



Massachusetts Department of Public Health

Tuberculosis in School Aged Children

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Objectives

- Discuss latent TB infection versus active TB disease
- Briefly discuss TB epidemiology
- Describe Mass Pediatric TB Risk Assessment
- Describe types of tests of TB infection
- Identify when to delay school entry
- Describe Directly Observed Therapy and Directly Observed Preventative Therapy
- Discuss current TB screening efforts for newly arrived families

I have no conflicts of interest to report.

Global TB Overview

- 2 billion people on Earth (1/4) have latent TB infection
- In 2021, 10.6 million people progressed to TB disease, including 1.2 million children
- In 2021, 1.6 million people died of TB
- Second leading cause of death due to an infectious disease

Source: <https://www.who.int/news-room/fact-sheets/detail/tuberculosis>

Date accessed: 12/2/2022

Local TB Statistics

- In 2022, 153 MA residents were reported and verified as having TB disease
- Incidence rate 2.2 per 100,000 persons (national case rate 2.5)

Source:

<https://www.mass.gov/lists/tuberculosis-data-and-statistics>

Accessed: 9/30/2023

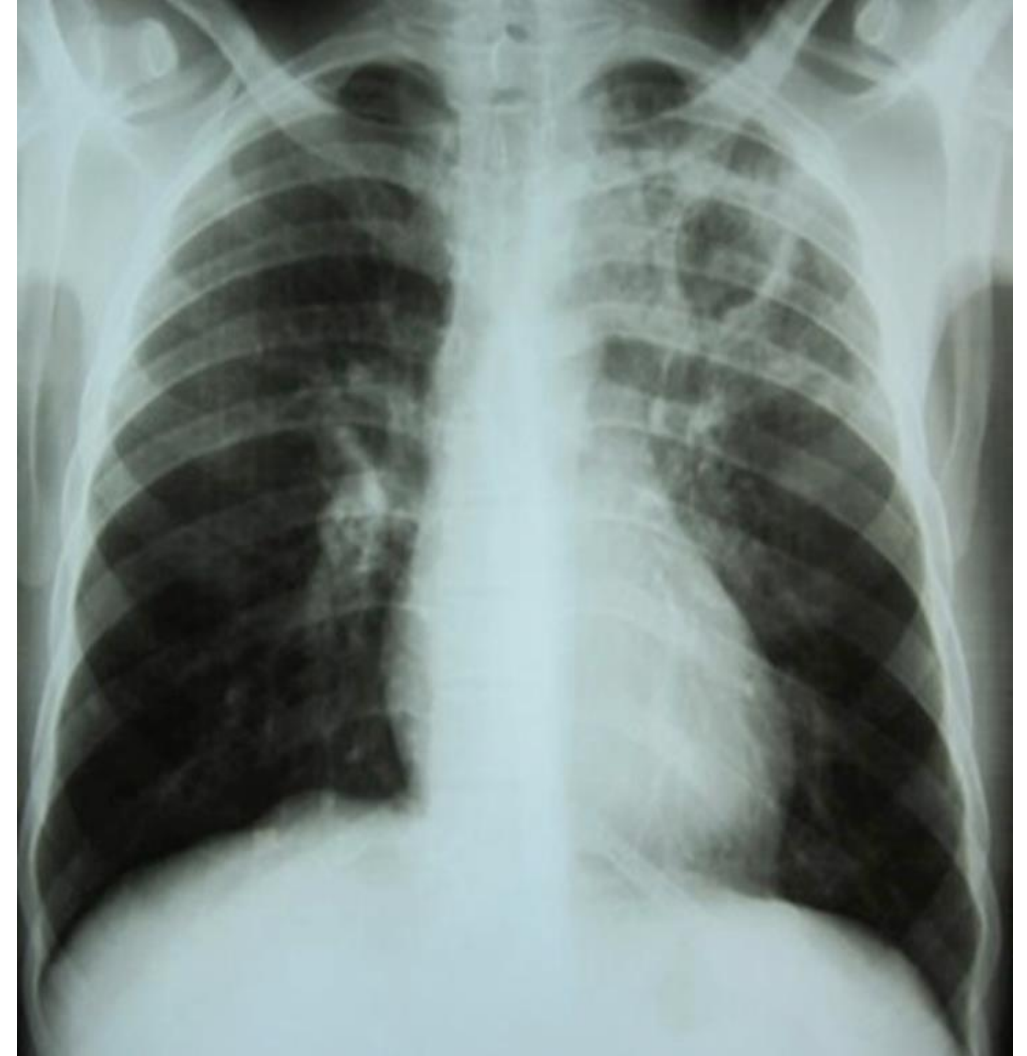
Age (years)	
<5	1 (1%)
5-14	1 (1%)
15-19	6 (4%)
20-24	17 (11%)
25-44	44 (29%)
45-64	48 (31%)
65+	36 (23%)

