Congenital Tuberculosis

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Levine Children’s Hospital
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Disclosures

- I have no financial disclosures

- I am not planning to discuss off-label use of any products
Terminology

- Congenital tuberculosis
  - Ante-partum (in utero)
  - Intrapartum

- Postpartum
  - Exposure to mother or other contact with contagious tuberculosis
  - More common than congenital tuberculosis
Congenital TB: Pathophysiology

- **Ante-partum**
  - Hematogenous spread through umbilical vein
    - Liver, lungs involved
  - Aspiration/inhalation of infected amniotic fluid
    - Lungs primarily involved
- **Intrapartum**
  - Aspiration/ inhalation of infected amniotic fluid or infected genital secretions
Perinatal TB: Transmission

- Congenital
  - Risk of transmission unknown
    - ? Higher if mother has primary disease

- Postpartum
  - Risk to infants is 60-80% if contact smear positive
  - Risk 30-40% if smear negative contact
## Risk of Disease Following Primary Infection

<table>
<thead>
<tr>
<th>Age</th>
<th>Disseminated TB/ TB meningitis</th>
<th>Pulmonary TB</th>
<th>No Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 year</td>
<td>10-20%</td>
<td>30-40%</td>
<td>50%</td>
</tr>
<tr>
<td>1-2 years</td>
<td>2-5 %</td>
<td>10-20%</td>
<td>75-80%</td>
</tr>
<tr>
<td>2-5 years</td>
<td>0-5%</td>
<td>5%</td>
<td>95%</td>
</tr>
<tr>
<td>5-10 years</td>
<td>&lt; 0-5%</td>
<td>2%</td>
<td>98%</td>
</tr>
<tr>
<td>&gt; 10 years</td>
<td>&lt; 0-5%</td>
<td>10-20%</td>
<td>80-90%</td>
</tr>
</tbody>
</table>

Lancet Infect Dis 2008; 8: 498-510
Congenital TB: Epidemiology

- Fewer than 400 cases reported in the literature
  - Most cases from prechemotherapy era
  - Most mothers from endemic areas living in non-endemic areas
  - Likely under-diagnosed, under-reported in developing countries

- Maintain high index of suspicion in neonates with born to mothers from endemic areas
### Congenital Tuberculosis Cases Reported in the English-Language Literature in the Era of Chemotherapy

<table>
<thead>
<tr>
<th>Reference</th>
<th>Years Cases Reported</th>
<th>No. of Cases</th>
<th>Age at Presentation (d)</th>
<th>No. Infants with Reactive TST</th>
<th>Common Symptoms</th>
<th>% Mortality (with Treatment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hageman et al.</td>
<td>1952-1980</td>
<td>26</td>
<td>NR</td>
<td>2 of 14</td>
<td>Respiratory distress, Fever, Hepatomegaly</td>
<td>46 (12)</td>
</tr>
<tr>
<td>Cantwell et al.</td>
<td>1980-1994</td>
<td>31</td>
<td>Median 24 (range 1 to 84)</td>
<td>0 of 9</td>
<td>Hepatosplenomegaly, Respiratory distress, Fever</td>
<td>38 (22)</td>
</tr>
<tr>
<td>Abughali et al.</td>
<td>1952-1994</td>
<td>58</td>
<td>NR</td>
<td>1 of 19</td>
<td>Respiratory distress, Hepatomegaly, Fever</td>
<td>45 (14)</td>
</tr>
<tr>
<td>Laartz et al.</td>
<td>1994-2002</td>
<td>16</td>
<td>Mean 17.4 (range 1 to 60)</td>
<td>1 of 4</td>
<td>Respiratory distress, Hepatomegaly, Fever</td>
<td>20</td>
</tr>
</tbody>
</table>

Avery’s Dis of the Newborn, 9th Ed.
PROTECT

them from

TUBERCULOSIS

Keep them away from sick people
Insist on plenty of rest
Train them in health habits
Consult the doctor regularly

This campaign made possible through the sale of Christmas Seals.
Pregnancy and Tuberculosis

