Tuberculosis in Children and Adolescents

George D. McSherry, MD
Division of Infectious Diseases
Penn State Hershey Children’s Hospital
Pediatric Section
Northeastern Regional Training and Medical Consultation Center
NJMS Global Tuberculosis Institute
TB Intensive Workshop
September 13-16, 2011

Classification System for TB

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No TB exposure Not infected</td>
<td>No history of exposure; negative reaction to tuberculin skin test</td>
</tr>
<tr>
<td>1</td>
<td>TB exposure No evidence of infection</td>
<td>History of exposure; negative reaction to tuberculin skin test</td>
</tr>
<tr>
<td>2</td>
<td>TB infection No disease</td>
<td>Positive reaction to tuberculin skin test; negative bacteriologic studies (if done); no clinical, bacteriologic, or radiographic evidence of active TB</td>
</tr>
<tr>
<td>3</td>
<td>TB, clinically active</td>
<td>History of previous episode(s) of TB; clinical, bacteriologic, or radiographic evidence of current disease</td>
</tr>
<tr>
<td>4</td>
<td>TB, not clinically active</td>
<td>History of episode(s) of TB; abnormal but stable radiographic findings; positive reaction to tuberculin skin test; negative bacteriologic studies (if done) and no clinical or radiographic evidence of current disease</td>
</tr>
<tr>
<td>5</td>
<td>TB suspected</td>
<td>Diagnosis pending</td>
</tr>
</tbody>
</table>

Epidemiology

- Tuberculosis remains the leading infectious disease in the world
  - Approximately 1/3 of the world’s population (>1.9 billion people) is infected with *M. tuberculosis*
  - In the 1990s:
    - 90 million new cases
    - 30 million deaths
  - Among children <15 years of age:
    - Approximately 13 million cases
    - 5 million deaths

Reported TB Cases*  
United States, 1982–2009

Number and Percent of All TB Cases Occurring Among Children <15 Years

Number of TB Cases in U.S.-born vs. Foreign-born Persons  
United States, 1993–2009*

Number and Percent Foreign-born Pediatric TB Cases,  
1993–2006

*Updated as of July 1, 2010.
Epidemiology: United States

- Case rates for all ages are higher in urban, low-income areas, and in nonwhite racial and ethnic minorities

- Specific groups with high LTBI and TB disease rates:
  - Immigrants and refugees from high-prevalence regions (Asia, Africa, Latin America, countries of the former Soviet Union)
  - International adoptees
  - Travelers to countries with high-prevalence
  - Homeless people
  - Residents of correctional facilities

Transmission of *M. tuberculosis* to Children

- Children are usually infected by an adult or adolescent in the immediate household

- Casual extra-familial contact is less often the source of infection

- Children rarely infect other children or adults:
  - Tubercle bacilli are relatively sparse in secretions
  - Children with pulmonary TB rarely cough
  - Cough, when present, lacks the force needed to aerosolize bacilli
**Risk of Progression to TB Disease**

- Immunocompetent adults: 5-10% lifetime risk of developing disease after infection
- Adults with TB infection and HIV infection: 5-10% annual risk of developing disease
- Children and the risk of TB disease:

**Risk of Tuberculosis Disease by Age**

<table>
<thead>
<tr>
<th>Age group</th>
<th>Lung disease</th>
<th>Pulmonary tuberculosis</th>
<th>Tuberculosis meningitis</th>
<th>No disease</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 years</td>
<td>10-20%</td>
<td>0-20%</td>
<td>0-20%</td>
<td>0-20%</td>
<td>High rates of mortality and mortality</td>
</tr>
<tr>
<td>1-2 years</td>
<td>2-5%</td>
<td>10-20%</td>
<td>2-5%</td>
<td>5-10%</td>
<td>High rates of mortality and mortality</td>
</tr>
<tr>
<td>2-5 years</td>
<td>0-5%</td>
<td>5%</td>
<td>0%</td>
<td>5%</td>
<td>-</td>
</tr>
<tr>
<td>5-10 years</td>
<td>&lt;0.5%</td>
<td>2%</td>
<td>0.5%</td>
<td>98%</td>
<td>&quot;Safe schoolyears&quot;</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>&lt;0.5%</td>
<td>10-20%</td>
<td>80-90%</td>
<td>10-20%</td>
<td>Effusions or adult-type pulmonary disease</td>
</tr>
</tbody>
</table>

Adapted from reference 36.