Latent TB Infection (LTBI)

- Immune system controls but doesn't clear the infection
- Patients are asymptomatic
- Normal chest X-rays
- Not infectious
- 10% risk for active TB disease at some point in their lives
- Latent TB treatment can reduce this risk
- Three different LTBI treatment regimens:
 - Isoniazid daily x 9 months
 - Rifampin daily x 4 months
 - Isoniazid plus rifapentine weekly x 12 weeks

Active TB Disease

- Can occur decades after primary infection
- Potential medical risk factors:
 - HIV
 - DM
 - ESRD
 - TNF-alpha blockers
 - Chemotherapy
 - Long-term corticosteroid use
 - Immunosuppression after organ transplant
- Psychosocial stressors
- Treatment with 4+ drugs for 6 to 12 months



TB Testing in the School Setting

- Each school district may set its own TB screening policies and procedures
- MA DPH recommends consideration of a TB risk assessment for incoming students
- Indications for TB testing would include:
 - Risks for TB exposure
 - Medical risks for progression to TB disease if exposed

Determining TB Risk in Children

- Birth, extended travel to, or residency in any country other than:
 - United States
 - Canada
 - Australia
 - New Zealand
 - Western or Northern Europe
- Known exposure to a person with infectious TB disease during the child's lifetime
- History of immunosuppressive disease or use of medications that might cause immunosuppression

Massachusetts Tuberculosis Risk Assessment Pediatrics

- Use this tool to identify asymptomatic **children and adolescents** to test for latent TB infection (LTBI).
- **Do not repeat testing** unless there are new risk factors since the last negative test.
- **For TB symptoms or abnormal chest X-ray consistent with active TB disease → Evaluate for active TB disease**

Evaluate for active TB disease with a chest X-ray, symptom screen, and if indicated, sputum AFB smears, cultures and nucleic acid amplification testing (NAAT). A negative tuberculin skin test or interferon gamma release assay does not rule out active TB disease.

Latent TB infection testing is recommended if any of the 3 boxes below is checked.
If latent TB infection test result is positive and active TB disease is ruled out, treatment of latent TB infection is recommended.

REPORT Latent TB Infection and Active or Suspected Active TB Disease

Go to www.mass.gov/tuberculosis for reporting forms

Born or lived in a country with an elevated TB rate

- Includes any country other than the United States, Canada, Australia, New Zealand, or a country in western or northern Europe.
- Interferon Gamma Release Assay (IGRA) is preferred over Tuberculin Skin Test (TST) for foreign-born persons ≥ 2 years old.
The TST is an acceptable test for all ages when administered and read correctly.

Immunosuppression, current or planned

HIV infection, organ transplant recipient; treated with TNF-alpha antagonist (e.g., infliximab, etanercept, others), or immunosuppressive interleukin antagonists, steroids (equivalent of prednisone ≥ 15 mg/day for ≥ 1 month) or other immunosuppressive medication

Close contact to someone sick with infectious TB disease during lifetime

No TB risk factors. TB test not indicated; no TB test done.

