Tuberculosis

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Objectives

- Understand the epidemiology and global burden of TB
- List the sign and symptoms and risk factors of different types of TB, with particular emphasis on pulmonary TB
- Describe trends and state reasons for resurgence of pulmonary TB
- List population subgroups at risk for pulmonary TB
- Draw the cycle of infection of pulmonary TB
- Outline procedures for community diagnosis of pulmonary TB with emphasis on the limitation of each procedure
- Describe measures for prevention and control for pulmonary TB
- Describe the role of WHO to address the global burden of TB, particularly directly observed therapy short course (DOTS) for pulmonary TB

TB IS THE TOP INFECTIOUS KILLER IN THE WORLD

IN 2017

1.6 MILLION TB DEATHS

INCLUDING **0.3 MILLION DEATHS** AMONG **PEOPLE WITH HIV**

TB IS THE **LEADING KILLER** OF **PEOPLE WITH HIV**

AND **MAJOR CAUSE** OF **DEATH** DUE TO **ANTIMICROBIAL RESISTANCE**

10 MILLION PEOPLE FELL ILL WITH TB

5.8 MILLION MEN

3.2 MILLION WOMEN

1 MILLION CHILDREN

EXPANDING ACCESS TO TB PREVENTIVE TREATMENT

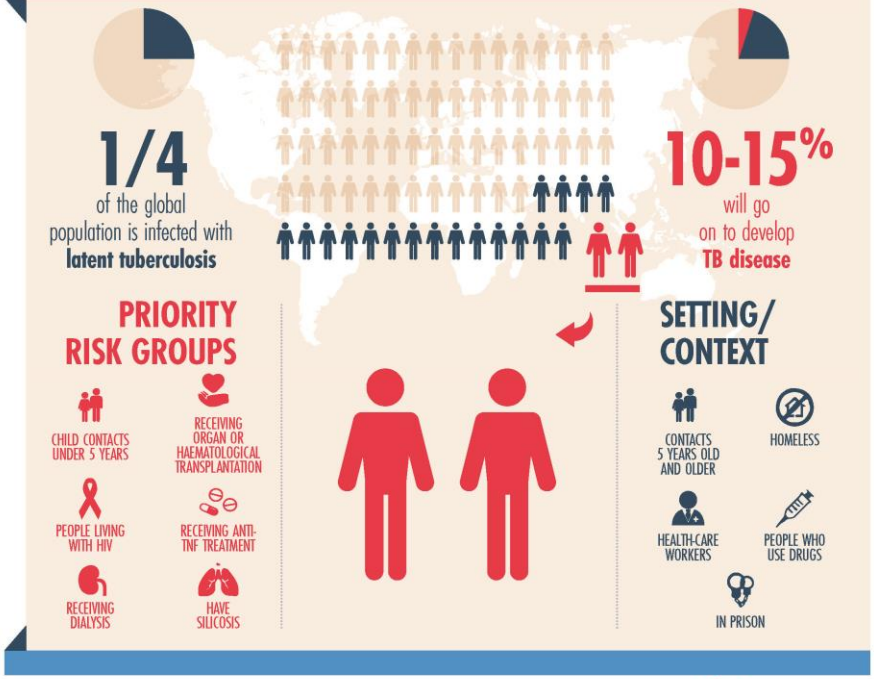
ONLY **36%** OF PEOPLE NEWLY ENROLLED IN **HIV CARE** WERE STARTED ON **TB PREVENTIVE TREATMENT**

ONLY **23%** OF **CHILDREN** UNDER 5 YEARS, ESTIMATED TO BE ELIGIBLE FOR **TB PREVENTIVE TREATMENT** WERE **STARTED ON IT.**

WHO recommends preventive treatment for people living with HIV and all contacts living in households with TB (including children under 5 years)

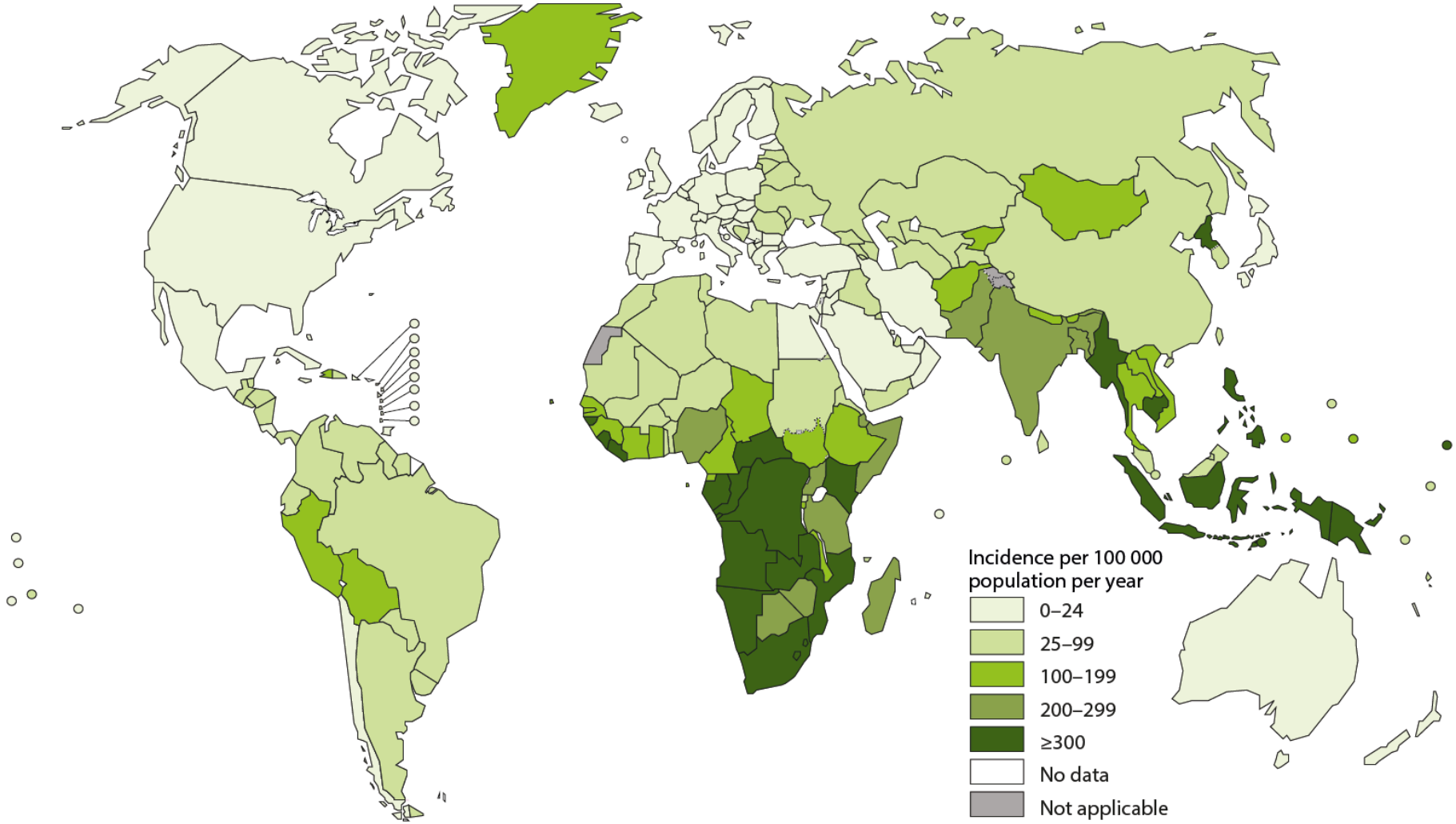
World Health Organization

TREATMENT OF TB INFECTION (LATENT TB)



World Health Organization

Estimated TB incidence rates, 2017



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: *Global Tuberculosis Report 2018*. WHO, 2018.

