

TUBERCULOSIS 101

DEE PRITSCHET, TB PREVENTION AND CONTROL
DECEMBER 3, 2015



OBJECTIVES

Participants will be able to:

- 1) Describe the pathology of tuberculosis
- 2) Define and explain the differences between TB infection and TB disease
- 3) Review the medications used to treat TB infection and TB disease



WHAT IS TUBERCULOSIS?



TUBERCULOSIS (TB)

TB is caused by a bacteria – *Mycobacterium tuberculosis*

- TB is treatable and with appropriate treatment, curable.
- If TB is **NOT** treated properly, people can develop drug resistant disease or die.



TB IS AN ANCIENT DISEASE

TB has plagued humans for thousands of years. Evidence of TB in humans dates back to over 4,000 years ago in ancient Egyptian mummies.



Historically, TB was known by a variety of names, including:

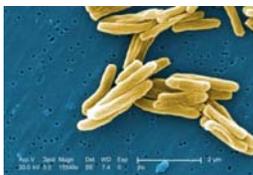
- Consumption
- Wasting disease
- White Plague

Before there was treatment for TB, a diagnosis of TB was considered by many to be a death sentence.



HISTORY OF TB DISEASE

- Tuberculosis organisms have been documented as early as 1000 BC.
- Until mid-1800s, many believed TB was hereditary.
- 1865 Jean Antoine-Villemin proved TB was contagious.
- 1882 Robert Koch discovered *Mycobacterium tuberculosis*, the bacteria that causes TB.





San Haven Sanatorium – Dunseith, ND

BEFORE TB ANTIBIOTICS, MANY PATIENTS WERE SENT TO SANITARIUMS

- Patients followed a regimen of bed rest, open air, and sunshine
- TB patients who could not afford sanatoriums often died at home

MYCOBACTERIA

MYCOBACTERIA THAT CAUSE TB DISEASE

- Mycobacterium tuberculosis*
- Mycobacterium bovis*
- Mycobacterium africanum*
- Mycobacterium microti*
- Mycobacterium canettii*

MYCOBACTERIA THAT DO NOT CAUSE TB DISEASE

- Mycobacterium avium*
- Mycobacterium fortitum*
- Mycobacterium chelonae*
- Mycobacterium goodsonae*
- Mycobacterium kansasii*

In the United States, most TB is caused by *Mycobacterium tuberculosis*



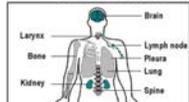
SITES OF TB DISEASE

Pulmonary TB – lungs, 80-85% of TB cases

Extra-pulmonary TB– outside of the lungs

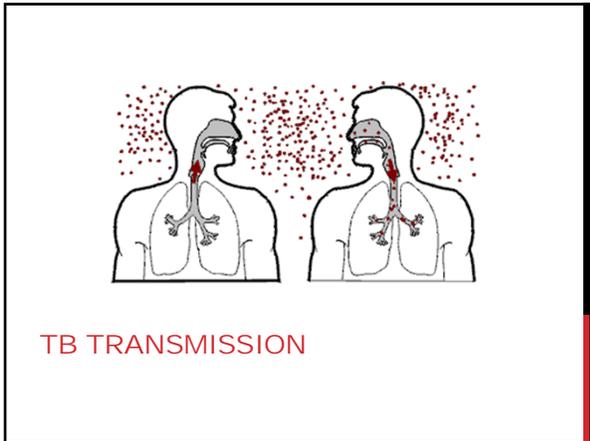
- Can occur anywhere in body
- Typical sites include larynx, lymph nodes, the pleura, brain, kidneys, bones, or joints
- Usually not infectious – always rule out pulmonary!
- Laryngeal TB is **extremely** contagious – hoarseness
- Found more often in those that are HIV infected, immunosuppressed person or young children

Bacilli may reach any part of the body, but common sites include:



Miliary TB – carried to all parts of the body, through the bloodstream





HOW IS TB SPREAD?

TB is spread person to person through the air via droplet nuclei.

