# Tuberculosis 101 for Clinicians

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# CONFLICT OF INTEREST STATEMENT

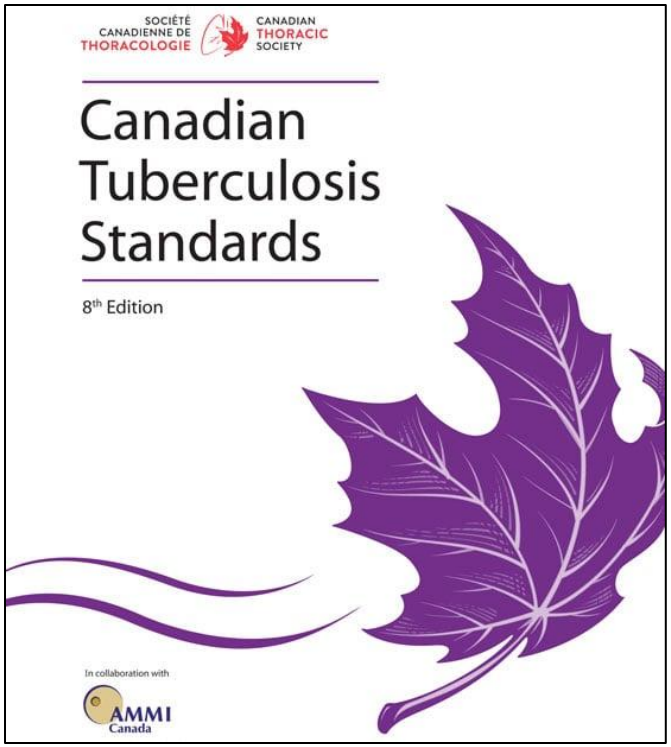
- There are no conflicts of interest to declare

# ACKNOWLEDGEMENTS


- Special thanks to Helen Twigg, TB nurse at SMDHU for her help in preparing the slides, and Dr. Rebecca Shalansky, Peel Public Health for her sharing of some of the content being presented today.

# REFERENCE RESOURCE

- Canadian TB Standards 8th Edition, published 2022
  https://www.tandfonline.com/toc/ucts20/6/sup1



# USEFUL / MORE CONCISE RESOURCE

- Tuberculosis Information for Health Care Providers https://hcp.lunghealth.ca/wp-content/uploads/2021/02/lhf_tuberculosis_6ed_digital-2.pdf

lung health starts now
lung health foundation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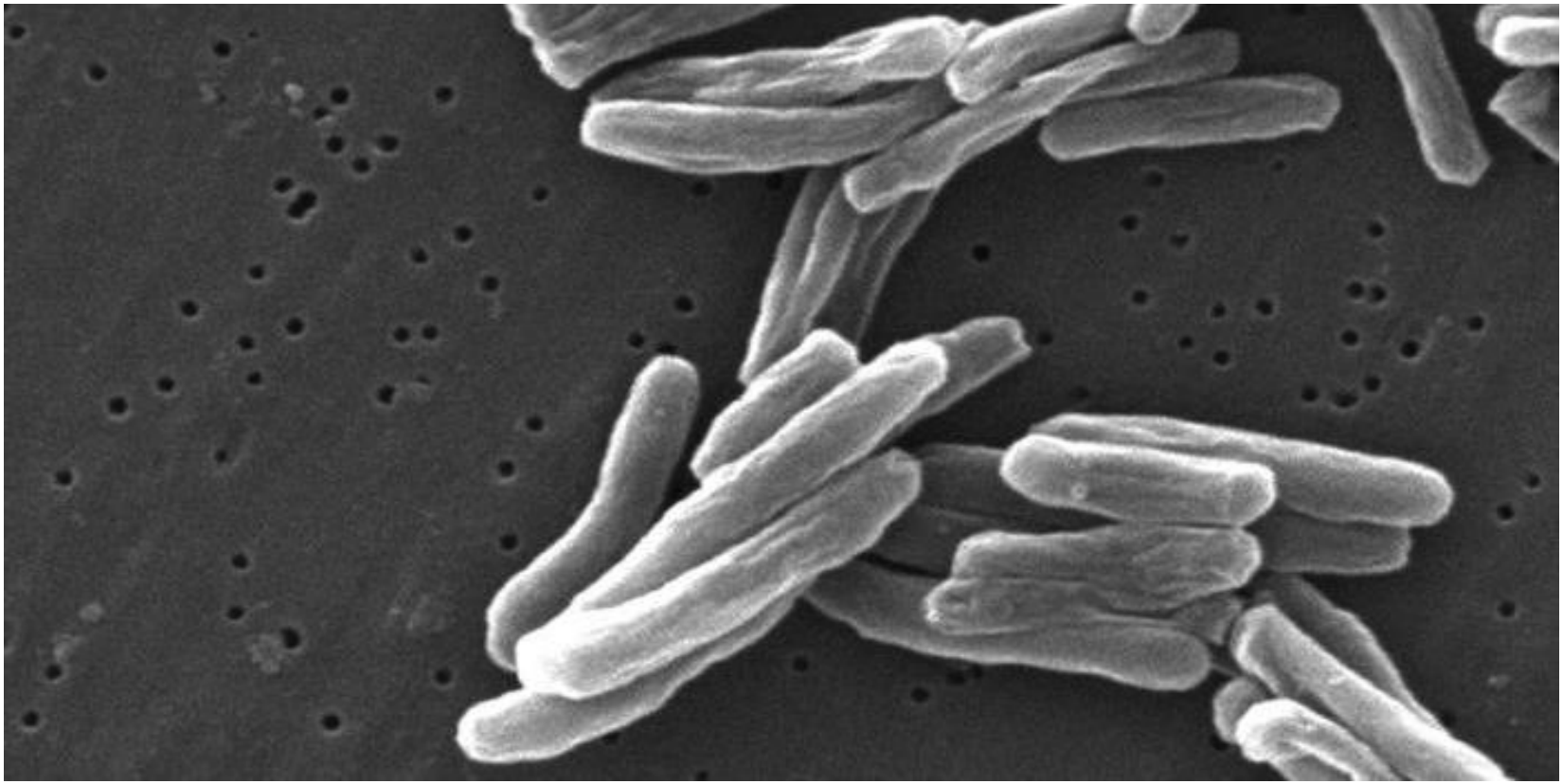
# LEARNING OBJECTIVES