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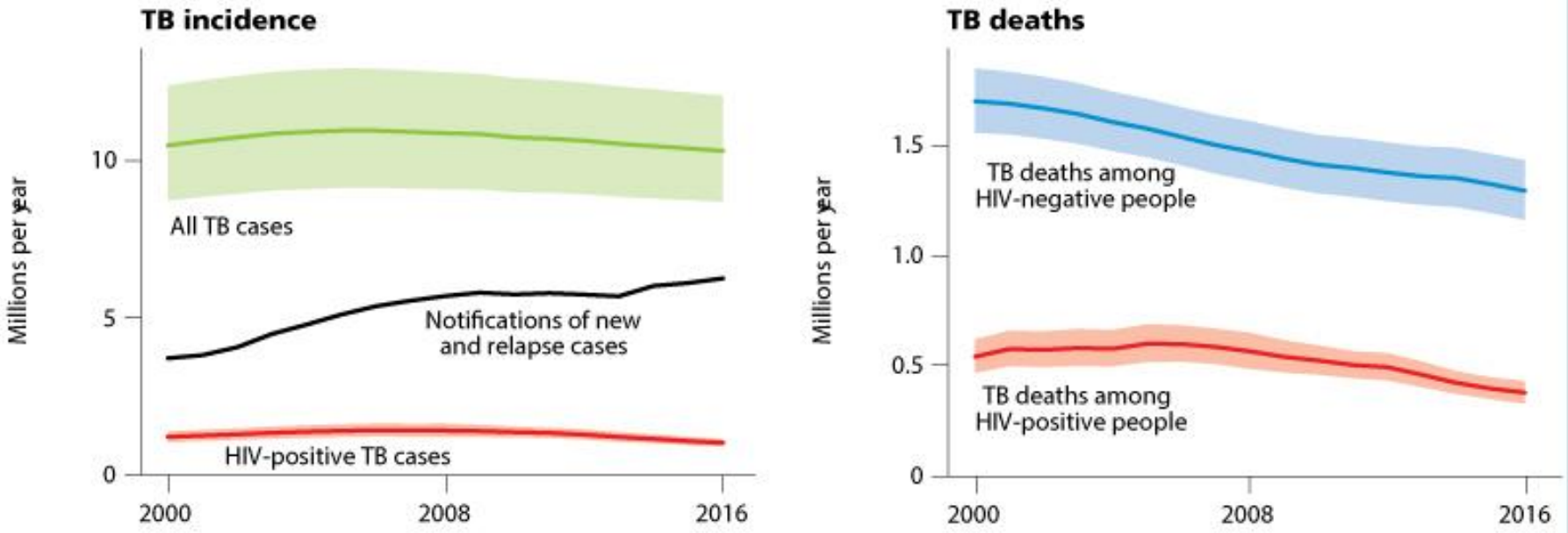
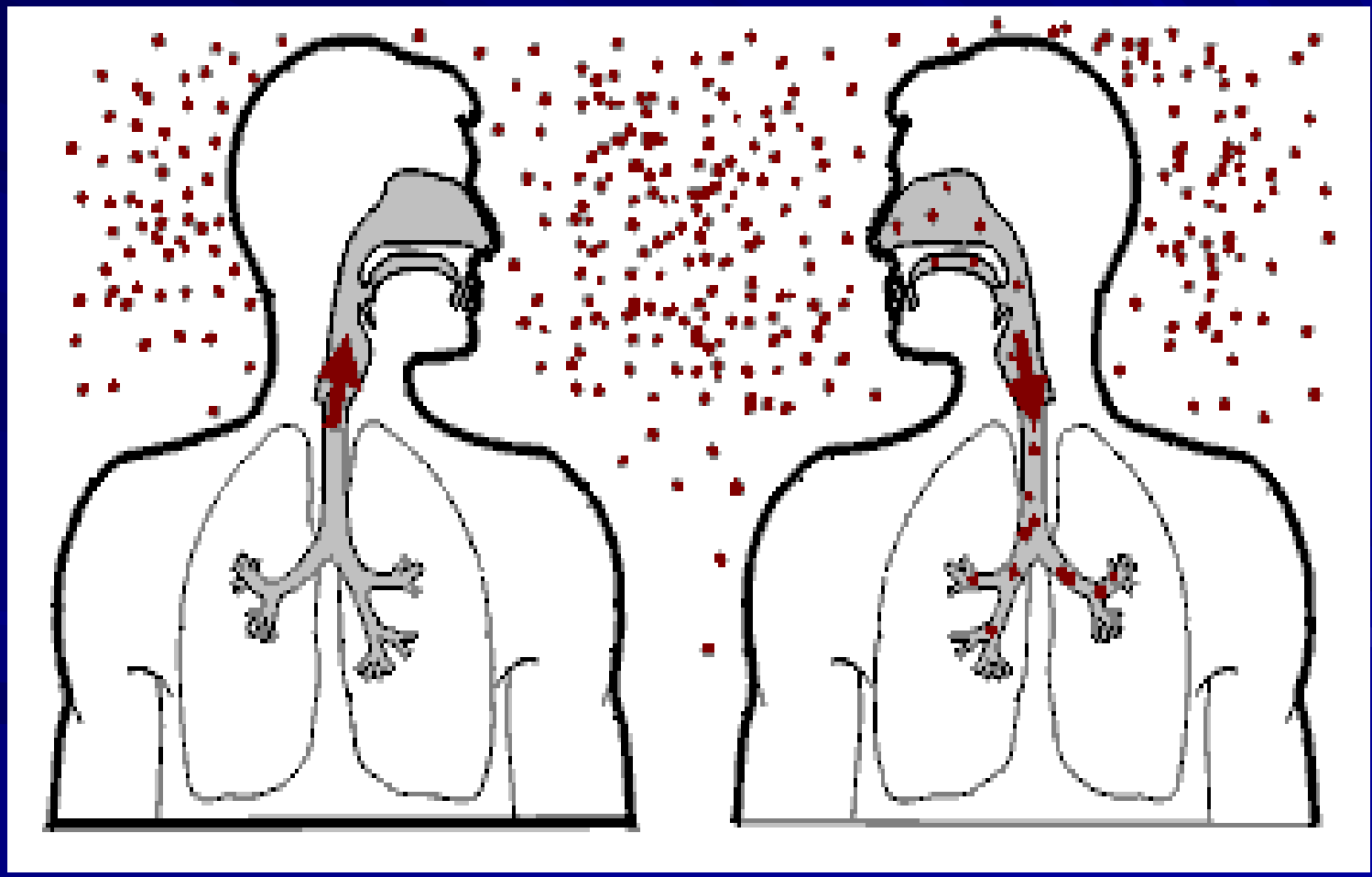
Global trends in the estimated number of incident TB cases and the number of TB deaths (in millions), 2000–2016



Shaded areas represent uncertainty intervals.