Table 1: Risk of pulmonary and extra pulmonary disease in children following infection with Mycobacterium tuberculosis

Increased Risk of Progression of LTBI to Tuberculosis Disease

- **Age groups:**
  - Infants and young children
  - Post pubertal adolescents

- **Recent infection:**
  - Highest risk in first 6 months after infection
  - Remains high for 2 years

- **Recent immigration**

- **Immunodeficiency:**
  - HIV infection, Hodgkin disease, lymphoma, diabetes mellitus, chronic renal failure, malnutrition
  - Immunosuppressive drugs:
    - Prolonged or high-dose corticosteroid therapy
    - Chemotherapy
    - Tumor necrosis factor (TNF-alpha) antagonists used to treat arthritis, Crohn's disease: Infliximab, etanercept, adalimumab, golimumab

Control of Tuberculosis in the United States

- **Case finding and treatment**

- **Contact investigations**
  - The most reliable TB control program is based upon aggressive and expedient contact investigations, rather than routine screening of large populations
  - Can be complex and may require lots of detective work

- **Targeted testing with tuberculin skin test or IGRA**

Prevention of TB in Children: Potential Missed Opportunities

- Failure to find and appropriately manage adult source cases (Case finding)

- Delay in reporting the initial diagnosis of TB

- Contact investigation interview failure

- Delay in evaluation of exposed children

- Failure to completely evaluate exposed children

- Failure to prescribe INH “window prophylaxis”

- Failure to maintain a contact under surveillance

- LTBI diagnosed; treatment not prescribed

- Failure to complete treatment for LTBI

Tuberculosis Exposure in Children

- **History, PE, TST, CXR are done**
  - CXR is done regardless of TST result

- **IF the child is:**
  - Asymptomatic and physical examination is normal
  - TST is negative (<5 mm)
  - Chest X-ray is normal

- **AND IF <4 years of age START “WINDOW PROPHYLAXIS”:**
  - Isoniazid (INH) 10 mg/kg (max., 300 mg) PO once daily
**Tuberculosis Exposure in Children**

- Why is “Window Prophylaxis” given if there is no evidence of TB infection or disease at the initial visit?
  - May already be infected
  - Infection more likely to progress to disease
  - Infants and younger children are more likely to have disseminated disease or meningitis

- TST repeated 8-10 weeks after contact broken with infectious adult:
  - If TST (-), discontinue INH
  - If TST (+), re-evaluate child and treat accordingly

---

**Timetable of Tuberculosis in Children after Walgren**

![Timetable](image)

---

**Contact Investigations and TB-Exposed Children: Case#1: The Need for Speed or Nightmare in Daycare**

4 yr old

TST: 0.0 mm
7

INDEX CASE (Patient)

- 6/14 (Monday): 39 year-old female was admitted to a suburban New Jersey hospital with history of fever, decreased appetite, 23 lb wt loss, cough for 3 months, night sweats
- Chest x-ray:

Presenting Patient (Index case)

- 6/17 (Thursday): Sputum was obtained for AFB studies; AFB smear reported as (4+); AFB subsequently confirmed as *M. tuberculosis*
- 6/19 (Saturday): Treatment with INH, RIF, PZA, & Emb started
- 6/21 (Monday): Presumptive case of TB verbally reported to local health department
  - Included in the report: Place of employment - a Daycare Center (DCC) *RED FLAG DAY #1*
  - Same day: Health department nurse contacted TB controller for the county

Contact Investigation Initiated

- 6/21 (Monday): Maintaining confidentiality, TB controller calls asst. dir. of DCC to schedule CI management meeting and on-site assessment; asst. dir. volunteers that index pt. is her aunt (*I know who this is...*)
  - Secretarial volunteer 1-2 hrs/week
  - Works at desk doing paperwork, filing
  - Little or no contact with children in the daycare
- Asst. dir. also reveals that she has 6 mo. old infant, exposed to index pt. socially on weekends (10 hrs/wk):
  - “Does not attend daycare”
  - “Diagnosed with pneumonia 4 weeks ago” *RED FLAG #2*
  - TB controller arranges with local health department to have TST placed that day on the infant at home; CXR scheduled
- In subsequent TB Q & A sessions with parents it is learned that infant was at daycare regularly

Contact Investigation, cont.

- 6/22: First of 4 interviews of index patient by 3 different interviewers is held in hospital
  - Infectious period: 3/17-6/14/04 (Contact broken)
  - May have spent more time daycare than originally described (2-3 hrs/day) by niece
    - Not much contact with children
    - Household (2) and social contacts (7) identified
- 6/23: On-site assessment of DCC conducted by TB controller:
  - High priority contacts: 35
    - 30 children attend: All ≤4 years of age
    - 5 staff members: Adults and adolescents
    - Daycare is in a church basement
Contact Investigation, cont.

