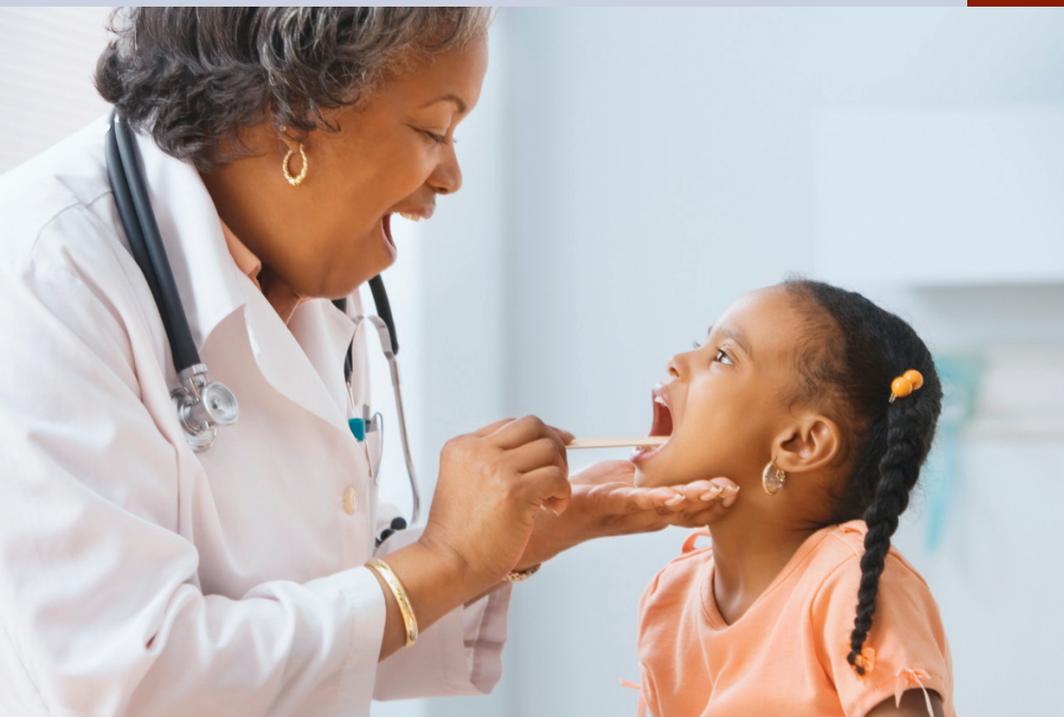


# TUBERCULOSIS HANDBOOK FOR SCHOOL NURSES



**RUTGERS**

Global Tuberculosis  
Institute

NEW JERSEY MEDICAL SCHOOL

# TUBERCULOSIS HANDBOOK FOR SCHOOL NURSES

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# TABLE OF CONTENTS

---

Introduction .....	4
<b>PART 1: TB FUNDAMENTALS</b> .....	5
Transmission and Pathogenesis .....	6
Clinical Presentation of LTBI and TB Disease .....	6
Testing for Tuberculosis .....	8
Targeted Testing in Children .....	8
Special Considerations .....	10
Evaluation of Children and Adolescents with Positive TST or IGRA Results .....	10
Treatment of LTBI and TB Disease .....	11
Treatment of LTBI .....	11
Treatment of TB Disease .....	12
Use of Pyridoxine .....	12
Adverse Reactions to TB Medications .....	13
<b>PART 2: APPLYING TB FUNDAMENTALS IN THE SCHOOL SETTING</b> .....	15
Directly Observed Therapy for Treatment of LTBI and TB Disease .....	16
Keys to Successful Treatment .....	18
<b>REFERENCES</b> .....	20
<b>RESOURCES</b> .....	21
<b>ADDITIONAL TB RESOURCES</b> .....	22
<b>PART 3: APPENDICES</b> .....	23
Appendix A: Frequently Asked Questions .....	24
Appendix B: Administration, Measurement, and Interpretation of TST .....	26
Appendix C: Screening for the Risk of TB Infection .....	29
Appendix D: Sample TB Risk Assessment Tool .....	30
Appendix E: Tuberculin Skin Test Record .....	31
Appendix F: Assessing for Adverse Reactions to TB Medications .....	32
Appendix G: Request for Medication to be Administered by the School Nurse .....	33
Appendix H: Directly Observed Therapy Log .....	34
Appendix I: Glossary of Terms .....	35

# INTRODUCTION

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This handbook has been prepared for school nurses who may be responsible for implementing tuberculin testing programs in their schools or working in collaboration with community providers in both the public and private sectors to manage the care of a child with tuberculosis (TB) disease or latent TB infection (LTBI).

In recent years there have been many policy changes related to TB testing, including a shift away from mass screening. Current recommendations focus on assigning risk, i.e., testing only those children found to have risk factors for tuberculosis. “Targeted testing” for tuberculosis places priority on these high risk groups by selecting those at the greatest risk for infection as well as those at risk for developing TB disease if infected (American Thoracic Society [ATS] & Centers for Disease Control & Prevention [CDC], 2000).

This handbook is divided into three sections:

- **TB Fundamentals** with a particular focus on school-aged children.
- **Applying TB Fundamentals in the School Setting** which covers issues related to medication administration, treatment adherence and directly observed therapy (DOT) in the school setting.
- **Appendices** that include risk assessment guidelines, medication side effects, and templates for record keeping.

