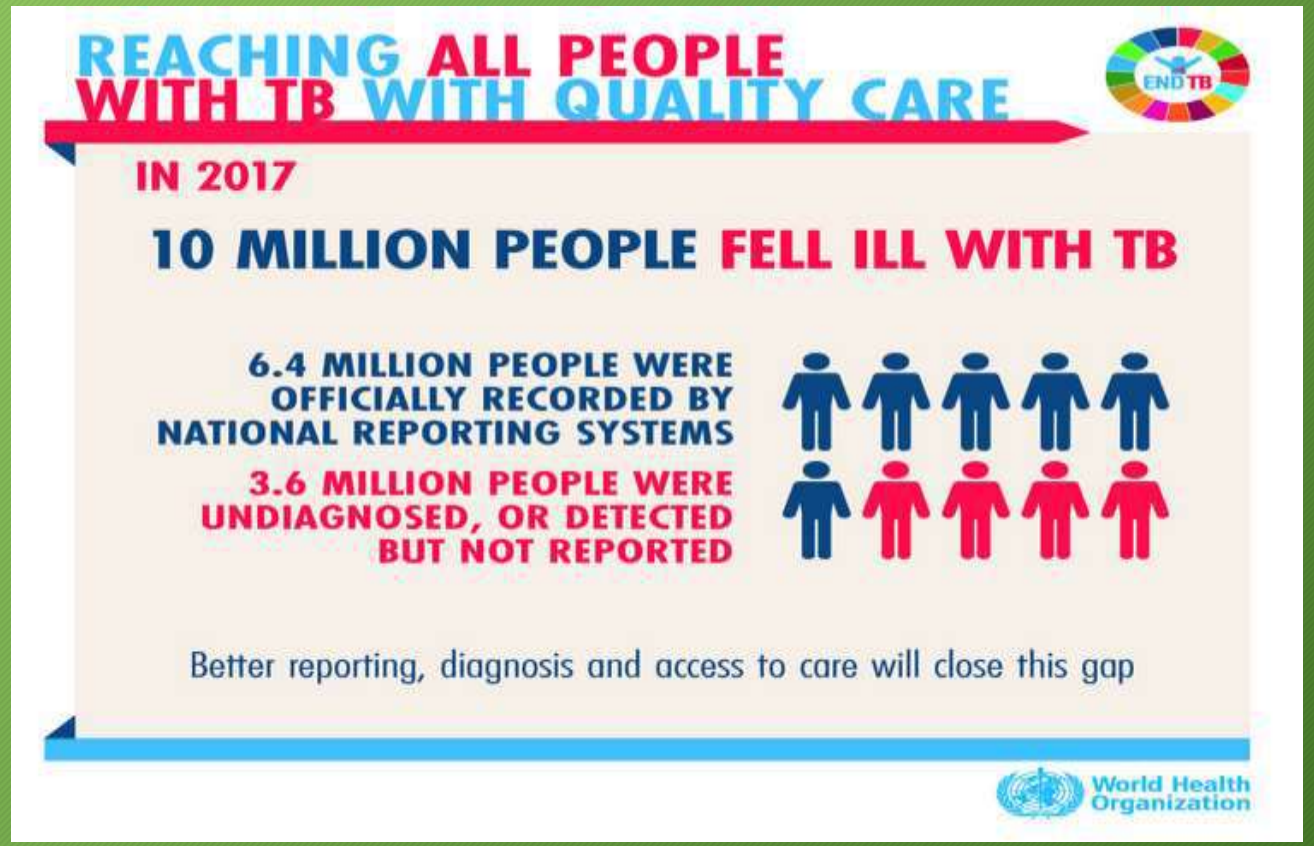
- Incidence of TB: 9.2 million in 2006.
- Prevalence : 14.4 million in 2006
- From 1995 to 2006 (12yrs) 31.8million
- Children's death due to meningitis & disseminated TB.
- Age group: 15-49yrs
- Now mortality & prevalence falling only to add MDRTB
- Reasons Poverty, PEM, Eco. Recession.

Tuberculosis: India story

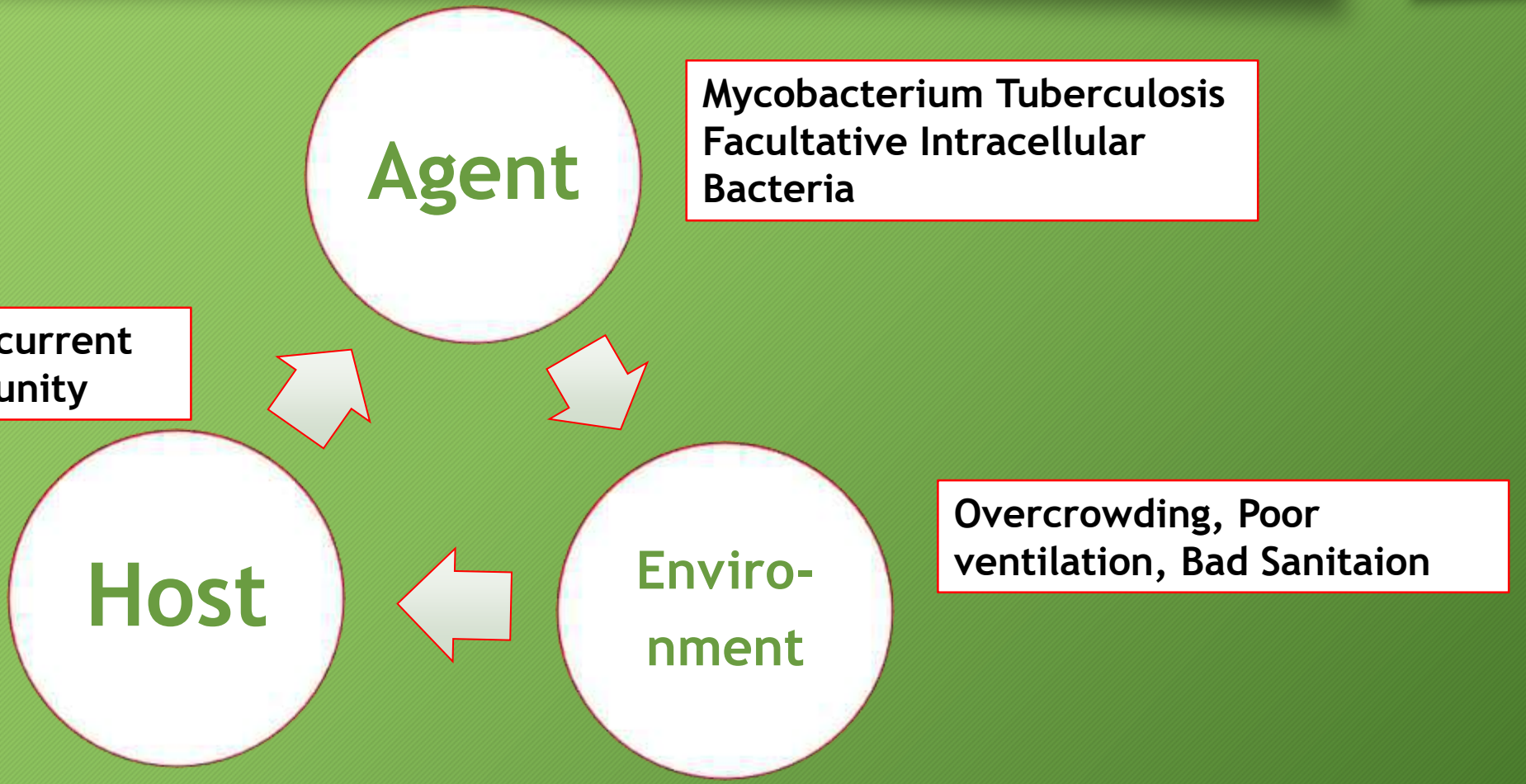
Highest TB burden country with 20% of global cases &

2/3 of SEAR

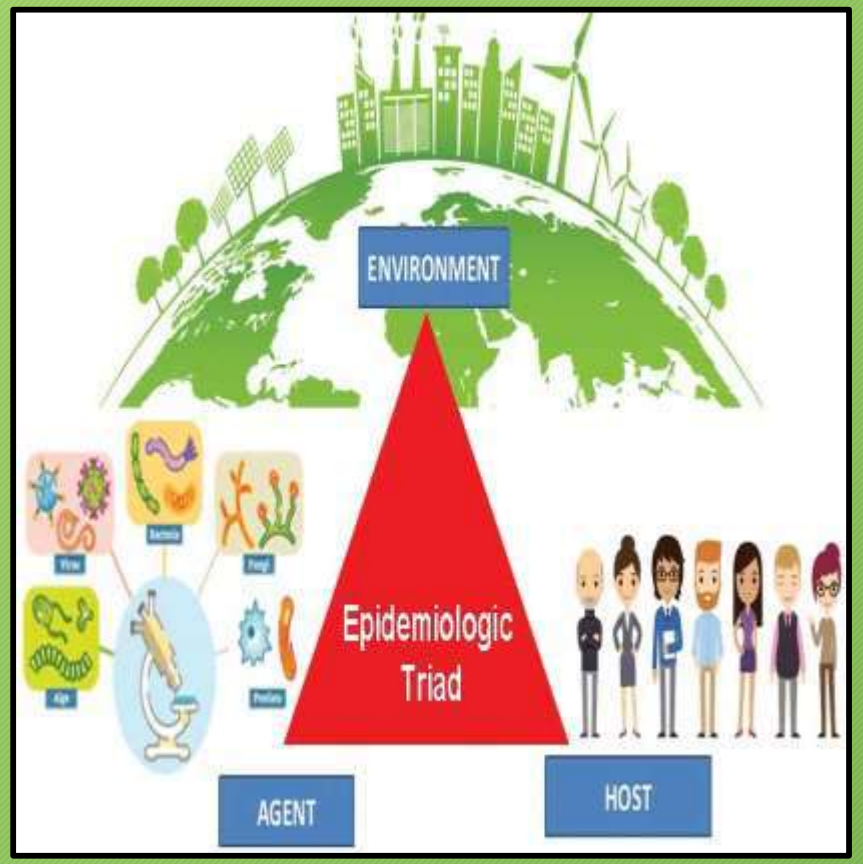
- 1.8 million/year
- 0.8 million new cases
- 2 out of 5 Indians infected & 5000/ day develop disease.
- 1 case infect= 10-15 persons/yr
- Death rate= 0.37million/yr
- DOTS in March1997 = 7.3 mil. On Rx
- Death rate: 29% to 4% =85% success
- Disease of Poor people