Provider: _____	Patient Name: _____
Assessment Date: _____	Date of Birth: _____

Targeted TB Testing and the School Health Form

Physical Examination		Date of Examination: _____	
Hgt: _____ (_____%) Wgt: _____ (_____%) BMI: _____ (_____%) BP: _____			
<i>(Check = Normal / If abnormal, please describe.)</i>			
<input type="checkbox"/> General _____	<input type="checkbox"/> Lungs _____	<input type="checkbox"/> Extremities _____	
<input type="checkbox"/> Skin _____	<input type="checkbox"/> Heart _____	<input type="checkbox"/> Neurologic _____	
<input type="checkbox"/> HEENT _____	<input type="checkbox"/> Abdomen _____	<input type="checkbox"/> Other _____	
<input type="checkbox"/> Dental/Oral _____	<input type="checkbox"/> Genitalia _____		
Screening:			
Vision: Right Eye	(Pass) (Fail) <input type="checkbox"/> <input type="checkbox"/>	Hearing: Right Ear	(Pass) (Fail) <input type="checkbox"/> <input type="checkbox"/>
Left Eye	<input type="checkbox"/> <input type="checkbox"/>	Left Ear	<input type="checkbox"/> <input type="checkbox"/>
Stereopsis	<input type="checkbox"/> <input type="checkbox"/>		
			Postural Screening: <input type="checkbox"/> <input type="checkbox"/>
			(Scoliosis/Kyphosis/Lordosis)
Laboratory Results:	<input type="checkbox"/> Lead _____	Date _____	<input type="checkbox"/> Other _____
The entire examination was normal: <input type="checkbox"/>			
Targeted TB Skin Testing: <input type="checkbox"/> Med-to-High risk (exposure to TB; born, lived, travel to TB endemic countries; medical risk factors):			
TB Test Type: <input type="checkbox"/> TST <input type="checkbox"/> IGRA Date: _____ Result: <input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Indeterminate/Borderline			
Referred for evaluation to: _____ Date: _____ <input type="checkbox"/> Low risk (no TB test done)			



Tuberculin Skin Test (TST)

- Screening test for TB infection, not disease
- Also known as PPD: Purified Protein Derivative
- First developed as a vaccine (not effective)
- Cut-off for a positive result depends on risk (both risk of acquisition and activation)
- Usually remains positive for life



TUBERCULOSIS
UNDISCOVERED-ENDANGERS YOU
The Tuberculin Test Discovers Infection!