- Rates of LTBI in pregnant women mimic those of the general population
- Pregnancy does not increase risk of TB
  - Presentation the same as in nonpregnant women
- Rarity of congenital TB may be due to genital disease leading to infertility
Tuberculosis and Infertility

- Genital TB is a major cause of infertility in women from endemic areas
  - 5-15% of infertility causes in endemic areas
  - 50-75% of women with genital TB are infertile
- Consider congenital TB in ill neonate born to mother from endemic area who underwent IVF
<table>
<thead>
<tr>
<th>Mother (age, years)</th>
<th>Maternal TB history; prenatal evaluation</th>
<th>Positive maternal specimens; microbiology</th>
<th>Infant case (sex)</th>
<th>EGA (days)</th>
<th>Age onset (days)</th>
<th>Clinical manifestations</th>
<th>Exam findings</th>
<th>Lab and radiograph findings</th>
<th>Positive infant specimens; microbiology</th>
<th>TB treatment (duration)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1 (38)</td>
<td>Cold abscess, chronic ascites; no pre-IVF TB evaluation</td>
<td>Endometrial biopsy; <em>M. africanum</em></td>
<td>1 (M) Twin A</td>
<td>31</td>
<td>19</td>
<td>Late-onset sepsis, respiratory failure, seizures</td>
<td>No HSM; no LAD</td>
<td>Anemia, CXR right upper lobe infiltrate</td>
<td>Lungs and pleura at autopsy; <em>M. africanum</em></td>
<td>A (7 days)</td>
<td>Died</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 (F) Twin B</td>
<td>31</td>
<td>33</td>
<td>Apnea, bradycardia, mild respiratory distress</td>
<td>No HSM; no LAD</td>
<td>No abnl labs, CXR right perihilar infiltrate</td>
<td>TST positive, no culture or AFB-positive specimens</td>
<td>L (7 days)</td>
<td>Recovered</td>
</tr>
<tr>
<td>M2 (30)</td>
<td>No history; no pre-IVF TB evaluation</td>
<td>Endometrial biopsy; MTB complex</td>
<td>3 (M)</td>
<td>32</td>
<td>24</td>
<td>Lethargy, mild respiratory distress, late-onset sepsis-like illness progressing to respiratory failure</td>
<td>Lethargic, diffuse bilateral crackles; no HSM; no LAD</td>
<td>CXR: right perihilar infiltrate</td>
<td>Blood (MTB), gastric aspirate, tracheal aspirate, MTB complex</td>
<td>A, C, L, R (IV)</td>
<td>E (1 month)</td>
</tr>
<tr>
<td>M3 (33)</td>
<td>No history; positive pre-IVF TST, normal chest X-ray, chest CT prenatally with calcified nodules and hilar LN</td>
<td>Endometrial biopsy (histology and smear positive), sputum (smear negative, culture positive); MTB complex</td>
<td>4 (F) Twin A</td>
<td>35</td>
<td>29</td>
<td>Fever, mild respiratory distress, pneumonia (miliary)</td>
<td>Febrile, retractions; no HSM; no LAD</td>
<td>CXR: diffuse nodular infiltrate</td>
<td>Gastric aspirate; MTB complex</td>
<td>A (3 months) (IV)</td>
<td>Recovered</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 (M) Twin B</td>
<td>35</td>
<td>29</td>
<td>Fever, mild respiratory distress, pneumonia</td>
<td>Febrile, retractions</td>
<td>None</td>
<td>A (3 months)</td>
<td>Recovered</td>
<td></td>
</tr>
</tbody>
</table>
TUBERCULOSIS

DON'T KISS ME!

