

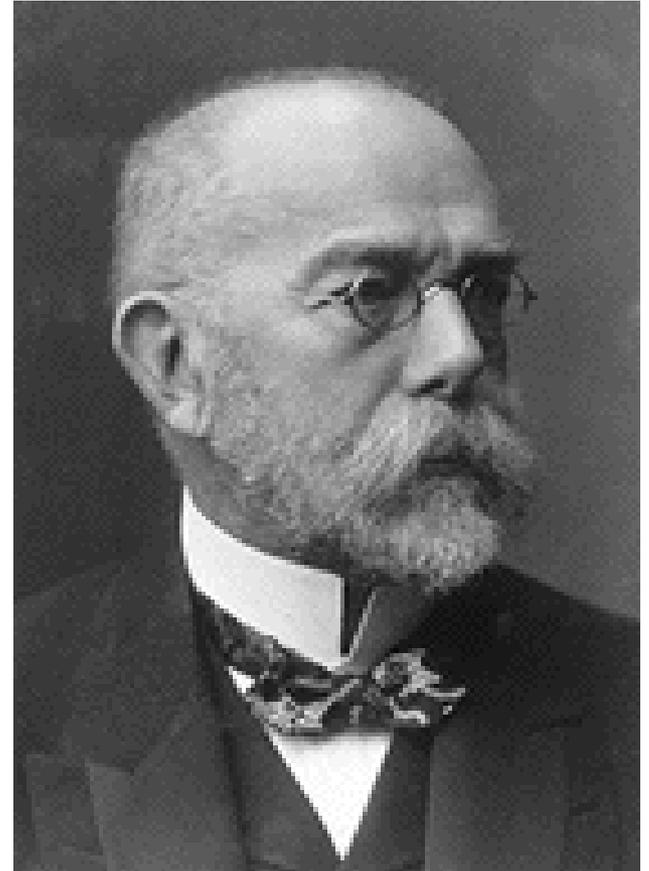
# Tuberculosis

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# Outline

- Microbiology
- Epidemiology
- Transmission
- Pathophysiology
- Symptoms
- Diagnosis
- Treatment

