

CONTACT INVESTIGATION  
HIGH SCHOOL



Barbara B. Andrino, M. D.  
Fairfax County Health  
Department

---

---

---

---

---

---

---

---

Patient 1

- 19 yo female who emigrated from Pakistan in July 2010
- She had TST placed 9/2011, 9 mm(negative), no CXR required
- Presented to Inova Fairfax Hospital in 12/2012 with history of cough for 4 months, fever to 101 degrees F, fatigue, night sweats and 10 lb. weight loss

---

---

---

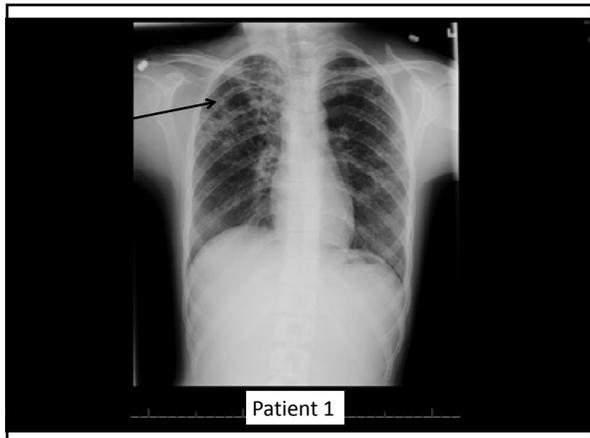
---

---

---

---

---



---

---

---

---

---

---

---

---

### Patient 1

- CXR showed moderate infiltrate in RUL with a cavity and mild infiltrate in LUL
- CT scan chest showed two cavitary lesions in the RUL
- Sputum AFB smear positive 3+
- Sputum culture M. tb, pan susceptible

---

---

---

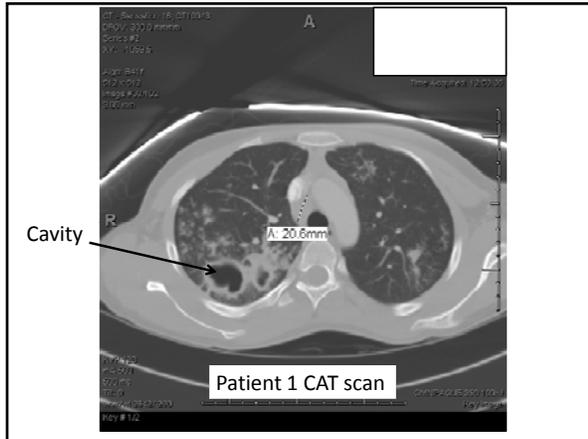
---

---

---

---

---



---

---

---

---

---

---

---

---

### Patient 2

- 14 yo female who emigrated from Ethiopia in February of 2013
- TST 11/2012 in Ethiopia 0 mm
- TST 2/15/13 18 mm @FCHD, CXR wnl
- Offered treatment for latent TB infection but parent declined

---

---

---

---

---

---

---

---

### Patient 2

- Presented in 6/2013 with 2 weeks of fever, decreased appetite, cough, fatigue, weight loss of 3 lbs, chills, night sweats
- Thought initially to have urinary tract infection, then thought to have community acquired pneumonia

---

---

---

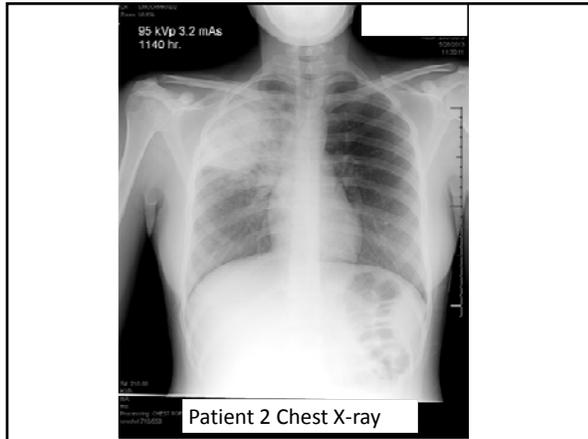
---

---

---

---

---



---

---

---

---

---

---

---

---

### Patient 2

- Noncavitary, right upper lobe infiltrate
- Sputum AFB smear positive
- HIV negative
- Sputum culture positive for M. tb
- Susceptibilities show organism resistant to Isoniazid (INH)
- Therapy changed: INH discontinued; Rifampin, Ethambutol and Pyrazinamide given 5 days a week by DOT for 26 weeks total

---

---

---

---

---

---

---

---

### Patient 3

- 16 yo female
- USA born
- No prior TST
- No foreign travel
- Shared one class with patient #1

---

---

---

---

---

---

---

---

### Patient 3

- Presented in May of 2013 with shoulder pain, chest tightness, minimal cough and increasing shortness of breath
- Noted by her primary doctor to have diminished breath sounds on her left chest and sent for a CXR.

