It Takes Village to Stop TB: Lessons from TB Contact Investigations in Health Care Facility Settings

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Southern Nevada Health District
Course Objectives

- Identify causes of and route of transmission of tuberculosis (TB)
- Explain the difference between active TB disease and latent TB infection (LTBI)
- State the two (2) primary objectives of a TB contact investigation
- Give two (2) examples of documented risk factors of developing LTBI after an occupational exposure for health care personnel
- Describe the importance of annual TB testing of health care personnel
TB is still around!??!
Background

- TB is one of the world’s deadliest diseases
- One-third of the world’s population is infected with TB
  - Accounting for approximately 2 billion people
- Each year, 8 million people around the world become ill with TB
- Asia accounts for 60% of new cases globally
- Incidence in sub-Saharan Africa is nearly twice Asia
  - 255 cases per 100,000 persons
- 2-3 million TB related deaths worldwide each year
- TB cases continue to be reported in every state
- Estimated 10-15 million persons in U.S. infected with M. tuberculosis
Background

- *Mycobacterium tuberculosis*
  - Rod-shaped bacteria
- 3400 BC Egyptian mummy spinal TB (Pott’s Disease)
- 2589 BC Chinese writing
- c 1500 BC in Hindu writing
- c 650 BC Assyrian Empire
- 460 BC Greece - Phthisis
Pathogens

- *Mycobacterium tuberculosis* complex (MTBC)
  - *M. tuberculosis*
  - *M. africanum*
  - *M. bovis*
  - *M. microti*
  - *M. caprae*
  - *M. canetti*

- Atypical *Mycobacterium* species (NTM’s ≈ 150)
  - AKA *Mycobacterium Other Than Tuberculosis* (MOTT)
    - *M. kansasii*
    - *M. gordonae*
    - *M. avium complex*
Non-Tuberculosis Mycobacterium

- NTM, also known as Mycobacterium Other Than Tuberculosis (MOTT)
- NTM rates are not nationally reportable and exact rates are unknown
- NTMs can be found in soil, food, water, and animals
- Municipal water systems (including tap water)
- Most infections acquired via ingestion, aspiration, or inoculation with the organism (water sources most common)
- Human to human transmission has not been documented
- Species such as Mycobacterium avium complex are commonly associated with HIV infection and severely immunocompromised states
  - M. avium complex encompasses intracellular, M. kansasii, and M. gordonae
  - Usually associated with pneumonia or disseminated infection
  - Leading cause of NTM infection in humans
- Treatment?
Tuberculosis Epidemiology

- 9,945 active cases in the U.S. in 2012
- Rates of TB related death have been steadily declining but are still a problem in the U.S.
- Nevada ranks in the top 15 states for increased rates of TB infection and disease
- Higher rates of infection in men than women
- Race and ethnicity rates
  - Asians > Native Hawaiian/Other Pacific Islander > Hispanic or Latino > Black or African American > White
Reported TB Cases
United States, 1982–2012*

*Updated as of June 10, 2013.
TB Case Rates, * United States, 2012

- Cases per 100,000.

- 3.2 (2012 national average)

- >3.2

*Cases per 100,000.
TB Case Rates by Race/Ethnicity,*
United States, 2003–2012**

*Cases per 100,000


Hispanic or Latino
American Indian or Alaska Native
Asian
Black or African American
Native Hawaiian or Other Pacific Islander
White

*All races are non-Hispanic.
**Updated as of June 10, 2013.
Countries of Birth of Foreign-born Persons Reported with TB, United States, 2012

Mexico (21%)
Philippines (12%)
India (8%)
Vietnam (7%)
China (6%)
Guatemala (3%)
Haiti (3%)
Other Countries 39%
Percent of Foreign-born with TB by Time of Residence in U.S. Prior to Diagnosis, 2012

*Foreign-born TB patients for whom information on length of residence in the U.S. prior to diagnosis is unknown or missing
### TB in Clark County

<table>
<thead>
<tr>
<th>Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Case Diagnosis</strong></td>
<td>85</td>
<td>70</td>
<td>75</td>
</tr>
<tr>
<td><strong>Foreign Born</strong></td>
<td>73%</td>
<td>79%</td>
<td>65%</td>
</tr>
<tr>
<td>• 18% Mexico</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 35% Philippines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 15 additional countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 19% Mexico</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 26% Philippines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 13 other countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Homeless</strong></td>
<td>2%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Uncontrolled Diabetes</strong></td>
<td>18%</td>
<td>13%</td>
<td>16%</td>
</tr>
<tr>
<td><strong>HIV/AIDS Co-infected</strong></td>
<td>2%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Children born in US with risk factors</strong></td>
<td>5%</td>
<td>4%</td>
<td>9%</td>
</tr>
</tbody>
</table>
Transmission