- To understand the use and role of the TB skin test and Interferon Gamma Release Assay (IGRA) blood test for latent TB and occupational health
- To understand the natural history of latent TB and role of latent TB treatment
- To recognize the higher risk populations, signs, symptoms and lab testing for active TB

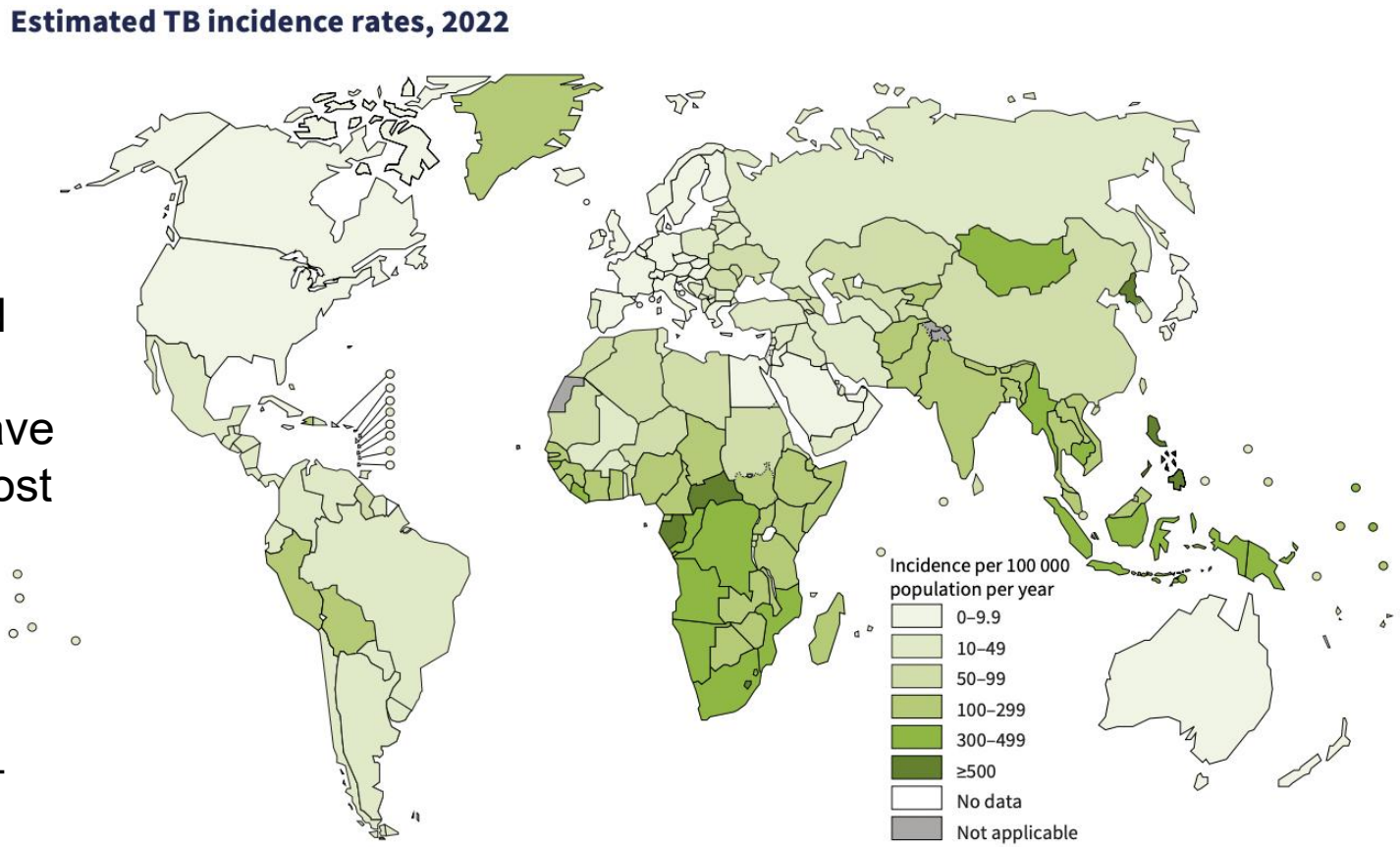
# MYCOBACTERIUM TUBERCULOSIS



# How much TB is out there?

# TB EPIDEMIOLOGY- GLOBAL

"COVID-related disruptions are estimated to have resulted in almost half a million excess deaths from TB in the three years between 2020–2022"




https://iris.who.int/bitstream/handle/10665/373828/9789240083851-eng.pdf?sequence=1

# TUBERCULOSIS

- *TB is a top killer worldwide, ranking alongside HIV/AIDS.*
- *TB places its heaviest burden on the world's most poor and vulnerable, aggravating existing inequalities.*
- *Due to TB, people face costs or suffer income loss equivalent on average to more than 50% of their income.*

## BURDEN

In 2022, an estimated **10.6 million people** fell ill with tuberculosis(TB) worldwide

A total of **1.3 million people died** from TB in 2022

**671 000 HIV positive individuals** developed TB with a **mortality of 167 000** in 2022

**410 000 people developed MDR-TB** in 2022 with an estimated **160 000 deaths**

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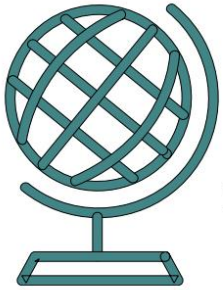
# TB EPIDEMIOLOGY- CANADA