***M. tuberculosis* may be expelled when an infectious person:**

- Coughs
- Sneezes
- Speaks
- Sings



Transmission occurs when another person inhales droplet nuclei.

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HOW TB INFECTION DEVELOPS IN THE BODY

- Persons become infected with TB when they inhale droplet nuclei that contain tubercle bacilli and the bacilli begin to multiply in the small air sacs of the lungs.
- A small number of bacilli enter the bloodstream and spread throughout the body. Usually within 2 to 8 weeks, the immune system intervenes, preventing further spread.
- At this point, the person is considered to have latent TB infection.
- Since the immune system is keeping the tubercle bacilli under control, people with latent TB infection do not feel sick and they cannot spread TB to others.



The immune system is keeping the bacteria (in red) under control.

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HOW TB DISEASE DEVELOPS IN THE BODY

- If the immune system cannot keep the tubercle bacilli under control, the bacilli multiply and destroy tissue.
- The bacteria usually attack the lungs, but can attack any part of the body such as lymph nodes, bones and joints, the brain, and other organs.
- At this point, the person has **TB Disease**.
- People with **TB Disease** may feel sick and may spread TB to others.



The immune system is no longer able to contain the bacteria



TB TRANSMISSION AND THE DEVELOPMENT OF TB DISEASE

- If another person inhales air that contains droplet nuclei, they may become infected. However, not every person that is exposed to TB becomes infected with *M. tuberculosis*.
 - Additionally, not everyone infected with *M. tuberculosis* becomes sick. People who are infected but not sick have **latent TB infection**. Some people with **latent TB infection** go on to develop **TB disease**.
- Thus, there are two TB-related conditions:
 - **TB Infection (LTBI)**
 - **TB Disease**
- About 5% to 10% of persons with normal immune systems will develop TB disease at some point in their lives. The risk of developing **TB disease** is the highest in the first 2 years after infection.



SYMPTOMS OF TB DISEASE

Persons with TB disease usually have one or more symptoms.

- **General symptoms of TB disease:**
 - Fever
 - Chills
 - Night Sweats
 - Weight Loss
 - Appetite Loss
 - Fatigue
 - Malaise
- **Symptoms of pulmonary TB disease:**
 - Cough lasting 3 or more weeks
 - Chest Pain
 - Coughing up blood or sputum (phlegm)
- **Symptoms of extrapulmonary TB disease depend on the part of the body that is affected.**
 - Spine may cause back pain
 - Kidneys may cause blood in urine
 - Lymph nodes may cause swelling in the neck



LIKELIHOOD OF DEVELOPING TB DISEASE

Once infected with TB bacteria

- 10% life time chance that TB disease will develop
 - Half the risk within the first 2 years
 - Gradually decreasing risk after the first 2 years
- 90% never develop the disease
- Other personal health factors can influence risk
 - HIV infection - single highest risk for progress to active disease, at 10% risk annually
 - Diabetes - 30% risk over lifetime



DIFFERENCES BETWEEN TB INFECTION AND TB DISEASE

PERSONS WITH TB DISEASE

- Usually feel sick
- Usually have one or more symptoms
- May be able to spread TB bacteria to others

PERSONS WITH TB INFECTION

- Do not feel sick
- Do not have any symptoms
- Cannot spread TB to others
- Are at risk for developing TB disease



TB CONTACTS

- Persons who spend a lot of time in enclosed spaces with people who have TB disease are at the highest risk of becoming infected with M. tuberculosis.
- This may include family members, friends, roommates, or coworkers.
- Public health workers are responsible for ensuring that these high-risk individuals are evaluated for TB infection and TB disease, and treated when appropriate.
- This activity is called a contact investigation.

Anyone can get TB.



INFECTION CONTROL

TB is an airborne disease that can be transmitted from one person to another, it is important to practice appropriate infection control procedures to protect others from getting TB.