- 6/23: Field visit by PHR to home of social contacts reveals a second 6 mo. old infant previously identified by index patient interview:
  - Significant social contact
  - History of pneumonia 3 weeks prior "RED FLAG #3"
  - PHR & TB controller consult with PNP and infant is referred to ER for evaluation
  - Chest radiographs are done:

6/23: 6 month old infant

- Right upper and middle lobe infiltrate with faint miliary pattern
- TST: 20 mm
- Admission PE: Somewhat lethargic
- LP - 10 wbc's: nl protein, nl glucose;
- Gastric aspirates X3: (+) *M. tuberculosis*

2nd 6 month-old infant

- Right upper and middle lobe collapse consolidation
- Hilar adenopathy
- TST: 17 mm
- Gastric aspirates X3: (+) *M. tuberculosis*
Contact Investigation

- 6/29 - 6/30: TST administered on all 35 daycare contacts and chest x-ray taken on all 30 children from daycare
- 6 extra clinic sessions scheduled at clinic in addition to 3 evening clinics at local health department to accommodate the medical evaluations of the 30 children

Contact Investigation Summary Results

<table>
<thead>
<tr>
<th>Daycare Center</th>
<th>35</th>
<th>30 &lt; 4 yrs old</th>
</tr>
</thead>
<tbody>
<tr>
<td>TST (+)</td>
<td>14/35 (40%)</td>
<td></td>
</tr>
<tr>
<td>TST (-)</td>
<td>21/35 (60%)</td>
<td></td>
</tr>
<tr>
<td>TB disease</td>
<td>7/35 (20%) All ≤ 4 yrs old</td>
<td></td>
</tr>
</tbody>
</table>

Investigation Totals 44 32 < 4 yrs old

| TST (+)        | 19/44 (43%) |
| TST (-)        | 25/44 (57%) |
| TB disease     | 9/44 (20%) All ≤ 4 yrs old |

Observations on Private Pediatrician Involvement in Contact Investigations

- 6 of 30 (20%) of the exposed children were initially evaluated in conjunction with their pediatricians:
  - TSTs read by pediatricians were reported in at least one case as negative, i.e.: Not in millimeters
  - TSTs 0.0 (zero) mm: (3)
    - H & PE, CXR done: None
  - TSTs 0.0 (zero) mm + CXR (-): (2)
    - H & PE done: None
  - INH prescribed for prophylaxis for 6 contacts <4 yrs of age: None
  - In each case TCs made to assure proper evaluation were followed by a referral to TB Center for the evaluation
Contact Investigation: Lessons

• Despite the rapidity of the contact investigation 9 cases of TB disease occurred in young children
  – Children develop disease soon after infection so it is imperative to move quickly

• Pediatricians are generally not familiar with standard evaluations of children exposed to tuberculosis and use of INH in such situations

• Radiological expertise with young children is important:
  – In this CI, 7/30 CXRs either needed to be repeated or were interpreted incorrectly

• Education: Parents, students, teachers, media

Case #2. Three generations, two families and a pediatrician….

Or, Source cases, index cases, and contact investigations… you never know what you’ll get if you keep your eyes open…and keep asking questions
Could this child have TB?

THE IMPORTANCE OF EPIDEMIOLOGY in childhood TB… if we could only find an adult source case…
Potential Missed Opportunities in TB Control

- Two children with LTBI from one family see their private pediatrician for evaluation and management after mother insists to health department that she would like them seen by the pediatrician:
  - Receive prescriptions for INH plus 8 refills
    - No follow-up appointments are given
    - Social history: Homeless, 5 children, mother with her own serious health problems, holding down a full-time job
  - Set-up for another missed opportunity? Strong probability
    - Will therapy for LTBI be completed?