**4.8** active TB cases per 100,000 population

Incidence of active TB (per 100,000) in specific populations*



Persons born outside Canada
**12.3**

Non-Indigenous Canadian born
**0.3**

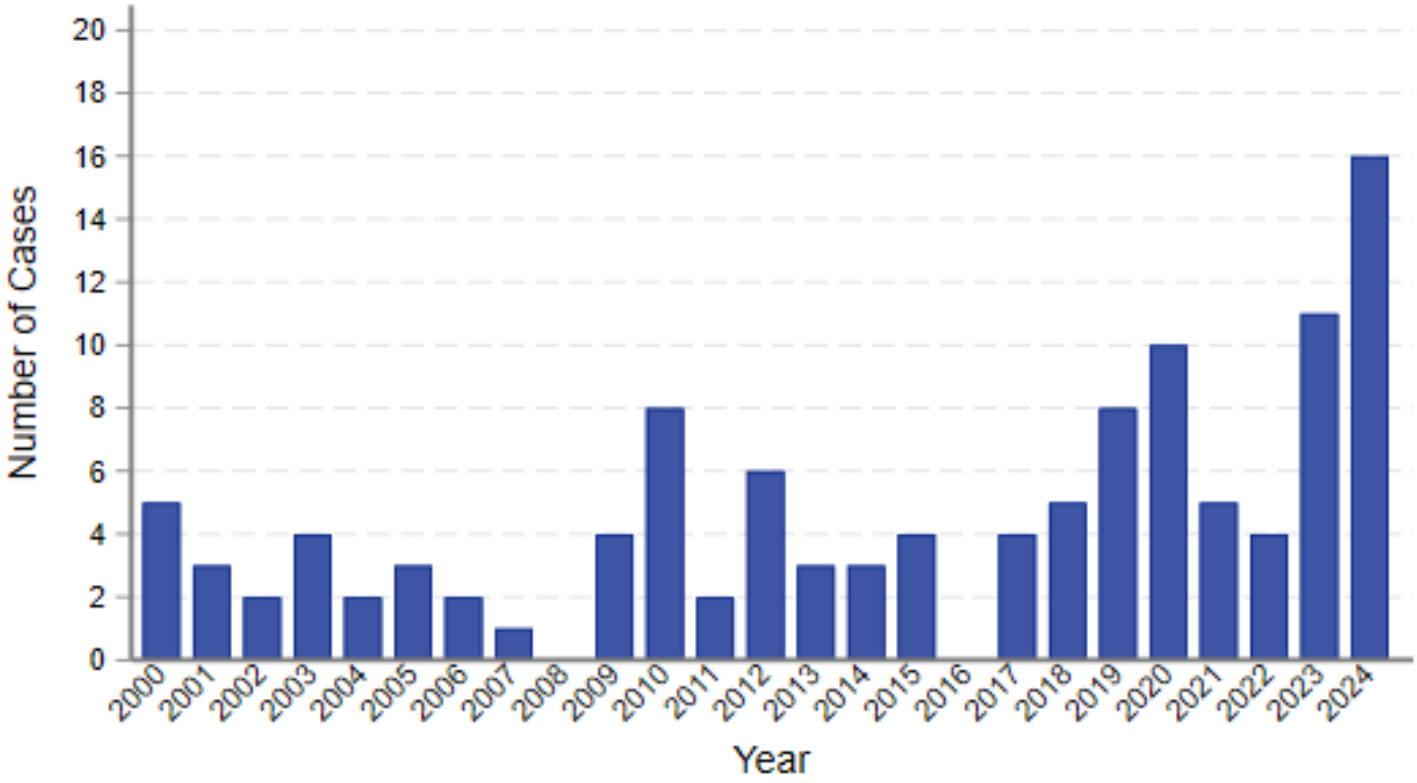
Incidence of active TB (per 100,000) among Indigenous peoples*

Inuit 135.1
First Nations 16.1
Métis 2.1

Indigenous peoples in Canada are disproportionally affected by TB due to ongoing impacts of colonization and health inequities.