---

---

---

---

---

---

---

---

Patient 3



---

---

---

---

---

---

---

---

### Pleural TB

- Admitted to Inova Fairfax Hospital
- Underwent a Video Assisted Thorascopic Surgery (VATS procedure)with pleural biopsy and chest tube placement
- Biopsy showed necrotizing granulomas
- TST 9 mm
- Quantiferon positive at 1.81, 1.06 (>0.35 IU/ml)

---

---

---

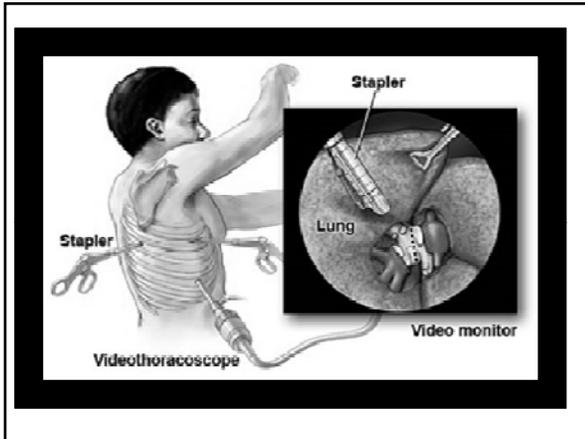
---

---

---

---

---



---

---

---

---

---

---

---

---

### Patient 3

- Pleural fluid showed predominance of lymphocytes, elevated Adenosine Deaminase (ADA) of 53
- Pleural fluid culture positive for M. tb, pan susceptible
- Sputa AFB smears negative x 3
- Sputa cultures negative x 3

---

---

---

---

---

---

---

---

### ADENOSINE DEAMINASE (ADA)

Enzyme involved in purine metabolism  
Primary function is development and maintenance of immune system  
May be elevated in pleural fluid, peritoneal fluid, and CSF of patients with TB  
Level above 40 IU/ml considered suggestive of Tb in pleural effusion

---

---

---

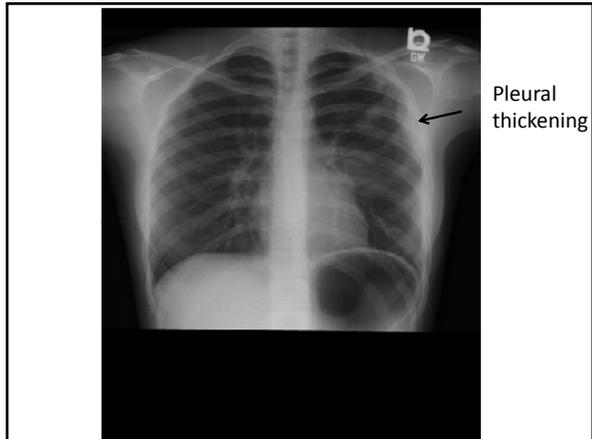
---

---

---

---

---



---

---

---

---

---

---

---

---

### CONTACT INVESTIGATION

---

---

---

---

---

---

---

---



Diversity in student body

---

---

---

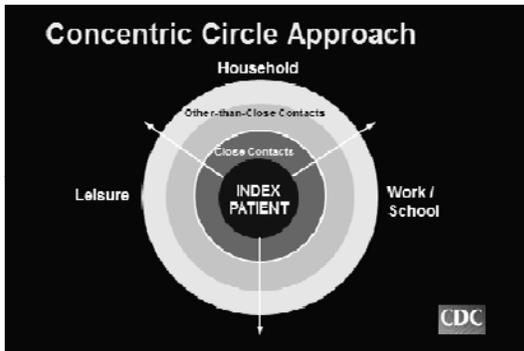
---

---

---

---

---



---

---

---

---

---

---

---

---

**High Priority Contacts\***

- 8 or more hours in small, poorly ventilated space
- 16 or more hours in small, well ventilated space
- 24 or more hours in a classroom size space
- 100 or more hours in a large open area

