

TUBERCULOSIS HANDBOOK FOR SCHOOL NURSES



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Global Tuberculosis
Institute

NEW JERSEY MEDICAL SCHOOL

TUBERCULOSIS HANDBOOK FOR SCHOOL NURSES

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INTRODUCTION

This handbook has been prepared for school nurses who may be responsible for collaborating with community providers in both the public and private sectors for screening, diagnosis and management of children with tuberculosis (TB) disease or TB infection.

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

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 TB infection and is sometimes also called latent TB infection (LTBI). Persons with TB infection have no signs, symptoms or radiographic evidence of TB disease and are unable to transmit the bacteria.

Since we know that TB infection is the precursor to TB disease, early diagnosis of children infected with *M. tuberculosis* is a critical step in preventing morbidity and mortality in the pediatric population. However, appropriate treatment of TB infection in these children is equally important and should include development of a plan to ensure treatment completion.

CLINICAL PRESENTATION OF TB INFECTION AND TB DISEASE

It is important to understand both the differences between TB infection and TB disease and the differences in their presentation in adults and young children. As noted in the table below, individuals with TB infection are not sick and are not infectious.

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

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

Further, young children (birth to puberty) manifest TB disease differently than adults. Young children with TB:

- Are often asymptomatic
- Have fewer tubercle bacilli in their lungs
- Lack the force to produce airborne bacilli while coughing
- Are rarely infectious

When symptoms do occur in young children, 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], 2015). Because young children with TB disease may not have symptoms, in some instances they are discovered and diagnosed during a contact investigation around an infectious case of TB in an adult or adolescent. Contact investigation is a systematic process used to identify persons (contacts) who were exposed to someone with infectious TB disease, assess them for infection with *M. tuberculosis* and TB disease and provide appropriate treatment, if necessary. Contact investigations are conducted by the jurisdictional health authority, generally the state or local health department.

TB disease in adolescents manifests similarly to disease in adults. Adolescents are more likely to present with pulmonary disease, and unlike young children, can be infectious.

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; they should also 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 (IGRAs). It is important to note that neither test can be considered the “gold standard” and a lack of reaction to the TST or a negative IGRA does not exclude TB infection or disease.

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 Assay (IGRA)

- Blood test
- Whole blood is mixed with TB antigens and analyzed in a laboratory
- Results based on amount of interferon-gamma released by white blood cells (QuantiFERON®-TB Gold In-Tube) 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. The American Academy of Pediatrics (AAP) notes that published data indicate IGRAs perform consistently well in children 5 years of age or older. Both the AAP and the Centers for Disease Control and Prevention (CDC) recommend IGRAs as the preferred test in children 5 years of age or older who have received the 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 the AAP notes that some data also support use of IGRAs in children as young as 3 years of age and indicates that they may be used in children 3 years of age or older.

TARGETED TESTING IN CHILDREN

Targeted testing finds children who are at risk for TB infection and therefore at risk for progressing to TB disease. Since children and adolescents with TB infection represent the future reservoir for cases of TB disease, it is important that they are diagnosed early and treated. **Children without risk factors should not be tested.** See Appendix C for additional information on screening children. Appendix D contains a sample record of testing for TB infection that can be used in a school setting.

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 health care resources (AAP, 2015).

The following is a summary of the AAP testing recommendations found in the Red Book: 2015 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 (contact investigation)
- Children with radiographic or clinical findings suggesting tuberculosis disease
- Children immigrating from countries with endemic infection (e.g., Asia, Middle East, Africa, Latin America and countries of the former Soviet Union*), including international adoptees
- Children with travel histories to countries with endemic infection and substantial contact with people who live in these countries**

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

**If the child is well and has no history of TB exposure, the TST or IGRA should be delayed for up to 10 weeks after return

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 and children in these categories merit special consideration. 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. Without recent TB exposure, these children are not at increased risk of acquiring TB infection.

Medical conditions that increase the possibility of progression from TB infection to TB disease include:

- Diabetes mellitus
- Chronic renal failure
- Malnutrition
- Congenital or acquired immunodeficiencies
- Use of tumor necrosis factor (TNF) alpha-antagonists or other immunosuppressive therapy

In addition, a TST or IGRA should be performed **before** initiation of immunosuppressive therapy including prolonged systemic steroid administration, organ transplantation, use of TNF-alpha antagonists or blockers or other immunosuppressive therapy in any child being placed on these treatments.

SPECIAL CONSIDERATIONS

Immunizations

Measles is a live-virus vaccine that can temporarily suppress tuberculin reactivity. Therefore, the TST should be administered before the measles, mumps, rubella (MMR) vaccine, simultaneously with the MMR vaccine or at least 4-6 weeks after the vaccine. 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 countries where TB is endemic 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. 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, and perhaps as young as 3 years of age, 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 health care 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 TB infection is recommended; these children should not be excluded from school. For children who have TB disease, attendance at school should be determined by the treating physician in conjunction with the jurisdictional health authority, which is the local health department in most instances.