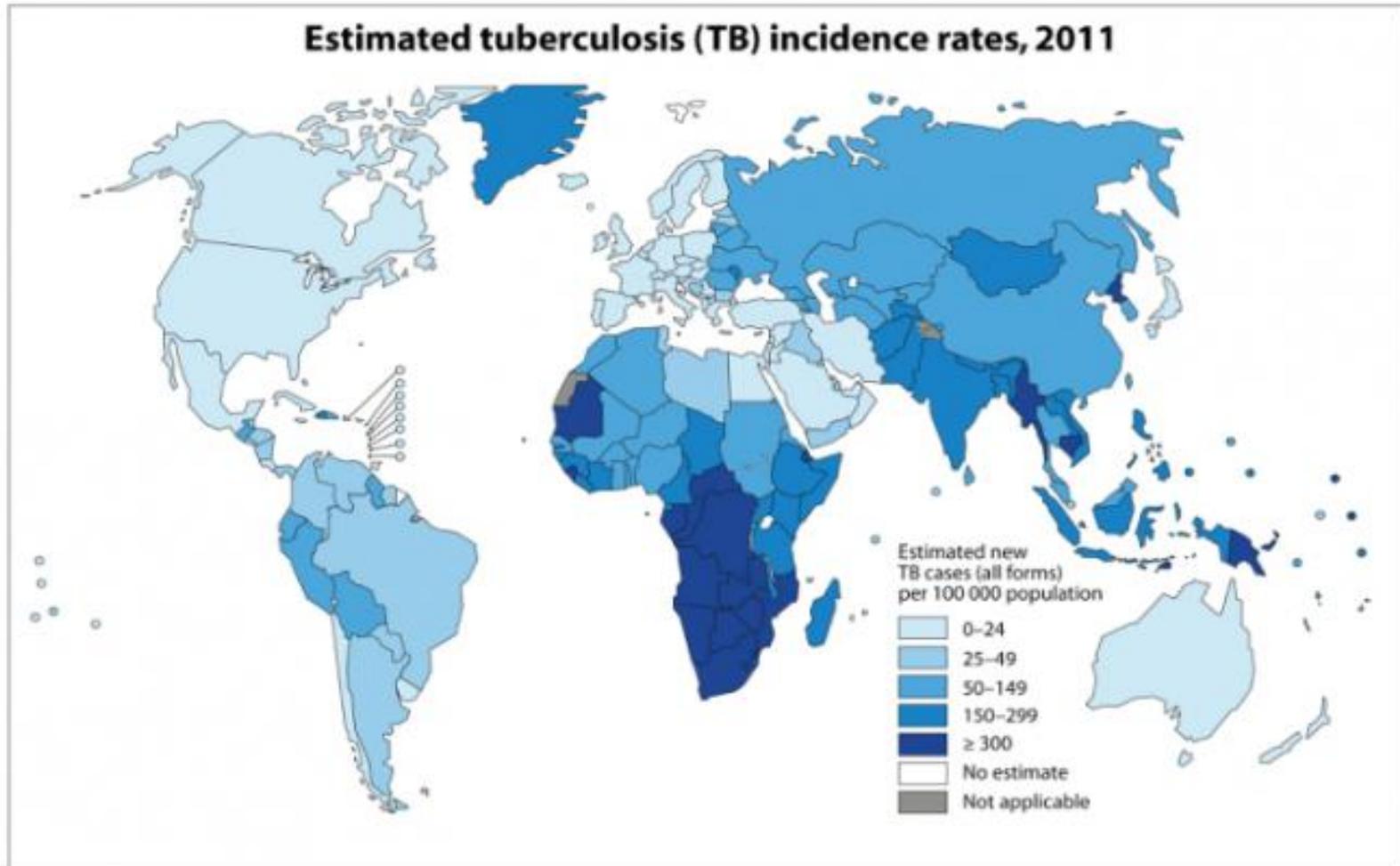
- The German doctor Robert Koch
- The first microbiologist to report in 1882 the isolation of the causative agent of tuberculosis



# Introduction

- TB is the most common cause of infectious disease–related mortality worldwide
- 2 billion have latent TB
- 3 million die of TB / year
- Increasing in the world
- Drug-resistant TB is also increasing
- Associated with poverty