Health-care facilities should have protocols designed to ensure:

- Prompt detection of TB
- Airborne precautions to prevent the spread of TB
- Treatment of persons who have suspected or confirmed TB

Personal respirators should be worn by health care workers to prevent the inhalation of droplet nuclei.

Surgical masks should be worn by infectious TB patients to prevent droplet nuclei from being expelled into the air.



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TESTING FOR TUBERCULOSIS

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TARGETED TESTING



Targeted testing is used to identify and treat persons who are at high risk for TB infection or at high-risk for developing TB disease once infected with *M. tuberculosis*.

Identifying and treating **TB Infection** prevents **TB Disease**.

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GROUPS AT HIGH RISK OF DEVELOPING TB INFECTION

HIV infection is the strongest known risk factor for progressing to TB disease.

People with diabetes have a 2-3 times higher risk of TB disease compared to people without diabetes.

Other people at high risk for infection with *M. tuberculosis* include:

- Contacts of persons known or suspected to have infectious TB Disease
- People who have come to the United States within the last 5 years from areas of the world where TB is common (for example, Asia, Africa, Eastern Europe, Latin America, and Russia)
- Persons who visit areas of the world where TB is common, especially if visits are frequent or prolonged
- People who live or work in congregate settings whose clients are at increased risk for TB disease
- Health care workers who serve clients who are at increased risk for TB disease



RISK OF DEVELOPING TB DISEASE

Other people that have weak immune systems that put them at high risk for developing TB disease include:

- Children younger than 5 years of age
- Persons who are receiving immunosuppressive therapy
- Persons who have had a gastrectomy or jejunioleal bypass
- Persons who weigh less than 90% of their ideal body weight
- Persons with silicosis, chronic renal failure, leukemia, lymphoma or cancer of the head, neck or lung
- Persons who abuse drugs and alcohol



RISK OF INFECTION

How infectious is the person with TB

Length of exposure

Environment in which transmission occurs

- Close proximity
- Indoors, Outdoors



TESTING FOR TB INFECTION

- **TST (Tuberculin Skin Test or Mantoux Test)**
 - Intradermal injection of purified protein derivative tuberculin
- **IGRA (interferon gamma release assay)**
 - QuantFERON-TB Gold
 - T-SPOT
- A positive **TST** or **IGRA** result only indicates if someone has been infected with *M. tuberculosis*. These tests cannot identify if a person has **TB disease**.



WHO CAN RECEIVE A TST

Almost everyone can receive a TST, including:

- Infants
- Children
- Pregnant women
- People living with HIV
- People who have had a BCG shot

***People who had a severe reaction to a previous TST *should not* receive another TST**



TUBERCULIN SKIN TESTING

Two Purified Protein Derivative (PPD) antigen products licensed by the FDA

- Tubersol
- Aplisol





HOW TO PERFORM THE TUBERCULIN SKIN TEST

Inject intradermally 0.1 ml of 5 TU (Purified Protein Derivative) PPD tuberculin
Produce a wheal 6 mm to 10 mm in diameter

READING THE TST



A person given the TST must have a trained health care worker examine their forearm within 48 to 72 hours. If the person does not return within 72 hours, the test results are not valid and the person will need another skin test.

To determine whether a TST reaction should be considered positive, a health care worker needs to interpret the reaction based on:

- Size of induration (measured in millimeters)
- Patient's Risk factors for TB

Redness around the injection site is not measured. This is because the presence of redness does not indicate that a person has TB infection.



CLASSIFICATION OF THE TB SKIN TEST

<p>An induration of 5 or more millimeters is considered positive in</p> <ul style="list-style-type: none"> -HIV-infected persons -A recent contact of a person with TB disease -Persons with fibrotic changes on chest radiograph consistent with prior TB -Patients with organ transplants -Persons who are immunosuppressed for other reasons (e.g., taking the equivalent of >15 mg/day of prednisone for 1 month or longer, taking TNF-α antagonists) 	<p>An induration of 10 or more millimeters is considered positive in</p> <ul style="list-style-type: none"> -Recent immigrants (<5 years) from high-prevalence countries -Injection drug users -Residents and employees of high-risk congregate settings -Mycobacteriology laboratory personnel -Persons with clinical conditions that place them at high risk -Children < 4 years of age -Infants, children, and adolescents exposed to adults in high-risk categories 	<p>An induration of 15 or more millimeters is considered positive in any person, including persons with no known risk factors for TB. However, targeted skin testing programs should only be conducted among high-risk groups.</p>
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Source: Centers for Disease Control and Prevention