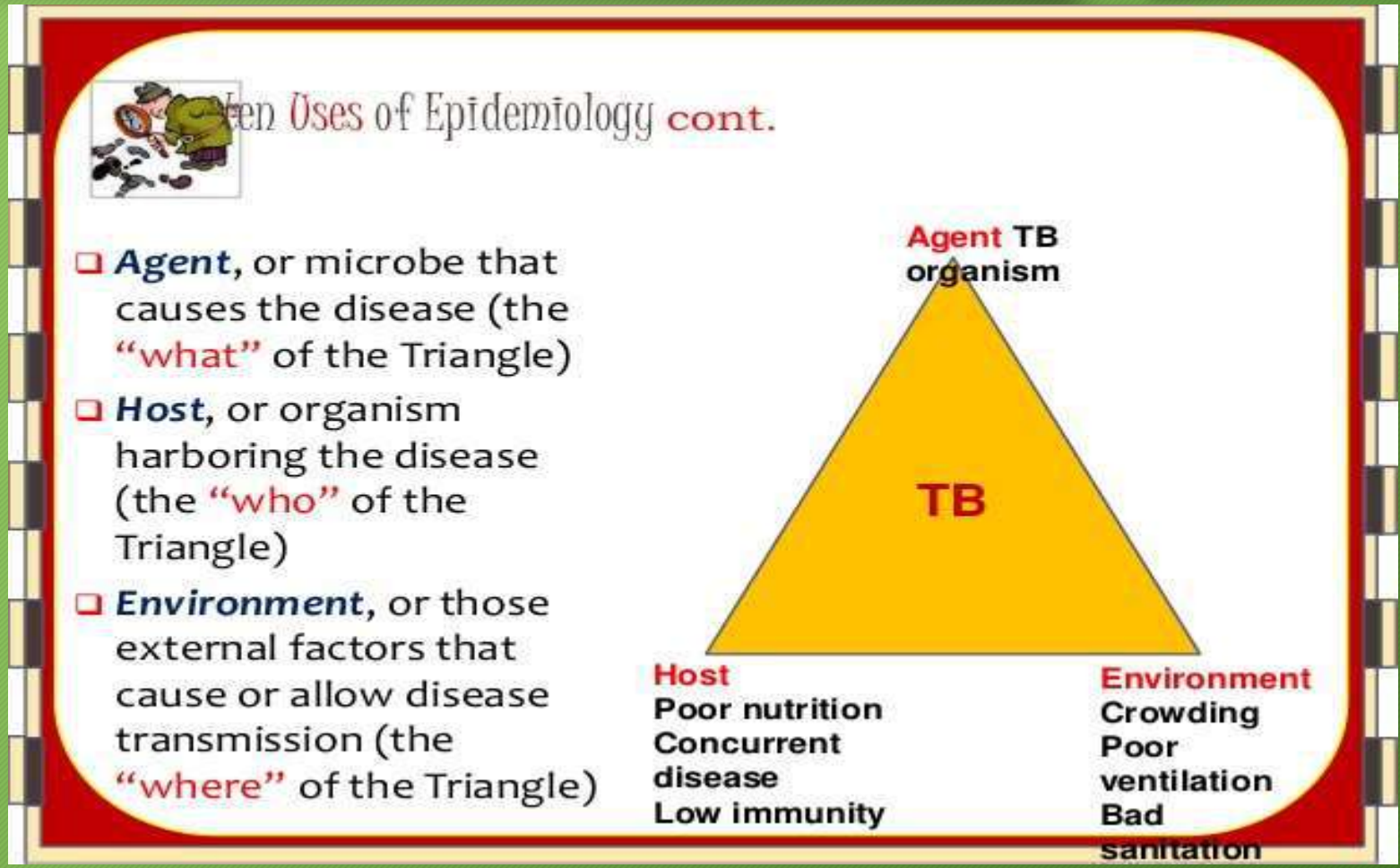


Tuberculosis: Epidemiological Triad



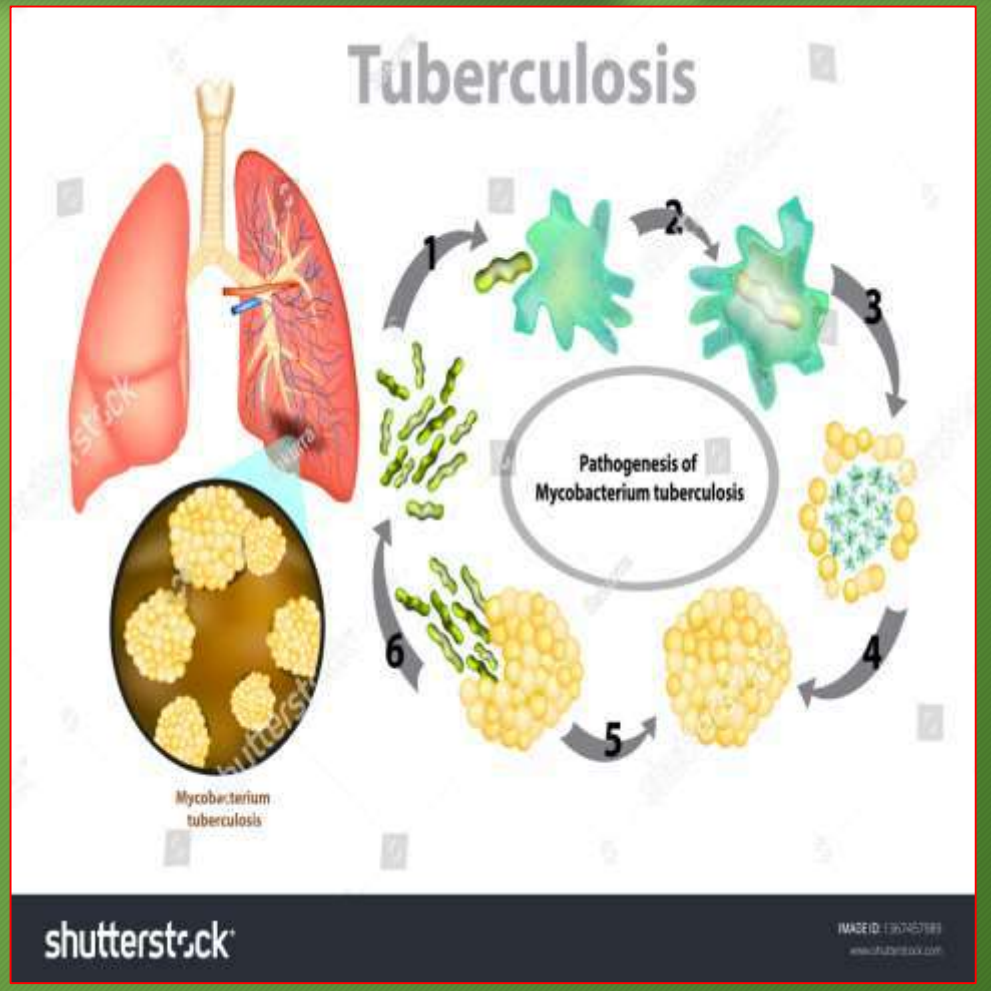
Tuberculosis: Epidemiological Triad





Agent Factor: TB

- Tuberculosis is caused by Mycobacterium Tuberculosis.
- It is gram +ve bacilli. Acid fast bacilli
- Facultative intracellular bacteria.
- Strains: Human, Bovine, Atypical 4types.
- Source of Infection:
  a) Human: common, 10-15person/yr: for yrs
  b) Bovine: infected milk
- Communicability: Pt infective as long as Untreated.
- Effective treatment ⇩ infectivity by 90% within 4 days.



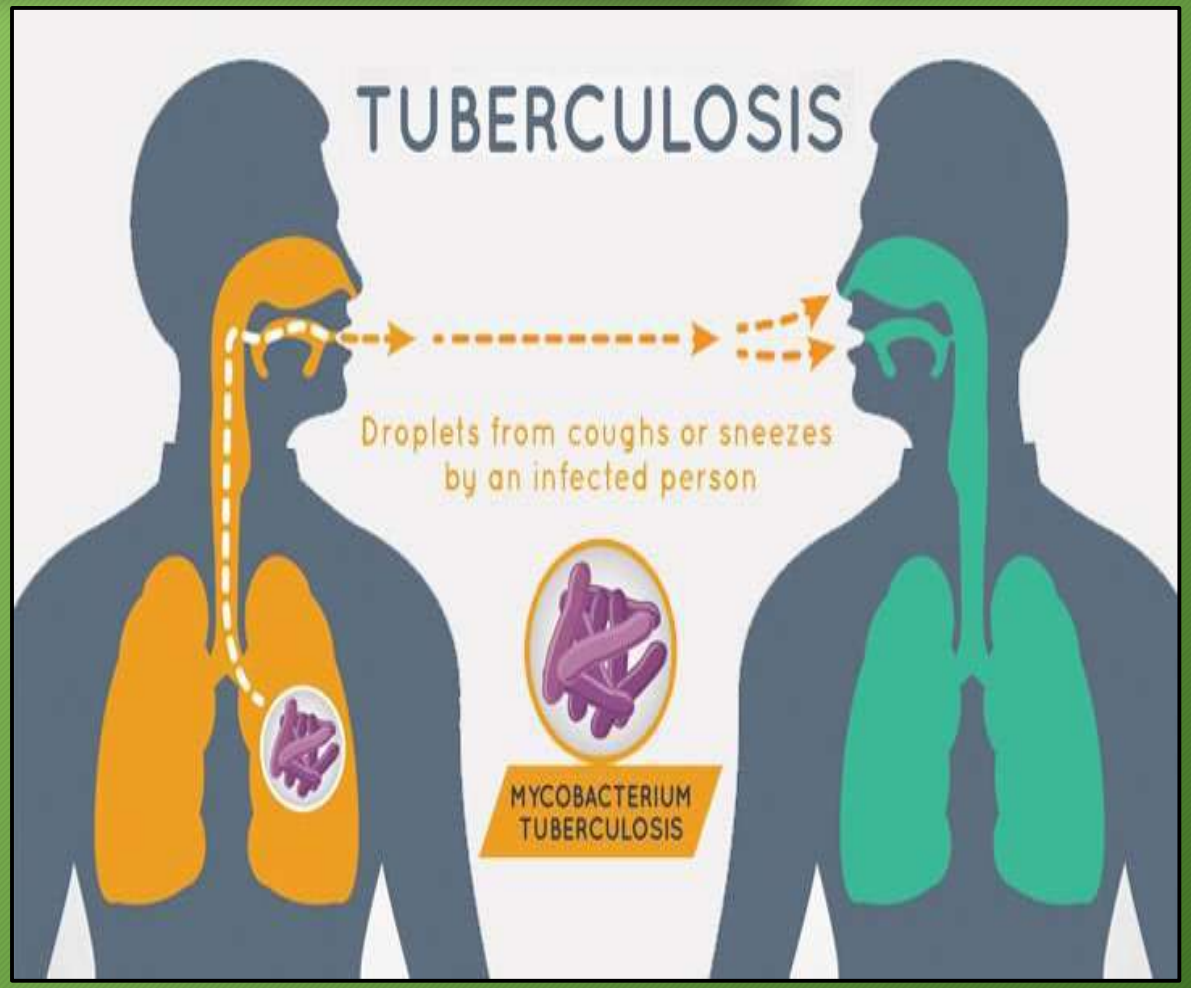
Source Of Infection:

(b) SOURCE OF INFECTION : -

- 2 sources - **human and bovine,**

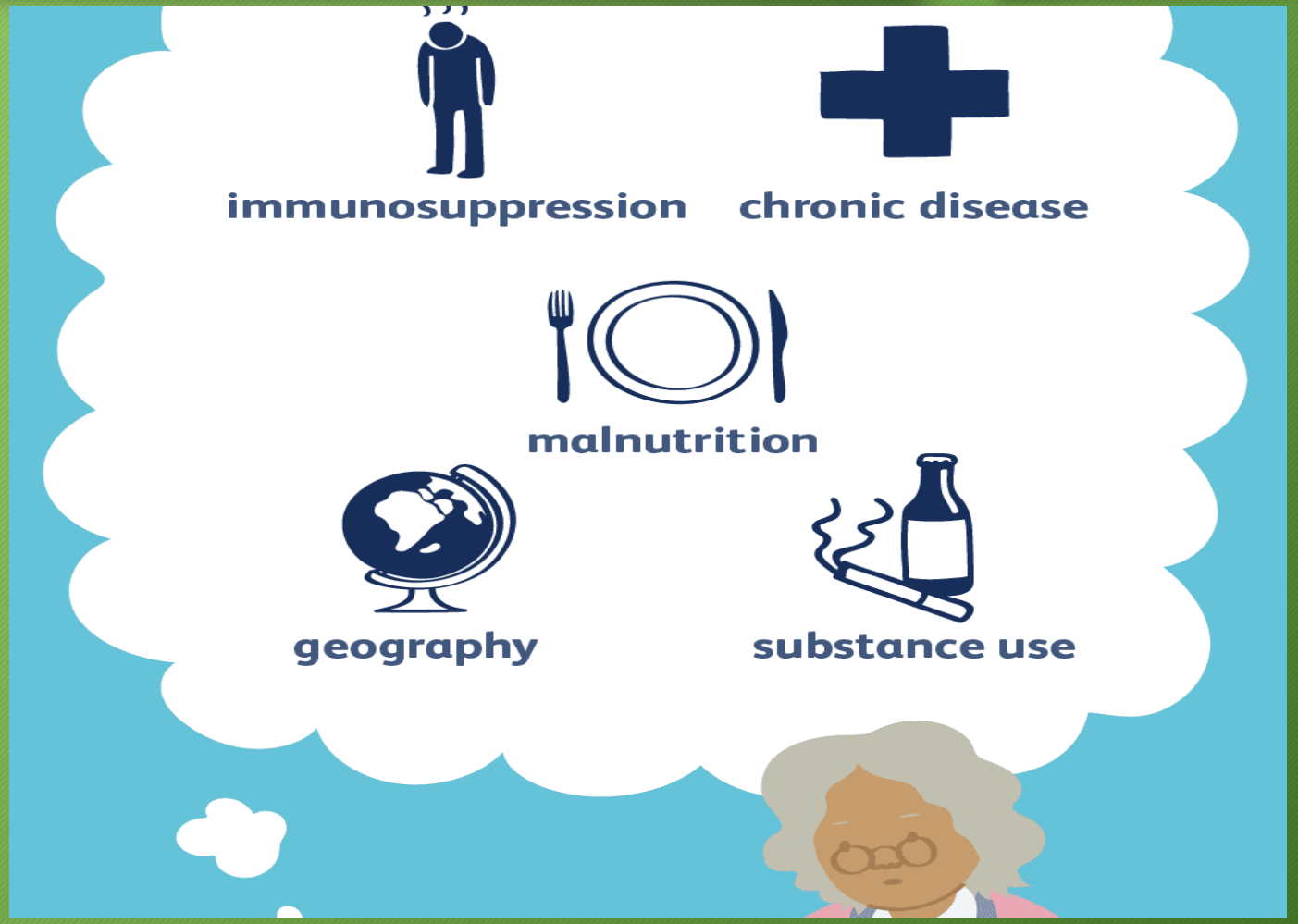
(i) Human source :

- **The most common is the human case whose sputum is positive for TB Bacilli either received no treatment or not been treated fully.**
- An estimated annual average of **10-15 persons contract infection from one case** of infectious pulmonary TB.
- Such sources **discharge the bacilli** in their **sputum for yrs**.
- TB bacilli in a human case are usually a mixed group –
- **some multiply very rapidly and some slowly.**
- The more **rapidly bacillary multiplies** the more **susceptible**

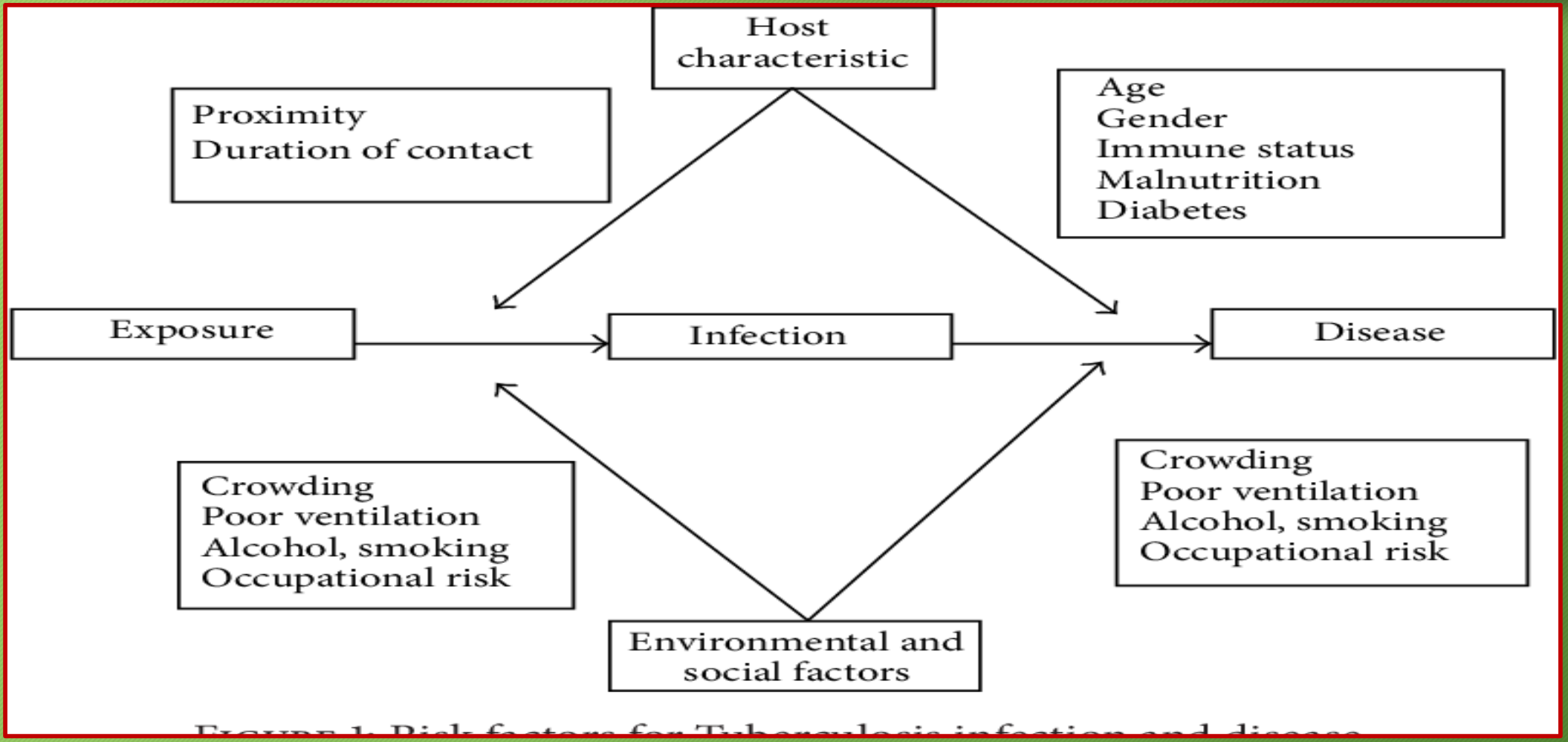


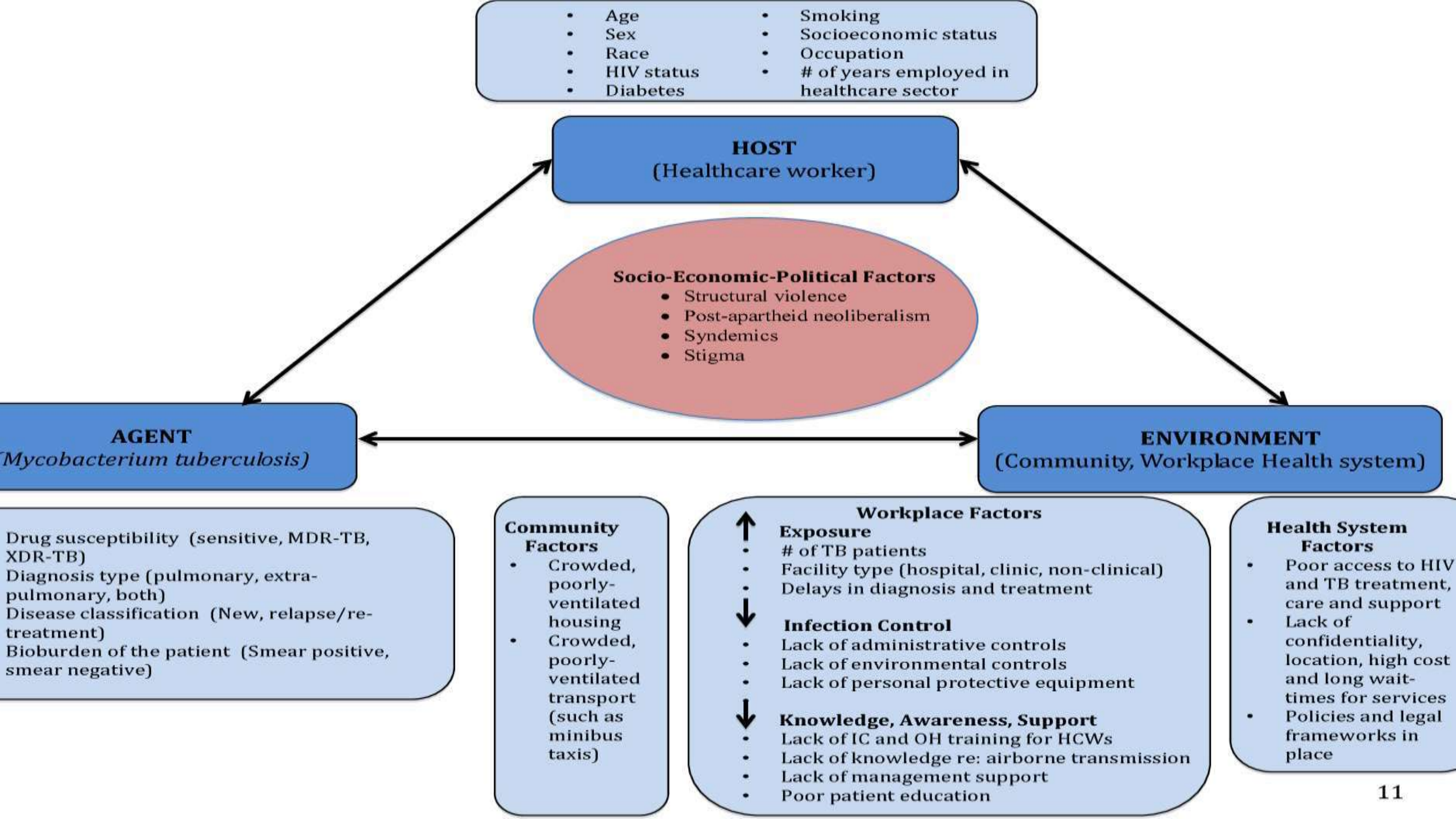
Host factors:

- Age: All ages. Childrens
- More in Males.
- Not a hereditary disease. ⇧ Risk.
- Nutrition: Malnutrition predisposes
- Smoking.
- Immunity: Cell mediated, Delayed Hypersensitivity.
- Social Factors: Barometer of Social Welfare.
- Poor QoL, Housing, Overcroweding, Population, Undernutrition, etc.