# Epidemiology

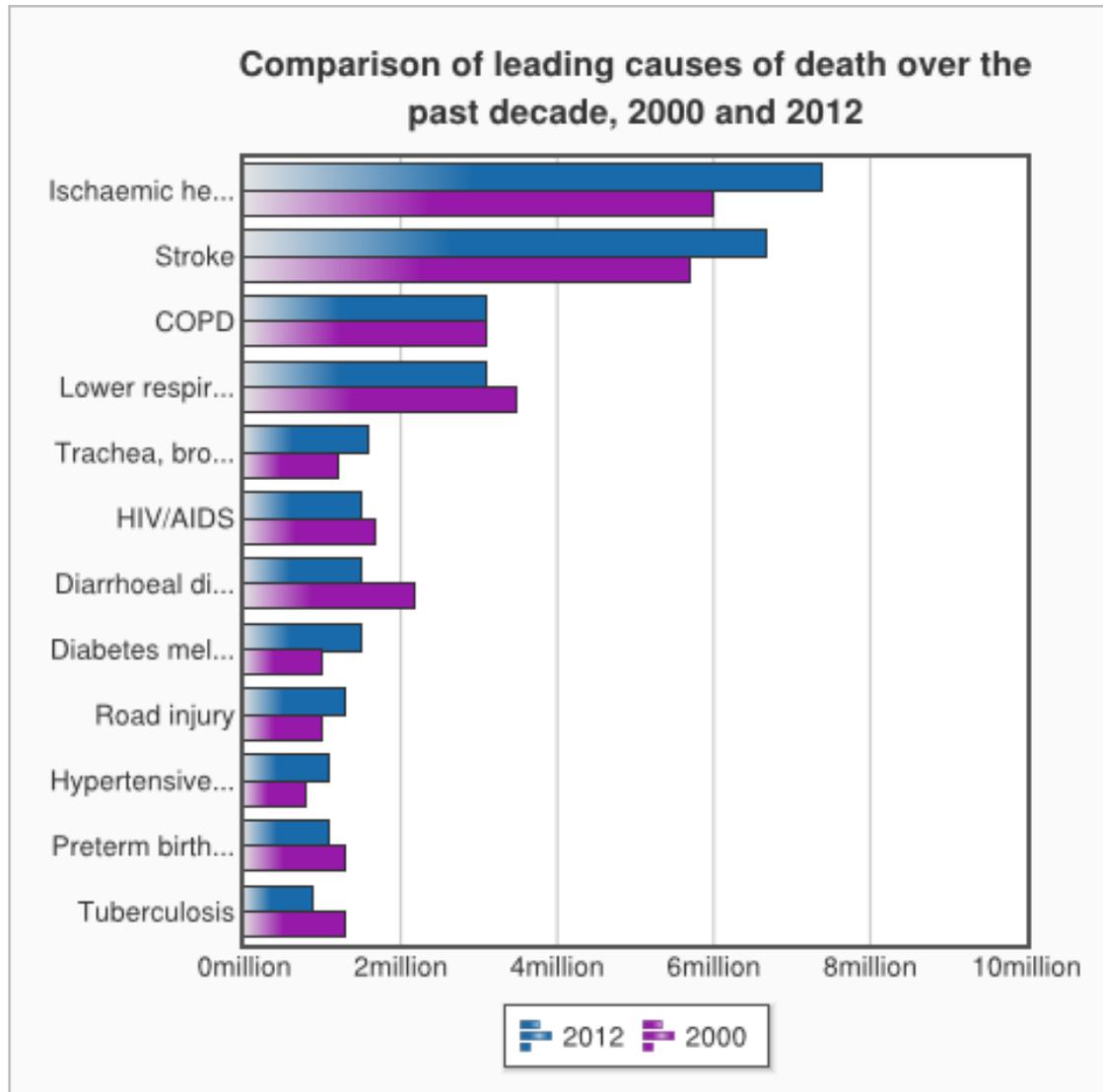


The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers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

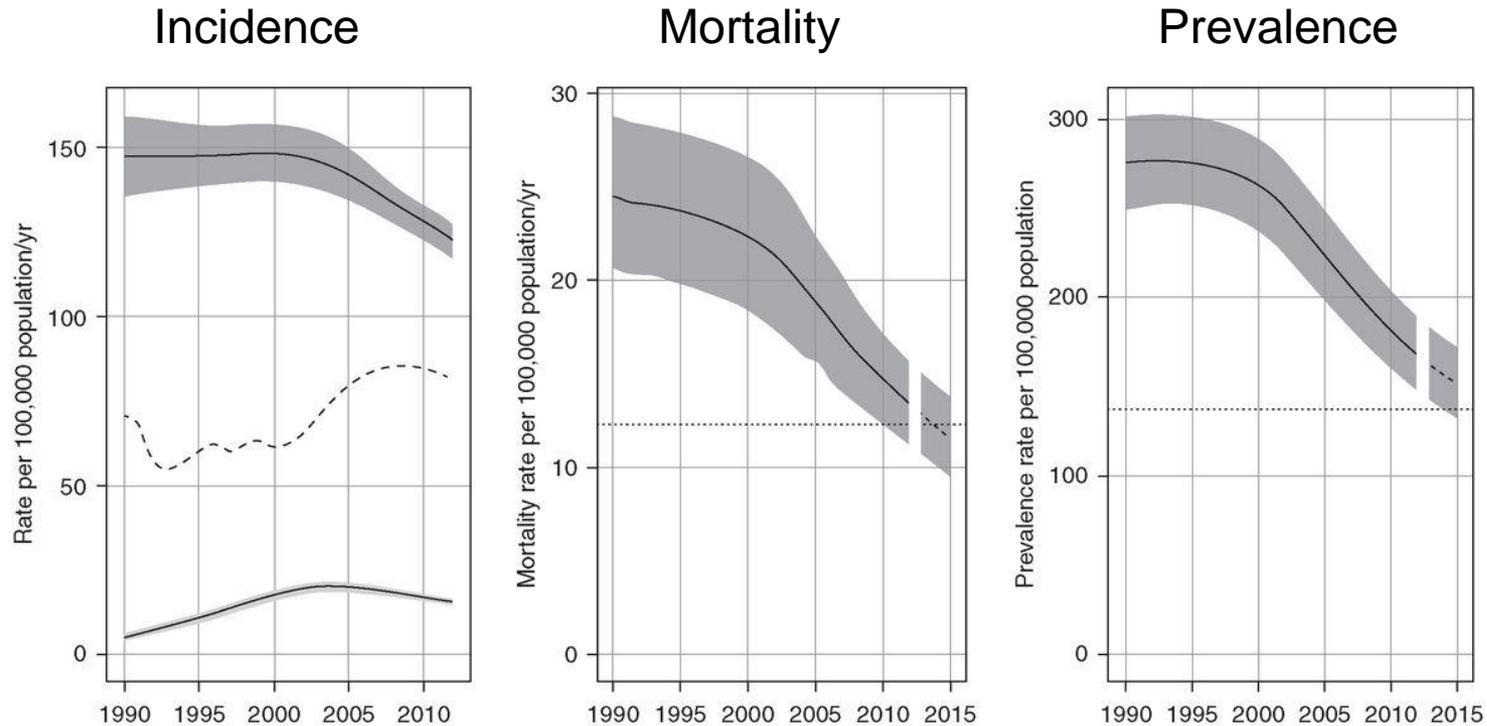
Source: *Global Tuberculosis Report 2012*. WHO, 2012.