Source: Global Tuberculosis Report 2017, WHO

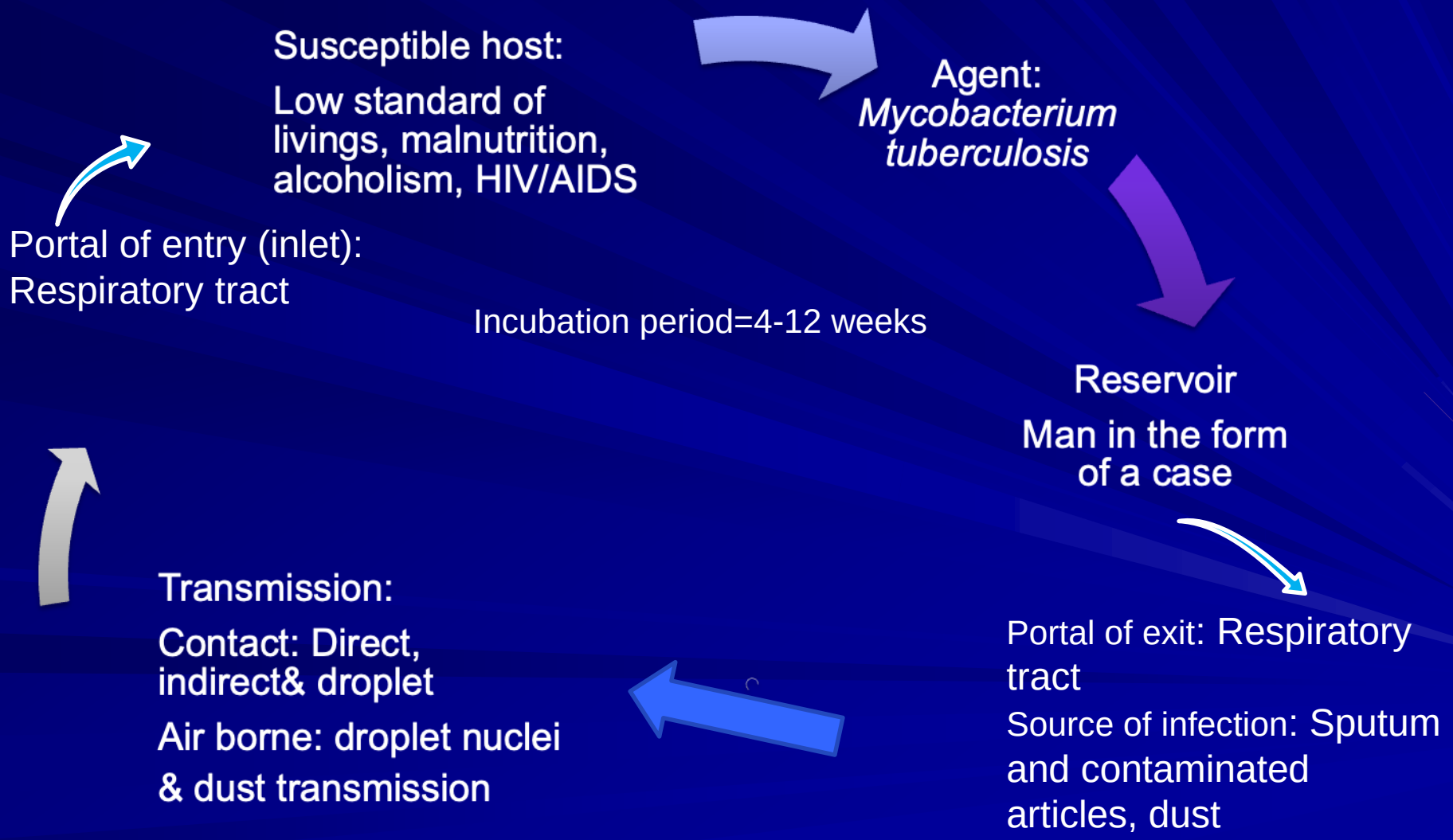
Transmission and Pathogenesis



Transmission of *M. tuberculosis*

- Spread by droplet nuclei
- Expelled when person with infectious TB coughs, sneezes, speaks, or sings
- Close contacts at highest risk of becoming infected and prolonged exposure usually needed to establish infection.
- Risk of transmission outdoors is reduced because of dilution and bacilli are killed by ultraviolet light.
- Transmission occurs from person with infectious TB disease (not latent TB infection).

CYCLE OF INFECTION OF PULMONARY TUBERCULOSIS



Probability TB Will Be Transmitted

- Infectiousness of person with TB
- Environment in which exposure occurred
- Duration of exposure
- Virulence of the organism

Conditions That Increase the Risk of Progression to TB Disease

- HIV infection
- Substance abuse
- Recent infection
- Chest radiograph findings suggestive of previous TB
- Diabetes mellitus
- Silicosis
- Prolonged corticosteriod therapy
- Other immunosuppressive therapy