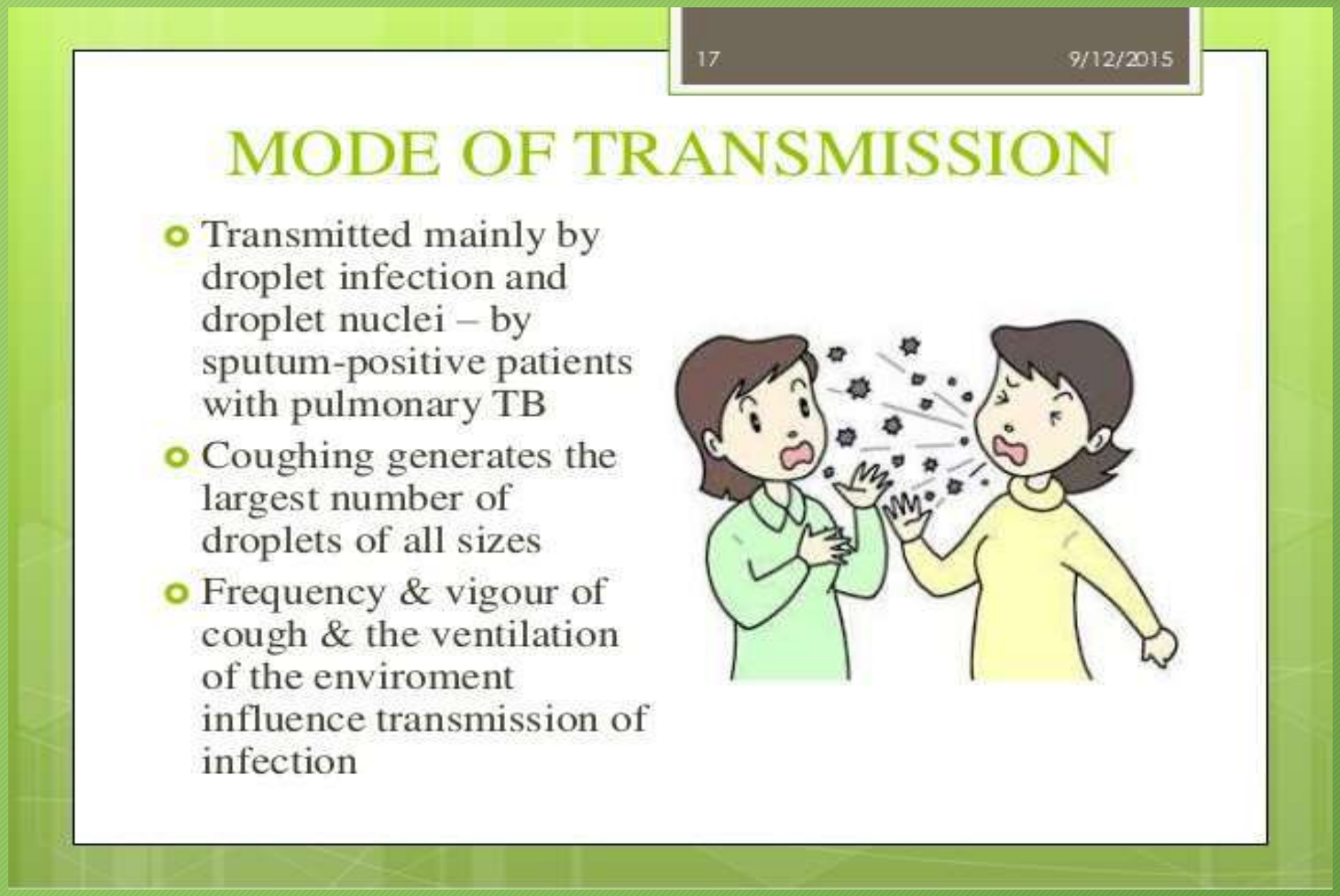


Host factors:




Age
Sex
Race
HIV status
Diabetes
Smoking
Socioeconomic status
Occupation
# of years employed in healthcare sector
HOST
(Healthcare worker)
Socio-Economic-Political Factors
Structural violence
Post-apartheid neoliberalism
Syndemics
Stigma
AGENT
(Mycobacterium tuberculosis)
ENVIRONMENT
(Community, Workplace Health system)
Drug susceptibility (sensitive, MDR-TB, XDR-TB)
Diagnosis type (pulmonary, extra-pulmonary, both)
Disease classification (New, relapse/re-treatment)
Bioburden of the patient (Smear positive, smear negative)
Community Factors
Crowded, poorly-ventilated housing
Crowded, poorly-ventilated transport (such as minibus taxis)
Workplace Factors
Exposure
# of TB patients
Facility type (hospital, clinic, non-clinical)
Delays in diagnosis and treatment
Infection Control
Lack of administrative controls
Lack of environmental controls
Lack of personal protective equipment
Knowledge, Awareness, Support
Lack of IC and OH training for HCWs
Lack of knowledge re: airborne transmission
Lack of management support
Poor patient education
Health System Factors
Poor access to HIV and TB treatment, care and support
Lack of confidentiality, location, high cost and long wait-times for services
Policies and legal frameworks in place

Modes of Transmission:



Mode of transmission	Frequency	Percentage
Droplet infection	150	50%
Coughing, sneezing and consuming food contaminated by TB patients	30	10%
Droplet infection and direct contact	28	9.3%
Droplet infection and use of materials contaminated by TB patients.	15	5%
Direct contact with TB patients	15	5%
Droplet infection and contaminated urine and stool	10	3.3%
Droplet infection and blood	10	3.3%
No idea	42	14%

Incubation Period:

- Incubation period for TB is from 3 to 6 weeks.

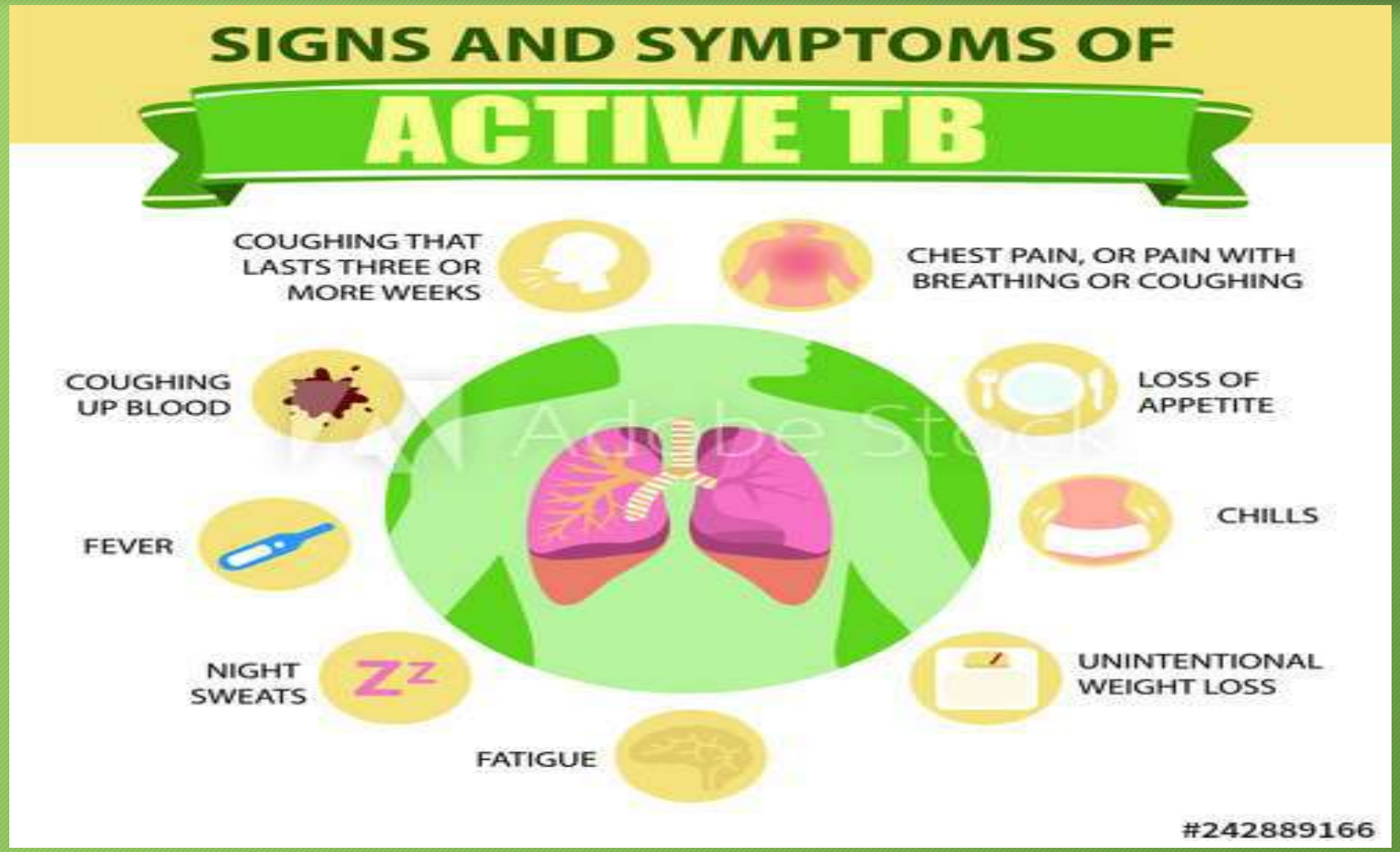
Incubation period

✓The incubation period from infection to demonstrable primary lesion or significant tuberculin reaction ranges from 2 to 10 weeks.

✓Latent infection may persist for a lifetime.

✓HIV infection appears to shorten the interval for the development of clinically apparent TB.

Clinical Features of TB:



M. Tuberculosis

Signs and Symptoms

1. Asymptomatic
2. Low grade fever
3. Night sweating
4. Cough (Purrulant sputum)
5. Dyspnoea
6. Chest pain
7. Lethargy
8. Anorexia
9. Weight loss
10. Hemoptysis

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Complications of TB:

Chronic complications of pulmonary TB

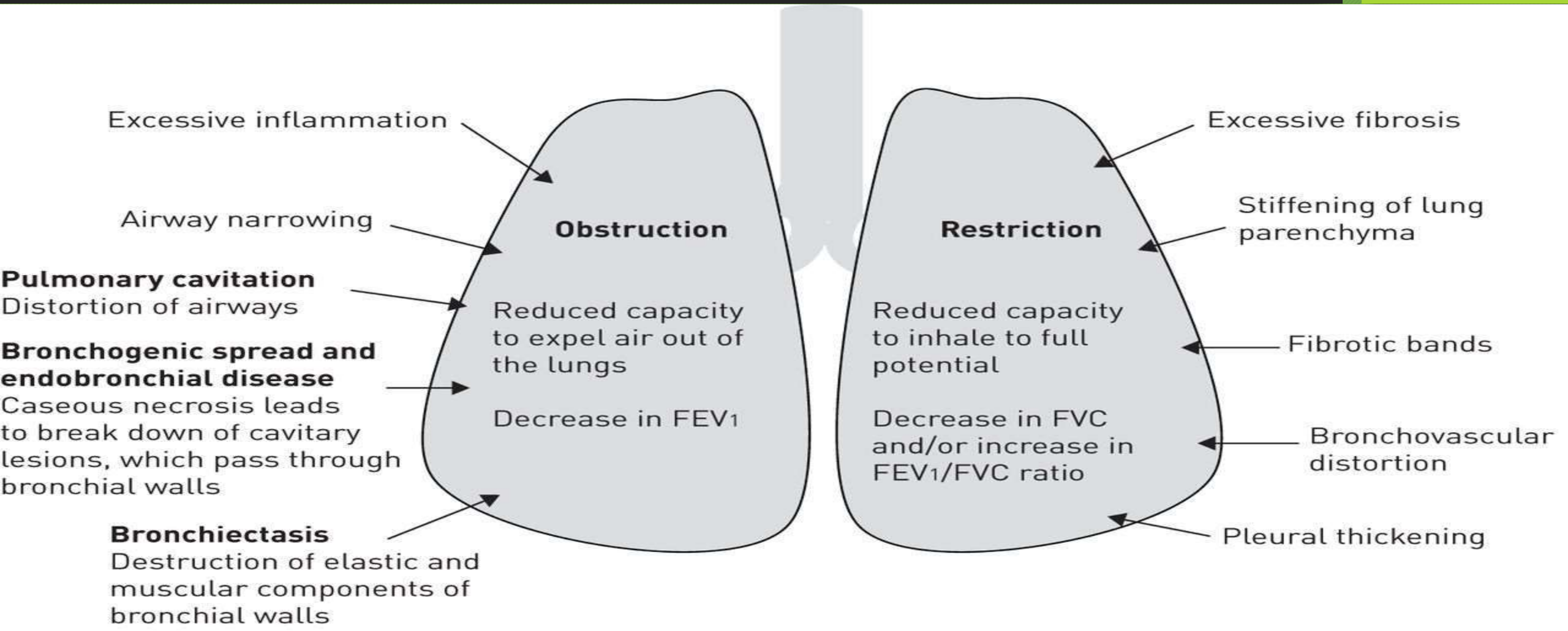
Pulmonary

- Massive haemoptysis
- Cor pulmonale
- Fibrosis/emphysema
- Atypical mycobacterial infection
- Aspergilloma
- Lung/pleural calcification
- Obstructive airways disease
- Bronchiectasis
- Bronchopleural fistula