# PART ONE

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## TB FUNDAMENTALS



# TRANSMISSION & PATHOGENESIS

TB is an airborne infectious disease caused by *Mycobacterium tuberculosis* (*M. tuberculosis*). Minute particles called droplet nuclei are expelled into the air when a person with TB disease of the lungs or respiratory tract coughs, sneezes, laughs, or sings. Transmission of *M. tuberculosis* can occur because these particles remain suspended in the air and may be inhaled by other individuals. Although TB disease can progress directly from the initial infection, in most cases the host's immune system contains this infection. The bacilli are walled off from the rest of the body and exist in an isolated form and may remain viable for years. This is referred to as latent *M. tuberculosis* infection or LTBI. Persons with LTBI have no signs, symptoms or radiographic evidence of TB disease and, are unable to transmit the bacteria.

Because we know that LTBI is the precursor to TB disease, early diagnosis of children infected with the *M. tuberculosis* is a critical step in preventing morbidity and mortality in the pediatric population. Equally important is the treatment of these children and a plan to ensure treatment completion.

## CLINICAL PRESENTATION OF LTBI AND TB DISEASE

It is important to understand both the differences between LTBI and TB disease and the differences in their presentation in adults and young children. Young children manifest TB disease differently than adults and in some instances are discovered and diagnosed during a contact investigation. They are often asymptomatic, have fewer tubercle bacilli in their lungs, and may lack the force to produce airborne bacilli while coughing, and are rarely infectious. When symptoms do occur, they may present as fever, cough, and weight loss or failure to gain weight. Although TB disease is most commonly found in the lungs, it can affect other parts of the body as well (i.e., extrapulmonary TB). (American Academy of Pediatrics [AAP], 2012).

<b>Latent TB Infection</b>	<b>Pulmonary TB Disease</b>
Inactive tubercle bacilli in the body	Active tubercle bacilli in the body
Results of tuberculin skin test (TST) or interferon-gamma release assay (IGRA) usually positive	Results of TST or IGRA usually positive
Findings on chest radiograph usually normal	Findings on chest radiograph usually abnormal
If collected, sputum smear and culture negative	Results of sputum smear and culture positive
Lack of symptoms	Symptoms such as cough, fever, weight loss
Not infectious	Often infectious before treatment

*Adapted from the CDC, Self-Study Modules on Tuberculosis, 2008.*

# TESTING FOR TUBERCULOSIS

School-based TB testing programs generally utilize tuberculin skin tests. It is important that school nurses are properly trained in the technique, and they should be familiar with other methods of testing for TB infection. In addition to the Mantoux tuberculin skin test that uses purified protein derivative (PPD), there are blood tests called interferon-gamma release assays (IGRA).

## **Tuberculin Skin Test (TST)**

- Delayed hypersensitivity test
- Uses the Mantoux method - Intradermal injection of purified protein derivative (PPD)
- Response (reaction) to antigen contained in the testing material is measured in millimeters of induration (*See Appendix B*)

## **Interferon-gamma Release Assays (IGRA)**

- Blood test
- Whole blood is mixed with antigens and analyzed in a laboratory
- Results based on amount of interferon-gamma released by white blood cells (QFT) or the relative number of specifically sensitized cells (T-Spot.®TB test)
- Results reported as positive, negative, or indeterminate or borderline and may also include numerical values
- Approved products include QuantiFERON®-TB Gold In-Tube, and T-SPOT®.TB

IGRAs have been approved for use in adults in all circumstances where a TST would be used. However, there is a lack of published data related to IGRA use in young children. Both the American Academy of Pediatrics (AAP) and Centers for Disease Control and Prevention (CDC) recommend IGRAs as the preferred test in children 5 years of age or older who have received BCG vaccine, although TST is also acceptable in this age group. CDC and AAP also agree that the TST is the preferred test for children less than 5 years of age, though IGRAs are an acceptable alternative.

## TARGETED TESTING IN CHILDREN

Targeted testing finds children who are at risk for LTBI and therefore at risk for progressing to TB disease. Because children and adolescents with LTBI represent the future reservoir for cases of TB disease, it is important that they are diagnosed and treated. **Children without risk factors**

**should not be tested.** (See Appendix C) It should be noted that there are some instances where routine testing is required for attendance in school, day care, or camp. This is to be discouraged because the yield of true positive results is low, and, therefore, is an ineffective use of healthcare resources (AAP, 2012).

The following is a summary of the AAP testing recommendations found in the Red Book: 2012 Report of the Committee on Infectious Diseases.

**Children for whom immediate TST or IGRA is indicated:**

- Contacts of persons with confirmed or suspected contagious tuberculosis
- Children with radiographic or clinical findings suggesting tuberculosis disease
- Children immigrating from countries with high prevalence of TB\* (e.g., Asia, Middle East, Africa, Latin America, and countries of the former Soviet Union), including foreign adoptees
- Children with travel histories to endemic countries and significant contact with people who live in these countries

\*Countries in Eastern Europe also have a high prevalence of TB

**Children who should have annual TST:**

- Children with HIV Infection (TST only)

**Children at increased risk for progression from infection to disease:**

Certain medical conditions can increase the possibility of progression to TB disease. Information regarding potential exposure to tuberculosis should be elicited from parents of these children. If histories or local epidemiological factors suggest a possibility of exposure, immediate and periodic TB testing should be considered. Medical conditions that increase the possibility of progression from TB infection to TB disease include:

- Diabetes mellitus
- Chronic renal failure
- Malnutrition

Information regarding potential exposure to tuberculosis should be elicited from parents of these children. If histories or local epidemiological factors suggest a possibility of exposure, immediate and periodic TB testing should be considered.