\*Contacts to Sm+ or Cavitory DZ

---

---

---

---

---

---

---

---

Examine the classrooms



---

---

---

---

---

---

---

---

Don't forget the bus



---

---

---

---

---

---

---

---

Look at airflow in the room



---

---

---

---

---

---

---

---

### Who are our canaries?

USA born



Many USA born with other risk factors for TB exposure/infection



---

---

---

---

---

---

---

---

The contact investigation would expand until the rate of positive skin test results for the contacts was indistinguishable from the prevalence of positive results in the community (5). In addition to its simplicity and intuitive appeal, an advantage to this approach is that contacts with less exposure are not sought until evidence of transmission exists. Disadvantages are that 1) surrogates for estimating exposure (e.g., living in the same household) often do not predict the chance of infection, 2) the susceptibility and vulnerability of contacts are not accommodated by the model, and 3) the estimated prevalence for tuberculin sensitivity in a specific community is generally is unknown. In addition, when the prevalence for a community is known but is substantial (e.g., >10%), the end-point for the investigation is obscured.

MMWR Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis December 16, 2005/Vol. 54/No. RR-15

---

---

---

---

---

---

---

---

### NHANES DATABASE

Study of prevalence of Tuberculosis Infection in the United States Population from 1999-2000

---

---

---

---

---

---

---

---

**TABLE 1. ESTIMATED LATENT TUBERCULOSIS INFECTION PREVALENCE AND NUMBERS WITH LATENT TUBERCULOSIS INFECTION IN THE CIVILIAN, NONINSTITUTIONALIZED U.S. POPULATION, 1999-2000**

Characteristics	LTBI Prevalence % (95% CI)	Population with Characteristic, n (x 1,000)	No. (x 1,000) with LTBI (95% CI)
All participants	4.2 (3.3-5.2)	268,284	11,213 (8,938-14,038)
Sex			
Male	5.2 (4.2-6.4)	131,052	6,747 (5,455-8,324)
Female	3.2 (2.3-4.0)	137,232	4,434 (3,110-6,294)
Age group, yr			
1-14	1.1 (0.5-2.4)*	57,262	636 (296-1,357)
15-24	2.4 (1.1-5.0)*	39,352	942 (449-1,948)
25-44	5.0 (3.7-6.6)	84,806	4,227 (3,170-5,612)
45-64	6.5 (4.5-9.5)	56,455	3,681 (2,511-5,341)
≥65	5.6 (3.7-8.4)	30,409	1,713 (1,135-2,562)
Race/ethnicity			
Non-Hispanic white	1.9 (1.3-2.9)	182,745	3,548 (2,361-5,313)
Non-Hispanic black/African American	7.0 (5.3-9.1)	32,036	2,244 (1,711-2,928)
Mexican/Mexican American	9.4 (7.6-11.5)	20,815	1,958 (1,589-2,402)
Other	10.8 (7.2-15.9)	32,688	3,523 (2,341-5,198)

**TABLE 1. ESTIMATED LATENT TUBERCULOSIS INFECTION PREVALENCE AND NUMBERS WITH LATENT TUBERCULOSIS INFECTION IN THE CIVILIAN, NONINSTITUTIONALIZED U.S. POPULATION, 1999-2000**

Characteristics	LTBI Prevalence % (95% CI)	Population with Characteristic, n (x 1,000)	No. (x 1,000) with LTBI (95% CI)
All participants	4.2 (3.3-5.2)	268,284	11,213 (8,938-14,038)
Sex			
Male	5.2 (4.2-6.4)	131,052	6,747 (5,455-8,324)
Female	3.2 (2.3-4.0)	137,232	4,434 (3,110-6,294)
Age group, yr			
1-14	1.1 (0.5-2.4)*	57,262	636 (296-1,357)
15-24	2.4 (1.1-5.0)*	39,352	942 (449-1,948)
25-44	5.0 (3.7-6.6)	84,806	4,227 (3,170-5,612)
45-64	6.5 (4.5-9.5)	56,455	3,681 (2,511-5,341)
≥65	5.6 (3.7-8.4)	30,409	1,713 (1,135-2,562)
Race/ethnicity			
Non-Hispanic white	1.9 (1.3-2.9)	182,745	3,548 (2,361-5,313)
Non-Hispanic black/African American	7.0 (5.3-9.1)	32,036	2,244 (1,711-2,928)
Mexican/Mexican American	9.4 (7.6-11.5)	20,815	1,958 (1,589-2,402)
Other	10.8 (7.2-15.9)	32,688	3,523 (2,341-5,198)
Poverty			
Poverty income index <1	5.5 (3.7-8.4)	15,406	8,488 (4,891-14,653)
Poverty income index <1	6.1 (4.0-9.1)	45,810	2,791 (1,853-4,160)
Education level			
<High school	5.6 (4.4-7.1)	100,297	5,575 (4,368-6,951)
High school graduate	5.4 (3.7-7.5)	57,679	1,804 (1,217-2,650)
Beyond high school	5.7 (4.3-7.7)	97,314	3,676 (2,575-5,107)
Birthplace			
U.S.	1.8 (1.4-2.1)	231,227	4,134 (3,073-5,607)
Foreign	18.7 (15.5-22.2)	37,057	8,008 (5,993-9,797)