If a child with a positive TST or IGRA result has been sent for evaluation and is awaiting results of the chest radiograph, a symptom assessment should be performed. A sample TB symptom assessment can be found in Appendix E. If the child does not have symptoms, they may attend school while awaiting x-ray results.

The diagnostic criteria for TB infection 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 TB INFECTION AND TB DISEASE

TREATMENT OF TB INFECTION

Rationale for treating TB 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 TB 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 TB infection are well tolerated by children and there is a low risk of toxicity

Medications used in the treatment of TB infection 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, 2015 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 4 months****

*Table reflects regimens recommended by both CDC and the AAP. An additional regimen, 3 months of daily INH and RIF is recommended by the AAP as a possible alternative regimen, but is not currently included in CDC recommendations.

** Preferred for treatment of TB infection in most children.

*** The INH and RPT regimen, often referred to as the 12-dose regimen, may be used for otherwise healthy patients age 12 years or above. Current CDC and AAP guidelines indicate that this regimen should not be used routinely for children age 2-11 years but may be considered when the likelihood of completing another regimen is low. However, published data from the CDC PREVENT-TB trial indicates that the 12-dose regimen is safe, well tolerated and an effective alternative to INH in children aged 2-17. This regimen is not recommended for children younger than 2 years of age, those with HIV/AIDS receiving antiretroviral therapy, pregnant patients or patients expecting to become pregnant while on treatment and patients who have TB infection with presumed INH or RIF resistance.

****Recommended by the AAP for pediatric contacts to cases of INH-resistant tuberculosis and when INH cannot be used.

Of note, children who have been treated with 2 months of daily isoniazid, rifampin, pyrazinamide and ethambutol as part of standard regimen for treatment of drug-susceptible TB disease (but are later found to have TB infection only) are considered to be treated for TB infection.

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, 2015)

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

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 TB medications well and adverse reactions are rare**. It is important though to monitor for such reactions and consult with the child's health care provider if they occur, as they are reversible when detected early (See Appendix F). **Medications should be stopped immediately if the child develops significant nausea, vomiting, anorexia, abdominal pain or jaundice which can be early signs of hepatotoxicity**. Parents should also be advised to seek advice from their child's health care 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	If mild, antihistamines may control symptoms, if moderate to severe, stop medications
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	Treat symptoms if mild, stop medication if moderate or severe <i>Other: RIF decreases the effectiveness of oral contraceptives. Advise use of non-hormonal contraceptive methods</i>
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	
	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) Hypotension Rash	Treat symptoms if mild, stop medication if moderate or severe <i>Other: RPT decreases the effectiveness of oral contraceptives. Advise use of non-hormonal contraceptive methods</i>
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 health care provider.

PART TWO

APPLYING TB FUNDAMENTALS IN THE SCHOOL SETTING



DIRECTLY OBSERVED THERAPY FOR TREATMENT OF TB INFECTION AND TB DISEASE

Directly observed therapy (DOT) is the term used to describe the observation of TB medication ingestion by a member of the health care team. While DOT is the standard of care for patients with TB disease, it can also improve adherence in children with TB infection. 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 TB infection or TB disease. This includes the 12-dose regimen of isoniazid and rifapentine.

The school setting is ideal 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 TB infection or TB disease, the referring agency (i.e., health department) 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 of these forms. The referring agency may also provide the medication on a monthly basis as well as guidance and support in areas of patient education, adherence, medication administration and monitoring for 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 TB infection is administered once weekly.

- Use a DOT log to document medication administration. The log should include the following information:
 - Child's name, date of birth, address and home phone number
 - Name and phone number of child's health care 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 health care 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 health care provider who is supervising the child's treatment and the child's parents or guardians. All communication should be documented.

KEYS TO SUCCESSFUL TREATMENT

This section identifies some potential challenges and barriers to successful treatment as well as suggested approaches to address these challenges.

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 health care 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 health care provider or health department. Medication for vacations or planned absences should *not* be sent home with the child for delivery to the parent or guardian.

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 DOT, 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). Rifampin capsules can be opened and the contents dissolved in a small amount (<5 ml) of warm water.

If crushed pills are to be added to food, consult the health care 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
 - Pudding
 - Ice cream
 - Yogurt
- Mix medication with the smallest amount of food possible, to ensure the child consumes all medication
- Once the medication is ingested, offer a spoonful of food without medication
- 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

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

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

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.

www.cdc.gov/tb

Find TB Resources Website

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.

www.findtbresources.gov

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.