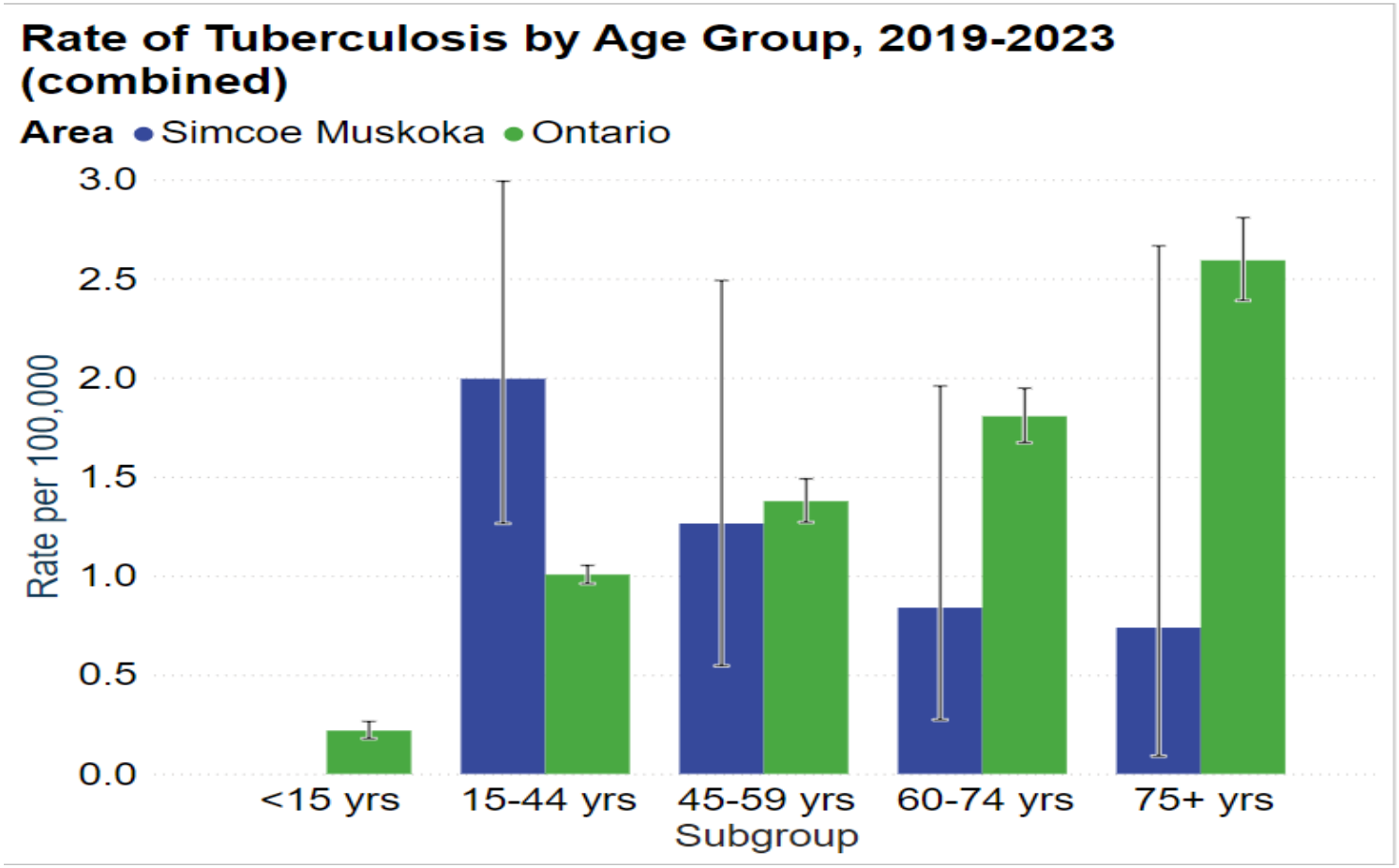
https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/tuberculosis-canada-2021-infographic/en-tb-surveillance-2021-infographic-finalv10-sept-2023.pdf

## Number of Tuberculosis cases in Simcoe Muskoka, 2000-2024




Data Source: Integrated Public Health Information System (iPHIS) [2000-2024]. Ontario Ministry of Health, extracted 12 May 2025
Data is preliminary.

# INCIDENCE OF TUBERCULOSIS IN SIMCOE MUSKOKA, BY AGE GROUP, 2019-2023 (COMBINED)

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# TB TRANSMISSION

# How does TB infection occur?

- Droplets or aerosols are inhaled and reach alveoli
- Once droplets or aerosols reach the alveoli, the person may develop **TB infection**
- It could take 2 to 8 weeks for an infected person to develop a +ve TB skin test
- TB is **not a highly infectious disease** despite it being an airborne respiratory disease and it requires usually hours of exposure to be infected. Transmission typically occurs within households.