**Results by Country of Birth**

Exposure	# of US Born Contacts Tested/Positive	% US Born Positive	# FB Contacts Tested/Positive	% FB Positive	# of Unknown Origin Tested/Positive	% Unk Positive
1	80/8	9.3%	48/11	22.5%	0/0	0%
2	65/2	3.1%	42/12	28.6%	1/0	0%
3	141/6	4.3%	80/5	16.7%	5/0	0%



### Expansion of Investigation

- Percentage of positives in the school USA-born population (9.3%, 3.1% and 4.3%) exceeded the estimated positive rate in the general USA-born. (1.8-4.2%)
- Due to the increased rate the investigation was expanded to include medium and low priority contacts.

---

---

---

---

---

---

---

---

When determining whether to expand the contact investigation, consideration of the following factors is recommended:

achievement of program objectives with high- and medium-priority contacts; and extent of recent transmission, as evidenced by

- unexpectedly high rate of infection or TB disease in high-priority contacts (e.g., 10% or at least twice the rate of a similar population without recent exposure, whichever is greater),
- evidence of secondary transmission (i.e., from TB patients who were infected after exposure to the source patient),
- TB disease in any contacts who had been assigned a low priority,
- infection of contacts aged <5 years, and
- contacts with change in skin test status from negative to positive between their first and second TST.

---

---

---

---

---

---

---

---

### 2<sup>nd</sup> TST Results

Exposure	# Indicated for Testing*	# Tested	# Positive	% Positive
1	30	27	2	7.4%
2	81	61	5	8.2%
3	131	66	3	4.5%
Total	243	154	10	6.5%




---

---

---

---

---

---

---

---

### Medium Priority Contacts\*

- Age  $\geq$ 4 yrs and  $<$ 15 yrs
- 4 or more hours in a small space
- 8 or more hours in a classroom size space
- 50 or more hours in large open space

\*Contacts to Sm+ or Cavitory DZ

---

---

---

---

---

---

---

---

### Test classes following as next circle




---

---

---

---

---

---

---

---

### Results by Country of Birth

Exposure	# of US Born Contacts Tested/ Positive	% US Born Positive	# FB Contacts Tested/ Positive	% FB Positive	# of Unknown Origin Tested/ Positive	% Unk Positive
1	86/8	9.3%	48/11	22.9%	0/0	0%
2	65/2	3.1%	42/12	28.6%	1/0	0%
3	141/6	4.3%	30/5	16.7%	5/0	0%
1 (+1 Class)	15/0	0%	6/1	16.7%	0/0	0%
1 (+2 Class)	29/3	10.3%	15/7	46.7%	0/0	0%
2 (+1 Class)	24/3	12.5%	15/6	40.0%	0/0	0%
2 (+2 Class)	36/4	11.1%	17/2	11.8%	1/0	0%
School	699/36	5.2%	349/105	30.1%	24/1	4.2%
Total	1095/62	5.7%	522/149	28.5%	31/1	3.2%




---

---

---

---

---

---

---

---

### Data Analysis

- All data was entered into TB Access Database from the data sources.
- Data was exported into Epi Info(statistical analysis software) and analyzed.



37

---

---

---

---

---

---

---

---

### LTBI Therapy

- Decision was made to treat all individuals with a positive TST with therapy for latent TB infection.
- Due to the presence of INH resistance in the organism of patient #2, Rifampin for 4 months was used as medication of choice.

---

---

---

---

---

---

---

---

### Lessons Learned

- Management of data is a challenge.
- Flexibility was required as more information developed.
- The true estimated prevalence in your community may not be readily available.
- Communication with all involved is important( contact investigation workers, private physicians in community, school officials, and general public).
- ICS( Incidence Command Center) structure was helpful in organizing coordinated effort.

---

---

---

---

---

---

---

---