In addition, a TST or IGRA should be performed by the healthcare provider before initiation of immunosuppressive therapy including prolonged steroid administration or use of tumor necrosis factor-alpha antagonists.

## SPECIAL CONSIDERATIONS

### **Immunizations**

Measles and other live-virus vaccines can temporarily suppress tuberculin reactivity. Therefore, the TST should be administered simultaneously with measles, mumps, rubella vaccine (MMR) or at least 4-6 weeks afterwards. The effect of other live virus vaccines on tuberculin reactivity is not known, though the same spacing recommendations apply. Although the effects of live-virus vaccines on IGRAs have not been determined experimentally, CDC recommends a similar approach.

### **BCG vaccine**

History of vaccination with the bacille Calmette-Guerin (BCG) vaccine is **not** a contraindication for testing for tuberculosis, provided such testing is part of a targeted testing program. BCG is not part of the vaccine schedule in the United States, but is used extensively throughout the world, especially in endemic countries for the specific purpose of protecting infants from the serious complications of TB disease. However, it does not provide lifelong immunity, and in fact, its effectiveness wanes over time.

Therefore, if a child is at risk for tuberculosis, a test for tuberculosis should be performed regardless of BCG vaccine history. A child with a positive TST result should be evaluated for TB disease and treated accordingly because the TST may have cross-reactivity (i.e. false positive results) in persons with a history of BCG. This does not occur with IGRAs. Therefore, IGRAs are recommended in children 5 years of age and older who have a history of BCG vaccination.

## EVALUATION OF CHILDREN AND ADOLESCENTS WITH POSITIVE TST OR IGRA RESULTS

Any child with a positive test result for *M. tuberculosis* infection that is done as part of a school TB testing program should be referred for further evaluation. This evaluation includes a detailed health history, physical assessment, and chest radiograph. By focusing on the presence

of symptoms, the risk of progression to TB disease, coexisting medical conditions, and radiographic evidence the healthcare provider is able to confirm or exclude TB disease.

Any child suspected of having TB disease, with questionable test results, or with unclear risk factors should be referred to a specialist. Your school district may have an agreement with the local health department, TB control program, or hospital where this assessment can be performed. If the findings of the chest radiograph are normal and TB disease has been ruled out, in most instances, treatment for LTBI is recommended and children should not be excluded from school. For children who have TB disease, attendance at school should be determined by the jurisdictional health authority, which is the local health department in most instances.

The diagnostic criteria for LTBI include the following:

- Positive test for TB infection
- Absence of symptoms or physical findings suggestive of TB disease
- Chest radiograph with no evidence of TB disease

(ATS & CDC, 2000; Pediatric Tuberculosis Collaborative Group, 2004).

## TREATMENT OF LTBI AND TB DISEASE

### TREATMENT OF LTBI

Rationale for treating latent tuberculosis infection in children includes the following: (Pediatric Tuberculosis Collaborative Group, 2004):

- Young children who are infected with TB are at greater risk of progression from latent infection to TB disease since their immune systems are less able to control infection
- Infection is likely to have been recent in young children. Recently infected persons are at a greater risk for developing TB disease
- Children have more years of life expectancy to potentially develop TB disease.
- Medications used to treat LTBI are well tolerated by children and there is a low risk of toxicity

Medications used in the treatment of LTBI include Isoniazid (INH), Rifampin (RIF), and Rifapentine (RPT). The table below outlines the different regimens, the medications used, and the duration of treatment.

## Treatment Regimens for LTBI

(AAP, 2012 and CDC, 2011)

Regimen	Duration
Isoniazid	Daily for 9 months *
Isoniazid and Rifapentine	Once weekly for 12 weeks provided by Directly Observed Therapy (DOT) **
Rifampin	Daily for 6 months

\* Preferred for children younger than 12 years of age

\*\*The isoniazid and rifapentine regimen, often referred to as the 12-dose regimen, may be used for otherwise healthy patients aged 12 years or above. This regimen may also be used on a case-by-case bases for children aged 2-11. It is not recommended for children younger than 2 years of age, those with HIV/AIDS receiving antiretroviral therapy, pregnant women or women expecting to become pregnant while on treatment, and patients who have LTBI with presumed INH or RIF resistance.

## TREATMENT OF TB DISEASE

Medications used in the treatment of TB disease include Isoniazid (INH), Rifampin (RIF), Pyrazinamide (PZA), and Ethambutol (EMB).