FACTORS THAT MAY AFFECT THE SKIN TEST REACTION

FALSE NEGATIVE

- Anergy
- Recent TB infection
- Very young age (<6 months old)
- Live-virus vaccination
- Overwhelming TB disease or other infection

FALSE POSITIVE

- Non-tuberculous mycobacteria BCG vaccination
- BCG vaccination



STORAGE AND HANDLING OF PPD

- Date and initial when vial is opened
- Discard 30 days after opening
- Draw up just prior to injection
- Store at 35-46 degrees Fahrenheit in a refrigerator or cooler with ice packs and keep out of direct light (antigen is sensitive to light and heat; these elements can affect antigen's stability and potency)



TWO-STEP TST

Done to establish a baseline for those that will be retested periodically

- If first test is positive, consider person infected
- If first test is negative, give 2nd test 1-3 weeks later

- If second test is positive, consider person infected
- If second test is negative, consider the person uninfected



KEY DEFINITIONS

REACTOR

An individual with a positive skin test reaction (size interpreted as "positive" based on risk factors) with no clear documentation or history of being skin tested in the last two years

CONVERTOR

Any individual with a negative skin test documented as baseline but who developed positive reaction with increase in reaction size of ≥ 10 mm within the past two years or a change from negative to positive on an IGRA



IGRA

Interferon Gamma Release Assay (IGRA) measure the cell-mediated response to specific TB antigen in whole blood.

Currently there are two IGRA's in use: **Quantiferon** (Cellestis) and **T-Spot** (Oxford)



QUANTIFERON



T-SPOT



ADVANTAGES OF IGRA'S

ADVANTAGES OF IGRA'S

- Requires a single patient visit
- Results not subject to ready bias and error
- Greater sensitivity and specificity – not affected by BCG or most nontuberculous mycobacteria
- Results are usually available within 24-48 hours
- Does not "boost" responses measured by subsequent tests as a TST may
- 30-50% of individuals with DM may have a negative TST.

DISADVANTAGES OF IGRA'S

- More costly than a TST
- Not recommended for use in children ≤ 5 years of age
- Blood must be processed in 8-30 hours
- Can have false positive, false negative and indeterminate test results



FACTORS THAT MAY AFFECT THE IGRA RESULT

FALSE POSITIVE

- Issues with collection of tubes
- Improper collection, transport of tubes, running or interpretation of the result

FALSE NEGATIVE

- Delay in incubation
- Improper collection, transport of tubes, running or interpretation or the result



T-SPOT



T-Spot uses 1 lithium or sodium heparin tube (EDTA is not recommended)

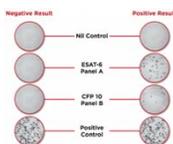
Requires differing amounts of blood:

- Adults and Children over 9 years old – 6 ml
- Children 2-9 years old - 4 ml
- Children up to 2 years old – 2 ml

Whole blood tubes must be stored at room temperature until packaged for transport

Interpretation of Results

Interferon-gamma is captured and presented as spots from T cells sensitized to Mycobacterium tuberculosis antigens.