# Leading causes of death



# Global trends in estimated TB incidence and estimated TB mortality



Global trends in estimated TB incidence and estimated TB mortality. (*Left*) Global trends in estimated incidence including HIV-negative and HIV-positive TB (dark gray, *top*) and estimated incidence of HIV-positive TB (light gray, *bottom*). The dashed line shows global trends in case notification rates (all forms of TB). (*Middle*) Global trends in estimated TB mortality excluding TB-associated AIDS deaths. The dotted line represents the Stop TB Partnership targets of halving mortality by 2015 compared with the level of 1990. (*Right*) Global trends in estimated TB prevalence. The dotted line represents the Stop TB Partnership targets of halving prevalence by 2015 compared with the level of 1990. Shaded areas represent uncertainty bands.

Philippe Glaziou et al. Cold Spring Harb Perspect Med 2015;5:a017798

# Epidemiology

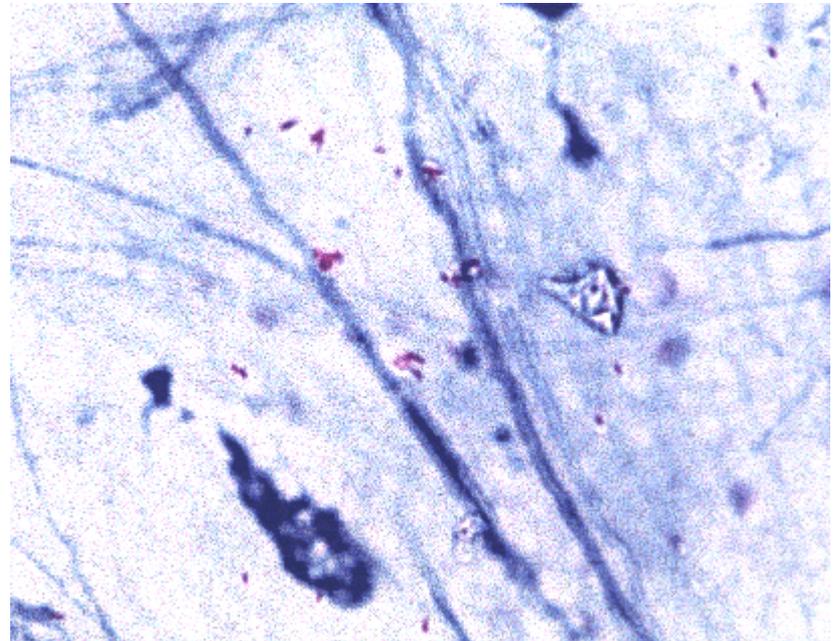
- Jordan 7 – 10 / 100,000
- USA: 4.4 / 100,000 (60% are foreigners)