Non-pulmonary

- Empyema necessitans
- Laryngitis
- Enteritis
- Anorectal disease
- Amyloidosis
- Poncet's polyarthritis

Complications of TB:



Complications of TB:

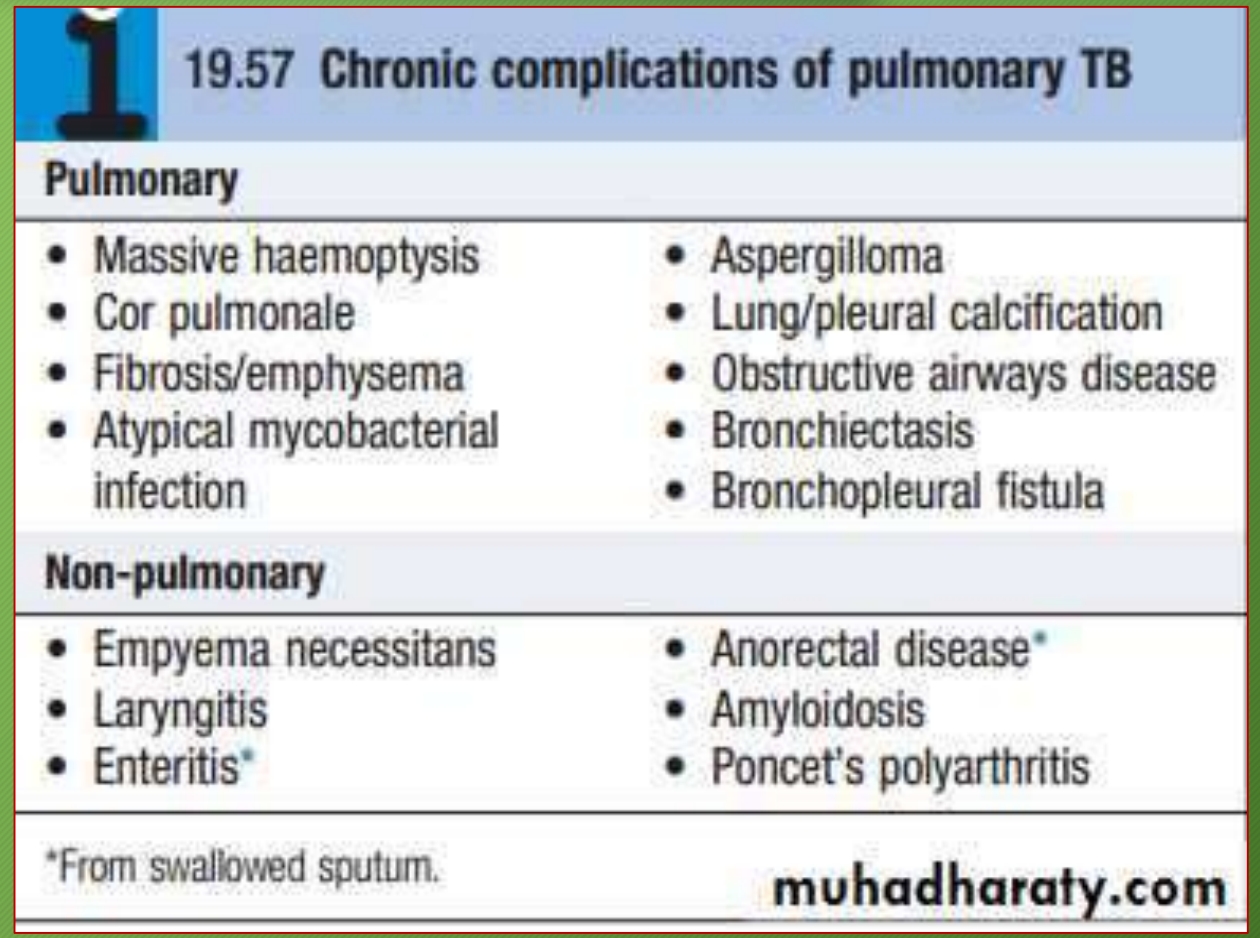
Complications of primary TB

caused by mediastinal lymph node

- atelectasis
- bronchonodular fistula
- TB bronchitis
- lymphohematogenous dissemination, generalized tuberculosis
- mediastinal or interlobar pleuritis
- etc.

caused by pulmonary component

- costal or diafragmatical pleuritis
- primary cavity
- primary tuberculoma
- primary caseous pneumonia



19.57 Chronic complications of pulmonary TB

Pulmonary

- Massive haemoptysis
- Cor pulmonale
- Fibrosis/emphysema
- Atypical mycobacterial infection
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- Lung/pleural calcification
- Obstructive airways disease
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Non-pulmonary

- Empyema necessitans
- Laryngitis
- Enteritis*
- Anorectal disease*
- Amyloidosis
- Poncet's polyarthritis

*From swallowed sputum.

muhadharaty.com

Diagnosis of Tuberculosis:

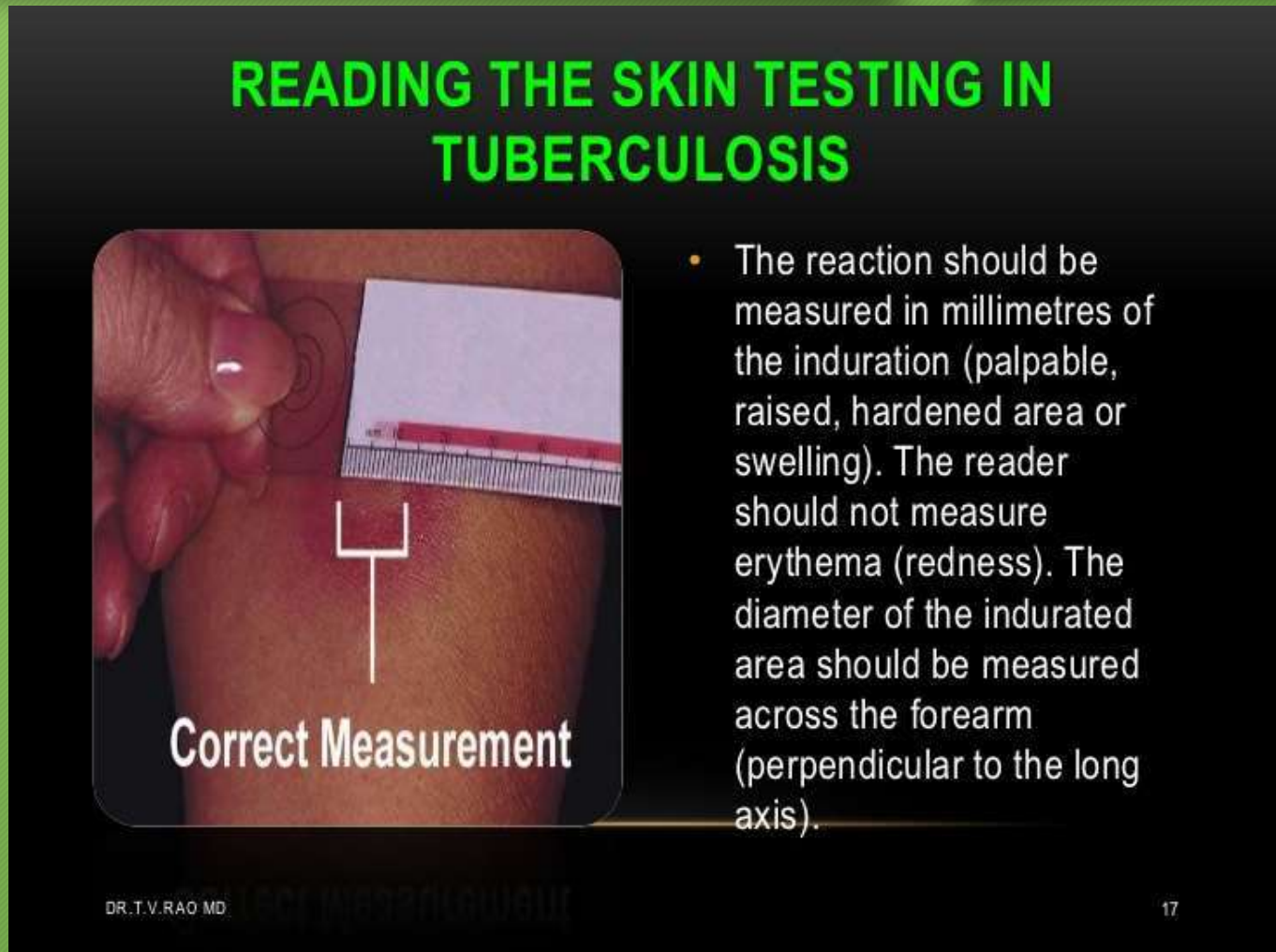
- Tuberculin Test: Von Pirquette
- +ve means: past/present infection.
- Only for estimating Prevalence
- 3types: Montoux test, Heaf test, Time multiple puncture test.

READING THE TUBERCULIN SKIN TEST

- Read 2-3 days after placing the test
- Feel for induration
- Color change without induration is ***not*** included in the measurement
- Use a ruler or calipers
- Have someone else check if unsure
- Always document the exact size (mm) – not just "positive" or "negative"

Tuberculin Test:

- Test material known as Tuberculin.
- 2 major antigens: Old Tuberculin, PPD.
- Dose: 1TU
- Intradermal injection in forearm 0.1ml
- Reading after 72 hours.
- Reaction: Erythema & Induration.
- Screening Test



Tuberculin Test:

READING THE TUB

- Read 2-3 days after placing the test
- Feel for induration
- Color change without induration is ***not*** included in the measurement
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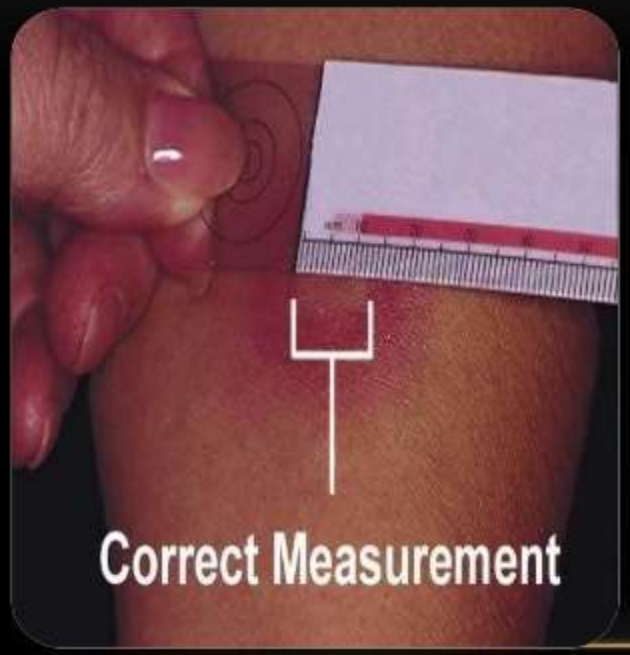
READING THE SKIN TESTING IN TUBERCULOSIS



- The reaction should be measured in millimetres of the induration (palpable, raised, hardened area or swelling). The reader should not measure erythema (redness). The diameter of the indurated area should be measured across the forearm (perpendicular to the long axis).