QFT



QFT-GIT requires 3 tubes provided by the lab
Each tube is designed to allow only 1 ml of blood to be collected

Gray – Negative Control or Nil – “background noise”

Red – Antigen – Response of the test

Purple – Positive Control or Mitogen – shows immune status and correct handling and incubation of the tubes

Will receive a numeric as well as a positive, negative or indeterminate result.
The result is based on IFN-g (Interferon gamma) concentration

Positive - ≥ 0.35

Negative < 0.35

Indeterminate - <0.35 or ≥ 0.35 if Nil > 8.0 and any result in Mitogen tube
Or any result in antigen and mitogen with > 8.0 in Nil



BCG VACCINATION

- Bacillus of Calmette and Guerin
- First officially used as a TB vaccine in 1921
- Poor efficacy but believed to be useful in some foreign countries to prevent TB disease in young children and infants

Not recommended in the United States

- Low risk of infection with M. tuberculosis
- Variable effectiveness of BCG
- Interpretation of tuberculin skin test result complicated by BCG



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TESTING INTERPRETATION & DIAGNOSIS

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TB DISEASE VS. TB INFECTION

TB DISEASE

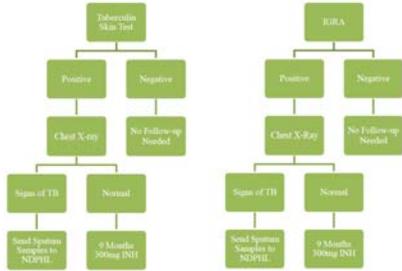
- Positive TST or IGRA
- Cough, fever, unexplained weight loss, chest pain, fatigue, loss of appetite
- Abnormal CXR
- Positive sputum smears
- Positive sputum cultures
- Infectious prior to treatment
- May have a negative sputum smear &/or culture

TB INFECTION (LTBI)

- Positive TST or IGRA
- Normal CXR
- Negative sputum smear
- Negative sputum culture
- Not infectious

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TB SCREENING ALGORITHM



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DIAGNOSIS OF TUBERCULOSIS

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MEDICAL EVALUATION

Anyone with symptoms of TB disease or anyone who has a positive tuberculin skin test (TST) or interferon-gamma release assay (IGRA) result should be medically evaluated for TB disease.

A medical evaluation generally consists of five parts:

- Medical history
- Physical examination
- Test for TB infection (TST or IGRA)
- Chest x-ray
- Bacteriological examination

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MEDICAL HISTORY

A medical history includes a patient's social, family, medical, and occupational information. Clinicians should ask patients if they have:

- Symptoms of TB disease (for example, unexplained weight loss, night sweats, loss of appetite, fever, fatigue, cough lasting 3 or more weeks, or coughing up blood or sputum)
- Been exposed to a person with infectious TB or have risk factors for exposure to TB
- Had latent TB infection or TB disease before (and, if so, whether they completed treatment)
- Any risk factors for developing TB disease

Clinicians should suspect TB disease in patients with any of these factors.



EVALUATE ALL PATIENTS WITH SYMPTOMS OF TB FOR TB DISEASE

Patients with symptoms of TB disease may be given a TST or an IGRA to help confirm infection with *M. tuberculosis*. However, these tests cannot confirm if a person has TB disease.



Patients with symptoms of TB disease should always be evaluated for TB disease, regardless of their test results.

1/4 to 1/3 of all active MTB cases have negative TST at onset of treatment.



Additionally, if a patient has symptoms of TB disease, clinicians should not wait for test results before starting other diagnostic tests.



CHEST X-RAY

A patient should have a chest x-ray if he or she has a positive IGRA or TST result or has signs and symptoms of TB disease.

The chest x-ray will usually appear abnormal when a patient has TB disease in the lungs. It may show infiltrates, cavities, effusions or opacities.

A chest x-ray does not rule out active TB in immune compromised individuals and children.

However, chest x-ray results cannot confirm that a person has TB disease. A variety of illnesses may produce abnormalities whose appearance on a chest x-ray resembles TB.



BACTERIOLOGICAL EXAMINATION

TB bacteriological examinations are done in a laboratory that identifies *M. tuberculosis* and other mycobacteria. Specimens are usually collected at a local health center or clinic and sent to a laboratory to be examined.