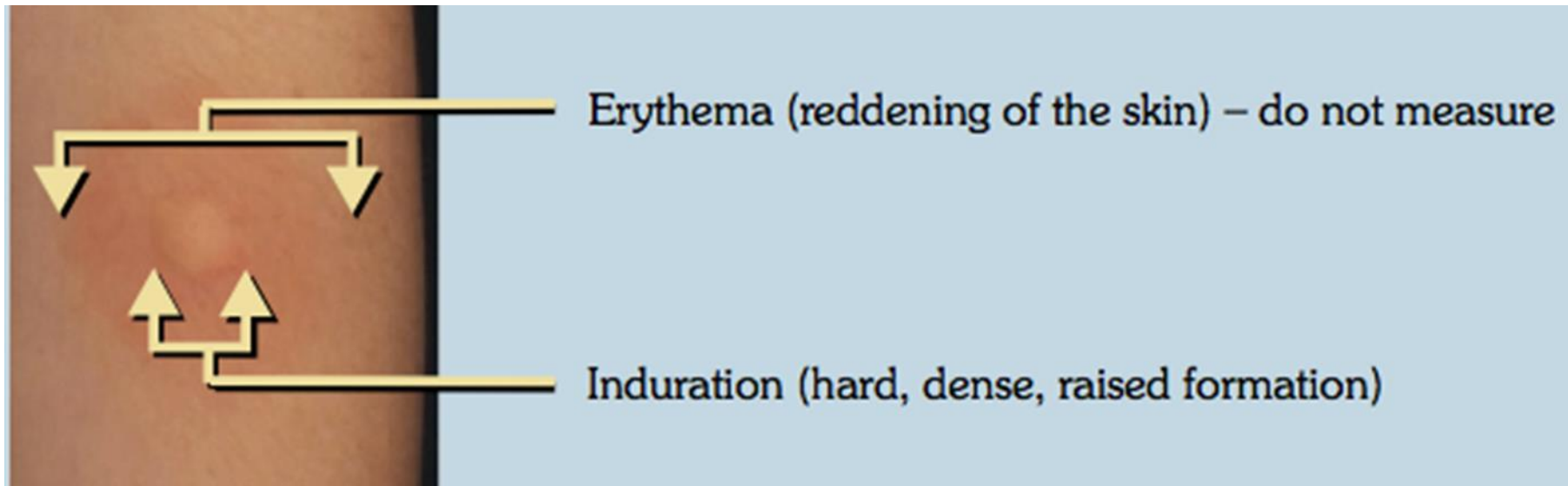
TST Placement

- 0.1 mL TST solution injected intradermally
- Multi-use vials kept refrigerated, discarded w/ 30 days of opening
- Choose a site carefully
- Avoid veins, margins of muscles, skin lesions, tattoos, etc
- Holding skin taut, insert needle at a 5-15 degree angle w/ bevel up
- Inject solution, assess for an adequate wheel (6-10 mm)
- If blood, dab with gauze
- No Band-Aids or adhesive tape



TST Reading

- TST should be read 48-72 hours after placement
- Measure induration **not** erythema
- Ballpoint pen can be helpful in feeling edge
- Only report the transverse measurement (the way a watch lies)



TST Reactions



Definitions of Positive TSTs in Children and Adolescents

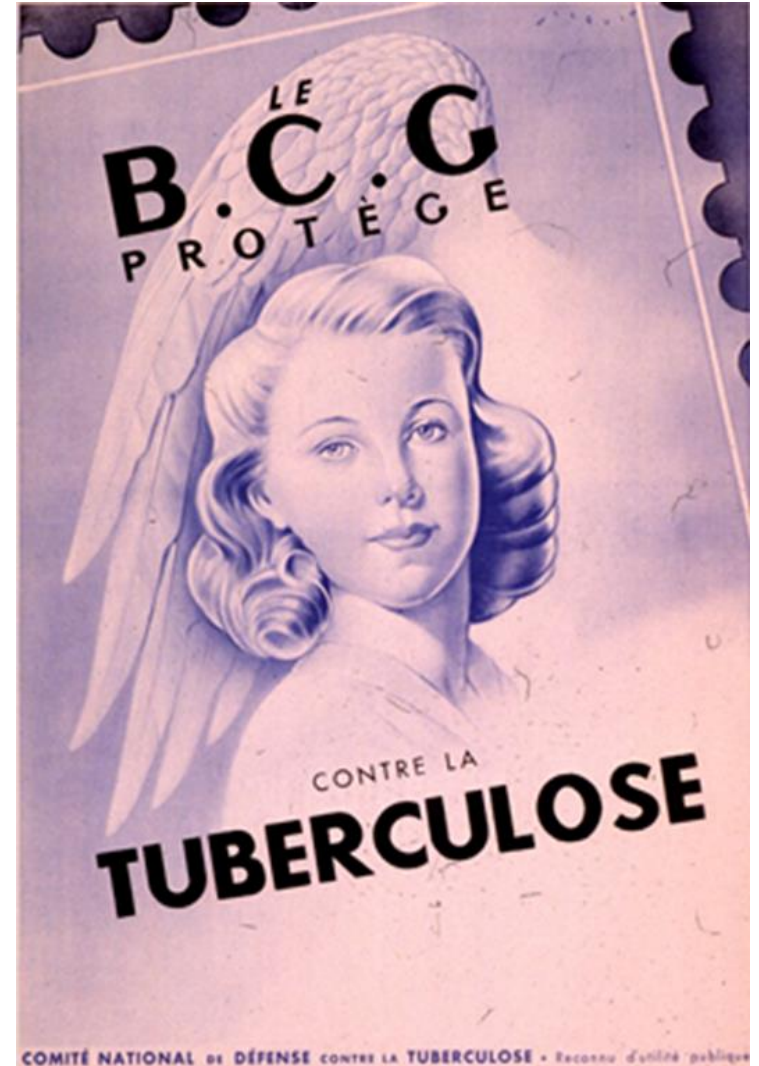
5 MM Induration	10 MM Induration	15 MM Induration
<ul style="list-style-type: none">• Close contact to known or suspected case of TB• Children with suspected active disease• Immunosuppressed	<ul style="list-style-type: none">• Children at risk for disseminated disease due to age (<4 yrs), or other co-morbid conditions, including diabetes, malnutrition, lymphoma, chronic renal failure• Children with increased risk of exposure from household contacts with TB infection, travel to high TB burden areas	<ul style="list-style-type: none">• Children 4 years or older without any risk factors <p>Generally, these children would not be recommended for testing to begin with</p>