- Spread by droplet nuclei
  - Airborne infection
- Transmitted by infectious TB person
  - NOT those with latent TB infection
- Expelled by active pulmonary and laryngeal TB cases
  - Speaking: 0 to 210 particles
  - Coughing: 0 to 3,500 particles
  - Sneezing: 4,500 to 1,000,000 particles
Transmission

- M. tuberculosis aerosol
- Active infection: 50% (Transmission)
- Latent infection: 95% (Transmission)
- Cure: 95% (Relapse) 5% (Relapse)
- Death: 50% (HIV/TB)
Transmission

- Tubercle bacilli can enter the blood stream and spread throughout the body
- Easily spread through the lymphatic system
- Tissues and organs that TB can infect
  - Regional lymph nodes, apex of the lungs, larynx, kidneys, spine, brain, and bone
- Less likely (rare)
  - Ingestion of unpasteurized cheese or milk and BCG bladder irrigation (M. bovis)
    - Person to person transmission of M. bovis is possible
- Congenital
Risk Factors for Transmission

- Close contacts are at highest risk of becoming infected
  - Household contact, incarceration, school
- Infectiousness of person with active pulmonary TB disease
- Environment in which exposure occurred
- Duration of exposure
- Virulence of the organism(?)

Standard Precautions

“Minimum infection prevention measures that apply to all patient care, regardless of suspected or confirmed infection status of the patient”

Personal protective equipment (PPE) based on potential for exposure to infectious agents

- Gloves
- Gowns
- Facemasks (procedure or surgical)
- Goggles
- Respirators (N-95)

Risk Factors for Development of TB

- Recent contact to an active case
  - Especially within first two years without LTBI treatment
- Recent converters
- Medical Conditions
  - HIV infection, diabetes, cancer, end stage renal disease, rheumatoid arthritis, drug induced immunosuppression, psoriasis, chronic respiratory illness (including COPD and asthma)
  - HIV is the strongest risk factor for development of TB disease: 7-10% each year without LTBI treatment
- Foreign-born persons from areas where TB is common
- Visitors to TB-prevalent countries
- Residents/employees of high-risk congregate settings
  - Jails, prisons, homeless shelters
- Substance abuse
- Health care workers serving high-risk clients
- Children and adolescents exposed to adults at increased risk
Tuberculosis Associated with TNF-α Drugs

- The Food and Drug Administration (FDA) determined in 2002 that tuberculosis (TB) disease is a potential adverse reaction from treatment with tumor necrosis factor-alpha (TNF-α) antagonists
  - Including infliximab (Remicade®), etanercept (Enbrel ®), and adalimumab (Humira ®)
- These agents work by inhibiting inflammatory cytokine, and are approved for treating rheumatoid arthritis and other autoimmune diseases
- Blocking TNF- α allows for TB disease to emerge from latent MTB infection
- Routine testing for TB is now indicated for all patients prior to initiation of anti-TNF alpha medications
- TB disease should be considered in the differential diagnosis of ALL immunocompromised patients with unexplained febrile illness
Screening and Diagnosis
Screening for TB

- Routine testing of low risk persons is no longer recommended
- Statutory requirements for testing of persons within certain occupations and/or congregate settings
- Best practices for testing persons at risk
- Best practices for determining a person’s risk

http://health.nv.gov/CD_HIV_TBProgram.htm
Screening for TB

- Contacts of people with confirmed or suspected contagious tuberculosis (contact investigation)
- Radiographic or clinical findings suggesting tuberculosis disease
- Immigrants from countries with endemic infection
  - International adoptees
- Travel histories to countries with endemic infection and substantial contact with indigenous people from such countries
- Employees/residents of facilities with people at high risk
- Black box warning labels
- Local TB prevalence
Annual TB Testing

- CDC MMWR “Guidelines for Preventing the Transmission of Mycobacterium tuberculosis in Health-Care Settings”
  - All health care workers (HCW) who have duties that involve face-to-face contact with patients with suspected or confirmed TB disease (including support staff) should be included in a TB screening program
    - HCW refers to all paid and unpaid persons with potential for exposure
    - HCWs entering patient or treatment rooms
    - Participating in aerosol-generating or producing procedures
    - Participating in suspected or confirmed MTB specimen processing
    - Installing, maintaining, or replacing environmental controls in areas in which persons with TB disease are encountered
- Required by NAC 441A.375
What about Bacille Calmette-Guérin (BCG)?