### Treatment Regimens for TB Disease

(AAP, 2012)

Disease	Regimen
Pan-sensitive TB (Organisms sensitive to all first-line drugs)	<p>For the first 2 months</p> <ul style="list-style-type: none"> <li>• Isoniazid</li> <li>• Rifampin</li> <li>• Pyrazinamide</li> <li>• Ethambutol</li> </ul> <p>• For the next 4 months</p> <ul style="list-style-type: none"> <li>– Isoniazid</li> <li>– Rifampin</li> </ul>
Multi-drug resistant TB (Organisms resistant to INH and RIF)	<ul style="list-style-type: none"> <li>• Treated with drugs to which organisms are sensitive</li> <li>• Any drug resistance should be managed by an expert</li> </ul>

## USE OF PYRIDOXINE

The use of pyridoxine (vitamin B6) supplementation is recommended for certain individuals receiving INH including children on meat and milk-deficient diets, exclusively breast-fed infants, children with nutritional deficiencies, children with symptomatic HIV infection, and pregnant adolescents. The recommended daily dose is up to 1 mg/kg/ (maximum 25 mg) (Pediatric Tuberculosis Collaborative Group, 2004).

# ADVERSE REACTIONS TO TB MEDICATIONS

In general, children tolerate medications used to treat tuberculosis well and adverse reactions are rare. It is important though to monitor for such reactions, as they are reversible when detected early. (See Appendix F). Medications should be stopped immediately if child develops significant nausea, vomiting, anorexia, abdominal pain, or jaundice which can be early signs of hepatotoxicity. Parents should be advised to seek advice from their child's healthcare provider if these symptoms occur.

## Signs and Symptoms of Adverse Reactions to TB Medications\*

Medication	Adverse Reaction	Signs & Symptoms	Comments
Isoniazid (INH)	Hepatitis/ Hepatotoxicity	Dark urine Yellow skin or eyes Nausea Vomiting Abdominal discomfort Flu-like symptoms (fever, muscle aches, headache)	Stop medications immediately if child develops significant nausea, vomiting, anorexia, abdominal discomfort, or jaundice
	Peripheral neuropathy	Numbness or tingling of fingers or toes	Pyridoxine supplementation may be indicated
	Hypersensitivity	Rash	
Rifampin (RIF)	Orange discoloration of bodily fluids (common)	Orange color of tears and urine	Expected side effect Stains contact lenses
	Hepatitis/ Hepatotoxicity	Dark urine Yellow skin or eyes Nausea Vomiting Abdominal discomfort Flu-like symptoms (fever, muscle aches, headache)	Stop medications immediately if child develops significant nausea, vomiting, anorexia, abdominal discomfort, or jaundice
	Hypersensitivity	Dizziness Flu-like symptoms (fever, muscle aches, headache) Rash	Other: RIF decreases the effectiveness of oral contraceptives. Advise use of non-hormonal contraceptive

(continued on next page)

## Signs and Symptoms of Adverse Reactions to TB Medications\*

(continued from previous page)

Medication	Adverse Reaction	Signs & Symptoms	Comments
Rifapentine (RPT)	Orange discoloration of body fluids	Orange color of tears and urine	Expected side effect Stains contact lenses
	Hematologic toxicity (thrombocytopenia, neutropenia)	Easy bruising bleeding	Directly observed therapy is essential when the INH-RPT regimen is prescribed
	Hepatitis/ Hepatotoxicity	Dark urine Yellow skin or eyes Nausea, Vomiting Abdominal discomfort Flu-like symptoms (fever, muscle aches, headache)	Other RIF decreases the effectiveness of oral contraceptives. Advise use of non-hormonal contraceptive
	Hypersensitivity	Dizziness Flu-like symptoms (fever, muscle aches, headache) Hypotension Rash	
Pyrazinamide (PZA)	Hepatitis/ Hepatotoxicity	Dark urine Yellow skin or eyes Nausea Vomiting Flu-like symptoms Loss of appetite Abdominal discomfort	Stop medications immediately if child develops significant nausea, vomiting, anorexia, abdominal discomfort, or jaundice
	Hyperuricemia	Joint pain or swelling	
Ethambutol (EMB)	Optic neuritis	Decreased visual acuity Decreased red-green color discrimination	Baseline and monthly visual acuity and red-green discrimination in children old enough to cooperate

\*Not a complete list of side effects/ drug-drug interactions. Consult the prescribing healthcare provider for more information.

# PART TWO

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## APPLYING TB FUNDAMENTALS IN THE SCHOOL SETTING



# DIRECTLY OBSERVED THERAPY FOR TREATMENT OF LTBI AND TB DISEASE

Directly observed therapy (DOT) is the term used to describe the observation of TB medication ingestion by a member of the healthcare team. While DOT is the standard of care for patients with TB disease, it can also improve adherence in children with LTBI. DOT is a priority for very young children, adolescents, immunocompromised children, and those with evidence of non-adherence. DOT is also the standard of care for those on intermittent regimens for LTBI or TB disease. This includes the 12 dose regimen of INH and rifapentine.

The school setting is an ideal setting for DOT because the child attends school five days a week during the academic year. A school nurse can observe and document medication ingestion and assess the child for possible medication side effects on a regular basis.

When the school nurse is asked to provide DOT for a child with LTBI or TB disease, the referring agency may visit the school and provide forms for documentation/permission such as medication order form, parental consent form, and DOT log. Refer to Appendix G and Appendix H for examples. They may also provide the medication on a monthly basis as well as guidance and support in areas of patient education, adherence, medication administration, and medication side effects.

