

# Session 2: Tools to prevent, diagnose and treat TB

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ACCELERATING ADVOCACY ON TB/HIV

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# Topics to be covered

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- TB/HIV Collaborative Activities
- TB Prevention Tools
- TB Diagnostics
- TB Vaccines
- Challenges in TB prevention, diagnosis and treatment



# TB/HIV Collaborative activities



# WHO Policy on Collaborative TB/HIV Activities

The overall goal is to decrease the burden of TB and HIV in dually affected populations.





# Collaborative TB/HIV Activities

- A. Establish mechanisms for integrated TB & HIV services
  - ▣ A.1. Set up or strengthen TB/HIV coordinating bodies
  - ▣ A.2. Conduct HIV and TB surveillance among TB and HIV patients
  - ▣ A.3. Carry out joint TB/HIV planning
  - ▣ A.4. Conduct TB/HIV monitoring and evaluation
- B. Decrease the burden of TB in PLHIV (Three Is)
  - ▣ B.1. Intensify TB case finding (ICF) and ensure quality TB treatment.
  - ▣ B.2. Introduce *Isoniazid* preventive therapy (IPT) and Antiretroviral therapy (ART)
  - ▣ B.3. Infection control (IC) for TB in health care and congregate settings (i.e. prisons).



# Collaborative TB/HIV Activities

- c. Decrease the burden of HIV in patients with presumptive and diagnosed TB
  - ▣ C.1. Provide HIV testing and counselling
  - ▣ C.2. Introduce HIV preventive methods
  - ▣ C.3. Provide *cotrimoxazole* preventive therapy (CPT) for TB patients living with HIV
  - ▣ C.4. Ensure HIV/AIDS prevention, treatment and care for TB patients living with HIV
  - ▣ C.5. Provide antiretroviral therapy to TB patients living with HIV

# TB/HIV Advocacy Priorities

At the national and global levels, AIDS control and TB control programs both need to address TB/HIV coinfection:

- ▣ People with HIV need to be routinely screened for TB and given appropriate treatment
- ▣ People with TB or at risk for TB should be counseled and tested for HIV, and be offered appropriate treatment



# Prevention





# Isoniazid preventive therapy (IPT)

- Isoniazid preventive therapy (IPT) involves a daily dose of isoniazid for 6 months and has been shown to reduce the risk of LTBI progressing into active disease.
  - ▣ For people with HIV, IPT has been shown to have a positive impact on preventing TB disease, especially when taken with antiretroviral therapy (ART).
  - ▣ One study showed that combined ART and IPT is more effective in reducing TB disease than either treatment used individually.


# IPT Challenges

Providing IPT is challenging and often not implemented because:

1. It is difficult to exclude cases of active TB disease in children, the elderly and people with HIV.
2. If IPT is mistakenly given when someone has active TB disease, they risk developing resistance
3. Side effects and toxicity
4. Concerns about adherence

# Cotrimoxazole preventive therapy (CPT)



- Cotrimoxazole preventive therapy (CPT) is effective at preventing a number of opportunistic infections and has been shown to significantly reduce mortality among HIV-positive individuals.
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# TB Diagnostics



# What is a diagnostic test?

A medical diagnostic test is any method or tool used to measure, identify, or analyze conditions of the body. Diagnostic tests detect changes in our bodies that indicate an unhealthy state or identify a source of disease.

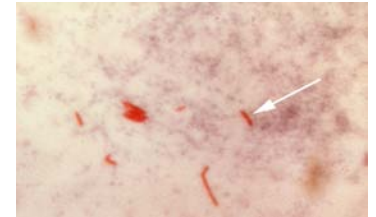
TB diagnostics are used to identify latent TB infection or active TB disease, as well as to provide information about drug resistance.

# Tests commonly used to confirm TB disease

- Sputum smear microscopy
- Culture test
- Symptom screen
- Tuberculin Skin Test (TST)
- Chest X-ray

# Sputum Smear Microscopy

- Sputum smear microscopy involves observing MTB under a microscope.
- **To view the presence of TB in the sputum:**
  - ▣ Sputum must be collected by the patient and smeared on a glass slide
  - ▣ For the bacteria to be visible, it must be stained
  - ▣ A microscope is used to identify the stained rod-shaped
  - ▣ Examination of sputum may take 5-15 minutes
  - ▣ Results are reported as smear-positive or smear-negative TB



# Smear Positive vs. Smear Negative TB

- **Smear-positive TB** refers to a TB case in which the sputum smear test shows the presence of MTB. The detection of MTB leads to a diagnosis of smear positive case.
- **Smear-negative TB** refers to a TB case in which the smear microscopy test results indicate that no TB bacteria are present in the sputum sample, but when using additional diagnostic tools TB diagnosis is confirmed. The absence of visible MTB under the microscope does not mean that there are no TB bacteria causing disease in the lung.