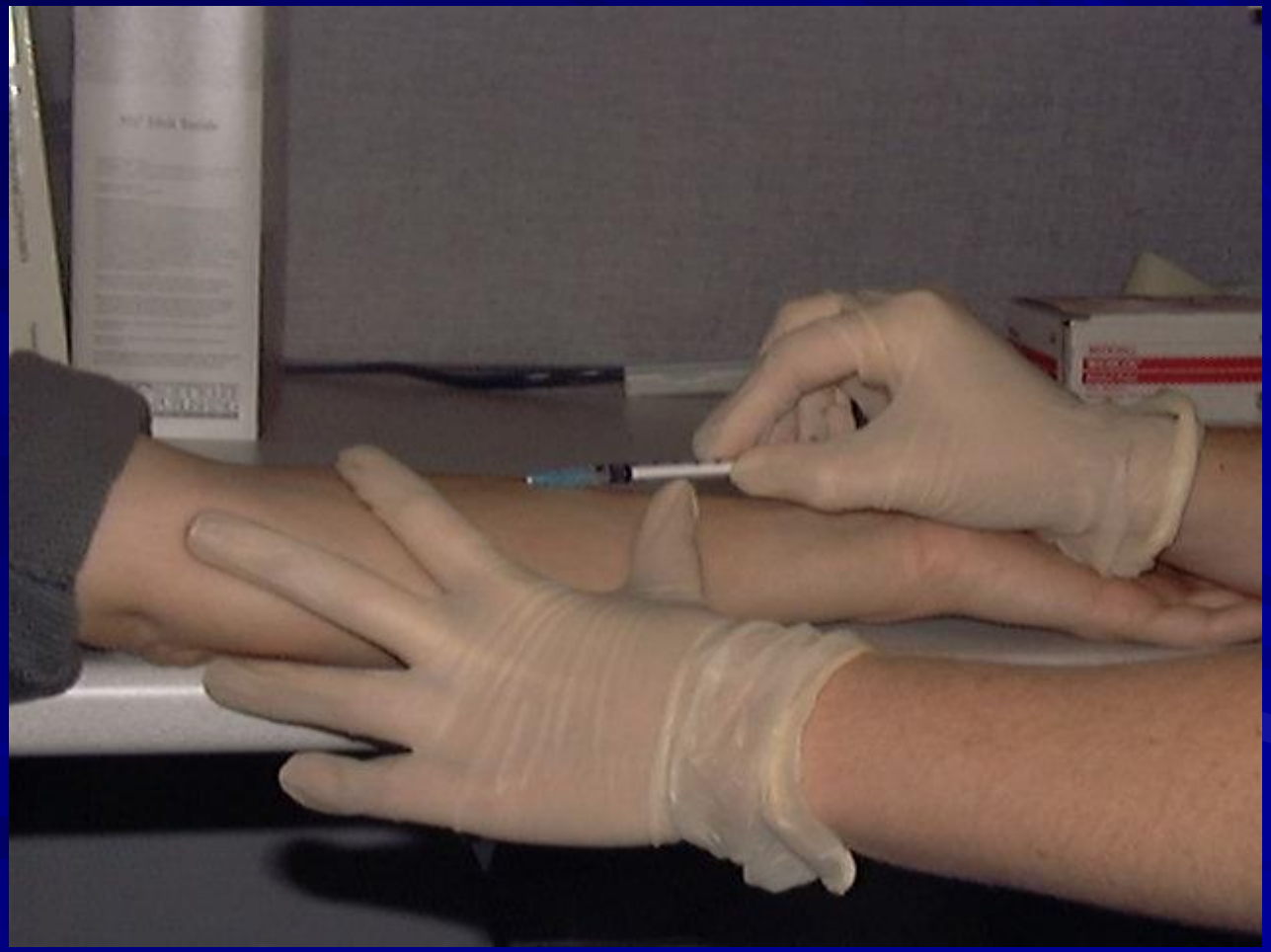
Common Sites of TB Disease

- Lungs
- Pleura
- Central nervous system
- Lymphatic system
- Genitourinary systems
- Bones and joints
- Disseminated (miliary TB)

Persons at Higher Risk for Exposure to or Infection with TB

- Close contacts of persons known or suspected to have TB
- Residents and employees of high-risk congregate settings
- Health care workers (HCWs) who serve high-risk Clients
- Medically underserved, low-income populations
- Persons with malnutrition
- Children exposed to adults in high-risk categories
- Persons who inject illicit drugs

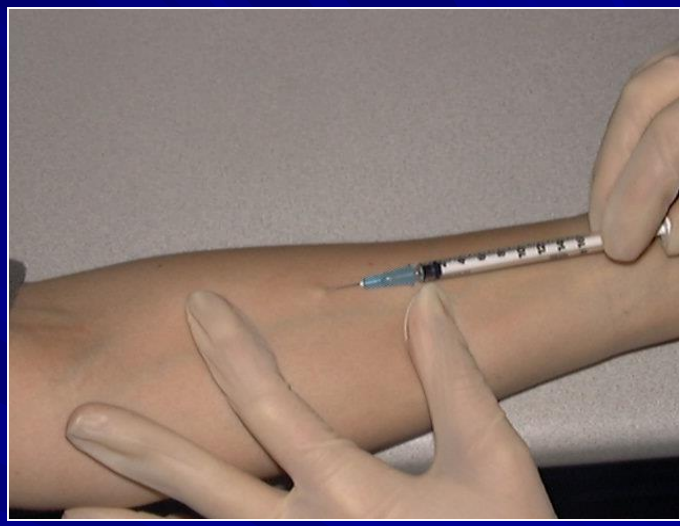
Testing for TB Disease and Infection



All testing activities should be accompanied by a plan for follow-up care

Administering the Tuberculin Skin Test

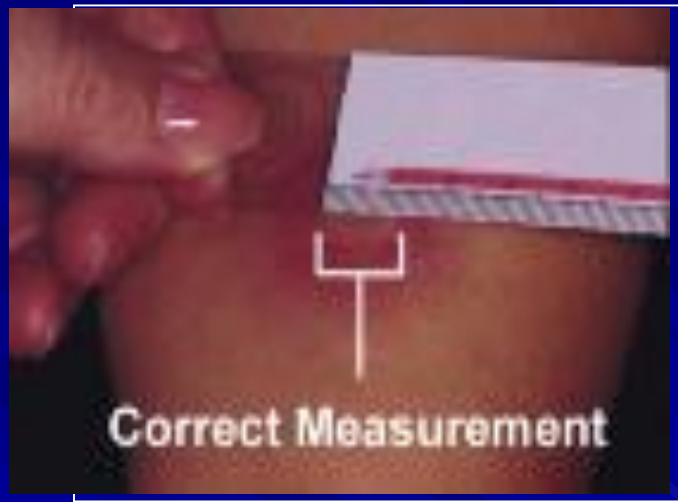
- Inject intradermally 0.1 ml of 5 TU PPD tuberculin



- Produce wheal 6 mm to 10 mm in diameter
- Do not recap, bend, or break needles, or remove needles from syringes
- Follow universal precautions for infection control

Reading the Tuberculin Skin Test

- Read reaction 48-72 hours after injection
- Measure only induration
- Record reaction in millimeters



A tuberculin skin test reaction is considered positive if the transverse diameter of the indurated area reaches the size required for the specific group.

Induration size	Group
≥ 5 mm	▪ HIV-positive persons. ▪ Patients with organ transplants and other immunosuppressed patients.
≥10 mm	▪ Recent immigrants from countries with a high prevalence of TB. ▪ HIV-negative injection drug users. ▪ Laboratory personnel. ▪ Health care workers. ▪ Persons with increased risk of TB e.g. DM, silicosis, ….
≥ 15 mm	▪ Persons with no risk factors for tuberculosis.

Factors that May Affect the Skin Test Reaction

Type of Reaction	Possible Cause
False-positive	▪ Non-tuberculous mycobacteria ▪ BCG vaccination
False-negative	▪ Recent TB infection ▪ Very young age (< 6 months old) ▪ Live-virus vaccination ▪ Overwhelming TB disease ▪ HIV positive people

Diagnosis of TB

Evaluation for TB

- Medical history
- Physical examination
- Mantoux tuberculin skin test
- Chest radiograph
- Bacteriologic or histologic exam

Symptoms of Pulmonary TB

- Productive, prolonged cough (duration of >3 weeks)
- Chest pain
- Hemoptysis

SYMPTOMS

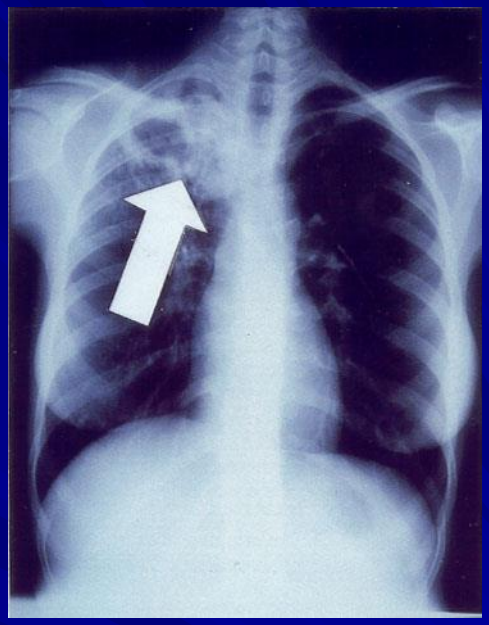

prolonged cough
chest pain
blood in cough or sputum
weakness / fatigue
weight loss / loss of appetite
fever / chills
night sweats