A bacteriologic examination has five components:

- Specimen collection
- Examination of acid-fast bacilli (AFB) smears
- Direct identification of specimen (nucleic acid amplification)
- Specimen culturing and identification
- Drug susceptibility testing



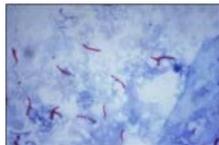
BACTERIOLOGIC EXAMINATION

- **Sputum collection** – those symptomatic or with abnormal chest x-rays consistent with TB, for AFB smear and culture:
 - A series of three samples
 - Spontaneous or induced
 - At least 8 hrs. apart, and one in early AM
- All specimens should be cultured, regardless of smear result
- Smear/stain results in 1 day, culture results take up to 6-8 weeks
- *M. tuberculosis* can be cultured from any body fluid or tissue
- Specimen collected depends on the site of potential disease



EXAMINATION OF AFB SMEAR

- Microscopic examination looking for AFB
- If found, then **SMEAR POSITIVE**
 - A positive smear does not confirm a diagnosis of TB
- Additionally, smear negative results do not exclude TB disease.



NUCLEIC ACID AMPLIFICATION TESTS

Nucleic acid amplification (NAA) tests can be used to identify *M. tuberculosis* bacteria in specimens.

- If NAA test and AFB smears are both **positive**, patients are presumed to have **TB disease** and should begin treatment.
- If NAA test is **negative** and AFB smears are **positive**, patients may be infected with **nontuberculous mycobacteria** (NTM).
- Cannot distinguish between live or dead organisms.
- The North Dakota Department of Health performs Amplified Mycobacterium Tuberculosis Direct Test (MTD) by Gen-Probe.
 - Testing performed on respiratory specimens including sputum, bronchial specimens or tracheal aspirates.
 - The MTD should not be tested with bloody specimens or if the patient has been treated with antituberculosis agents within the last 12 months.



CULTURE

All specimens should be cultured, regardless of whether the AFB smear is positive or negative. A culture must be done to confirm the diagnosis of TB disease.



- A **positive** culture means that *M. tuberculosis* was identified in the specimen. This confirms the diagnosis of **TB disease**. Confirmed using DNA probes.
- A **negative** culture means that *M. tuberculosis* was **NOT** identified in the specimen. However, this does not exclude diagnosis of **TB disease**. Some patients with negative cultures are diagnosed with **TB disease** based on their signs and symptoms and response to treatment.

Because TB is a reportable disease, laboratories should report positive results within 24 hours by telephone or fax to the primary health care provider and to the state TB control program, as required by law.



DRUG SUSCEPTIBILITY TESTING

Drug susceptibility testing determines which drugs can kill the tubercle bacilli. If the tubercle bacilli are killed by a particular drug, they are susceptible to that drug. If tubercle bacilli can grow in the presence of a particular drug, they are resistant to that drug.

- Mono-resistant TB is resistant to one TB treatment drug
- Poly-resistant TB is resistant to at least two TB treatment drugs (but not both isoniazid and rifampin)
- Multidrug-resistant TB (MDR TB) is resistant to both isoniazid and rifampin
- Extensively drug-resistant TB (XDR TB) is a rare type of MDR TB that is resistant to isoniazid and rifampin, plus any fluoroquinolone and at least one of three injectable second-line drugs

Drug susceptibility testing should be done when the patient is first found to have a positive culture. This is very important because patients who are treated with drugs to which their TB is resistant will not be cured, and using the wrong drugs can lead to further drug resistance.



DRUG RESISTANCE

PRIMARY RESISTANCE Caused by person-to-person transmission of drug-resistant organisms	SECONDARY RESISTANCE Develops during TB treatment: <ul style="list-style-type: none">• Patient was not given appropriate treatment regimen• Patient did not follow treatment regimen as prescribed
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TREATMENT OF TB INFECTION & TB DISEASE



TREATMENT OF TB INFECTION (LTBI)

- Treatment of latent **TB infection** is essential to controlling and eliminating TB in the United States.
- Treating latent **TB infection** greatly reduces the risk that a person with TB infection will progress to **TB disease**.