Some guidelines for providing DOT in the school setting include:

- Use a parent/guardian consent form to obtain permission for medication administration in school
- Choose the time and place of medication administration to ensure privacy and protection of the child's identity
- Establish a protocol for managing missed doses due to illness or vacation
- Consider intermittent regimens. It is generally administered 2 to 3 times per week and should be given at the same time each day. The interval between doses should be 48 hours. The 12-dose regimen for LTBI is administered once weekly.
- Use a DOT log to record medication administration that includes the following:
  - Child's name, date of birth, address, and home phone number
  - Name and phone number of child's healthcare provider
  - Name of prescribed TB medications and dosing schedule
  - Name and signature of person dispensing the medication, the date and time

The school nurse and the child's healthcare provider or health department along with parents or guardians are partners in the health and recovery of the child with TB. Therefore, maintaining a good relationship and clear, ongoing communication is important. Problems or concerns about medication administration or the child's health should be communicated directly to the healthcare provider who is supervising the child's treatment and all communication should be documented.

# KEYS TO SUCCESSFUL TREATMENT

This section suggests ways to manage some potential barriers to successful treatment.

## **School Absences and Vacations**

School absences and vacations may prevent a child from receiving medications. Therefore, it is important to establish a plan for these absences prior to initiation of DOT. The school office can provide information about a child's absence. However, it may be more efficient to have the child's parent or guardian agree to contact the school nurse directly regarding an absence. If a child who is being treated for TB disease is absent from school, the child's healthcare provider or health department should be contacted so alternate arrangements for medication administration can be made. It is also helpful to review the school calendar as the plan for DOT is being designed and to share it with the healthcare provider or health department.

## **Missed Directly Observed Therapy Appointments:**

If a child does not report to the school nurse for medications:

- Check to see if the child is absent and follow the absentee procedure that has been instituted
- If the child is present, discreetly locate the child, without compromising confidentiality
- Avoid problems by choosing a convenient time for therapy, such as before school or at lunchtime

## **Difficulty Taking Medications**

All TB medications can be safely administered at the same time. If the child complains of upset stomach or nausea after taking the medication, offering a small snack may relieve the discomfort. Unfortunately, some children have trouble swallowing pills. Most TB medications, with the exception of rifampin, can be crushed and placed in food, making swallowing easier and more palatable (Starke & Smith, 2004). If food is used, consult the healthcare provider or a pharmacist and consider the following strategies:

- For children unable to swallow tablets, tablets can be crushed and mixed with food to mask the bitter taste. Parents can provide food the child likes. Examples include:
  - Applesauce
  - Mashed bananas
  - Yogurt
- Mix medications with the smallest amount of food possible, to ensure the child consumes all medications
- Once the medication is ingested, offer a spoonful of food without medication, and follow that with water
- Vary the choices of foods periodically, so that the child does not develop an aversion to a certain food
- If possible, schedule medication administration when the child is likely to be hungry and less likely to refuse
- Do not add crushed medication to a full glass of water or other liquids, as the drug will sink to the bottom

### **Lack of Incentives**

Incentives can help if a child is hesitant about taking medications or does not understand the consequences of non-adherence, (ATS & CDC, 2000). While schools may not have access to incentives, many clinics and health departments have effective incentive programs and are willing to share ideas and resources. In addition, positive feedback which boosts a child's morale and small, tangible rewards, such as stickers or certificates can also improve adherence.

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# ADDITIONAL TB RESOURCES

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## **Centers for Disease Control and Prevention (CDC) Division of Tuberculosis Elimination**

[www.cdc.gov/tb](http://www.cdc.gov/tb)

*The CDC Division of Tuberculosis Elimination's website contains information on TB in the United States and provides TB education and training materials and resources.*

## **Find TB Resources Website**

[www.findtbrsources.org](http://www.findtbrsources.org)

*This website includes a searchable database of materials from numerous national and international organizations. The site also includes information about other TB organizations, how to order materials, and funding opportunities.*

## **TB Regional Training and Medical Consultation Centers (RTMCCs)**

*CDC funds five regionally-assigned RTMCCs to provide training, education and medical consultation services to TB health care workers. The RTMCC all-products page provides RTMCC produced TB educational materials.*

<http://sntc.medicine.ufl.edu/rtmccproducts.aspx>

## **Curry International Tuberculosis Center**

*CITC serves: Alaska, California, Colorado, Hawaii, Idaho, Nevada, Oregon, Utah, Washington, and the U.S. Pacific Island Territories.*

3180 18th Street, Suite 101, San Francisco, CA 94110

415-502-4600 (Phone) 415-502-4620 (Fax)

[www.nationaltbcenter.ucsf.edu](http://www.nationaltbcenter.ucsf.edu)

## **Heartland National Tuberculosis Center**

*HNTC serves: Arizona, Arkansas, Kansas, Louisiana, Missouri, New Mexico, Nebraska, Oklahoma, Texas.*

2303 SE Military Drive, San Antonio, TX 78223

800-839-5864 (Phone) 210-531-4500 (Fax)

[www.heartlandntbc.org](http://www.heartlandntbc.org)

## **Mayo Clinic Center for Tuberculosis**

*MCCT serves: Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Ohio, North Dakota, South Dakota, Wisconsin, and Wyoming.*

855-360-1466 (Phone)