Medical History

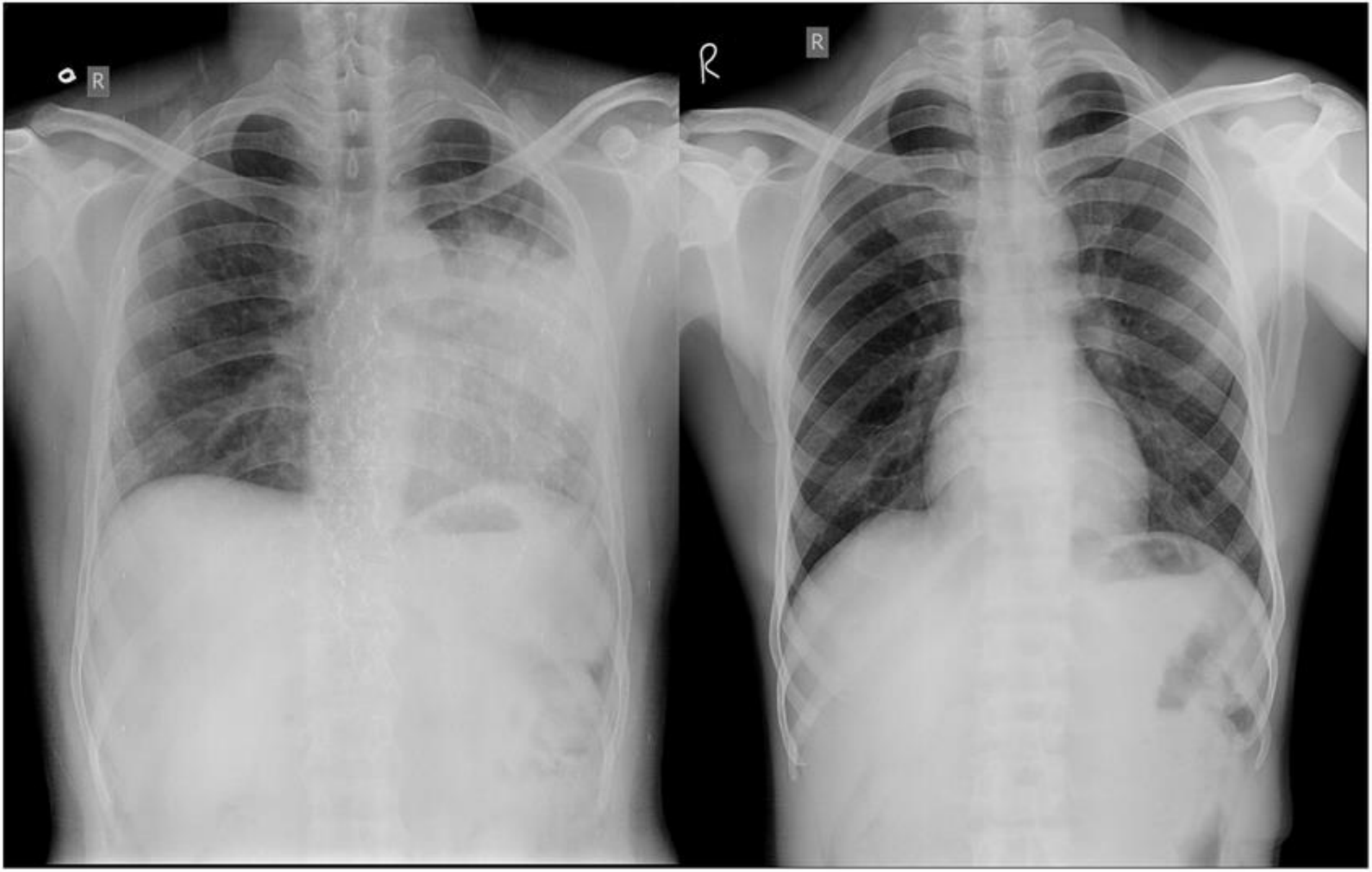
- Symptoms of disease
- History of TB exposure, infection, or disease
- Past TB treatment
- Demographic risk factors for TB
- Medical conditions that increase risk for TB disease

Chest Radiograph

- Abnormalities often seen in apical or posterior segments of upper lobe or superior segments of lower lobe
- May have unusual appearance in HIV-positive persons
- Cannot confirm diagnosis of TB



Arrow points to cavity in patient's right upper lobe.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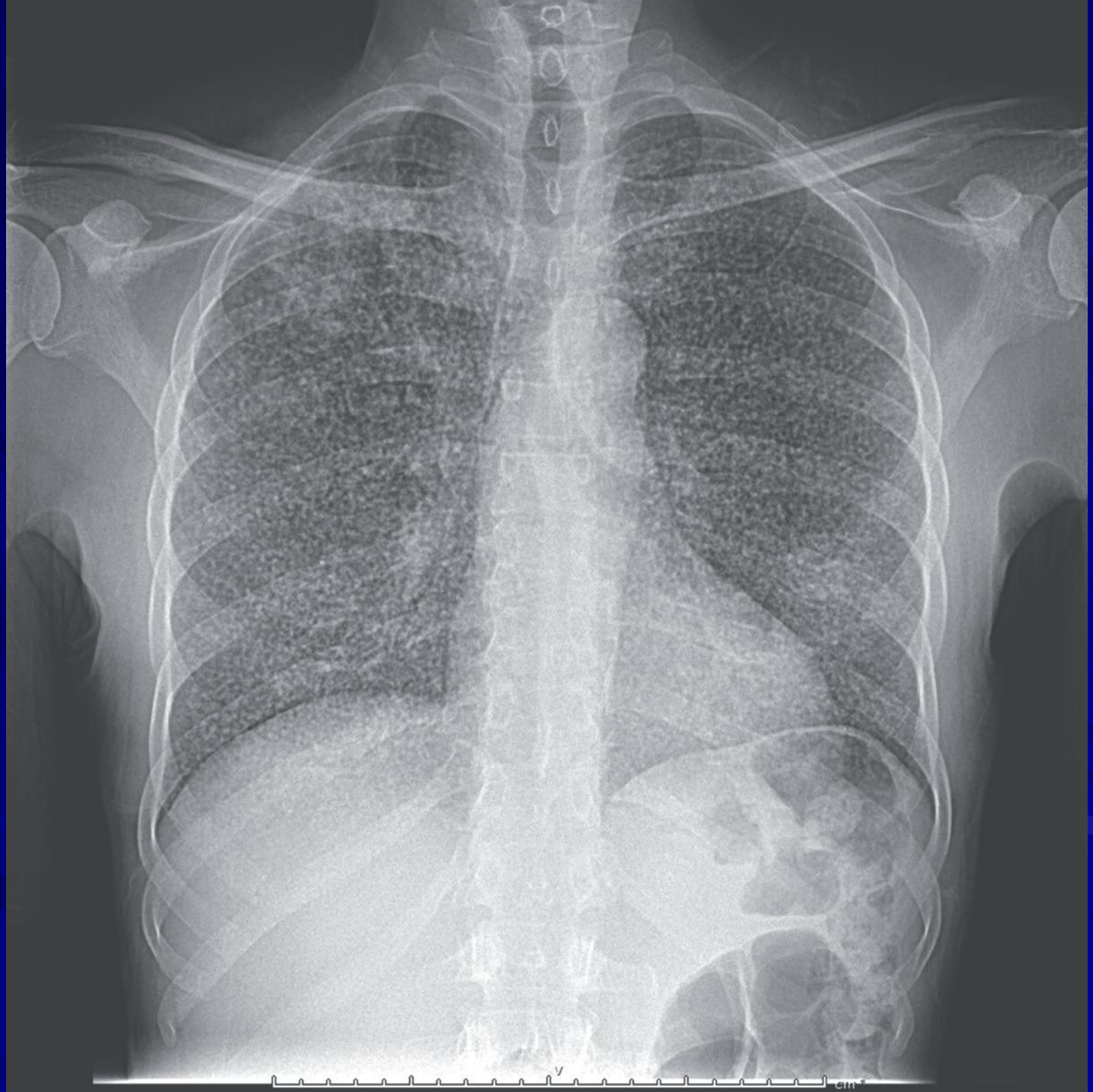