Tuberculin test result: measure of Indurations

1. > 10 mm induration : Positive
2. < 6mm induration : Negative
3. 6-9mm induration: Borderline

Diagnosis of Tuberculosis:

1. **Sputum Examination.**
2. CBC
3. ESR
4. Chest X-ray

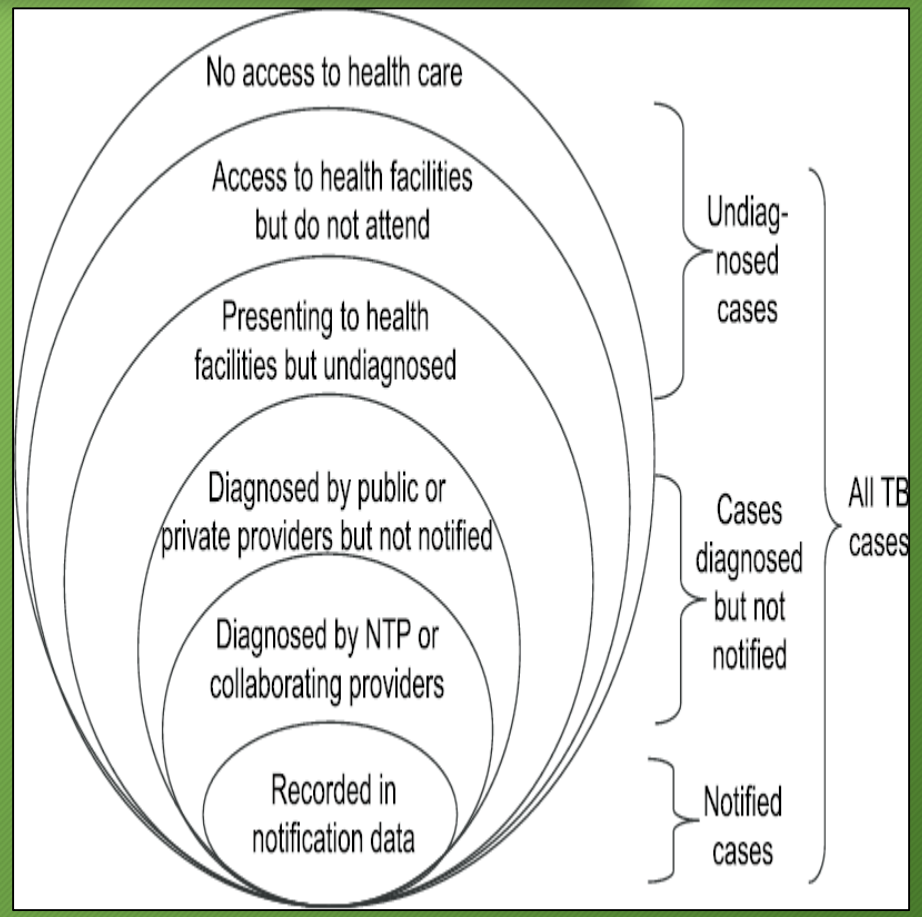
Sputum Collection

- Sputum specimens are essential to confirm TB
  - Specimens should be from lung secretions, not saliva
- Collect 3 specimens on 3 different days
- Spontaneous morning sputum more desirable than induced specimens
- Collect sputum before treatment is initiated

Control of Tuberculosis:

- **Aim:**

1. **Reduction in Prevalence & Incidence <1%**
2. **Two Step Approach : Curative & Preventive.**
3. **Increase diagnosis and screening tests for finding undiagnosed cases detection.**



Control of Tuberculosis:

- **Preventive Care:**

1. **BCG Vaccination.**
2. **Use of Mask by TB patients.**
3. **Hygiene & sanitation measures.**
4. **Improve QoL**
5. **Stop Smoking and Alcohol intake**

Control of Tuberculosis:

- **Curative Treatment:**

1. **Case finding: Cases,**
   Target groups,
   Screening tests
   Sputum examination
2. **Treatment of TB patients**

- **Curative Treatment:**

1. **Case finding: Ist step. Early detection +ve cases.**
2. **Def: A patient who's sputum is positive for TB bacilli.**
3. **Target group**
4. **Case finding tools: Sputum exam, Sputum culture, TT**

Control of Tuberculosis:Chemotherapy

- In every active case

Objectives:

- ❑ To Cure,
- ❑ Elimination of Slow & fast multiplying bacilli,
- ❑ Sputum Negativity
- ❑ Adequate, Appropriate, & applied to entire pool of TB cases.

- Drugs : 12/13 drugs.
- Six essential
- Criteria for TB drug: Effective, Free from side-effects, easy administration, cheap.
- Two groups: a) Bactericidal
  b) Bacteriostatic

Control of Tuberculosis:Chemotherapy

Bactericidal drugs:

1. **Rifampacin(RMP):**

- **Powerful>INH**
- **Permeates all membranes BBB**
- **In combination with INH cure Extensive TB in 9months.**

- **Mode of Use: Oral drug**
- **Dose: 10-12 mg/kg/wt**
- **Usually 450-600mg**
- **For intermittent: 900mg**
- **Side effects: Hepatotoxicity, Gastritis, Purpura, Influenza, Nephrotoxicity, Thrombocytopenia**
- **Should not restarted within 3wks - hypersensitivity**

Control of Tuberculosis:Chemotherapy

Bactericidal drugs:

2. Isoniazide(INH):

- **Powerful, easily penetrates membranes.**
- **Active against Intracellular & extracellular bacilli.**
- **Effective: Rapidly multiplying bacilli= Active/acute**
- **Ideal TB drug**

- **Mode of Use: Oral drug**
- **Dose: 4-5 mg/kg/wt**
- **Usually 300mg**
- **For intermittent: 700mg**
- **Side effects: GI irritation, Peripheral Neuropathy, blood dyscrasia, Hyperglycemia, Liver toxicity.**
- **Pyridoxin in association**

Control of Tuberculosis:Chemotherapy

Bactericidal drugs:

3.Streptomycin:

- **Effective: Rapidly multiplying bacilli= Active/acute**
- **Less effective on slow multipliers.**
- **No action on persisters.**

- **Mode of Use: IM Injection**
- **Dose: 0.75-1gm in single injection**
- **Requires organizational setup**
- **Side effects: Vestibular damage, Nystagmus, Renal damage.**

Control of Tuberculosis:Chemotherapy

Bactericidal drugs:

4.Pyrizinamide:

- **Effective: Slow multiplying bacilli= Chronic phase**
- **effective on Intracellular.**
- **Increases sterilizing ability of RMP.**
- **Imp in Short course.**

- **Mode of Use: Oral**
- **Dose: 30mg/kg/wt**
- **1.5 to 2gm in 2/3 doses.**
- **Side effects: Hepatotoxic**

Control of Tuberculosis:Chemotherapy

Bacteriostatic drugs:

"**Bacteriostatic**" means that the agent **prevents the growth** of bacteria (i.e., it keeps them in the stationary phase of growth)

5.Ethambutol:

- **Used in combination to prevent resistance to other drugs.**
- **Prevents multiplication of TB bacilli.**

- **Mode of Use: Orally**
- **Dose: 15mg/kgwt in 2/3 doses**
- **Replaces PAS**
- **Side effects: Retrobulbar neuritis**

Control of Tuberculosis:Chemotherapy

Bacteriostatic drugs:

6.Thioacetazone:

- **Only combination drug to INH**
- **Commonly used in India.**
- **Side effects: GI irritation, blurring of vision, haemolytic anaemia, Urticaria.**

- **<u>Other drugs:</u>**
- **Ethianomide**
- **PAS**
- **Prothionomide**
- **Cycloserine**
- **Kanomycine, Viomycine etc**

Control of Tuberculosis:Chemotherapy

ANTI- TB DRUGS

FIRST LINE

ISONIAZID
RIFAMPICIN
PYRAZINAMIDE
ETHAMBUTOL
STREPTOMYCIN

SECOND LINE

THIOACETAZONE
PAS
ETHIONAMIDE
CYCLOSERINE
KANAMYCIN
CAPREOMYCIN
AMIKACIN

NEWER DRUGS

CIPROFLOXACIN
OFLOXACIN
CLARITHROMYCIN
AZITHROMYCIN
RIFABUTIN

Control of Tuberculosis: Chemotherapy

Drug	Dosage	Adverse effects
Rifampicin	<50kg body weight: 450mg daily ≥50kg body weight: 600mg daily	Hepatotoxicity Liver enzyme induction Orange discoloration of urine and contact lenses
Isoniazid	300mg daily	Peripheral neuropathy Hepatitis Psychosis (rare)
Pyrazinamide	<50kg body weight: 1.5g daily ≥50kg body weight: 2g daily	Hepatotoxicity Gout/arthropathy
Ethambutol	15mg/kg daily	Loss of visual acuity Colour blindness Visual field defect
Rifater (rifampicin/isoniazid/ pyrazinamide)	<40kg body weight: 3 tablets daily 40–49kg body weight: 4 tablets daily 50–64kg body weight: 5 tablets daily ≥65kg body weight: 6 tablets daily	As above for rifampicin, isoniazid and pyrazinamide
Rifinah (rifampicin/isoniazid)	<50kg: 3 tablets of 150mg/100mg ≥50kg: 2 tablets of 300mg/150mg	As above for rifampicin and isoniazid

Control of Tuberculosis: Chemotherapy

SHORT COURSE CHEMOTHERAPY(SCC)

DURATION
6-9 MONTHS

ADVANTAGES
- ✓RAPID BACTERIOLOGICAL CONVERSION
- ✓LOWER FAILURE RATES
- ✓REDUCTION IN EMERGENCE OF DRUG RESISTANT BACILLI