[www.mayo.edu/tuberculosis-center](http://www.mayo.edu/tuberculosis-center)

## **Global Tuberculosis Institute at Rutgers, The State University of New Jersey**

*GTBI serves: Connecticut, District of Columbia, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.*

225 Warren Street, PO Box 1709, Newark, 07101-1709

973-972-3270 (Phone) 973-972-3268 (Fax)

<http://globaltb.njms.rutgers.edu>

## **Southeastern National Tuberculosis Center**

*SNTC serves: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia, Puerto Rico, and the U.S. Virgin Islands.*

Physical Address: 2055 Mowry Rd. Suite 250, Gainesville, FL 32611

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<http://sntc.medicine.ufl.edu>

# PART THREE

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## APPENDICES



# APPENDIX A

## FREQUENTLY ASKED QUESTIONS

- Q. *Why do some children take vitamin B6 with their INH while others do not?***
- A. Although not prescribed routinely, vitamin B6 (pyridoxine) is used to prevent peripheral neuropathy due to INH in children with poor nutrition. The child's healthcare provider will determine this need. Most children have no need for B6 supplementation. However, some healthcare providers prescribe vitamin B6 for all patients who take INH regardless of nutritional status.
- Q. *We had a TB outbreak in our school, and one of the teachers insisted that he must know how he was exposed. Isn't it a teacher's right to know?***
- A. No. You are a healthcare professional, and the infectious person is a patient. Standard provider and patient confidentiality must be maintained at all times.
- Q. *A child to whom I give medications is frequently absent. What is my responsibility in making sure this child gets medications?***
- A. Alternative plans for DOT must be established at the start of treatment. Arrangements may be made with the local health department or whoever provides outreach for TB patients.
- Q. *Sometimes I am unable to locate a child for TST reading within the recommended 48-72 hours time frame. Do I have to repeat the test?***
- A. TST reaction may be visible for up to 7 days after the test was administered. If there is no induration on the arm or the induration is not large enough to be interpreted as positive, the skin test must be repeated. If the induration is large enough to be interpreted as positive within 7 days of administration, this result can be used.

**Q. Do all new students and school employees in my school district require a test for TB Infection?**

A. TB skin testing regulations may vary by state. Consult your local health department and school board for more information.

**Q. What are the responsibilities of the school nurse when a student, teacher, or staff member has been diagnosed with tuberculosis?**

A. Contact investigations are usually managed by the health department, often in collaboration with school officials. The results of the investigation will determine the extent of transmission and need for TB testing. School nurses often assist in gathering information, providing baseline data, risk assessment, and if testing is indicated, assisting with TST or IGRA testing.

# APPENDIX B

## ADMINISTRATION, MEASUREMENT, INTERPRETATION OF TST

The Mantoux test is the recommended TST. It is administered by injecting 0.1 ml of 5 TU of purified protein derivative (PPD) solution intradermally into the volar surface of the forearm using a 27-gauge needle with a tuberculin syringe. (CDC, 2003). TST administration interpretation should be performed by a trained healthcare professional.

### ADMINISTRATION OF TST

- Store purified protein derivative (PPD) solution at 36-46° F and separate from other biologics, for example DTaP
- Avoid fluctuations in temperature. Do not store on the refrigerator door
- Label the vial with date it was opened and discard unused portion within 30 days
- Explain purpose of the test to the child and how it will be performed
- Fill syringes immediately prior to administration
- Select injection site; avoid areas of skin with veins, rashes, or excess hair
- Cleanse the area with alcohol swab and inject PPD solution just below the surface of the skin, forming a 6-10 mm wheal (a pale, raised area with distinct edges)
- Measure the wheal using a TST ruler. If no wheal forms or if it is less than 6 mm, the test should be repeated immediately at a site that is approximately 2 inches from the original site or on the opposite arm
- Clean the ruler with alcohol swab after use.
- Dab the area with cotton at the injection site if minor bleeding occurs,
- Do not cover the area with a bandage
- Record date, time, and site of the intradermal injection
- Record the brand name of the PPD solution, the lot number, manufacturer, and expiration date
- Instruct child and parent not to scratch the site or cover it with a bandage
- Inform parent and child of the importance of returning for a reading of the TST within 48-72 hours (2-3 days)
- Give written appointment to return for TST reading

## MEASUREMENT OF TST REACTIONS

- Locate the skin test site and verify with child/parent
- Inspect and palpate area with fingertips to distinguish areas of induration from erythema
- Measure area of induration perpendicular to the long axis of the arm
- Using a ballpoint pen, mark edges of induration
- Measure the distance between the two edges of induration using a TST ruler with millimeter calibration
- Measure only induration, not erythema

## DEFINITION OF POSITIVE TST RESULTS IN CHILDREN

The interpretation of the TST is based on a person's risk of TB infection and of progression to TB disease if infected.