YOUR KISS OF AFFECTION
THE GERM OF INFECTION
**Congenital Tuberculosis**

- Clinical presentation typically at 2-4 weeks of age
  - Nonspecific- mimics bacterial sepsis
    - Fever, respiratory distress
    - CXR may be abnormal
    - Hepatosplenomegaly

- Additional manifestations
  - OM/drainage
  - Lymphadenopathy
  - Cutaneous disease
Congenital TB and Prematurity

- Affected infant often born prematurely
  - Multiple reports from neonatal intensive care units

- Two fold greater risk of prematurity among Mexican infants born to 35 mothers with pregnancy complicated by TB

# Clinical Features of Congenital Tuberculosis

<table>
<thead>
<tr>
<th>Sign or Symptom</th>
<th>No. of Patients</th>
<th>Frequency(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory distress</td>
<td>44</td>
<td>76</td>
</tr>
<tr>
<td>Hepatomegaly +/- splenomegaly</td>
<td>38</td>
<td>65</td>
</tr>
<tr>
<td>Fever</td>
<td>33</td>
<td>57</td>
</tr>
<tr>
<td>Lymphadenopathy</td>
<td>19</td>
<td>33</td>
</tr>
<tr>
<td>Poor feeding</td>
<td>18</td>
<td>31</td>
</tr>
<tr>
<td>Lethargy, irritability</td>
<td>16</td>
<td>30</td>
</tr>
<tr>
<td>Abdominal distention</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>Failure to thrive</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Ear discharge</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Rash</td>
<td>5</td>
<td>9</td>
</tr>
</tbody>
</table>

Avery’s Dis of the Newborn, 9th Ed.
Pulmonary Congenital TB

DOL 10

DOL 14
Figure 1  Serial chest radiographs.  A. Normal chest radiograph at admission.  B. Bilateral infiltrates on day 7.  C. Normalisation after completion of treatment.
Extrapulmonary Congenital TB

Diagnosis of Congenital TB: Revised Diagnostic Criteria

- Proved tuberculous lesions AND
- 1 of the following
  - Lesions in the first week of life
  - Primary hepatic complex or caseating hepatic granulomas
  - TB of the placenta or maternal genital tract
  - Exclusion or postnatal transmission by thorough investigation of contacts.

Evaluation for Congenital TB

- TST - unreliable but helpful to have baseline
  - IGRA - very limited data
- Chest radiograph (PA, lateral)

- Mycobacterial confirmation
  - Gastric aspirates, tracheal secretions
  - Cerebrospinal fluid
  - Blood culture
  - Otorrhea, tissue
  - Yield higher than for older children
### Results of Diagnostic Procedures Performed on 29 Infants With Congenital Tuberculosis Reported from 1980 to 1994

<table>
<thead>
<tr>
<th>Type of Specimen</th>
<th>Acid-Fast Smear</th>
<th>Mycobacterial Culture</th>
<th>Smear or Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric aspirate</td>
<td>8/9</td>
<td>8/9</td>
<td>9/11</td>
</tr>
<tr>
<td>Endotracheal aspirate</td>
<td>7/7</td>
<td>7/7</td>
<td>7/7</td>
</tr>
<tr>
<td>Ear discharge</td>
<td>2/2</td>
<td>1/1</td>
<td>2/2</td>
</tr>
<tr>
<td>Cerebrospinal fluid</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>Urine</td>
<td>0/2</td>
<td>0/2</td>
<td>0/2</td>
</tr>
<tr>
<td>Peritoneal fluid</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
</tr>
<tr>
<td>Bronchoscopic specimen</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
</tr>
<tr>
<td>Biopsy specimen</td>
<td>14/19</td>
<td>11/12</td>
<td>16/21</td>
</tr>
<tr>
<td>Lymph node</td>
<td>7/8</td>
<td>6/6</td>
<td>7/8</td>
</tr>
<tr>
<td>Liver</td>
<td>4/6</td>
<td>1/2</td>
<td>4/6</td>
</tr>
<tr>
<td>Skin</td>
<td>1/3</td>
<td>1/1</td>
<td>2/2</td>
</tr>
<tr>
<td>Lung</td>
<td>1/1</td>
<td>1/1</td>
<td>2/2</td>
</tr>
<tr>
<td>Ear discharge</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
</tr>
</tbody>
</table>