X ray findings in TB

- https://www.youtube.com/watch?v=U7zvKbjYX7I

Sputum Specimen Collection

- Obtain 3 sputum specimens for smear examination and culture
- Persons unable to cough up sputum, induce sputum, bronchoscopy or gastric aspiration
- Follow infection control precautions during specimen collection

Smear Examination

- Strongly consider TB in patients with smears containing alcohol acid-fast bacilli (AAFB)
- Results should be available within 24 hours of specimen collection
- Presumptive diagnosis of TB

Cultures

- Use to confirm diagnosis of TB
- Culture all specimens, even if smear negative
- Results in 4 to 14 days when liquid medium systems used

Blood Tests for TB Infection
Interferon Gamma Release Assays (IGRA)

- **Quantiferon** is a simple-blood test, a modern alternative to the tuberculin skin test that can aid in diagnosing *M. tuberculosis* infection.
- Quantiferon is highly specific and sensitive.
- They do not help differentiate latent tuberculosis infection (LTBI) from tuberculosis disease.

Blood Tests for TB Infection

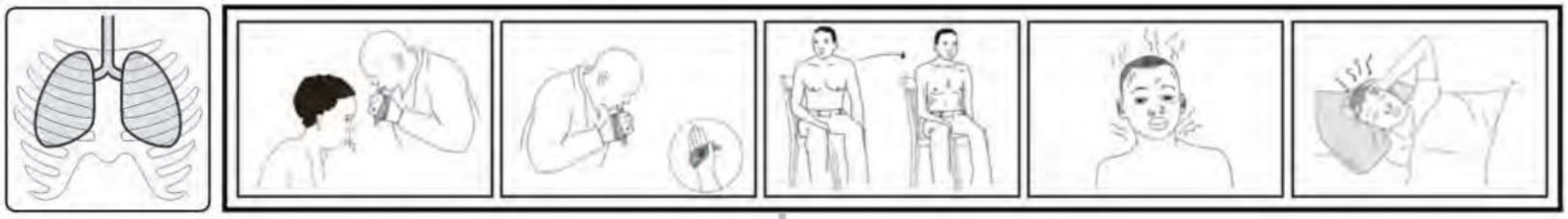
What are the advantages of Quantiferon?

- Requires a single patient visit to conduct the test.
- Results can be available within 24 hours.
- Prior BCG (Bacille Calmette-Guérin) vaccination does not cause a false-positive Quantiferon result.
- A positive test result suggests that *M. tuberculosis* infection is likely; a negative result suggests that infection is unlikely.
- Used to detect persons with Latent TB infection.

Latent Tuberculosis Infection (LTBI)

- **LTBI** is defined as a state of persistent immune response to stimulation by Mycobacterium tuberculosis antigens with no evidence of clinically manifest active TB.
- There is an increased chance of developing active TB disease from the infection.
- Isoniazid has been the standard treatment for LTBI.

FIG. 3. WHO's recommended screening strategy for TB prevalence surveys *(21)*



ABNORMAL CXR and/or POSITIVE SYMPTON SCREEN

NO

NO BACTERIOLOGICAL TESTING

YES

BACTERIOLOGICAL TESTING

Microscopy culture, Xpert MTB RFI

CXR: chest X-ray.

Treatment of TB Infection

DIRECTLY OBSERVED TREATMENT, SHORT COURSE(DOTS)CHEMOTHERAPY

- Health care worker watches patient swallow each dose of medication
- Consider DOT for all patients
- DOT can lead to reductions in relapse and acquired drug resistance
- Use DOT with other measures to promote adherence

The five elements of DOTS

- **Political commitment with increased and sustained financing**
- **Case detection through quality-assured bacteriology**
- **Standardized treatment, with supervision and patient support**
- **An effective drug supply and management system**
- **Monitoring and evaluation system, and impact measurement**

Treatment of TB for HIV-Negative Persons

- Include four drugs in initial regimen
  - **Isoniazid (INH)**
  - **Rifampicin (RIF)**
  - **Pyrazinamide (PZA)**
  - **Ethambutol (EMB) or streptomycin (SM)**
- Adjust regimen when drug susceptibility results are known

Extrapulmonary TB

- In most cases, treat with same regimens used for pulmonary TB

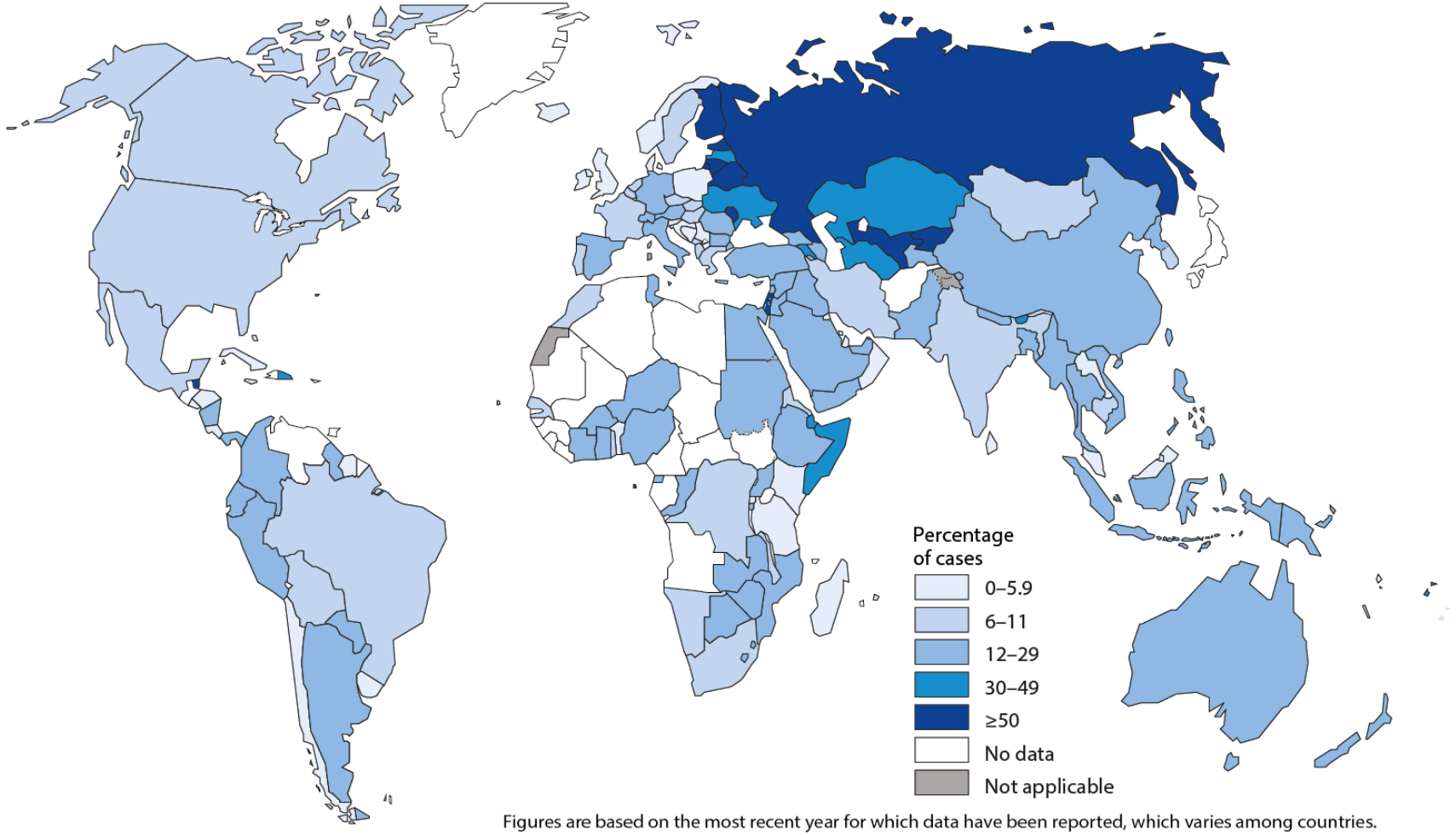
Bone and Joint TB, Miliary TB,
or TB Meningitis in Children