300 Frank H. Ogawa Plaza, Suite 520, Oakland, California 94612-2037

510-238-5100 (Phone)

<http://www.currytbcenter.ucsf.edu/>

Heartland National Tuberculosis Center

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

2303 SE Military Drive, San Antonio, TX 78223

800-839-5864 (Phone)

www.heartlandntbc.org

Mayo Clinic Center for Tuberculosis

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

Siebens 6-02, Mayo Clinic, 200 First Street SW, Rochester, MN 55905

855-360-1466 (Phone)

www.mayo.edu/tuberculosis-center

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

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

PART THREE

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 health care provider will determine this need. Most children have no need for B6 supplementation. However, some health care providers prescribe vitamin B6 for all patients who take INH regardless of nutritional status.
- Q. *We had a case of TB 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 health care 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 in your area.
- Q. *Sometimes I am unable to locate a child for TST reading within the recommended 48-72 hour 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 managed by the health department, often in collaboration with school officials. The results of the investigation will determine the potential extent of exposure 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 AND 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 and interpretation should be performed by a trained health care 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: Hodgkin's disease, lymphoma, diabetes mellitus, chronic renal failure or malnutrition
- Child born in region of the world with high prevalence of TB
- Child with a history of travel to high prevalence regions of the world
- Child who has frequent exposure to high-risk adults (HIV-infected, homeless, users of illicit drugs, residents of nursing homes, incarcerated or institutionalized)

** 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 AND 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 one year of age. After one year of age, risk assessment for tuberculosis should be performed at the time of routine care, annually if possible. Testing should be performed only if one or more risk factors are present (AAP, 2015). As noted earlier, children with HIV infection should be tested annually. Children with certain medical conditions that increase the possibility of progression to TB disease should be tested if the risk assessment suggests a possibility of exposure. School nurses should be provided with guidelines from their state department of health indicating who requires TB testing in the school setting.

The following validated questions for determining risk of TB infection in children in the United States are recommended by the AAP.

- Has a family member or contact had a tuberculosis disease?
- Has a family member had a positive test for TB infection?
- Was your child born in a high-risk country (countries other than U.S., Canada, Australia, New Zealand or Western and North 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?

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 66% of TB cases in the United States occurred among non-US-born persons. Sixty-two percent of those cases reported in 2014 occurred in people from seven countries; Mexico, Philippines, India, Vietnam, China, Guatemala and Haiti (CDC, 2015). Additionally, the World Health Organization (WHO) list of countries with a high burden of TB is available at: <http://www.stoptb.org/countries/tbdata.asp>

APPENDIX D

SAMPLE RECORD: TEST FOR TB INFECTION

Student 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 E

SAMPLE TB SYMPTOM ASSESSMENT TOOL

Name (Last, First, MI)		Birthday (mm/dd/yyyy)	
Street Address		Telephone Number	
City	State	Zip Code	
Date of TB Symptom Assessment (mm/dd/yyyy):			
<p>Symptoms Suggestive of TB (Check all that apply):</p> <p><input type="checkbox"/> Productive cough of undiagnosed cause (more than 3 weeks in duration)</p> <p><input type="checkbox"/> Coughing up blood (hemoptysis)</p> <p><input type="checkbox"/> Unexplained weight loss (10 pounds or greater without dieting)</p> <p><input type="checkbox"/> Night sweats (regardless of room temperature)</p> <p><input type="checkbox"/> Unexplained loss of appetite</p> <p><input type="checkbox"/> Very easily tired (fatigability)</p> <p><input type="checkbox"/> Fever</p> <p><input type="checkbox"/> Chills</p> <p><input type="checkbox"/> Chest pain</p> <p>If any symptoms are reported a chest radiograph is an essential criterion for school admission.</p>			
<input type="checkbox"/> No Symptoms Suggestive of TB Reported or Observed			
Name of Licensed MD/RN (Print)			
Signature of Licensed MD/RN		Date	

Adapted from the NJ Department of Health and Senior Services
 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 health care 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
 - Flu-like symptoms
 - 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.

Parent/Guardian Signature: _____

Date: _____ Phone: _____

Contact Information _____

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.

Physician 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 H

SAMPLE DIRECTLY OBSERVED THERAPY LOG

[illegible]

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 affect interferon-gamma release assay 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 United States, the IGRAs that are currently approved are QuantiFERON®-TB Gold In-Tube, and T-SPOT®.TB

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 TB infection and TB disease; although relatively safe, it may cause hepatitis and other adverse reaction in some patients

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)—antigens such as the type of tuberculin used in the TST to produce an immune response

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 TB infection treatment

Rifapentine—a drug used to treat TB infection; 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 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

Tuberculosis infection—refers to the condition when a person is infected with tubercle bacilli but has not developed TB disease

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