# Mortality

- case-fatality was 50% for untreated pts before antibiotics
- now 4%

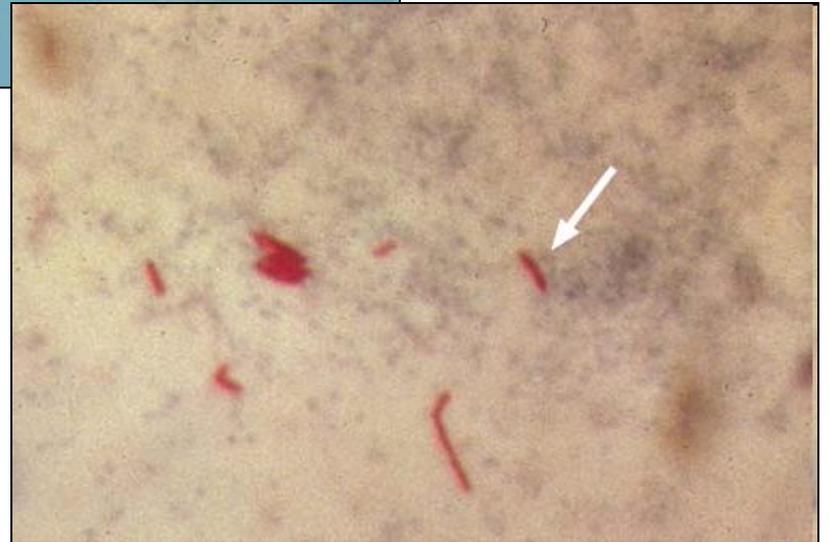
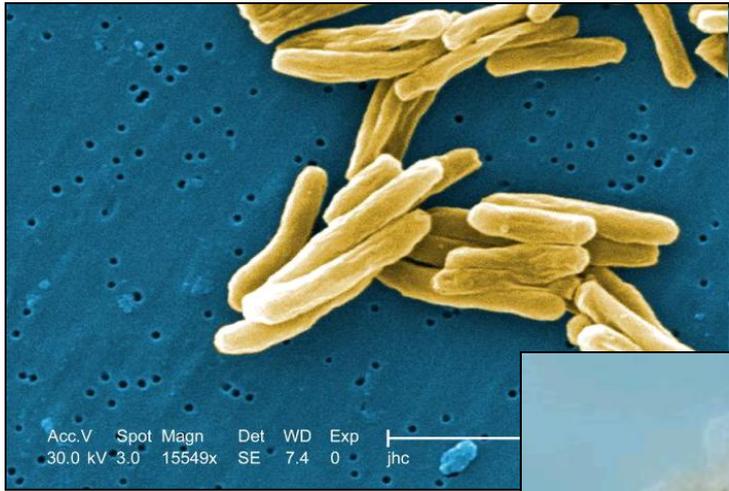
# Microbiology

- *Mycobacterium tuberculosis*
- *M. bovis*
- *M. microti* (rodents)
- *M. africanum*
- *M. canetti*



# Microbiology

- ***M tuberculosis***
- slow-growing organism
  - 4-8 weeks for visible growth on solid medium
- Acid fast bacilli
  