- Treat for a minimum of 12 months

Multidrug-Resistant TB (MDR TB)

- Presents difficult treatment problems
- Treatment must be individualized
- Clinicians unfamiliar with treatment of MDR TB should seek expert consultation
- Always use DOT to ensure adherence

Percentage of previously treated TB cases with MDR/RR-TB*



* MDR = multidrug-resistant ; RR= rifampicin-resistant
MDR/RR-TB = RR-TB cases including MDR-TB cases

Figures are based on the most recent year for which data have been reported, which varies among countries. Data cover the period 2005–2018. The high percentages of previously treated TB cases with RR-TB in Belize, Guam and Sao Tomé and Principe refer to only a small number of notified cases (range: 1–8 notified previously treated TB cases).

Data Source: *Global Tuberculosis Report 2018*. WHO, 2018.

World Health Organization

WHO EFFORTS

STRATEGY

A WORLD FREE OF TB
ZERO deaths, disease, and suffering due to TB

END THE GLOBAL TB EPIDEMIC

	MILESTONES		TARGETS	
			SDG*	END TB
	2020	2025	2030	2035
Reduction in number of TB deaths compared with 2015 (%)	35%	75%	90%	95%
Reduction in TB incidence rate compared with 2015 (%)	20%	50%	80%	90%
TB-affected families facing catastrophic costs due to TB (%)	0%	0%	0%	0%

* The United Nations Sustainable Development Goals (SDGs) include ending the TB epidemic by 2030 under Goal 3.

INTEGRATED, PATIENT-CENTRED CARE AND PREVENTION

How pillar 1 works : Key actions

A. Early diagnosis of TB including universal drug-susceptibility testing, and systematic screening of contacts and high-risk groups

B. Treatment of all people with TB including drug-resistant TB, and patient support

D. Preventive treatment of persons at high risk; and vaccination against TB

C. Collaborative TB/ HIV activities; and management of co-morbidities

Community TB Control

Preventing and Controlling TB

- Three priority strategies:
  - Identify and treat all persons with TB disease
  - Identify contacts to persons with infectious TB; evaluate and offer therapy
  - Test high-risk groups for latent TB infection (LTBI); offer therapy as appropriate

BCG Vaccination

- In countries where tuberculosis is prevalent and the risk of childhood infection is high, the national policy is to administer **BCG** very early in infancy either at:
- Birth or at 6 weeks of age with other immunizing agents such as DPT and polio.

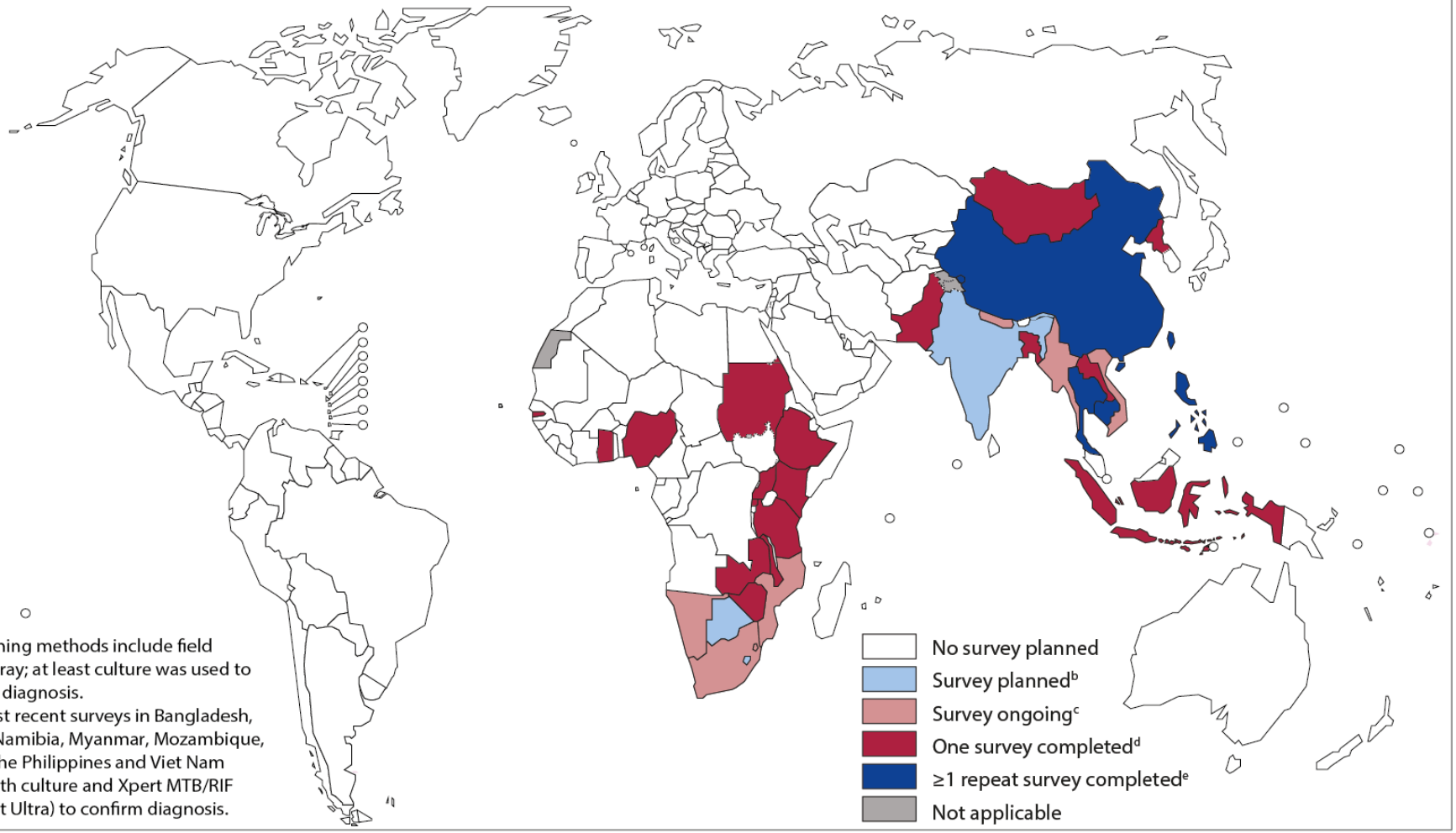
Health care providers should work with health department in the following areas