# Sputum Smear Microscopy

- **Advantages:**+ Conclusive results may be obtained the same day.
- **Disadvantages**
  - Fails to detect active TB cases 50% of the time
  - Only useful for pulmonary TB. Cannot detect extrapulmonary TB
  - Up to 61% of HIV-positive individuals have sputum smear-negative TB, so test incorrectly diagnoses as not having TB, delaying proper diagnosis and treatment.

# Culture Test



- ❑ Bacteria culture is the growth of bacteria in vitro (or in a controlled environment outside of the body).
- ❑ TB culture uses both liquid and solid media that contain nutrients necessary to grow MTB.
- ❑ Sputum is collected, liquified and placed in a culture
- ❑ Technicians wait for TB to grow to confirm results.
- ❑ Results are reported as culture positive or culture negative.

# Culture Test

- **Advantages:** + Very accurate in diagnosing TB  
+ Detects TB in children and people with HIV
- **Disadvantages**
  - 3 to 6 weeks for results
  - Requires laboratories with advanced equipment and trained staff

# Drug susceptibility testing (DST)

- DST is a method to identify drug resistance
- DST is done using solid or liquid culture
- DST can provide information about:
  - ▣ Which TB drugs the bacteria is responsive to
  - ▣ The appropriate treatment regimens
  - ▣ Whether a person has multidrug-resistant TB (MDR-TB) or extensively drug-resistant TB (XDR-TB)

# DST Challenges

- It can take almost 2 months to determine which drugs the TB bacteria is resistant to
- Requires laboratories with advanced equipment and trained staff



## Nucleic Acid Amplification Test (NAAT): Xpert MTB/RIF

**Xpert MTB/RIF** is a diagnostic test which involves placing a small amount of sputum into a self-contained cartridge which decontaminates the sample, breaks open the cells, and copies the DNA to determine whether tuberculosis is present.

# Xpert MTB/RIF

## **Advantages**

- + Very accurate in detecting TB
- + Can detect resistance to rifampin (important for MDR-TB patients)
- + Results available within 2 hours
- + Requires minimal sample preparation

## **Disadvantages**

- Requires expensive machinery (~\$17,000 for the machine and \$17 per cartridge)
- Machine requires electric supply and annual calibration

# Limitations of Xpert MTB/RIF

- Not appropriate for use as point-of-care tests in local settings (e.g: local health clinic) where most TB patients go for care.
- Requires electricity, equipment, and some degree of infrastructure and trained technicians.
- Expensive for middle and low-income countries where TB is most prevalent.





# TB Vaccines



# What is the current TB vaccine?

- Bacille Calmette-Guérin (BCG) is currently the **ONLY** successful TB vaccine.
- BCG is a weakened form of the TB bacterium that does not cause disease but stimulates an immune response.
- BCG provides only ~80% protection against two forms of extrapulmonary TB — **miliary** (disseminated throughout the body) and **meningeal** (in the lining of the brain) in infants and children.
- WHO estimates BCG saves the lives of over 40,000 children each year.



# Limitations of BCG

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- BCG is not effective in preventing pulmonary TB – the most common form of TB
- BCG's protection is lost by adolescence
- BCG is NOT recommended for use in HIV-positive infants because it causes a severe immune reaction and offers little to no protection against miliary and meningeal TB.



# Challenges in TB prevention, diagnosis and treatment



# Challenges: Smear-negative TB

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- People with HIV and children have fewer TB bacteria in their sputum due to their weak or underdeveloped immune systems.
- As a result, the chance of **smear-negative TB results** increases because fewer TB bacilli are released in the sputum.
- Up to 61% of people coinfecting with HIV and TB generate **smear-negative tests**, meaning the sputum smear test incorrectly indicates the person does not have TB, delaying diagnosis and treatment.



# Challenges: TB Drugs

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- ❑ Adherence issues
- ❑ Duration of treatment
- ❑ Potentially toxic side effects
- ❑ Drug availability and quality
- ❑ Drug interactions (e.g. with ARVs)
- ❑ Poor cure rates for MDR-TB and XDR-TB
- ❑ Little to no evidence on how to treat pediatric TB



# Summary

- Current tools to prevent, diagnose and treat TB are not sufficient
  - ▣ IPT is not widely available or used to prevent the development of active TB disease;
  - ▣ The most commonly used diagnostic tool (smear microscopy) misses up to 50% of cases in people with HIV;
  - ▣ Culture tests take too long to confirm TB or drug-resistance;
  - ▣ Xpert/MDR-RIF is a good diagnostic tool but expensive and not easily accessible;
  - ▣ Some of the most powerful anti-TB medications cannot be used in conjunction with ARVs.

# Summary

- Current tools to prevent, diagnose and treat TB are not sufficient
  - ▣ TB drug regimens are long and cure rates are low
  - ▣ BCG vaccine is not recommended for use in HIV-positive children;
  - ▣ Annually ~9.4 million people develop active TB disease, and 1.7 million die; and
  - ▣ To address the dual epidemic of TB and HIV, scale up of TB/HIV collaborative activities is **urgently** needed.



# Conclusion

Civil society activists need to become science based activists for TB research, treatment, and policy so that they can demand for increased resources and political support for TB and TB/HIV.