### **≥5 mm induration**

- Child who is a close contact of a person with known or suspected TB
- Child with radiologic or clinical evidence of active TB disease
- Child receiving immunosuppressive therapy or with immunosuppressive conditions including HIV Infection

### **≥10 mm induration**

- Child younger than 4 years of age (AAP)\*
- Child with medical conditions such as: lymphoma, Hodgkin's disease, diabetes mellitus, chronic renal failure, or malnutrition
- Child born in region of the world with high prevalence of TB
- Child who has frequent exposure to high-risk adults (HIV-infected, homeless, residents of nursing homes, institutionalized, incarcerated, users of illicit drugs, or migrant workers)
- Child with a history of travel to high prevalence regions of the world

*\* CDC considers a 10 mm TST result positive in a child younger than 5 years of age.*

### **≥15 mm induration**

- Child ≥ 4 years of age with no risk factors

## DOCUMENTATION & EDUCATION

- Record date TST was administered
- Record the results in millimeters of induration (00 mm if there is no induration) rather than as positive or negative
- Record date and time of reading
- Record name of person reading TST
- Explain the significance of a positive TST result and the next steps in evaluation
- Inform family of possibility that TB control personnel may test other household members in search of a source case
- Counsel family that there is no need for future TB skin testing if the child has a positive TST result
- Provide child/parent with appropriate educational materials
- Instruct child who had no induration when the TST was measured at 48-72 hours to return for evaluation if a reaction occurs up to 1 week after the visit
  - Measure any induration that develops and consider that to be the result

# APPENDIX C

## SCREENING FOR THE RISK OF TB INFECTION

The American Academy of Pediatrics (AAP) suggests that a risk assessment for TB be performed at the provider's first encounter with the child, every six months until age two, and then annually if possible. Testing should be performed only if one or more risk factors are present (AAP, 2012). The following four questions were validated by several studies and incorporated into a risk assessment questionnaire (Pediatric Tuberculosis Collaborative Group, 2004)

- Was child born in a high-risk country (countries other than U.S., Canada, Australia, New Zealand or Western European countries)?
- Has child traveled and had contact with the resident population in a high-risk country (Africa, Asia, Latin America, countries of the former Soviet Union, or Eastern Europe) for more than a week?
- Has child been exposed to anyone with TB disease?
- Has a family member or close contact had a positive TST result?

See template for risk assessment questionnaire – Appendix D

Providers should become familiar with the incidence of TB in the countries from which their patients and families are emigrating. The most current data available indicates that 63% of TB cases in the United States occurred among foreign-born persons. Sixty-one percent of those cases reported in 2012 occurred in people from seven countries. Additionally, the World Health Organization (WHO) list of countries with a high burden of TB is available at [http://www.who.int/tb/publications/global\\_report/2013](http://www.who.int/tb/publications/global_report/2013).

# APPENDIX D

## SAMPLE TB RISK ASSESSMENT TOOL

Persons with any of the following risk factors are candidates for TB testing, unless there is written documentation of a previous positive TST or IGRA result.

<b>Risk Factor</b>	<b>Yes</b>	<b>No</b>
Was the child born in a high-risk country? (Any country other than United States, Canada, Australia, New Zealand, or Western Europe)	_____	_____
Has the child traveled and had contact with the resident population of a high-risk country? (Africa, Asia, Latin America, Eastern Europe, countries of the former Soviet Union)	_____	_____
Has the child had close or prolonged contact with someone with infectious TB disease?	_____	_____
Has the child had close or prolonged contact with someone with a positive TB test or IGRA?	_____	_____

Adapted from a questionnaire developed by the Pediatric Tuberculosis Collaborative Group (2004)

Available as a Microsoft Word document at:  
<http://globaltb.njms.rutgers.edu/educationalmaterials/productfolder/tbhandbook.html>

# APPENDIX E

## SAMPLE RECORD: TEST FOR TB INFECTION

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip Code \_\_\_\_\_

Telephone \_\_\_\_\_

### TST

Date and time TST administered \_\_\_\_\_

Name of person who administered TST \_\_\_\_\_

Site of TST \_\_\_\_\_

Manufacturer of PPD solution, lot #, expiration date \_\_\_\_\_

Results of TST recorded in millimeters of induration \_\_\_\_\_

Date and time TST interpreted \_\_\_\_\_

Name of person who measured induration \_\_\_\_\_

### IGRA

Date test performed \_\_\_\_\_

Type of test:

QuantiFERON®–TB Gold In-Tube

T-SPOT®-TB

### Results

*Available as a Microsoft Word document at:*

<http://globaltb.njms.rutgers.edu/educationalmaterials/productfolder/tbhandbook.html>

# APPENDIX F

## ASSESSING FOR ADVERSE REACTIONS TO TB MEDICATIONS

Presence of any side effects or adverse reactions should be reported immediately to the healthcare provider. The following questions can be used to elicit information regarding medication side effects and adverse reactions.

### **A. Subjective**

1. Do you have any of the following?
  - Abdominal pain
  - Nausea or vomiting
  - Loss of appetite
  - Fatigue
  - Rash
2. Are you taking any medications other than anti-TB medications?
3. Has there been a change in your appetite?
4. What color is your urine (may be orange for patients taking rifampin)?

### **B. Objective**

1. Does the child have signs and symptoms of hepatitis including any of the following?
  - Yellow eyes
  - Yellow skin
  - Dark urine
2. Does the child have a rash?
3. Does the child have a fever?
4. Is the child gaining weight steadily (re-evaluate monthly)?

# APPENDIX G

## SAMPLE REQUEST FOR MEDICATION TO BE ADMINISTERED BY THE SCHOOL NURSE

Student \_\_\_\_\_

DOB \_\_\_\_\_ Grade \_\_\_\_\_

Classroom #/floor \_\_\_\_\_

I, the parent/guardian of the above named student, request that the school nurse administer medication prescribed by the physician listed below. I agree to arrange for the supply of medications to be given to the school nurse.