False Negative and False Positive TSTs

- False negative TB Skin Tests
 - Anergy (inability to react to skin test due to weakened immune system)
 - Recent TB infection (within 10 weeks of exposure)
 - Remote TB infection (fading immunologic memory)
 - Recent live-virus vaccination (last 4-6 weeks)
 - Overwhelming TB disease
 - Incorrect method of administration or reading
 - Incorrect interpretation of reaction
- False positive TB Skin Tests
 - Infection with nontuberculous mycobacteria (NTM)
 - Incorrect method of administration or reading
 - Incorrect interpretation of reaction
 - Previous BCG vaccination

BCG Vaccination

- Developed by Albert Calmette and Camille Guerin in 1906
- “BCG” – Bacille Calmette-Guerin
- First used in France in 1921
- Never widely adopted in U.S.
- Still one of the most commonly used vaccines worldwide
- Administered to babies at birth in medium and high-incidence TB countries
- Leaves characteristic scar



BCG Vaccination 2

- What it does
 - Protects babies against the most severe forms of TB in childhood
 - Increases risk for false positive TSTs
 - This effect wanes over time
- What it doesn't do
 - Provide lifelong protection against all forms of TB disease
 - Adults with a BCG hx are just as likely to get pulmonary TB as adults without



So, Enter the IGRA

- New blood tests for TB infection developed that would not cross-react with BCG vaccination
- Reduce false positive results in BCG-vaccinated individuals
- First new test for TB infection in 100 years
- IGRA – Interferon Gamma Release Assays
- Two available tests:
 - Quantiferon-TB Gold Plus (QFT)
 - T-Spot TB Test

IGRA Results

Can be affected by:

- Tube filling
- Vigorousness of shaking
- Length of incubation
- Patient's underlying immune status
 - Immunocompromised patients can have indeterminate results
- Recent live virus vaccination or viral illness
 - If possible, recommend delaying IGRA draw 4-6 weeks after live virus vaccination or viral infection

Comparing TB Skin Tests and IGRAs

Both have their strengths and limitations

TB Skin Test	Interferon Gamma Release Assays
Inexpensive	Expensive
Requires 2 visits	Just one visit for blood draw, but...
Affected by prior BCG vaccination	Not affected by prior BCG
Subjective interpretation	Lab-reported value
More consistent results	More variability in results
Does not identify TB disease, or patients likely to get TB disease	Does not identify TB disease, or patients likely to get TB disease
	Slightly greater sensitivity

IGRA and TST Agreement by Age

Ho C.S., Feng P.I.,
Narita M., et al.
Comparison of three
tests for latent
tuberculosis infection in
high-risk people in the
USA: an observational
cohort study. *Lancet Inf
Dis.*2022; 22(1): 85-96.