# TERMINOLOGY

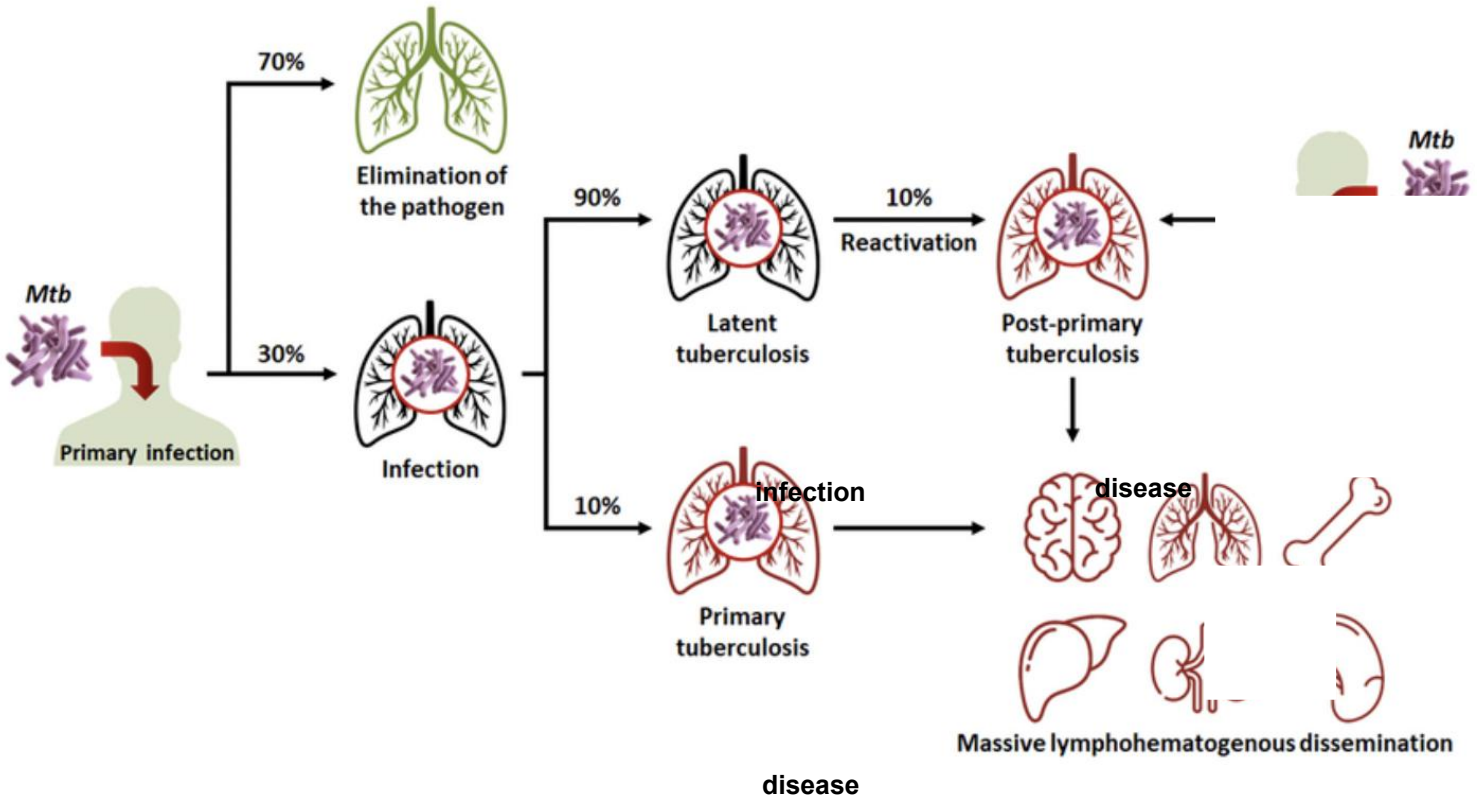
## TB Infection = Latent TB

- Asymptomatic
- Not infectious
- ¼ global population infected
- Treatment to prevent progression to TB disease
- Diagnosed via TB skin test or IGRA blood test

## TB Disease = Active TB

- Symptomatic (cough, hemoptysis, fevers, chills, night sweats, weight loss)
- Infectious if in respiratory tract
- Can present in any part of the body
- Treatment to cure
- Diagnosed via
  - imaging e.g. chest xray AND
  - fluid/tissue sampling like sputum, CSF, biopsy for acid-fast bacilli staining, molecular testing and culture

# DISEASE PROGRESSION




https://www.researchgate.net/figure/Evolution-of-the-different-clinical-stages-of-tuberculosis-TB-from-primary-infection_fig1_367400507- edited

# COMMON CASE SCENARIO

- Mrs. H is a 43 year-old woman born in India. She immigrated to Ontario 12 years ago with her family. She has been hired as a PSW and requires a two-step TB skin test before starting work.
  - She believes she had the BCG vaccine as a baby
  - She is otherwise healthy and is asymptomatic

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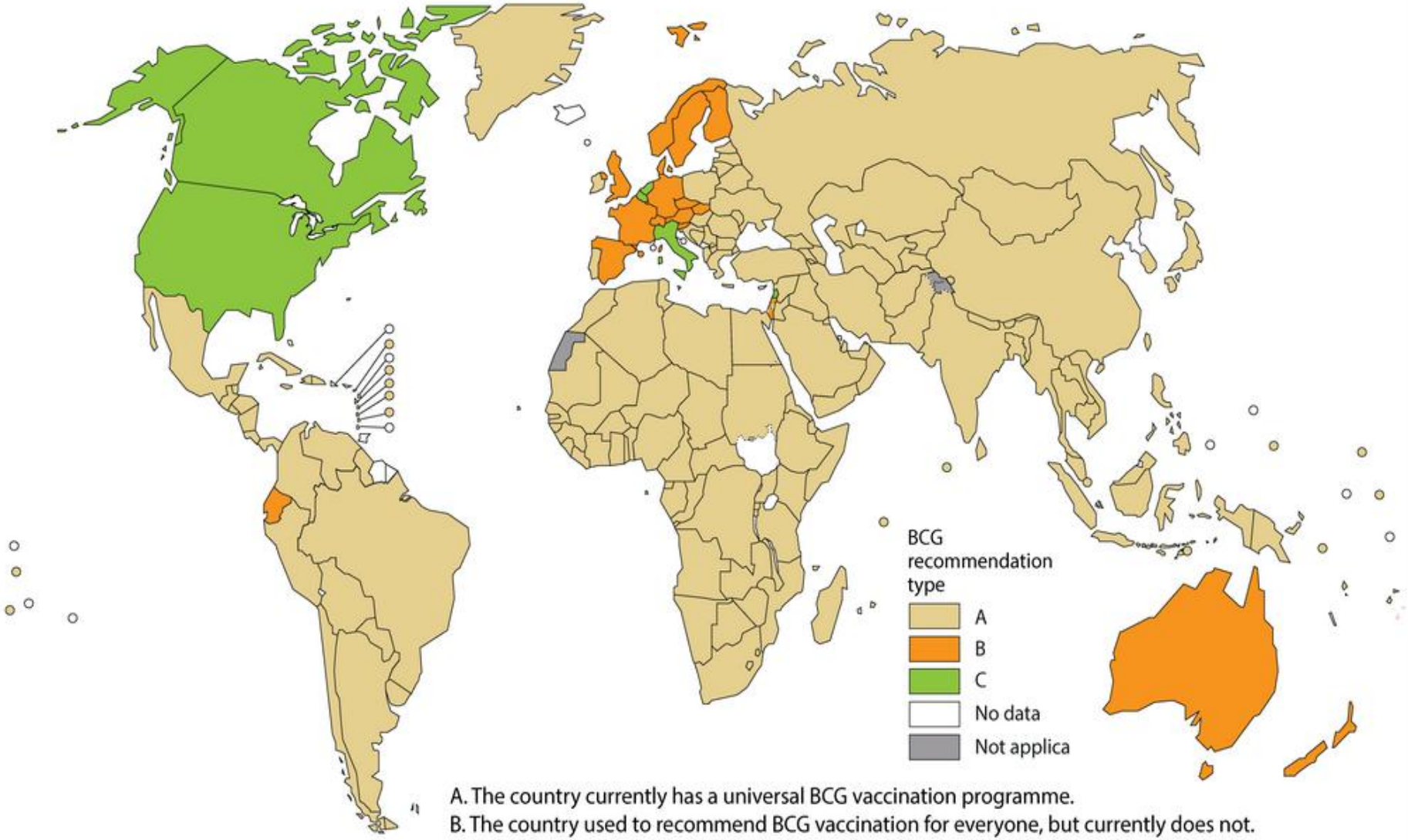
# BCG VACCINE