Potential Missed Opportunities in TB Control

- Initially, 5/18 children are diagnosed as TB-exposed
  - Two (Ages 6 & 28 months) identified in the contact investigation have 0.0 mm TSTs and normal CXRS at the health department
  - Mother (same family as above) insists to health department that she would like them to be seen by their private pediatrician
    - No PE done
    - No INH “window prophylaxis” given
Case History: Final Numbers

- Eighteen children were exposed to a 26-year old woman with bilateral cavitary pulmonary tuberculosis:
  - 15/18 (83%) children are infected
    - 9/15 (60%) develop TB disease
      - 2 after initial negative TST (Missed opportunity)
      - 1 TB meningitis, 2 miliary
    - 6/15 (40%) have LTBI
      - 3/18 (17%) are TB-exposed but not infected
- Through 3 generations: All 2nd and 3rd generation cases preventable
  - TB-infected child of today may become the index pt. of tomorrow without treatment for LTBI

AAP Recommendations: Targeted TB Testing

- What is Targeted TB Testing?
  - Identifies persons at high risk for TB who would benefit by treatment of LTBI

- Why not do universal, administratively mandated TB testing with the TST or IGRA as the screening tool?
  - Daycare, schools, summer camp.

- Answer: Limitations of the tests
  - Universal testing means that large numbers of low risk children will be tested
    - Even with specificity approaching 99%, if LTBI prevalence is ≤1%, the majority of positives are false positive
      - Resulting in unnecessary evaluation and treatment: Diverts resources
      - Increasing risk of adverse events
    - IGRA specificity reduces but does not eliminate all false positives in low risk population
**Targeted TB Testing**

- **Risk assessment:**
  - Signs and symptoms consistent with TB disease
  - Contact and source-case investigations
  - ≥1 risk factor identified on screening risk-assessment questionnaire
    - General pediatric practice
    - School-based healthcare
  - High risk of progression due to underlying conditions

**Targeted TB Testing Risk-Assessment Questionnaire**

- Has a family member or contact had TB disease?
- Has a family member had a positive TB skin test?
- Was your child born in a high-risk country (i.e. outside US, Canada, Australia, New Zealand, or Western European countries)?
- Has your child traveled to a high-risk country and spent >1 week with the resident population?

Red Book 2009

**Parental Reading of Tuberculain Skin Testing**

- TST was placed on 37 children from different families
  - Parents were instructed verbally about
    - The importance of the test
    - When and how to read induration
    - Given written instructions
    - Had the date stamped on their hands
    - Site was marked with permanent marker and a bracelet with the reading date was placed on the child’s hand

- Results: 36/37 returned for reading
  - Only 22% of families (8/36) were able to both read and document skin test results appropriately

Cheng TL, PIDJ 1996

**BCG Vaccine and Tuberculin Skin Testing**

- History of a BCG is never a contraindication to tuberculin skin testing
- Interpretation of TST results in BCG recipients is the same as for people who have not received the vaccine
- Difficult to distinguish between (+) TSTs caused by infection with *M. tuberculosis* and those caused by BCG
  - Reactivity does not occur in some children after receipt of BCG
  - If BCG does cause a positive TST, the reaction is generally negative by 5 years of age
  - If child is from a high-burden country, (+) PPD is almost always due to LTBI
- Therefore, management of children with a history of BCG and a (+) TST includes:
  - Diagnostic evaluation including a chest radiograph
  - Appropriate treatment
Interferon gamma release assays: Use in children

- Published experience less in children
- Can be used in children ≥5 yrs of age
- May be useful in children who received BCG vaccine
- Do not distinguish between LTBI and TB disease
  - Negative IGRA does not rule out either in child with suspicious findings
- Interpretation of negative IGRA in child with (+) TST is not clear
  - No longitudinal studies to establish negative predictive value

Evaluation of the Child with a positive TB test (TST, IGRA)

- Evaluation of all children with a positive TB test should include:
  - A careful history for symptoms of disease
  - Physical examination
  - Chest radiographs (PA & lateral)
  - Household investigation

Treatment of Latent Tuberculosis Infection

- INH 10-15 mg/kg (max., 300 mg) PO daily for 270 doses
  - Efficacy approaches 100%
- Alternative: Twice weekly directly observed (DOT) INH 20-40 mg/kg (max., 900 mg) PO for 72 doses
- Monitor index case isolate sensitivities
- Hepatotoxicity from INH is rare in children:
  - A monthly assessment for clinical evidence of hepatotoxicity should be made: malaise, loss of appetite or weight, nausea, vomiting, abdominal pain, jaundice
  - Routine monitoring of LFTs is not indicated

School-Based DOT

- School nurse can administer DOT in school
- Clinician will provide regimen for nurse to follow
- School nurse can give feedback to clinician on frequency of dosing that works well for child (medication must be given only once a day, but can vary the amount of times per week as per physician order)
- School nurse can also provide feedback on child’s medical condition
**Treatment of Latent Tuberculosis Infection**

- **Rifampin 10-15 mg/kg/day (max. 600 mg) po daily for 6 months is an alternative**
  - INH not tolerated
  - Index patient isolate INH-resistant