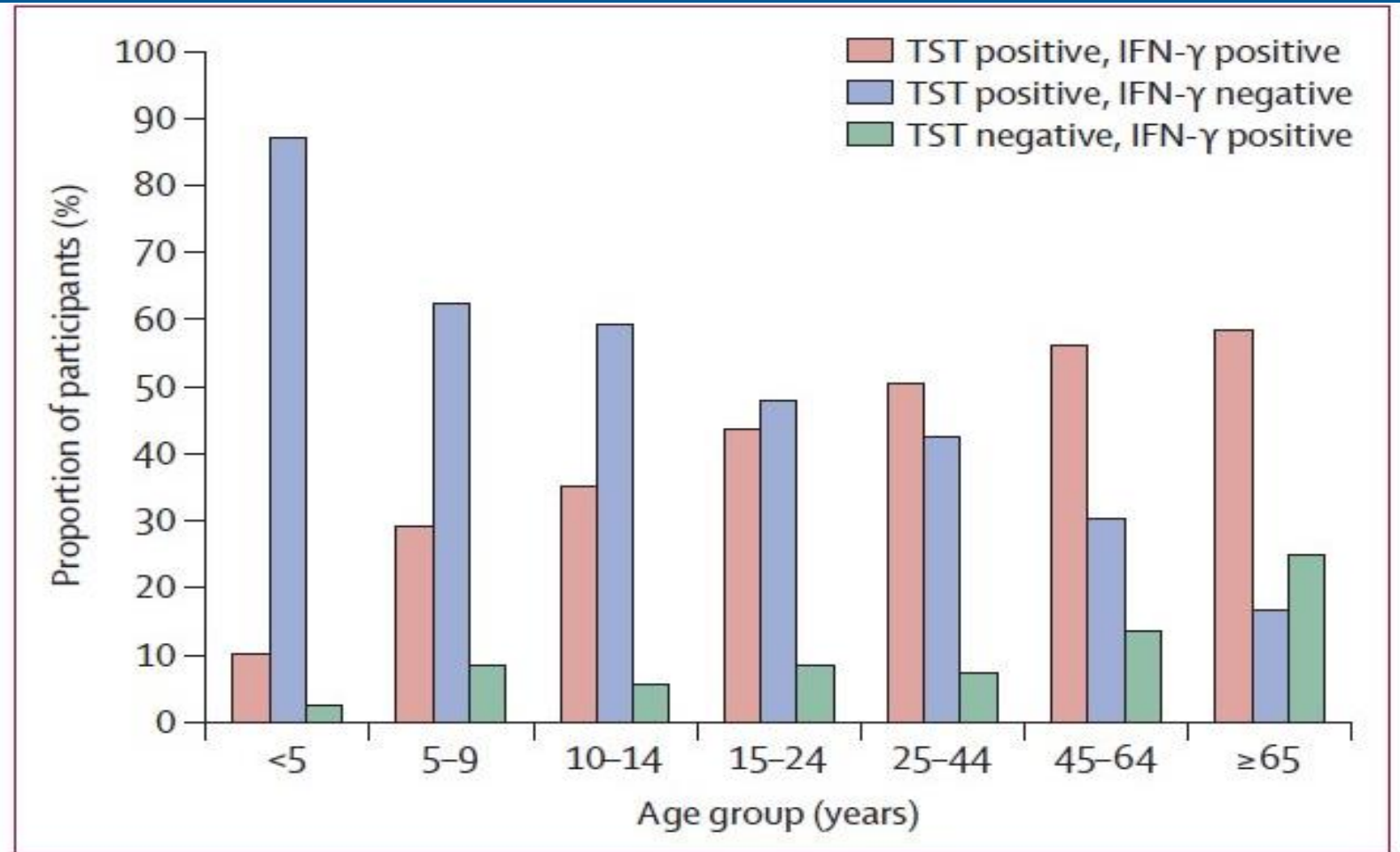


Figure 2: Test combinations for non-US-born participants with at least one positive test
IFN-γ denotes either IFN-γ release assay. TST=tuberculin skin test.

If Child Has a Positive TST or IGRA?



Evaluation of Children with Positive TST or IGRA

- Detailed health history, family history, and physical exam
- Chest radiograph
- Evaluation of signs and symptoms
 - Cough or fever for 2-3 weeks or more
 - Loss of weight or failure to gain weight
 - Lethargy
 - Lymphadenopathy

Latent TB and active TB disease are both reportable conditions in Massachusetts.

TB and School Entry

- Asymptomatic children with pending chest X-ray results should not be excluded from school for a positive TST or IGRA
- Families should be counseled on importance of medical evaluation and encouraged to consider preventative treatment for TB infection if prescribed

Managing a Child with Active TB

- Children with active TB disease, even pulmonary TB, are generally not infectious to others
- Source case investigation will be initiated to identify any family members or caregivers who may need TB evaluation and treatment
- Child with active TB will be monitored by local public health nurse, with support from state TB nurses for duration of treatment
- Sometimes will remain home from school for two weeks from the start of treatment
- Treatment is administered under directly observed therapy (DOT), which may be provided at school

TB Contact Investigations in Schools

- A contact investigation (CI) in schools may be indicated if a child is considered to have been infectious to others
- The CI is a partnership between the school district, the local board of health, and the MA Dept of Public Health (MDPH)
 - Identification, notification, and testing for exposed individuals
 - Sample letters available to assist schools in notifications
 - Onsite IGRA testing by Quest may be provided
 - All efforts made to protect the student's confidentiality
- MDPH offers informational sessions for community education and to field questions from parents/guardians
 - Generally evening Zoom sessions to maximize participation
- Outreach to local pediatricians may also be provided by MDPH