- Live attenuated TB vaccine
- Used in high incidence TB countries
  - Canadian Inuit populations
- Given at or close to birth (most effective)
- Typically leaves a scar
- 51% effective in preventing disease and up to 78% effective in protecting newborns from miliary (disseminated) or meningeal TB.
- Highly protective against death (≥80% effectiveness) until 14 years of age
- Protection starts to decline at 10-15 years


In general
•the BCG vaccine scar has a raised center
•the smallpox vaccine scar is depressed, with lines that radiate to the edges

# BCG vaccination policy by country*




A. The country currently has a universal BCG vaccination programme.
B. The country used to recommend BCG vaccination for everyone, but currently does not.
C. The country recommends BCG vaccination only for specific groups.
Source: The BCG World Atlas 2nd Edition. http://www.bcgatlas.org/index.php, accessed 25 July 2017.

* BCG = Bacille-Calmette-Guérin



Data Source: *Global Tuberculosis Report 2017*. WHO, 2017.

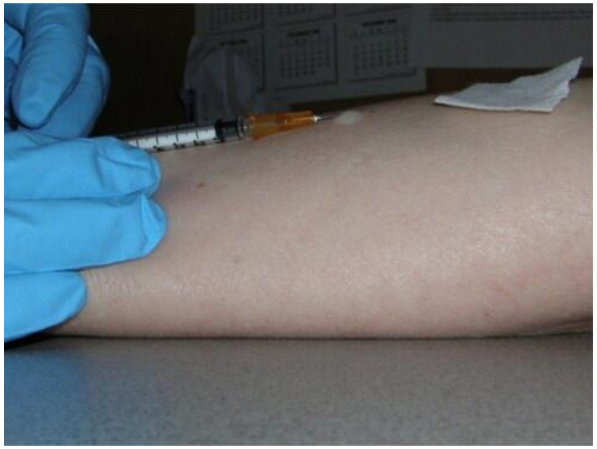


World Health Organization

# TB SKIN TEST

- TB antigen solution (tuberculin)
- Implanted intradermally in the forearm
- Delayed hypersensitivity reaction indicates body has developed immune response to TB (previously infected)
- 2 Step TB test:
  - Same procedure as 1 step repeated within 7-28 days
  - Ensures that the first step was not a false negative, as sometimes it takes the second step to wake up the immune system's memory of a previous TB infection. Indicated in those who may be subject to future increased TB risk and regular TB testing
  - **2 Step TB test only needs to be performed once in a lifetime**

Time 0:



Time 48-72hrs:

https://www.tandfonline.com/doi/full/10.1080/24745332.2022.2036503

# TB SKIN TEST INTERPRETATION

- Among BCG-vaccinated persons, TST specificity was estimated in a meta-analysis to be 59% (95% CI: 46 to 73%)
- However, studies conducted in Canada and several other countries show that if BCG was received in infancy (the first year of life), only 1% had a TST result of ≥10 mm if tested >10 years later.
- Therefore, **a history of BCG vaccination received in infancy can be ignored as the cause of a positive result in all persons aged 10 years and older when interpreting an initial TST reaction of 10 mm or greater**"
- However, the TST can still be a false positive test.

| TST result | Situation in which reaction is considered positive* |
|---|---|
| 0-4 mm | In general this is considered negative, and no treatment is indicated. |
| | Child under 5 years of age and high risk of TB infection |
| ≥5 mm | HIV infection |
| | Contact with infectious TB case within the past 2 years |
| | Presence of fibronodular disease on chest x-ray (healed TB, and not previously treated) |
| | Organ transplantation (related to immune suppressant therapy) |
| | TNF alpha inhibitors |
| | Other immunosuppressive drugs, e.g. corticosteroids (equivalent of ≥15 mg/day of prednisone for 1 month or more; risk of TB disease increases with higher dose and longer duration) |
| | End-stage renal disease |
| ≥10 mm | All others, including the following specific situations:<br>– TST conversion (within 2 years)<br>– Diabetes, malnutrition (<90% ideal body weight), cigarette smoking, daily alcohol consumption (>3 drinks/day)<br>– Silicosis<br>– Hematologic malignancies (leukemia, lymphoma) and certain carcinomas (e.g. head and neck) |