TWO PHASES

INTENSIVE PHASE
1-3 MONTHS
TO KILL OFF AS MANY FAST MULTIPLYING BACILLI AS POSSIBLE

CONTINUATION PHASE
4-6 MONTHS
TO KILL THE REMAINING DORMANT BACILLI

Control of Tuberculosis: Chemotherapy

Directly Observed Treatment Short Course (DOTS) Therapy

DOTS

Pura course ↓ Pakka ilaai

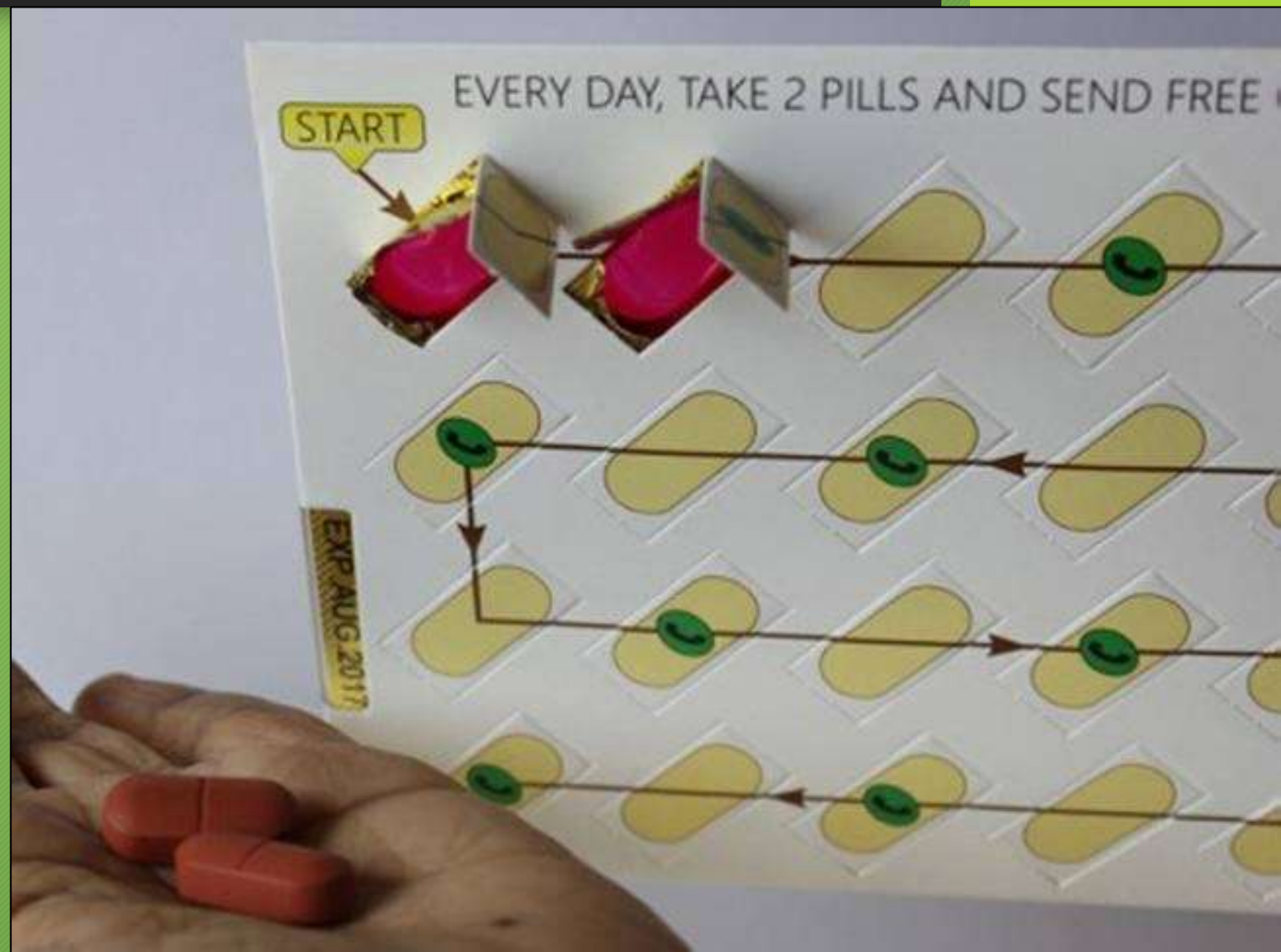
Control of Tuberculosis: Chemotherapy

DOTS Regimen

Category	Type of Patient	Regimen	Duration in months	Test at month
Category I Color of box: **RED**	New Sputum Smear Positive New Sputum Smear Negative New Extra Pulmonary New Others	2 $(HRZE)_3$, 4 $(HR)_3$	6	2
Category II Color of box: **BLUE**	Sputum Positive relapse Sputum Positive failure Sputum Positive treatment after default	2 $HRZES)_3$, 1 $(HRZE)_3$ 5 $(HRE)_3$	8	3

H-ISONIAZID R- RIFAMPICIN Z-PYRAZINAMIDE E- Ethambutol

Control of Tuberculosis: DOTS



Control of Tuberculosis: DOTS Plus

MULTI DRUG RESISTANT TB (MDR-TB)

ATLEAST RESISTANT TO ***ISONIAZID*** AND ***RIFAMPICIN***
TREATMENT BASED ON DOTS – PLUS

DOTS- PLUS

INTENSIVE PHASE 6-9 MONTHS

KANAMYCIN
OFLOXACIN
CYCLOSERINE
ETHINAMIDE
ETHAMBUTOL
PYRAZINAMIDE

CONTINUATION PHASE 18 MONTHS

OFLOXACIN
CYCLOSERINE
ETHIONAMIDE
ETHAMBUTOL

Control of Tuberculosis: DOTS Plus

RNTCP Regimen for MDR TB

- This regimen comprises of 6 drugs - Kanamycin, Levofloxacin, Ethionamide, Pyrazinamide,Ethambutol and Cycloserine during 6-9 months of the **Intensive Phase** and 4 drugs- Levofloxacin, Ethionamide, Ethambutol and Cycloserine during the 18 months of the **Continuation Phase.**
- **6 (9) Km Lvx Eto Cs Z E / 18 Lvx Eto Cs E .**
- ***SPECIAL SITUATION***:

1) In case of intolerance to Kanamycin, then Capreomycin (or PAS if injectable agent not feasible) is the available substitute drug.

2) In case of intolerance leading to discontinuation of other oral second-line drug, paminosalicylic acid (PAS) is the available substitute drug.

3) Baseline Kanamycin mono - resistance should lead to substitution of Kanamycin with Capreomycin.

4) Baseline Ofloxacin mono - resistance should lead to substitution of Levofloxacin with the combination of Moxifloxacin and PAS.

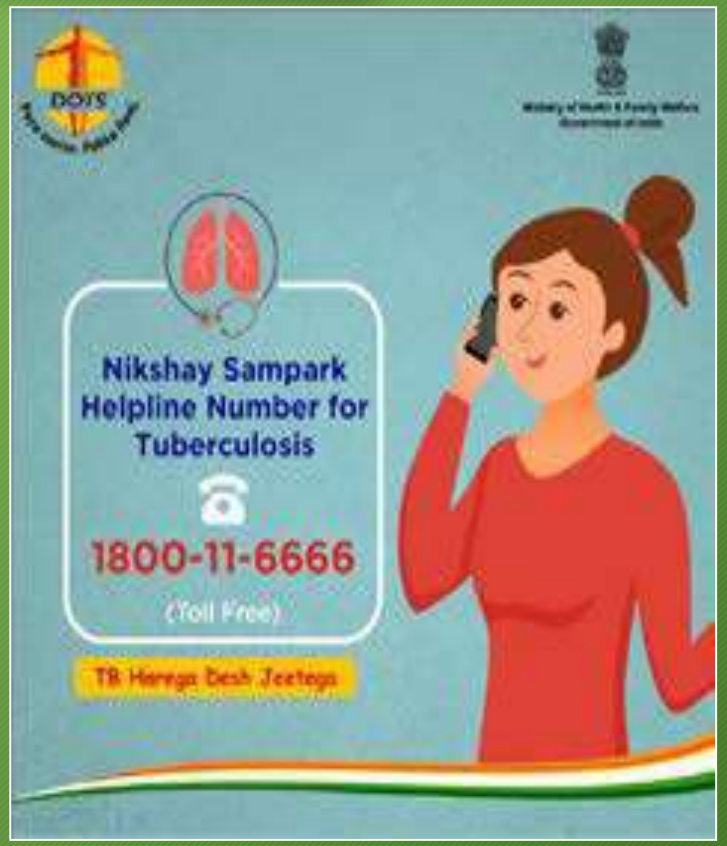
5) Baseline Ofloxacin and Kanamycin resistance (i.e. XDR TB) should lead to declaration of outcome, referral to DR-TB Centre for pre-treatment evaluation for Regimen for XDR TB.

Revised National Tuberculosis Control Programme

- The National TB Programme (NTP) was started in 1962 for TB control in India. This programme was not able to give expected results in India
- The NTP was reviewed in 1992
- As a result of the review and pilot studies in 1993, the DOTS strategy was adopted in India under the Revised National TB control Programme - RNTCP
- The programme was implemented in a phase manner and by 24th March 2006, the entire country was covered under the programme