Maternal Tuberculosis

- Mother often asymptomatic
  - > 50% diagnosed after infant diagnosed
- Evaluation of mother critical to diagnosis
  - PE, including genital/pelvic examination
  - TST, IGRA
  - Chest radiograph
  - Microbiological confirmation (e.g. sputum)
  - Placenta/endometrial biopsy, culture
    - Often sole confirmation of diagnosis
THE NEXT TO GO

FIGHT TUBERCULOSIS

Red Cross Christmas Seal Campaign
Transmission of TB in Children

- Most non-adolescent children with TB are not infectious
- Compared with adults, children are less likely
  - To have productive cough
  - To generate force to aerosolize organism
  - To have large numbers of infectious organisms
Isolation of the Hospitalized Pediatric Patient with TB

- Nosocomial transmission in pediatric setting rare

- Adults accompanying children into the hospital may be source cases and potentially infectious
  - Emphasis on infection control should be on adults accompanying the admitted child

- Isolate children with until infectiousness excluded in patient and adults accompanying patient
Isolation of the Hospitalized Pediatric Patient with TB

- Isolation for suspected or confirmed pulmonary or extrapulmonary TB until patient and accompanying adults deemed noninfectious
- Limit adult visitors to two who can promptly be evaluated for potential infectiousness
  - CXR is critical component of evaluation
  - Until evaluation complete, visitors should wear masks
- If adults accompanying patient not contagious and patient not infectious, isolation may be discontinued
Pediatric Patients with Increased Risk for Infectiousness

- Cavitary or extensive pulmonary disease (e.g. adolescents)
- Positive sputum AFB smears
- Laryngeal involvement
- Congenital TB undergoing procedures involving the oropharyngeal airway
- Cough-inducing or aerosol-generating procedures (e.g. bronchoscopy, induced sputum collection)
## Congenital TB and Exposures

<table>
<thead>
<tr>
<th>Year</th>
<th>Neonate</th>
<th>Mother</th>
<th>Setting</th>
<th>Exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>65 d</td>
<td>Endometrial biopsy positive for TB</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MTB confirmed postmortem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sputum positive for MTB</td>
<td>NICU</td>
<td>35/37 exposed neonates treated</td>
</tr>
<tr>
<td>2002</td>
<td>29 wk</td>
<td>African American</td>
<td>NICU</td>
<td></td>
</tr>
<tr>
<td></td>
<td>21 d</td>
<td>Endometrial biopsy positive for TB</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sputum positive for MTB</td>
<td>NICU</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tracheal aspirate positive for MTB</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Philippines</td>
<td>NICU</td>
<td>6/13 (22%) HCWs TST+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Endometrial biopsy positive for TB</td>
<td></td>
<td>27/85 neonates treated</td>
</tr>
<tr>
<td>2004</td>
<td>29 wk</td>
<td>Nigeria</td>
<td>NICU</td>
<td></td>
</tr>
<tr>
<td></td>
<td>102 d</td>
<td>Endometrial biopsy positive for TB</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tracheal aspirate positive for MTB</td>
<td>NICU</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Philippines</td>
<td>NICU</td>
<td>6/13 (22%) HCWs TST+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Endometrial biopsy positive for TB</td>
<td></td>
<td>27/85 neonates treated</td>
</tr>
<tr>
<td>2014</td>
<td>33 wk</td>
<td>Eritrea</td>
<td>PICU</td>
<td>1/156 patients TST+ 22 (14%) visitors TST+ 3/41 (7%) HCW TST+ 66 neonates treated</td>
</tr>
<tr>
<td></td>
<td>26 d</td>
<td>Sputum positive for TB</td>
<td>NICU</td>
<td></td>
</tr>
</tbody>
</table>

### Table 1  TST results among exposed infants and visitors in the NICU and PICU

<table>
<thead>
<tr>
<th>Contacts identified</th>
<th>TST 1</th>
<th>TST 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>NICU infants</td>
<td>66</td>
<td>61/61 negative</td>
</tr>
<tr>
<td>PICU infants and children</td>
<td>43</td>
<td>36/36 negative</td>
</tr>
<tr>
<td>NICU visitors</td>
<td>84/100 negative 16/100 positive</td>
<td>50/58 negative 8/58 positive</td>
</tr>
<tr>
<td>PICU visitors</td>
<td>40/56 negative 16/56 positive</td>
<td>19/22 negative 3/22 positive</td>
</tr>
</tbody>
</table>

TST = tuberculin skin test; NICU = neonatal intensive care unit; PICU = paediatric intensive care unit.