- **MDR-LTBI: TREAT????NOT TREAT????**
  - Treatment can reduce risk of disease by up to 2/3
  - Regimen based on susceptibilities of index patient isolate

- **Child from a country with “a lot of resistance” shouldn’t treat with more than just INH? No.**

**How Children with Tuberculosis are Identified**

- **Presentation with a symptomatic illness**
- **Discovery of a child with pulmonary tuberculosis during contact investigation of an adult with tuberculosis**
  - Few or no symptoms
  - Evaluation: (+) TST and abnormal CXR
  - In some areas of U.S. up to 50% of children with PTB are discovered in this manner
  - Before significant symptoms have developed

**Pediatric TB Cases by Site of Disease, 1993–2006**

- **Any extrapulmonary involvement** (totaling 28.9%)
  - Pulmonary: 71.8%
  - Lymphatic: 18.9%
  - Miliary: 1.5%
  - Meningeal: 1.5%
  - Bone & Joint: 1.5%
  - Other: 3.9%

*Any extrapulmonary involvement which includes cases that are extrapulmonary only and both patients may have more than one disease site but are counted in mutually exclusive categories for surveillance purposes.

**Mycobacteriologic Diagnosis of Tuberculosis**

- **Adults:** 70-90% have a sputum that is (+) for *M. tuberculosis*
- **Children:**
  - Tubercle bacilli are relatively few in number
  - Sputum generally cannot be obtained from children <10 yrs old
  - Gastric aspirates in children with PTB
    - 30-40% sensitive in children
    - 60-70% sensitive in infants
  - Bronchoalveolar lavage (BAL): Sensitivity may be less than gastric aspirates
- **CDC:** 15,946 pediatric cases, 1993-2006: 24% lab (+), 51% clinical criteria, 24% provider diagnosis
Difficulties in the Diagnosis of Tuberculosis in Children

- Children are often asymptomatic or symptoms are nonspecific: Fever, poor appetite, poor weight gain or weight loss
  - Approximately 25-30% of disease is extrapulmonary
  - Meningitis and miliary disease tend to develop soon after infection
    - 70-80% occur in children 0-4 years of age
- Epidemiologic link (The adult source case)
  - Crucial to identify the adult source case for the child
    - Provides strong evidence that the child suspected of having TB disease actually has TB
    - May be the only isolate available for susceptibility testing

- Physical examination may be normal
- TST may be negative (10%)
- Chest radiograph: Any lobe of the lung may be involved
  - Good technique/Experience with children
  - Two views
  - Careful interpretation
Tuberculosis in Adolescents

- Adolescents develop tuberculosis in one of two ways:
  - Reactivation of infection acquired during childhood
    - Chronic pulmonary tuberculosis
    - The closer to puberty at the time of infection the greater the risk of reactivation
  - Progression of infection acquired during adolescence to disease:
    - Classic primary disease
    - Progressive primary pulmonary tuberculosis
    - Chronic pulmonary tuberculosis

Reactivation Tuberculosis

- Constitutional symptoms often more prominent than respiratory symptoms
  - Weight loss and fever are very common
  - Cough, chest pain, hemoptysis
  - Drenching night sweats occur several times per week
- Cavitary lesions frequently seen

Pulmonary TB: Adolescents
Case #3: A missed opportunity:

Why LTBI is important

OR

Can you die from TB if you are a teenager?

Case

• 8-year old girl, recently arrived from Haiti was evaluated at the DOH for a 12 mm TST reaction

• There were no symptoms of TB disease and PE was normal

• A chest radiograph was done:

Hospital Admission

• The pt., now 13-years of age was admitted to an outside hospital with a 3 week history of fever, cough, increasing dyspnea, weakness

  – She had been sent home by the school nurse on 4 occasions over 2 months for the fever and cough and then for weight loss and weakness

  • She was seen on 2 occasions by her PCP and was given antibiotics (azithromycin) And twice in EDs of local hospitals:

    – The last ED visit was 9 days PTA when chest radiographs were done and amoxicillin-clavulanate (Augmentin) was given

    – There was no improvement with antibiotic

• INH 200 mg po once daily; #30 tabs were dispensed

• There are no notes in the chart until 6 months later when the following is written: “Overdue for medication refill.”