BEFORE STARTING TREATMENT FOR TB INFECTION

It is important to rule out TB disease. Treating TB disease with a latent TB infection treatment regimen can lead to drug resistance. People with symptoms of TB disease or chest x-ray findings suggestive of TB should be given treatment for TB disease, not latent TB infection.

All patients being considered for treatment of latent TB infection should receive a medical evaluation to:

- Rule out TB disease
- Determine whether the patient has ever been treated for latent TB infection or TB disease before. Generally, people who have already completed treatment do not need to be treated again, unless they may have been re-infected.
- Identify any medical problems that may complicate therapy or require more careful monitoring.
- Determine if the patient is taking a medication which may interact with latent TB infection treatment drugs.



TB INFECTION TREATMENT

- **Isoniazid(INH) – 9 months (270 doses)**
 - May be given daily or twice a week
- **Isoniazid-Rifapentine (3HP)- 12 week course**
 - Must be given DOT.
 - Not recommended for:
 - People with HIV/AIDS who are taking antiretroviral (ARV) treatment
 - People who are presumed to have been infected with isoniazid (INH) or rifampin (RIF) resistant M. tuberculosis
 - Pregnant women or women expecting to be pregnant within the 12-week regimen
 - Children younger than 2 years old
- **Rifampin (RIF) – 4 months**
 - In situations where RIF cannot be used (HIV-infected persons receiving protease inhibitors – rifabutin may be substituted)



TREATMENT OF HIGH RISK CONTACTS

- Sometimes treatment for latent TB infection is given to people even if they have a negative TST or IGRA result.
- These contacts include:
 - Children 5 years old or younger (referred to as window prophylaxis)
 - People living with HIV/AIDS
 - Other immunosuppressed persons who may develop TB disease quickly after infection



TREATMENT OF TB DISEASE

- Treating **TB disease** with several drugs is more effective at killing all of the tubercle bacilli and helps to prevent drug resistance.
- The drugs most commonly used to treat TB disease are:



Isoniazid, Rifampin, Pyrazinamide, and Ethambutol pills

- Isoniazid (INH)
- Rifampin (RIF)
- Pyrazinamide (PZA)
- Ethambutol (EMB)



LENGTH OF TREATMENT

- TB disease must be treated for at least 6 to 9 months. In some cases, treatment can last much longer, for example, 18 to 24 months or longer to treat multidrug-resistant TB (MDR TB).
- Regimens for treating TB have an initial phase of 2 months, followed by a continuation phase of either 4 or 7 months. This is because even though most tubercle bacilli are killed within the first 8 weeks of treatment (initial phase), there are still active bacilli in the body. Treatment with at least 2 drugs must continue for several more months to kill remaining bacilli (continuation phase).
- If treatment is not continued for a long enough time, the remaining bacilli may continue to grow, causing TB disease to re-occur.



TREATMENT REGIMEN

The preferred regimen for treating drug-susceptible TB disease in persons not infected with HIV is:

Initial phase:

- Daily isoniazid (INH), rifampin (RIF), pyrazinamide (PZA), and ethambutol (EMB) for 56 doses (8 weeks)

Continuation phase:

- Daily isoniazid (INH) and rifampin (RIF) for 126 doses (18 weeks)
- Twice-weekly isoniazid (INH) and rifampin (RIF) for 36 doses (18 weeks)



SERIOUS ADVERSE REACTIONS TO TB DRUGS

All patients being treated for TB disease should be educated about the symptoms caused by adverse reactions to the drugs they are taking.

If any of these symptoms occur, patients should STOP their medication and contact their health care provider immediately.