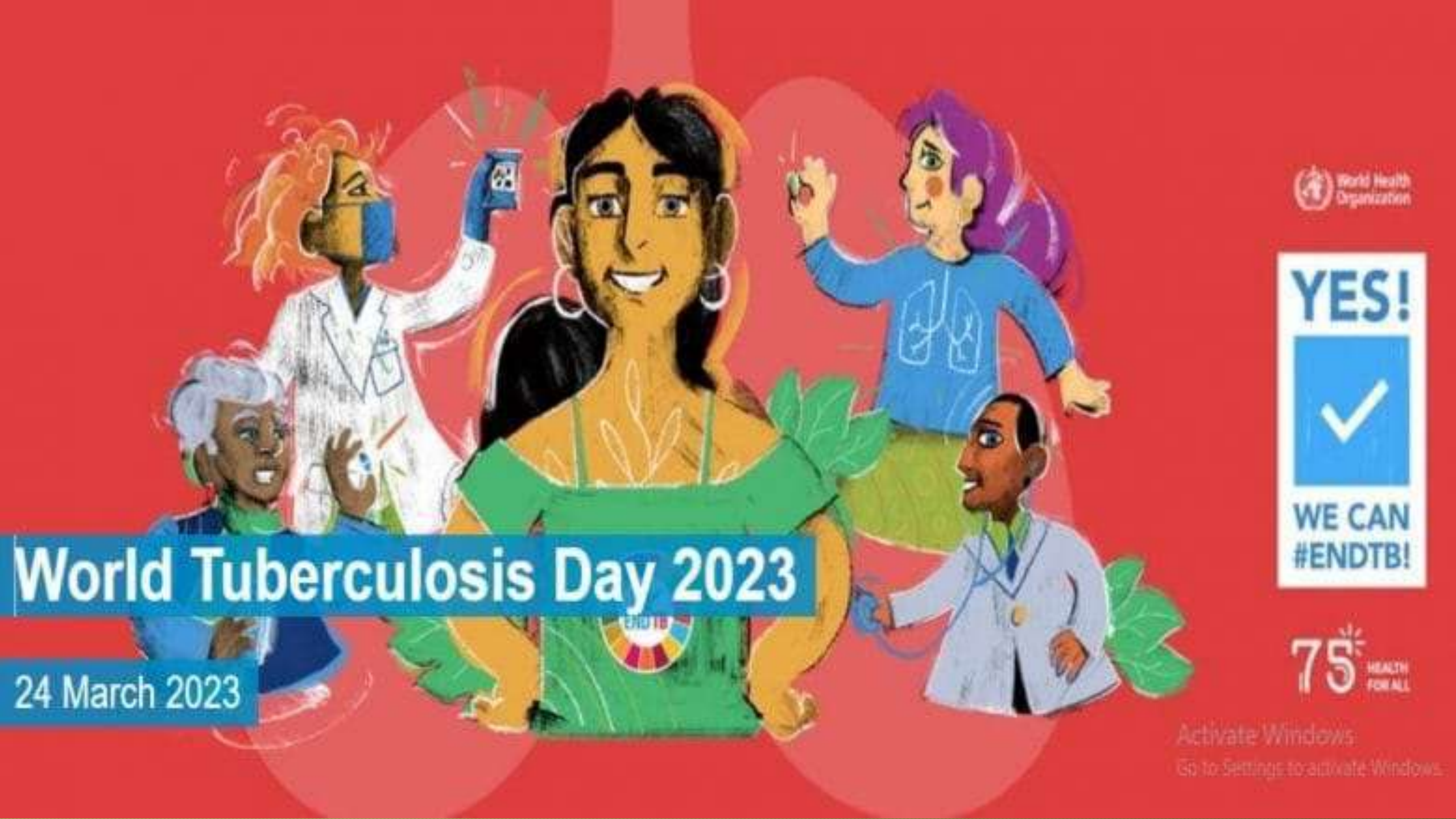
Control of Tuberculosis: RNTCP

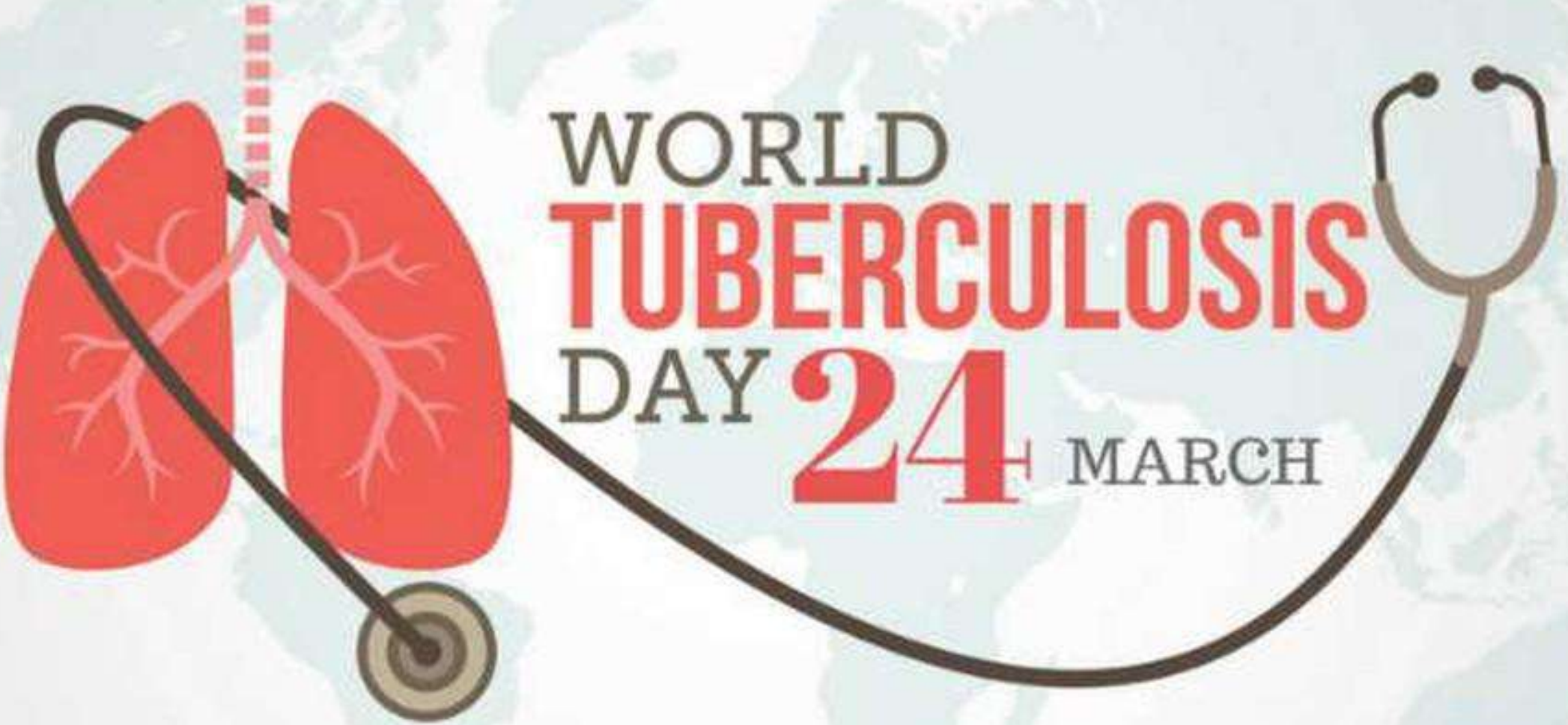
Status of treatment	Total Notified	%
Notified and Not initiated on treatment	1,32,297	6%
Currently on treatment	11,36,475	47%
Notified, Initiated treatment, and outcome assigned	11,36,043	47%
Total=	24,04,815	



Control of Tuberculosis: RNTCP

Indicator	Private	%	Public	%	Grand Total	%
Total Notified 2018	**483781**		**1619047**		**2102828**	**6%**
Treatment initiated	**469665**	**97%**	**1555842**	**96%**	**2025507**	**47%**
Treatment Success	**342066**	**71%**	**1337201**	**83%**	**1679267**	**47%**
Died	**8368**	**2%**	**70776**	**4%**	**79144**	**4%**
Total Expenditure 9398.62	639.94	639.86	677.78	2759.44	2237.79	2443.81*


World Health Organization
YES!
WE CAN
#ENDTB!
World Tuberculosis Day 2023
24 March 2023
75 HEALTH FOR ALL
Activate Windows
Go to Settings to activate Windows.


WORLD
TUBERCULOSIS
DAY 24 MARCH

WORLD TB DAY

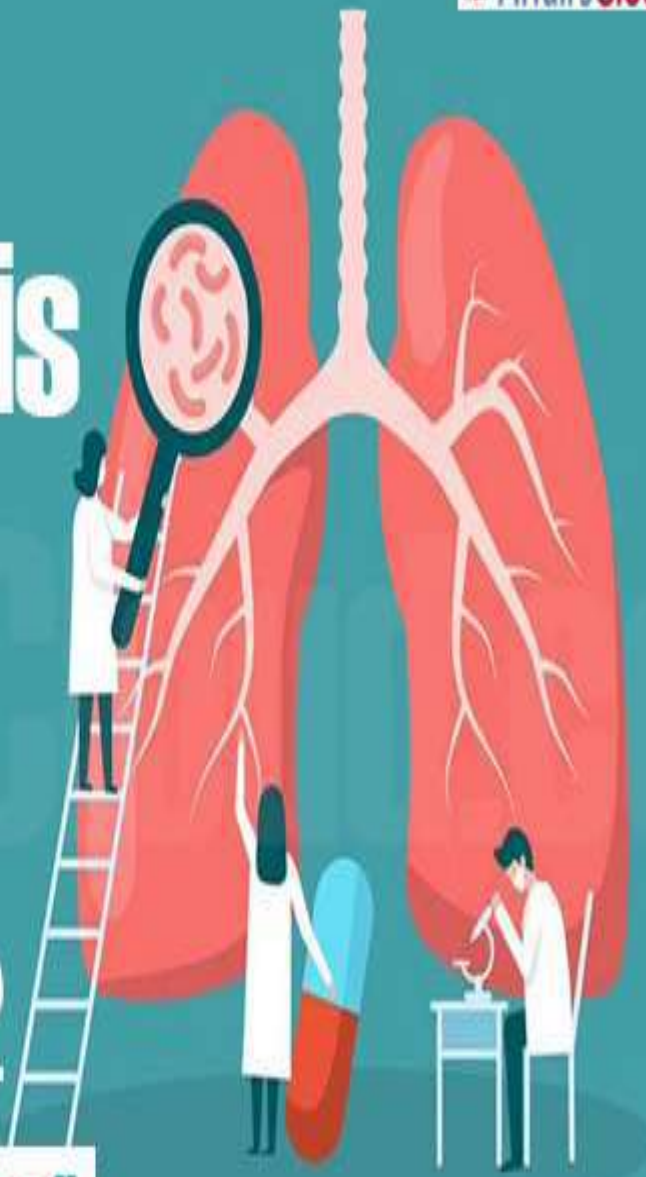
MARCH 24

- IT'S TIME to test and treat latent TB infection.
- IT'S TIME to speak up.
- IT'S TIME to end stigma.
- IT'S TIME to strengthen TB education and awareness among health care providers.

IT'S TIME! END TB

AffairsCloud

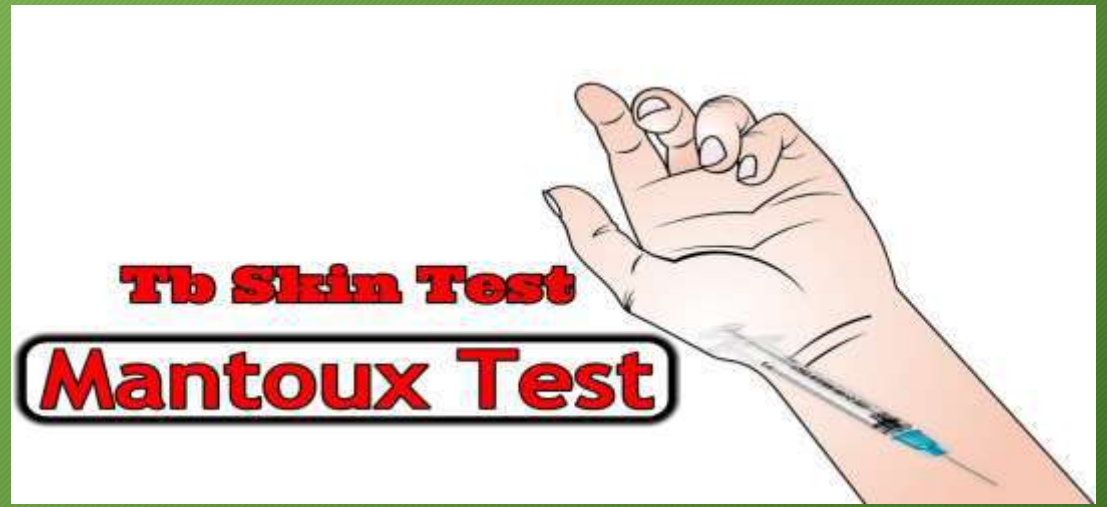
World Tuberculosis Day



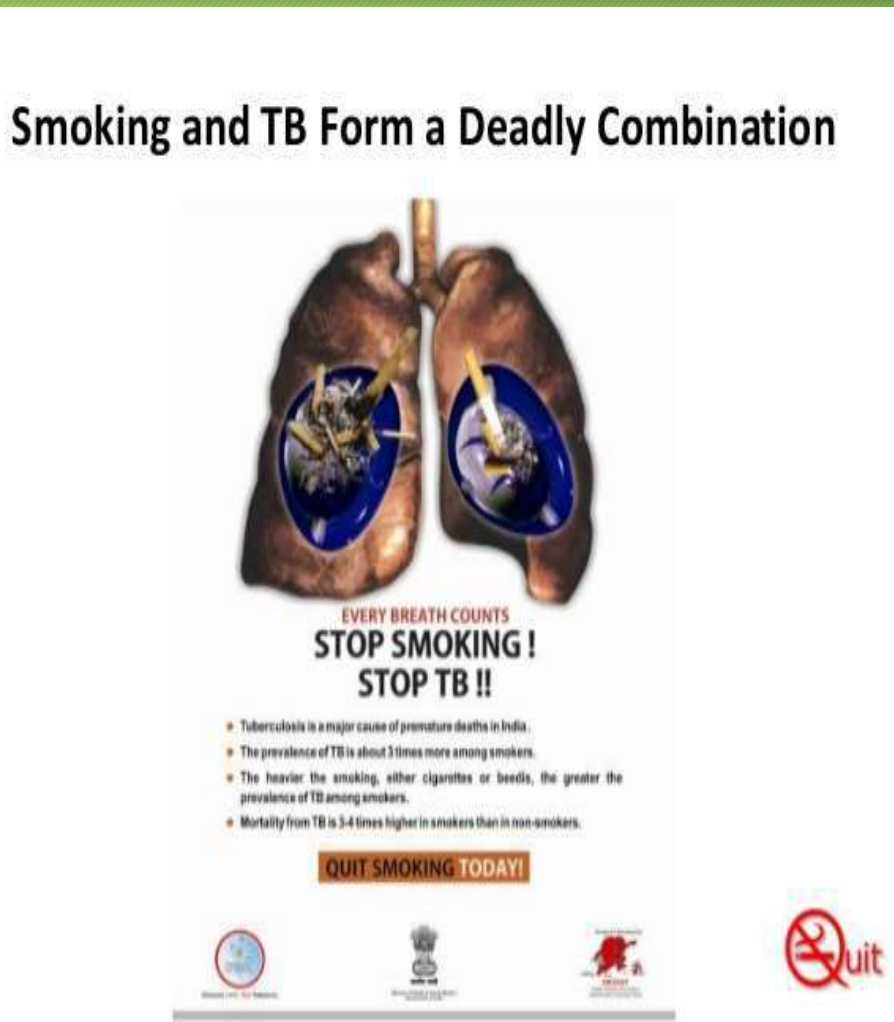
March 24 - 2022

"Invest to End TB. Save Lives"

Control of Tuberculosis: RNTCP



Control of TB



Functions and Use of Nikshay:

The Nikshay serves as a National TB Patient Information management tool for all sectors and for all types of patients. Programme staff manages information of each patient throughout the patient lifecycle related to

a. Testing (Diagnosis & follow up)
b. Treatment initiation
c. Public health action (Contact tracing, comorbidities)
d. Adherence monitoring
e. Outcomes
f. Transfer and referral for testing

It acts as a Surveillance tool under National TB Elimination Programme

Control of TB

Key findings/results

- Result 1
- Result 2
- Result 3

Key findings/results

- Result 1
- Result 2
- Result 3

Key findings/results

- Result 1
- Result 2
- Result 3

Key findings/results

- Result 1
- Result 2
- Result 3

First research area

Group member name

Supporting content

Heading

- List item
- List item
- List item

Heading

- List item
- List item
- List item

Second Research Area

Group member name

Supporting content

Heading

- List item
- List item
- List item

Heading

- List item
- List item
- List item

Third research area

Group member name

Supporting content

Heading

- List item
- List item
- List item

Heading

- List item
- List item
- List item

Project Summary

Optional statement

Conclusion

- Brief summary of what you discovered based on research

Appendix

- Works cited
- Additional supporting data