- ***M bovis***
  - From cattles



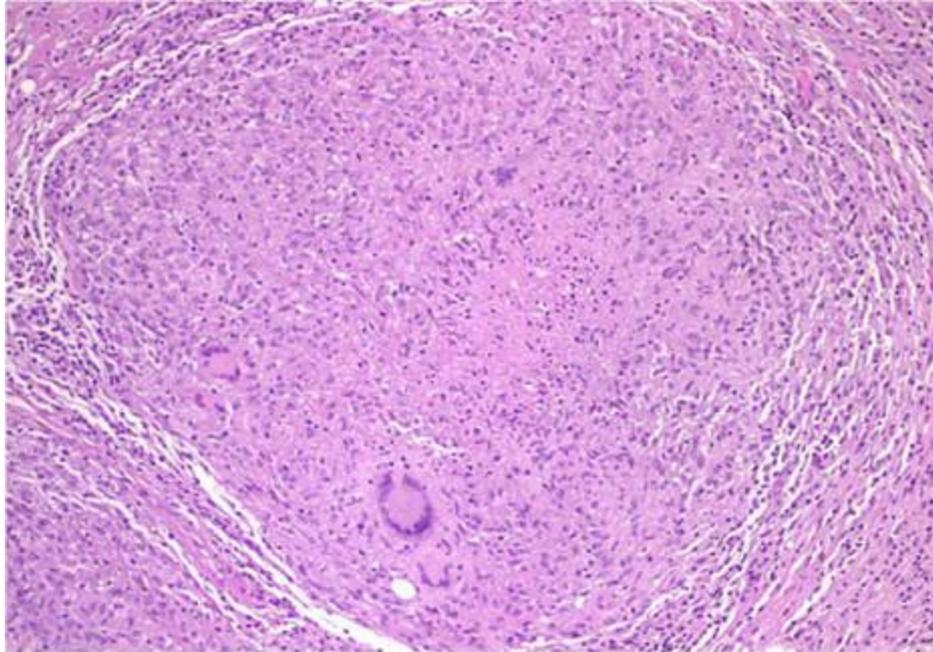
# Transmission

- Airborne



# Pathophysiology

- Humans are the only known reservoir for *Mycobacterium tuberculosis* (MTB)
- Transmission: airborne droplet nuclei
  1. When inhaled, droplet nuclei are deposited within the terminal airspaces of the lung
  2. macrophages ingest and transport the bacteria to regional lymph nodes
    - A. may be killed by the immune system
    - B. they may multiply and cause primary TB
    - C. may become dormant and remain asymptomatic
    - D. may proliferate after a latency period (reactivation disease)



Histological examination: caseous necrotic granuloma

# symptoms

## **Pulmonary tuberculosis (TB)**

- cough
- fever
- weight loss
- hemoptysis
- chest pain
- anorexia, fatigue, and night sweats

# symptoms

## **TB meningitis**

- Headache that is either intermittent or persistent for 2-3 weeks
- Subtle mental status changes may progress to coma over a period of days to weeks
- Fever may be low-grade or absent