Symptoms of serious adverse reactions include:

- No appetite
- Nausea
- Vomiting
- Yellowish skin or eyes
- Fever for 3 or more days
- Abdominal pain
- Tingling fingers or toes
- Skin rash
- Aching joints
- Dizziness
- Tingling or numbness around the mouth
- Easy bruising, bleeding
- Blurred or changed vision
- Ringing in the ears
- Hearing loss



MINOR ADVERSE REACTIONS TO TB DRUGS

• **Minor side effects include:**

- Rifampin can cause orange urine, saliva, tears or dentures
- Rifampin can make people more sensitive to the sun

• **The side effects listed below may be considered serious or minor, depending on the patient:**

- Rifampin makes birth control pills and implants less effective.
- Rifampin can cause withdrawal symptoms for patients taking methadone (used to treat drug addiction).

• If any of these symptoms occur, patients can continue taking their medicine, but they should inform their health care provider.



MONITORING AND EVALUATION OF TREATMENT

• Every patient newly diagnosed with TB disease should have a specific treatment and monitoring plan developed in collaboration with their local health department.

• **This plan should include:**

- Description of treatment regimen
- Methods of monitoring for adverse reactions
- Methods of assessing and ensuring adherence to treatment
- Methods for evaluating treatment response

• Patients should be evaluated at least monthly during therapy for adverse reactions, adherence to regimen, and signs and symptoms of TB disease.



TREATMENT ADHERENCE

- Patients must be adherent to cure **TB disease**.
- Non-adherence to treatment can lead to **treatment failure** and the development of **drug-resistant TB**.
- Adherence to treatment may be difficult for many reasons.
 - Treatment for **TB disease** lasts many months
 - Patients may start to feel better soon after taking their medication and no longer have symptoms, thus making them reluctant to continue taking several medications



DIRECTLY OBSERVED THERAPY

DOT (Direct Observed Therapy) means that a health care worker or other designated individual (excluding a family member) watches the patient swallow every dose of the prescribed TB drugs ("supervised swallowing").

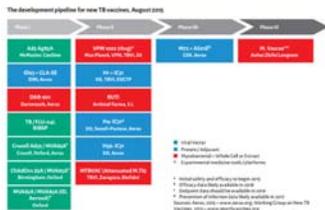
DOT is not just dispensing medications

- Listen attentively and respectfully; use open, relaxed body language
- Assure patient of privacy and confidentiality
- Avoid being judgmental or accusatory and never show frustration
- Use simple, nonmedical terms
- Use appropriate language level for the patient



ON THE HORIZON

- Development of new vaccines for tuberculosis
- New TB medications to treat MDR TB
 - Bedaquiline
 - Delamanid
- Research being done for new TB medications
- Studies being done for shorter treatment regimens



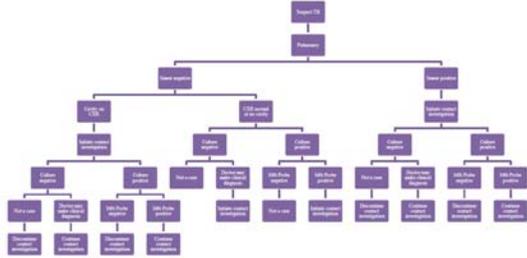
RESOURCE MATERIALS



ESTIMATED TUBERCULOSIS INCIDENCE RATES, 2014

Estimated TB incidence rates, 2014

SUSPECT PULMONARY TB: AFB SMEAR AND CHEST X-RAY

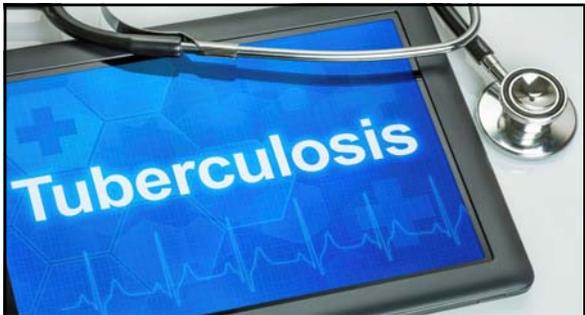


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SUSPECT PULMONARY TB: AFB SMEAR AND MTD PROBE



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THANK YOU!

Acknowledgement: <http://www.cdc.gov/tb/webcourses/TB101/intro.html>