Key resources:
- The Online TST/IGRA interpreter
- BCG World Atlas

https://www.tandfonline.com/doi/full/10.1080/24745332.2022.2036503

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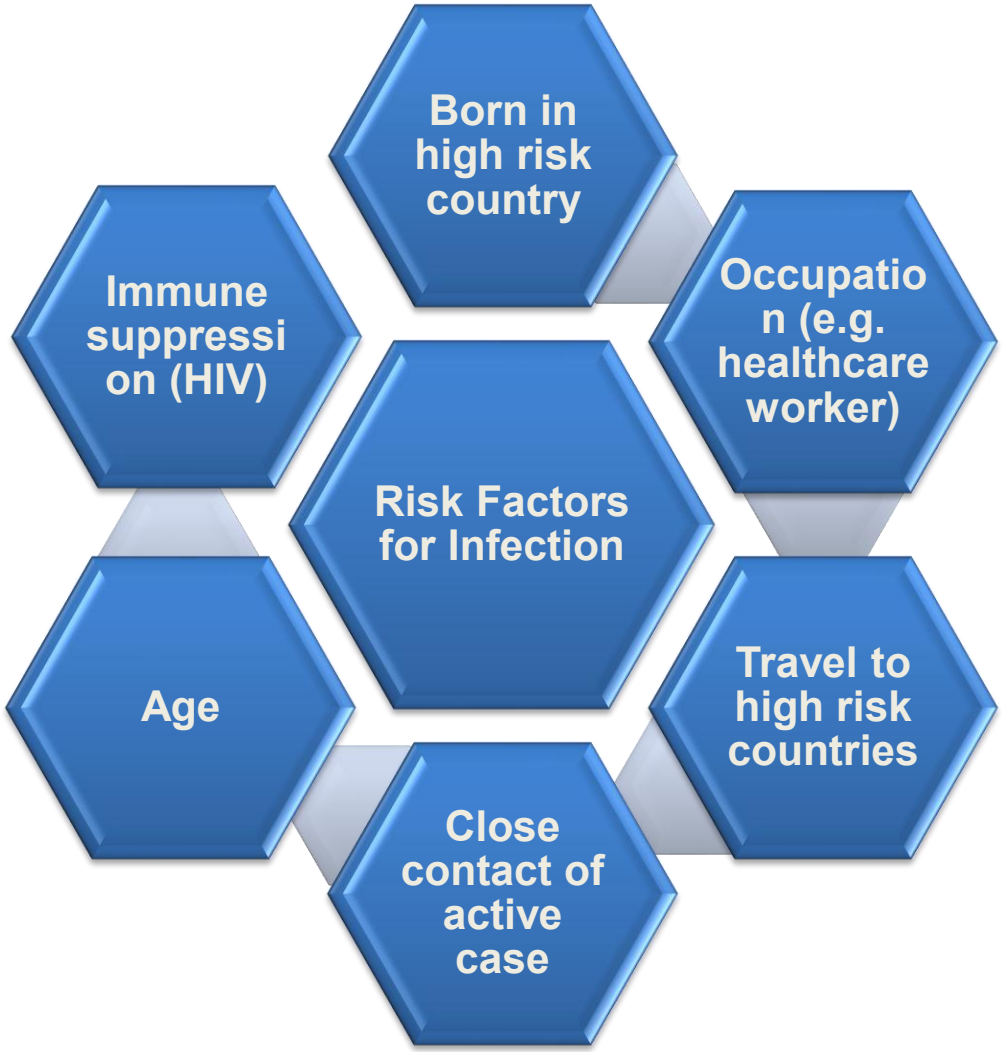
# RISK FACTORS FOR INFECTION

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# COMMON CASE SCENARIO (CONTINUED)

- Mrs. H is a 43 year-old woman born in India. She immigrated to Ontario 12 years ago with her family. She has been hired as a PSW and requires a two-step TB skin test before starting work.
  - Mrs. H's TST is implanted. She returns 2 days later and you measure an induration of 15 mm. Now what?

# Why do we do TB skin testing for health care providers (HCP)?

- Primary reason is to detect a future TB infection if the HCP is exposed to TB at work
- Another reason is to detect previous latent TB infection
- A negative baseline for most HCPs would be a TB skin test of < 10mm.  For our region that has a low incidence of TB transmission in our health care institutions, there is not a need to do annual or periodic TB skin tests unless there has been an exposure.
- If there is an exposure, an increase in the induration on repeat testing would be suspicious of an infection

# INTERFERON GAMMA RELEASE ASSAY (IGRA) VS. TB SKIN TEST(TST)

- Interferon gamma release assay (IGRA) is a blood test that is another method to diagnose LTBI. Therefore, it can complement the TST in certain situations
- In general, IGRAs are more specific (about 98%) than the TST in populations vaccinated with BCG, especially if BCG is given after infancy or multiple times.
- Not currently funded by OHIP…cost is approximately $104.00 through Lifelabs/Gamma Dynacare through the usual lab requisition…however Ontario Health, based on guidance from the Ontario Health Technology Advisory Committee, recommends publicly funding interferon-gamma release assay (IGRA) testing for latent tuberculosis infection. However, note that TSTs for employment/volunteer positions are not covered by OHIP and the cost to the patient varies from $40 to $100 for the 4 visits
- Also useful, if your TB skin test is borderline positive or/and you want to be treated for latent TB
- Neither TST nor IGRA should be used to diagnose active TB disease

# TB SCREENING

## Skin Test

- Intradermal implantation of inactivated TB antigen
- Can react with BCG vaccine
- Requires two visits (one-step)
- Costs for employment/ volunteer purposes is around $40-$100 total as OHIP does not cover

## IGRA

- Blood test for proteins specific to TB exposure
- Not publicly funded in Ontario
- One visit
- Lab cost $104

# MANAGEMENT OF A POSITIVE TB SKIN TEST/LATENT TB INFECTION (LTBI)

Rule out active disease:

- Symptom review
- Focused physical exam
- **Chest X ray noting that periodic or repeat chest x-rays are not required nor recommended for those going to school, working in health care institutions or changing workplaces unless there are signs and symptoms of active TB.**
- +/- sputum or other cultures if symptomatic
- No role for future TST testing if positive
- It is estimated that 1 in 4 foreign born persons in Canada have latent TB.

# BEFORE STARTING LATENT TB TREATMENT (LTBI)

- Treatment is a risk/benefit discussion
- Individual has 5-10% lifetime risk of progression to active TB disease with the highest risk in the first few years after being infected.
- If treatment declined, counsel persons with +ve TB skin tests that they have latent TB infection and to ensure if they have symptoms of active pulmonary or extra-pulmonary disease to seek medical attention for their symptoms and to inform the HCP that they have latent TB.
- Treatment regimen: Daily Rifampin x 4 months is the best option at this time and the medication is available free of charge from the public health unit for those without a drug benefit plan/OHIP+/ODSB

# RIFAMPIN

| Medication | Common side effects | Uncommon but important side effects |
|---|---|---|
| **Rifampin**** | rash<br>nausea/vomiting*<br>dizziness<br>diarrhea (liquid formation containing sorbitol only)<br>drug induced hepatitis† and/or hyperbilirubinemia<br>rash<br>nausea/vomiting*<br>dizziness<br>diarrhea | 'flu-like' illness with fever<br>hypotension<br>leukopenia<br>thrombocytopenia |

- Orange staining body fluids

- Dose: 10mg/kg daily (max 600mg) x 4 months
- Monitoring
  - Baseline LFTs, and hepatitis screen, monthly LFTs and check ins for side effects

Interactions:

- Estrogens
- Anticonvulsants
- Coumadin
- Glucocorticoids
- Digoxin
- Antiarrhythmics
- Sulfonylureas
- Theophylline
- Cyclosporine
- Methadone
- Ketoconazole

https://yukon.ca/sites/yukon.ca/files/tbmanual-chapter8.pdf

# CASE SCENARIO

- Mr. T is a 22 year-old man born in India. He came to Ontario a year ago as a student at a local college. He has a 5 week history of a mucousy cough.  Denies fever, night sweats, weight loss or blood in sputum.  No known exposure to TB.