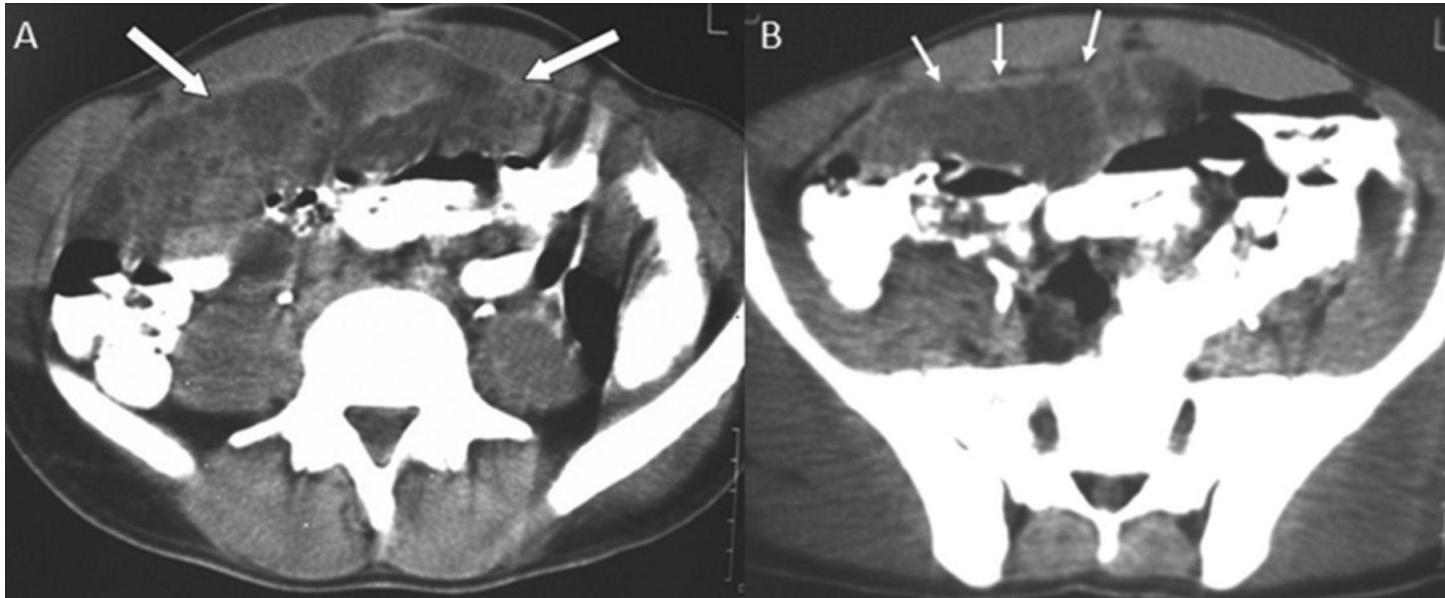
# Skeletal TB

- Most common is the spine (Pott disease)
  - back pain or stiffness
  - Lower-extremity paralysis occurs in 50%
- TB arthritis usually involves one joint
  - the hips and knees are affected most commonly > the ankle > elbow > wrist > and shoulder

# Gastrointestinal TB

Any site in the GI may become infected:

- non healing ulcers of the mouth or anus
- difficulty swallowing
- abdominal pain mimicking peptic ulcer disease
- malabsorption
- diarrhea
- hematochezia



CT: large amount of loculated viscous fluid (arrows; A) and enhanced diffuse peritoneal thickening (arrows; B). Posteriorly displaced small bowel loops could be seen.



A peritoneal laparoscopy showing multiple extensive yellow-white nodules on the peritoneal surface