### Table 2  Tuberculin skin test results among exposed personnel in the NICU and PICU

<table>
<thead>
<tr>
<th>Identified contacts</th>
<th>Pre-exposure PPD</th>
<th>Post-exposure PPD</th>
<th>Treatment provided for LTBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>NICU personnel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>38/82 negative</td>
<td>3/24 conversion</td>
<td>3/3</td>
</tr>
<tr>
<td></td>
<td>32/82 positive</td>
<td>0/6 positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/82 NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PICU personnel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>15/33 negative</td>
<td>0/11 conversion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14/33 positive</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4/33 NA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tuberculosis robs you
Public health protects you
Christmas seals finance the campaign against tuberculosis
Management of the Newborn Whose Mother has LTBI

- Mother has reactive TST and normal CXR
  - If mother is asymptomatic, no separation of mother and infant is necessary
    - Mother should be treated for LTBI

- Newborn needs no further evaluation

- Household members should be evaluated for TB infection or disease
Management of the Newborn Whose Mother has Suspected TB

- Mother has signs/symptoms of TB and/or abnormal CXR
  - Evaluation of mother (e.g. PE, sputum, HIV serology)
  - Evaluate infant for congenital TB
    - If excluded, begin INH
  - Separation of mother and infant until evaluation complete and, if TB suspected, until mother receiving appropriate therapy
- Once INH started for infant, separation no longer necessary unless mother has DR TB
- Isolation of newborn if intubated or undergoing procedures involving airway
Management of Infant with Postnatal Exposure to Maternal TB

- Determine if age of infant and duration of symptoms in mother warrant evaluation for congenital tuberculosis
- Evaluation of infant
  - PE, TST, chest radiograph
  - GA, induced sputum, CSF if warranted
- If mother untreated, separate until isoniazid started for infant
- If evaluation negative
  - Start isoniazid
  - Repeat TST in 2-3 months
  - Consider empiric treatment for LTBI if repeat TST in infant would not be reliable (< 6 months of age)
Are we going to see

**THE END OF TB**

in our lifetimes?

A call from the millennium children of the Eastern Mediterranean Region

World Health Organization

Original text for the Golden Millennium
Tuberculosis Transmission in a Hospital Neonatal Intensive Care Unit — North Carolina, 2016

Jess Rinsky, PhD, MPH
Epidemic Intelligence Service Officer
North Carolina Division of Public Health

66th Annual Tuberculosis/Respiratory Institute
September 27, 2017
Congenital Tuberculosis

• <300 cases reported in the scientific literature since 1982

• Tuberculosis in infants is typically associated with low risk of transmission to others
  ▫ Tubercle bacilli load is relatively low in pulmonary secretions
  ▫ Experience little or no cough
  ▫ Rarely can produce infectious airborne droplets

• Transmission to healthcare personnel has been documented
  ▫ Prolonged exposure
  ▫ Therapeutic measures

• Transmission to other patients has occurred related to inadequate disinfection of respiratory equipment
Initial Report to Public Health

November 30
6 hospital personnel
New positive TST
Timeline

INFANT

July 21–August 6
NICU

- Pre-term (25 weeks gestation)
- High-frequency oscillatory ventilation (HFOV)
- Died on August 6 after 17 days of life

November 30
6 hospital personnel
New positive TST
### Timeline

**INFANT**

**July 21–August 6**

- NICU
- Pre-term (25 weeks gestation)
- High-frequency oscillatory ventilation (HFOV)
- Died on August 6 after 17 days of life

**November 30**

- 6 hospital personnel
- New positive TST

**MOTHER**

- Non-specific symptoms
- Originally from Kenya
- Respiratory distress
- BAL smear-negative
Timeline