- Overall planning and policy development
- Identification of persons with clinically active TB
- Management of persons with disease or TB suspects
- Identification and management of persons with TB
- Laboratory and diagnostic services
- *Data collection and analysis*
- *Training and education*

Data Collection and Analysis

- TB reporting required in every state
- All new cases and suspected cases promptly reported to health department
- All drug susceptibility results sent to health department

Countries in which national population-based surveys of the prevalence of TB disease have been implemented using currently recommended screening and diagnostic methods* since 2000 or are planned in the future (status in August 2018)



* Screening methods include field chest X-ray; at least culture was used to confirm diagnosis.
The most recent surveys in Bangladesh, Kenya, Namibia, Myanmar, Mozambique, Nepal, the Philippines and Viet Nam used both culture and Xpert MTB/RIF (or Xpert Ultra) to confirm diagnosis.

Data Source: *Global Tuberculosis Report 2018*. WHO, 2018.

World Health Organization

Training and Education

- TB control programs should
- Provide training for program staff
- Provide leadership in TB education to the community
- Ensure community leaders, clinicians, and policymakers are knowledgeable about TB
- Educate the public

Why is it a concern for Saudi Arabia?

World Health Organization

www.who.int/tb

TUBERCULOSIS & DIABETES

THE DUAL EPIDEMIC OF TB AND DIABETES

DEADLY LINKAGES

- People with a weak immune system, as a result of chronic diseases such as diabetes, are at a higher risk of progressing from latent to active tuberculosis.
- Diabetes triples a person's risk of developing TB. About 15% of TB cases globally may be linked to diabetes
- TB can temporarily cause impaired glucose tolerance which is a risk factor for developing diabetes
- The likelihood that a person with TB will die or relapse is significantly higher if the person also has diabetes.
- A large proportion of people with diabetes as well as TB are not diagnosed, or are diagnosed too late.

KEY ACTIONS

- Early detection can help improve care and treatment outcomes of both diseases. All people with TB should be systematically screened for diabetes. Systematic screening for TB in people with diabetes should be considered in settings with high TB prevalence.
- WHO-recommended treatments should be rigorously implemented for people with TB/diabetes.
- It is important that proper care for diabetes is provided to minimize the risk of TB.
- Diabetes prevention on population level also helps prevent TB.
- A joint response is needed to ensure coordinated clinical management and address common health system bottlenecks and social determinants

World Health Organization

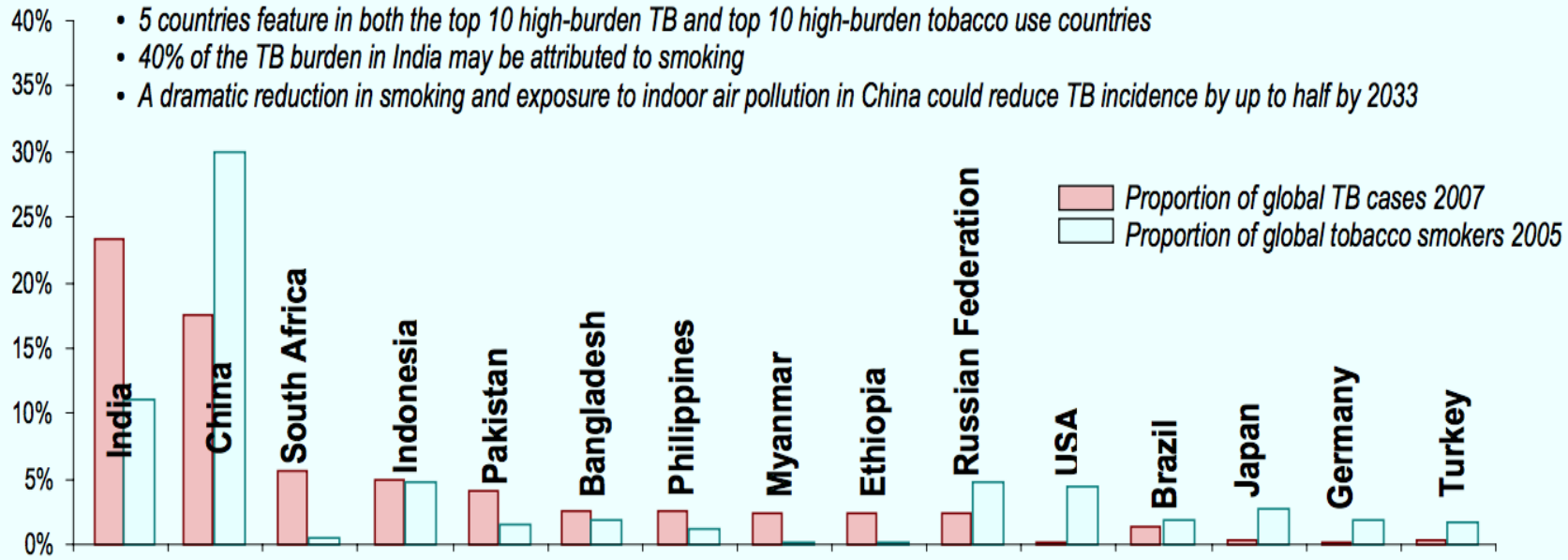
TUBERCULOSIS & TOBACCO

www.who.int/tb
www.who.int/tobacco

A strong association

- Smoking substantially increases the risk of tuberculosis (TB) and death from TB
- More than 20% of global TB incidence may be attributable to smoking
- Controlling the tobacco epidemic will help control the TB epidemic
- Smoking is a risk factor for TB, independent of alcohol use and other socioeconomic risk factors
- Smoking increases the risk of TB disease by more than two-and-a-half times
- The WHO monograph on TB and tobacco describes other linkages and evidence

Correlation of high-burden TB and high-burden tobacco-use countries



THE TUBERCULOSIS EPIDEMIC

- 2 billion people are infected with the TB bacilli
- TB is a disease of poverty with the vast majority of deaths occurring in low- and middle-income countries with more than half of all deaths occurring in Asia
- 9.27 million new TB cases in 2007
- 1.75 million people died from TB in 2007
- 5% of all TB cases have multidrug-resistant TB

THE TOBACCO EPIDEMIC

- More than 1 billion people smoke with nearly 70% of them living in low- and middle-income countries
- Tobacco use is the leading preventable cause of death
- More than 5 million people die per year from tobacco use. Unchecked, the epidemic will kill more than 8 million people per year by 2030