# Other sites

- TB lymphadenitis (scrofula)
- Genitourinary TB
- Cutaneous TB

# Diagnosis

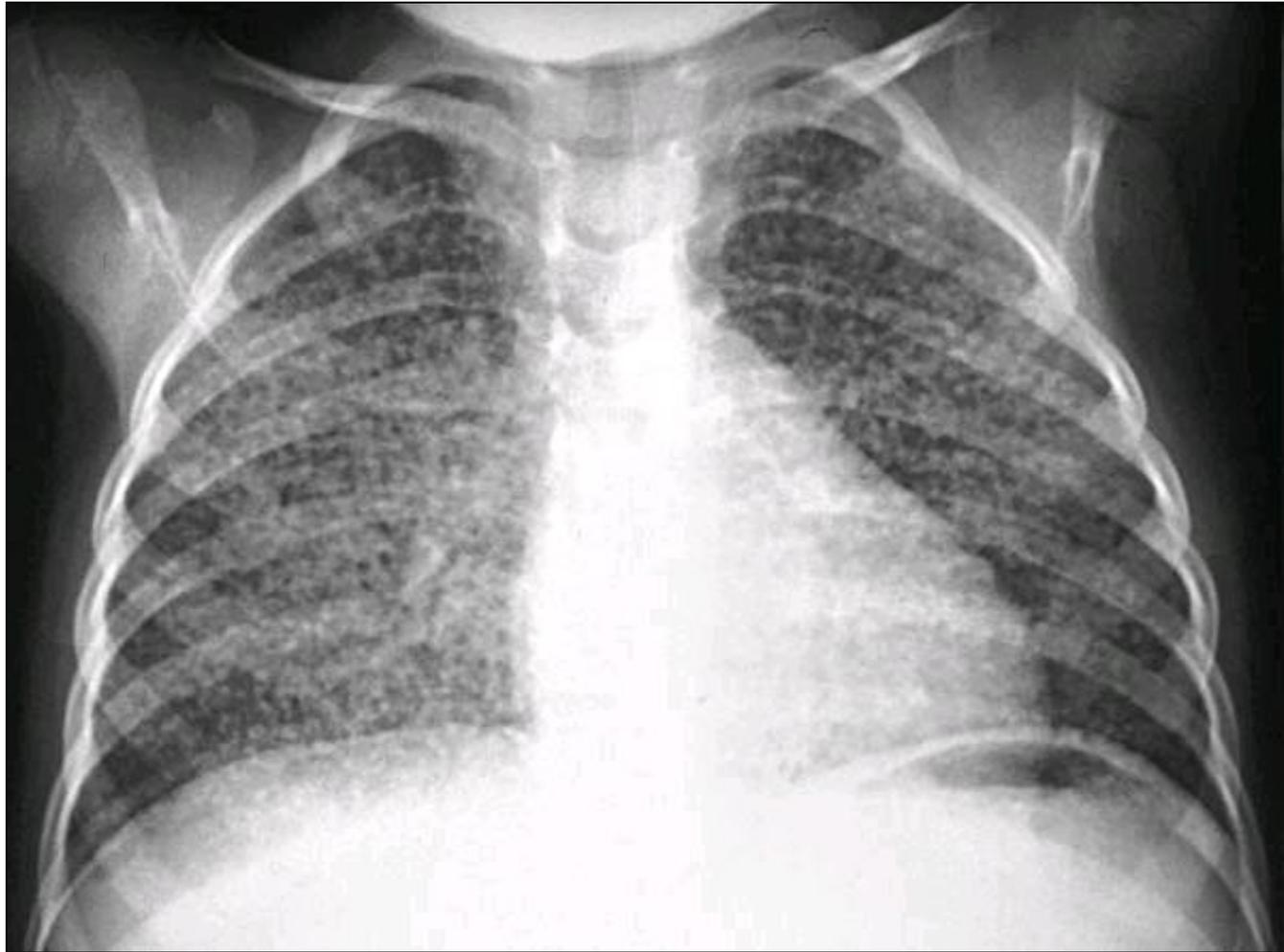
- sputum: in the early morning on 3 days
  - every 8 hours (hospital)
  - Children: early-morning gastric aspirate
- bronchoscopy with biopsy and bronchial washing
- bone marrow Bx
- liver Bx
- $\pm$  blood cultures
  
- PCR on smears

# Diagnosis

- Obtain HIV in all patients with TB
- CXR
  - may show a patchy
  - nodular infiltrate
  - upper-lobe involvement is most common
  - in any part of the lung
  - cavity: indicates advanced infection
    - high bacterial load
- Miliary TB: appearance of numerous small nodular lesions that resemble millet seeds on CXR



# Miliary TB



# PPD

- PPD: tuberculin skin testing (Mantoux test)
  - is the most widely available test for diagnosing TB in the absence of active disease (**Latent infection**)
  - intradermal injection
  - 48-72 hours
  - size of induration, not the erythema
  - Booster effect
  - ? Dx role in TB

# PPD

- PPD testing for tuberculosis (TB) is done among persons at **high risk** for the development of TB disease who would benefit from treatment of latent TB infection (LTBI)
- All testing activities should be accompanied by a **plan** for the necessary follow-up medical evaluation and treatment

# Groups that should be tested for LTBI

1. Persons at higher risk for exposure to or infection with TB
  - Close contact of a person known or suspected to have TB
  - Residents and employees of high risk settings
  - HCW
  - Low income populations
  - Children exposed to adults in high risk

# Groups that should be tested for LTBI ...cont

## 2. Persons at higher risk for TB once infected

- Illicit drug use
- Certain medical conditions
- HIV
- Recently infected with *M. TB* (2 yrs)

# PPD



Figure 2. Measurement of PPD in millimeters where induration diameter is largest. 4

# Treatment of TB

- Initial empiric treatment of TB
- Start on a 4-drug regimen
  - INH (isoniazid)
  - Rifampin
  - Pyrazinamide
  - Ethambutol or streptomycin
- Prolonged course > 6 months

# Infection control in hospital

- Respiratory isolation
  - negative pressure room
  - N95 mask



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