INFANT

July 21–August 6
NICU

August 21
BAL grows
*Mycobacterium tuberculosis*

November 30
6 hospital personnel
New positive TST

MOTHER
## Timeline

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 21–August 6</td>
<td>NICU</td>
</tr>
<tr>
<td>August 21</td>
<td>BAL grows <em>Mycobacterium tuberculosis</em></td>
</tr>
<tr>
<td>August 29</td>
<td>Diagnosed with congenital tuberculosis</td>
</tr>
<tr>
<td>November 30</td>
<td>6 hospital personnel, New positive TST</td>
</tr>
</tbody>
</table>

INFANT

MOTHER
## Timeline

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 21–August 6</td>
<td>INFANT: NICU</td>
</tr>
<tr>
<td>August 21</td>
<td>BAL grows Mycobacterium tuberculosis</td>
</tr>
<tr>
<td>August 29</td>
<td>INFANT: Diagnosed with congenital tuberculosis</td>
</tr>
<tr>
<td>November 30</td>
<td>6 hospital personnel New positive TST</td>
</tr>
<tr>
<td>October</td>
<td>MOTHER: Contact investigation around mother completed</td>
</tr>
</tbody>
</table>
Infant Contact Investigation Aims

• Identify infant’s contacts

• Evaluate contacts for tuberculosis infection

• Provide recommendations
Infant Contact Investigation Steps

• Visited Hospital A

• Contact: a person who treated, or spent time in the NICU with, the infant infected with tuberculosis
## Evaluation of Infant Contacts

<table>
<thead>
<tr>
<th>Contact type</th>
<th>TST</th>
<th>IGRA</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visitors</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
## Evaluation of Infant Contacts

<table>
<thead>
<tr>
<th>Contact type</th>
<th>TST</th>
<th>IGRA</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCP</td>
<td>X</td>
<td></td>
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</tbody>
</table>

### Infants

### Visitors
## Evaluation of Infant Contacts

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</table>
| Infants      | X   | X    | • Preemptive latent tuberculosis treatment  
                      • Monitoring until age 2 years |
| Visitors     |     |      |                                                |
## Evaluation of Infant Contacts

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</tbody>
</table>
Results: Healthcare Personnel

135
Potentially exposed

132 (98%)
Evaluated

7 (5%)
New positive TST
Results: Healthcare Personnel

• Job type
  ▫ 4 nurses
  ▫ 2 respiratory therapists
  ▫ 1 neonatologist

• All performed high-risk procedures including stabilization, intubation, suctioning

• None had prolonged exposure to the infant’s mother
Results: Infants

- Potentially exposed: 26
- Notified by phone or visit: 0
- Clinical assessment: 0
- Follow-up assessment: 0
- Treatment started: 0

Completed step
No treatment; monitoring until age 2
Lost to Follow-up

Number of Infants

0 5 10 15 20 25 30

Potentially exposed  Notified by phone or visit  Clinical assessment  Follow-up assessment  Treatment started
Results: Infants

- **Potentially exposed**: 26
- **Notified by phone or visit**: 25

### Steps
- **Completed step**:
- **No treatment; monitoring until age 2**:
- **Lost to Follow-up**: 4

**Number of Infants**

- **Potentially exposed**: 26
- **Notified by phone or visit**: 25
- **Clinical assessment**: 4
- **Follow-up assessment**: 4
- **Treatment started**: 4
- **Lost to Follow-up**: 4

**Number of Infants**
Results: Infants

- Potentially exposed: 26
- Notified by phone or visit: 25
- Clinical assessment: 22
- Follow-up assessment: 4
- Treatment started: 0
- Completed step
- No treatment; monitoring until age 2
- Lost to Follow-up
### Results: Infants

<table>
<thead>
<tr>
<th>Step</th>
<th>Number of Infants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potentially exposed</td>
<td>26</td>
</tr>
<tr>
<td>Notified by phone or visit</td>
<td>25</td>
</tr>
<tr>
<td>Clinical assessment</td>
<td>22</td>
</tr>
<tr>
<td>Follow-up assessment</td>
<td>22</td>
</tr>
<tr>
<td>Treatment started</td>
<td></td>
</tr>
</tbody>
</table>