Signature \_\_\_\_\_

Date \_\_\_\_\_ Phone \_\_\_\_\_

### PHYSICIAN'S STATEMENT

In order to protect the health of the above named, it is necessary for her/him to have the following medication during school hours.

Diagnosis \_\_\_\_\_

Medication \_\_\_\_\_

Dosage \_\_\_\_\_

Time to be administered \_\_\_\_\_

Possible side effects that might be expected: \_\_\_\_\_

\_\_\_\_\_

Next scheduled office visit \_\_\_\_\_

I authorize the school nurse to administer the above medication.

Signature \_\_\_\_\_

Date \_\_\_\_\_ Phone \_\_\_\_\_

*Adapted from Jersey City School District, Jersey City, New Jersey.*

*Available as a Microsoft Word document at:*

<http://globaltb.njms.rutgers.edu/educationalmaterials/productfolder/tbhandbook.html>



# APPENDIX I

## GLOSSARY OF TERMS

**Adherence to treatment**—following the recommended course of treatment by taking all the prescribed medications for the entire length of time necessary

**Adverse reaction**—negative side effect resulting from the use of a drug (for example, hepatitis, nausea, headache)

**BCG**—bacille Calmette-Guérin (BCG), a vaccine for TB disease that is used in many countries but rarely used in the United States; may cause a false-positive reaction to the TST but does not effect QuantiFERON®-TB Gold test (QFT-G) results

**Close contact**—a person who has shared the same air space in a household or other enclosed environment for a prolonged period of time (days or weeks, not minutes or hours) with a person with suspected or confirmed TB disease

**Continuation phase**—the period after the first 8 weeks of TB disease treatment, during which tubercle bacilli that remain after the initial phase are treated with at least two drugs

**Directly observed therapy**—a strategy devised to help patients adhere to treatment; a designated person watches the TB patient swallow each dose of the prescribed drugs

**Droplet nuclei**—very small droplets (1 to 5 microns in diameter) containing M. tuberculosis that may be expelled when a person who has infectious TB coughs, sneezes, speaks, or sings

**Erythema**—redness around the site of the injection when a TST is done; erythema is not considered when the reaction size is measured

**Ethambutol (EMB)**—a drug used to treat TB disease; may cause vision problems. Ethambutol should be used cautiously in children who are too young to be monitored for changes in their vision

**Immunosuppressive therapy**—therapy that suppresses, or weakens, the immune system

**Induration**—swelling that can be felt around the site of injection after a TST is done; the reaction size is the diameter of the swollen area, measured across the forearm

**Infectious**—capable of spreading infection; a person who has infectious TB disease expels droplets containing M. tuberculosis into the air when he or she coughs, sneezes, speaks, or sings

**Interferon-gamma release assay (IGRA)**—a type of blood test that measures a person's immune reactivity to M. tuberculosis. In the U.S., QuantiFERON®-TB Gold In-Tube and T-SPOT TB® are currently available IGRAs

**Intermittent therapy**—a treatment schedule in which the patient takes each prescribed medication two or three times weekly at the appropriate dosage

**Isoniazid (INH)**—a drug that is used for treating LTBI and TB disease; although relatively safe, it may cause hepatitis and other adverse reaction in some patients

**Latent Mycobacterium tuberculosis infection (LTBI)**—refers to the condition when a person is infected with tubercle bacilli but has not developed TB disease

**Mantoux tuberculin skin test**—a method of testing for TB infection. A needle and syringe are used to inject 0.1 ml of 5 tuberculin units of liquid tuberculin between the layers of the skin (intradermally), usually on the forearm and the reaction is measured in 48 to 72 hours

**Mycobacterium tuberculosis**—the organism that causes TB in humans and is sometimes called the tubercle bacillus; belongs to a group of bacteria called mycobacteria

**Pathogenesis**—how an infection or disease develops in the body

**Peripheral neuropathy**—damage to the sensory nerves of the hands and feet, causing numbness or tingling in the hands and feet

**PPD (purified protein derivative)**—a tuberculin skin test that uses PPD tuberculin

**Pulmonary TB**—TB disease that occurs in the lungs typically causing a cough and an abnormal chest x-ray; pulmonary TB is usually infectious if untreated.

**Rifampin (RIF)**—a drug used to treat TB disease; also used for LTBI treatment

**Rifapentine**—a drug used to treat LTBI; used once weekly with isoniazid

**Smear**—a specimen that has been smeared onto a glass slide, stained, washed in an acid solution, and then placed under the microscope for examination; used to detect acid-fast bacilli in a specimen

**Sputum**—phlegm from deep in the lungs, collected in a sterile container for processing and examination

**Targeted testing**—a TB control strategy to identify persons at high risk for latent TB infection and persons at high risk for developing TB disease who would benefit from treatment

**Transmission**—the spread of an organism, such as *M. tuberculosis*, from one person to another; probability of transmission depends on the contagiousness of the patient, the type of environment, the length of exposure, and the virulence or strength of the organism

**Tubercle bacilli**—another name for the *Mycobacterium tuberculosis* organisms that cause TB disease

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