Managing a Child with Latent TB Infection in School

- Directly Observed Preventative Therapy (DOPT) at school
- Monitor side effects of medications
- Support adherence
- Communicate with parents and the local public health nurse if missed doses

Newly Arrived Families in Emergency Housing (1)

- Many newly arrived families have come from or transited through TB-endemic countries
- In August 2023, nurses contracted by DPH began health assessments to support school readiness
 - International vaccination cards were translated and information entered into MIIS
 - Planning for administration of any needed catch-up vaccines
- Anticipated that most of these children would screen positive on TB risk assessments, and that a test of TB infection would be recommended

Newly Arrived Families in Emergency Housing (2)

- Recognized need for TB testing prior to any potential live virus vaccination
- From September 5 to October 6, 2023, onsite testing events were held in emergency housing sites for draw of IGRAs and blood lead levels
- To date, over 800 children have received IGRA testing in communities across the state
 - Approximately 2% of all IGRAs have been positive
 - Children with a positive IGRA are referred for evaluation and care

Newly Arrived Families in Emergency Housing (3)

- Testing events in emergency assistance housing sites have presented some unique challenges
- Onsite testing events can help bring testing most proximate to children and their families
- Individual sites not always conducive to large-scale events or interventions
- Alternate strategies currently being discussed to meet the needs of new residents, to provide low-barrier access to testing, and to deliver these services in family-friendly and client-centered manner

Online Resource

Tuberculosis Screening in Children: Information for Massachusetts School Nurses

Guidance from the Massachusetts Department of Public Health (DPH) on the risk-based approach to screening for TB, methods of testing for TB infection, and the symptoms of active TB disease.

Tuberculosis (TB) is an airborne infectious disease caused by *Mycobacterium tuberculosis*. Screening can identify children at increased risk for TB infection, and who may benefit from TB testing. Treatment is available to reduce the risk of developing active TB, and medications are available to cure TB disease.

TB Risk Assessment and Testing

Summary

- DPH recommends that school-aged children in Massachusetts public or private schools should have a [Pediatric Tuberculosis Risk Assessment](#) completed and documented on the school health form.
- The Pediatric TB Risk Assessment may be performed by school nurses, primary care providers, pediatric clinics, or local public health nurses.
- Children who are at risk of exposure to TB should be tested for TB infection using either the Mantoux tuberculin skin test (TST) or interferon-gamma release assay (IGRA). IGRAs are preferred over TSTs for persons 2 years of age or older with a history of BCG vaccination.
- Children with positive TST or IGRA results should receive a TB symptom screen and be referred for medical evaluation.
- Symptoms that should prompt urgent medical evaluation include unexplained cough for more than 2-3 weeks, fevers, night sweats, weight loss or failure to gain weight, lymphadenopathy, or excessive fatigue.
- Asymptomatic children with positive TSTs or IGRAs and pending chest X-ray results should not be excluded from school but should complete a medical evaluation as soon as possible and preferably within 90 days.

Take Home Points

- Not all children are at equal risk of TB infection
- Massachusetts Pediatric TB Risk Assessment can help identify those who would benefit from testing
- Testing for TB infection may include a TST or IGRA
- IGRAs are preferred for children who have received BCG
- Children with positive tests should be referred for evaluation
- Asymptomatic children with positive tests of TB infection should not be excluded from school entry
- School nurses can help support treatment for children with active TB and latent TB infection with school-based directly observed therapy

Resources

1. Massachusetts Pediatric TB Risk Assessment

mass.gov/doc/massachusetts-tuberculosis-risk-assessment-pediatrics/download

2. Massachusetts Pediatric Tuberculosis Risk Assessment User Guide

mass.gov/doc/massachusetts-pediatric-tuberculosis-risk-assessment-user-guide/download

3. Information on Tuberculosis for Patients and Families in English and 23 other languages

mass.gov/lists/tb-information-for-your-patients-in-english-and-other-languages

4. BCG World Atlas, McGill University

bcgatlas.org/index.php

5. Latent and Active TB Case Report Forms

mass.gov/how-to/report-a-case-of-tuberculosis-disease-or-latent-tb-infection

Questions ?



Massachusetts Department of Public Health

Contact

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