# ANOTHER CASE SCENARIO

- Mr. T is a 22 year-old man born in India. He came to Ontario a year ago as a student at a local college. He has a 5 week history of a mucousy cough. Denies fever, night sweats, weight loss or blood in sputum. No known exposure to TB.

# RISK FACTORS FOR ACTIVE TB DISEASE

## Medical

- Age (extremes)
- Lung disease
  - Smoking
  - Silicosis
- Immunocompromised
  - HIV/AIDS
  - Immunosuppressive medication
    - *Cancer treatment*
    - *Post transplant*
    - *Autoimmune d/o treatment*
- Diabetes
- Renal disease
- Low body weight
- Alcohol use

## Exposure

- TB endemic population
  - Born in TB endemic country
  - Indigenous Canadian, especially Inuit
- Living in a congregate setting
  - Prison
  - Shelter
  - Refugee camp
- Occupational exposure
  - Healthcare
  - Work in a congregate setting

https://www.canada.ca/en/public-health/services/diseases/tuberculosis/prevention-risks.html

# SIGNS & SYMPTOMS OF ACTIVE DISEASE

Classic Pulmonary Symptoms (but beware they may have just have chronic cough):

- weight loss
- fevers
- chills
- night sweats
- chronic cough (3+ weeks)
- hemoptysis
- no appetite
- chest pain

The health care provider examination findings for active respiratory tuberculosis are usually within normal limits even with advanced disease.

# SIGNS & SYMPTOMS OF ACTIVE DISEASE

Extra Pulmonary - often site specific:

- Swollen nodes (lymphatic disease)
- Headache/neck stiffness (meningeal disease)
- Chronic UTI (renal disease)
- Bone pain/ joint swelling (osteomyelitis)
- Bowel obstruction (intestinal TB)

# DIAGNOSIS OF ACTIVE PULMONARY TB DISEASE

- Chest X-Ray- P/A and lateral
  - Classic finding is upper lobe cavitation but more often, there are abnormal findings that overlap with other lung conditions such as pneumonia and pleural effusion.

- Sputum samples for “M Tuberculosis” on public health req.
  - Collect 3 sputum specimens (either spontaneous or induced) on the same day, a minimum of 1 hour apart or optimally, sputum should be from an early morning collection from a deep productive cough on 3 consecutive days into 3 separate sterile urine bottles. Each need to be labelled for the date and time of collection.
  - 3 separate public health requisitions requesting “sputum for M. tuberculosis”

- Advise patient to self-isolate and wear a mask at home and limit contact with household until results are available

- Contact Public Health if highly suspicious so that we can reinforce self-isolation direction and follow sputum results.

# DIAGNOSTIC TESTING

- Sputum
- Induced Sputum
- Bronchoscopy
- Gastric Aspirate
- Stool
- Lymph Node aspiration
- Biopsy

# LABORATORY TESTING

- Sputum Smear microscopy (Public Health Lab)
  - Acid-Fast Bacilli (AFB) staining (takes 1 day from receipt)

- If AFB +ve, then molecular/NAAT testing is done to see if AFB is from mycobacterium TB vs other mycobacterium such as Mycobacterium avium complex (MAC) (up to 4 days).

- If AFB –ve, and clinician is still highly suspicious of TB, can request lab to do the NAAT testing (within 72 hours of sputum receipt by lab) to be more certain that patient does not have TB, as NAAT testing has higher sensitivity

- Mycobacterial Culture will be done regardless of AFB results. Useful for antibiotic sensitivities. Occasionally, culture is positive despite AFB –ve. (up to 7 weeks)…usually indicates low infectivity

# TB CLINICS

- West Park
- Toronto Western Hospital
- St. Michael's Hospital
- Mackenzie/Richmond Hill sites – limited days

# SMDHU'S ROLE IN TB MANAGEMENT

- Support latent TB diagnosis and treatment
- Support TB cases and suspect cases
- Provide TB medication at no cost
- Direct Observed Therapy
- Monitor patient completion of treatment for active cases
- Contact investigations
- Immigration Medical Surveillance for TB through IRCC
- Provide information to health care professionals and public about TB

# TB WORKUP

## TB Screening

- Workup for latent TB infection
  - Population at risk for TB
  - High risk job setting
  - Before immunocompromising therapy
- TB skin test *or* IGRA

## TB Diagnosis

- Workup for active TB disease
- CXR, sputum sample, compatible symptoms

# KEY POINTS

- TB often does not present with classic textbook symptoms
- Have TB on your differential if symptoms and risk of previous exposure is high (e.g. from a TB endemic country or is an older Canadian-born person who lived at a time when TB was more prevalent in Canada)
- Counsel persons with +ve TB skin tests that they have latent TB infection and to ensure if they have symptoms of active pulmonary or extra-pulmonary disease to seek medical attention for their symptoms and to inform the HCP that they have latent TB.
- Consider latent TB treatment in your patients
- Consider use of IGRA to improve specificity of +ve TB skin tests if the +ve TB skin test is surprising or borderline positive, and/or latent TB treatment is being considered.

# Questions?

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