- **Completed step**: 26
- **No treatment; monitoring until age 2**: 4
- **Lost to Follow-up**: 4
Results: Infants

- Potentially exposed: 26
- Notified by phone or visit: 25
- Clinical assessment: 22
- Follow-up assessment: 22
- Treatment started: 18

Completed step | No treatment; monitoring until age 2 | Lost to Follow-up
--- | --- | ---
26 | 4 | 4
25 | 4 | 4
22 | 4 | 4
22 | 4 | 4
18 | 4 | 4
Results: NICU Visitors

• 23 screened

• 1 positive (4%)
Results: NICU Visitors

- 23 screened
- 1 positive (4%)
Conclusions

• Transmission of tuberculosis from a congenitally-infected infant occurred in a NICU
  ▫ Annual tuberculosis screening was key in identifying transmission

• Respiratory support likely contributed to transmission
  ▫ HFOV (unfiltered)
  ▫ Aerosol-generating procedures

• Coordinated efforts by hospital and public health staff resulted in high screening and treatment rates
Recommendations

• Early detection and diagnosis of tuberculosis infection in pregnant women

• When evaluating infants born to mothers with epidemiologic risk factors
  ▫ Consider tuberculosis
  ▫ Control measures

• Evaluate all persons who share airspace with an infant infected with tuberculosis during a
  ▫ Prolonged period
  ▫ Aerosol-generating procedures
# Acknowledgements

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- Jenni Wheeler
- CDB colleagues

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- Ruth Lassiter
- Sue Lynn Ledford
- Kursten Lyon
- Kim McDonald
- Mel Messer
- Odell Parker
- Marie Rogers

**Hospital A**
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- Jessica Dixon
- Chris Ingram
- Carla Stevens
- Tom Young

**CDC**
- Stacey Bosch
- Jorge Salinas
- Jonathan Wortham
References


Questions?

Jess Rinsky, PhD, MPH
Jess.rinsky@dhhs.nc.gov
Phone: 919.707.5902
A Contact Investigation:
Health Department Nursing Perspective

Presented By: Darlene Farmer RN
Contributors: Kursten Lyon RN, Susan Sauls RN,
Julie Talbert RN and Debra Turner RN
Initial Plan Devised

- Joint meeting held with hospital, state and county health department representatives regarding contact plan
- First notification made by hospital
- First health department visit at Wake County regardless of county of residence
Initial Plan for Infants

* SICC appointment: PPD placement, QFT, weight, chest x-ray, follow up appointment scheduled for TB clinic
* Wake County TB Visit: Chest x-ray CD uploaded for MD review, Epi completed, PPD read, MD called for orders, patient education, preventive medication initiated

* Plan of care determined: clinic visit, home visit, needed transfers
Upon arrival family was to present a green paper to administrative staff alerting staff this patient was to be registered in clinic room not the lobby

- Additional nurse assigned for infant evaluations
- Compressed Initial Visit: infants to receive evaluation and meds in one visit instead of two
- Supplies: oral syringes, pill crushers, medicine cups
- Pharmacy Coordination
Plan Alterations

* X-ray CD obtained prior to infant visit to allow MD time to evaluate x-ray and write medication orders, to ensure medication could be initiated on first visit

* Additional coordination with other county agencies and other county health departments: CC4C, Nurse Family Partnership, Child Health Clinic, Primary Care Providers, State TB Nurse Consultants

* Every 6 month chest x-ray up to 2 years of age for infants unable or unwilling to take medication
Adult Contacts

* Family Members offered QFT at hospital, positives to be followed at health department
* Employees tested per occupational health at hospital, positives to be followed at health department
* Preventive medication provided by Wake County through hospital occupational health
Success

* Medication Tolerance
* Collaboration between county and agencies
* Collaboration and flexibility of health department pharmacy
* Hotwash

Struggles

* Provider Buy In
* Family Buy In
* Socioeconomic Issues
* Mobility and out of county location
* Establishing initial contact
* Follow-up
* Communication