• There were no further notes….until 5 years later.
Case

- **PE:** Cachetic, weak appearing female with flat affect and in mild respiratory distress
- **T:** 103.2°F  **HR:** 160’  **RR:** 22’  **O₂ sat:** 92%
- **Wt:** 78.7 lbs  **UBWt:** 96.7 lbs
- **Treatment:** IV ceftriaxone and oral azithromycin
- **Sputa sent:**
  - Smear: Few AFB; culture (+) MTB; pansensitive
  - Smear: Few AFB; culture (+) MTB
  - Smear: Rare AFB; culture (+) MTB

---

**Vital Sign Graphic Sheets**

- **TB meds started:** RIPE
- **No notes on chart from 7/2-7/7**
- **Concern with continued fever, a short note appears in the chart:**
  - Please arrange social service consult for pt. “noncompliance” with medications, family safety.
  - ? Should we obtain court intervention? Or possible referral to DYFS?
- **Health insurance medical director recommend conference call between PCP and a Dr. Lee Reichman of TB Center at UMDNJ in Newark**
**Case**

- **7/12: Discharge**
  - Remains febrile
  - Came directly to Chest Clinic with “TB escort” plus brother and sister
    - Cachetic, weak with unsteady gate
    - Continued treatment added Boost supplement, ibuprofen
    - DOT by RN
    - Home visit by CRNP
      - Weak, tires easily, poor oral intake bed ridden, bed-bathroom, bedroom had no windows, home was very warm (no AC)
      - Tachypneic, tachycardic

- **7/19: Wt 72 lbs**

- **7/24: CT scan chest (high resolution)**
  - Call from CRNP, pt. very weak, tachypneic, may need admission

**Case**

- **Hospitalized 7/24-8/17: TB, weaker, hypoxia, cachexia; wt down to 66 lbs**

- **RR - 40’ O₂ sat 90%**

- **Continued TB meds; oxygen**

- **NGT placed for continuous nutritional supplementation**

- **Gradually regained strength and began to walk**

- **Discharge: 8/17 RR – 20’ on 1L oxygen; Wt 76 lbs**
  - TB meds and supplement
  - AC purchased and placed in home

- **8/23: Wt. 88 lbs; RR = 18’ O₂ sat 97% on RA**

- **9/20: Wt. 97 lbs; RR = 18”**

- **11/1: Wt. 99 lbs**

- **12/13: Wt 102 lbs**
Treatment of Tuberculosis in Children and Adolescents

- If INH resistance rate >4% or if other risk for resistance include four drugs in initial regimen:
  - Isoniazid (10 mg/kg/day, range 10-20, max. 300)
  - Rifampin (15 mg/kg/day, range 10-20, max. 600)
  - Pyrazinamide (20-30 mg/kg/day)
  - Ethambutol (15-25 mg/kg/day)

- Directly observed therapy (DOT)

- Monitor LFTs – Depends on severity of disease

- Follow susceptibility studies of Mtbc isolate (Index and/or child isolate)
  - Important to be familiar with resistance patterns in the community

Negotiating a Plan for DOT

- Establish plan with family for DOT while child is in the hospital or at first out-patient visit
  - Assess child/family
  - Coordinate necessary resources/services
  - Individual treatment regimens:
    - Time/food/place/who
    - Daily vs. intermittent
    - Involve outreach worker/school nurse

- Renegotiate if non-adherence occurs

Assessing Adherence Barriers

- Parents: Adherence can be influenced by:
  - Parenting skills
  - Motivation
  - Personal health beliefs, stigma
  - Other competing life circumstances

- In children and adolescents adherence can be influenced by:
  - Developmental level
  - Behavioral characteristics

Difficulties in Treatment

- Lack of:
  - Initial symptoms
  - Observable improvement
  - Culture “proof”

- Child unfriendly dosing forms, chronic dosing

- Education of the caregiver or multiple caregivers

- Language/cultural differences
  - “There’s no TB in my country”
  - Social consequences of diagnosis

- Effect of employment on adherence

- Communication with the child
Summary

• Reported cases of tuberculosis in the U.S.:
  – More than 2/3 occurs in nonwhite racial and ethnic groups
  – More than 50% occur in foreign born persons
  – Among children case rates are highest in infants and postpubertal adolescents

• Children are usually:
  – Infected by adult or adolescent household contacts
  – Not infectious (contagious)

• Contact investigations and targeted TB testing are mainstays of TB control in the U.S.
  – Evaluation of TB-exposed child: PA, CXR, window prophylaxis
  – Risk assessment questionnaires are the most effective screening tool to detect children at risk for LTBI

• TB diagnosis in young children requires a high index of suspicion

• DOT is key to successful treatment