- Created in 1921
- Only partially effective
- Some protection against severe forms of pediatric TB
- Unreliable against adult pulmonary TB
- Most widely administered vaccine in the world, but...
- Never more cases of TB in history than now!

Steps to Diagnosis TB Disease

- Medical evaluation
  - History and risk of exposure
    - Mantoux tuberculin skin test
      - Purified protein derivative (PPD)
    - Interferon Gamma Assays (Blood test)
      - QuantiFERON ® (QFT-Gold In Tube)
      - T-Spot TB ® Test
  - Radiologic evidence
    - Chest x-ray (standard screening)
    - Computerized tomography (CT) scan
### Latent TB Infection vs. Active TB Disease

<table>
<thead>
<tr>
<th>A person with latent TB infection (LTBI)</th>
<th>A person with active TB disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small amount of TB bacteria in the body (alive but inactive)</td>
<td>Large amount of active TB bacteria in the body</td>
</tr>
<tr>
<td>Cannot spread TB bacteria to others</td>
<td>May spread TB bacteria to others</td>
</tr>
<tr>
<td>Does not feel sick</td>
<td>May feel sick and may have symptoms such as cough, fever, and/or weight loss</td>
</tr>
<tr>
<td>Usually has a skin test or blood test result indicating TB infection</td>
<td>Usually has a skin test or blood test result indicating TB infection</td>
</tr>
<tr>
<td>Typically has a normal chest x-ray</td>
<td>May have an abnormal chest x-ray</td>
</tr>
<tr>
<td>Sputum smears and cultures are negative</td>
<td>Sputum smears and cultures may be positive</td>
</tr>
<tr>
<td>Does <strong>NOT</strong> require respiratory isolation</td>
<td>May require respiratory isolation</td>
</tr>
<tr>
<td>Should consider treatment for latent TB infection to prevent TB disease</td>
<td>Needs treatment to treat active TB disease</td>
</tr>
</tbody>
</table>
Symptoms of Active TB

- Systemic
  - Fever
  - Chills
  - Night sweats
  - Weight loss (unexplained)
  - Fatigue
  - Anorexia

- Pulmonary TB Specific
  - Productive and prolonged cough
    - 3 weeks or longer in duration
  - Chest pain
  - Hemoptysis

- Extrapulmonary Specific
  - Pain at the site of disease
  - Enlarged lymph nodes
  - Cyst of mass development
Extra-pulmonary Abnormalities

Site Specific Extrapulmonary TB Signs and Symptoms

- Pain at site of disease
- Kidney
  - Blood in the urine
- Meningitis
  - Headache or confusion
- Larynx
  - Causes hoarseness
- Genitourinary
  - Fertility issues
Diagnosis

- TB symptoms and severity can rate from none to overwhelming
  - Approximately 10-20% have none of the “classic symptoms”
- Illness can range from indolent to fulminant
- Symptoms and findings can be both local and systemic
  - Local in the case of disseminated TB (lymph node, CNS, bone, and solid organ – kidney)
- TB infection/disease can involve any organ or tissue in the body
Steps to Diagnosis TB Disease

- Medical evaluation
  - Bacteriologic exam (sputum, tissue sample or biopsy, exudate from wound or cyst, etc.)
  - Smears and culture
  - **Must have at least 10^5 bacillary load to detect bacteria in stained smear**
  - Positivity of sputum smear is directly related to infectiousness
  - Obtain 3 sputum specimens for acid-fast bacilli (AFB)
  - Always rule out pulmonary involvement!
Diagnostic Microbiology

- Detection of AFB in stained smears
  - Provides first bacteriologic clue of TB
  - Scales:
    - Negative < Rare < Few < Moderate < Many
    - Negative < 1+ < 2+ < 3+ < 4+
- Rapid detection of M. tuberculosis
  - Nucleic acid amplification (NAA) tests/polymerase chain reaction (PCR)
  - GeneXpert ® - NAA by PCR identifies targeted nucleic acid sequences in the TB genome
    - Also detects Rifampin resistance
- Cultures are used to confirm the diagnosis of TB
  - Takes 6 to 8 weeks
Radiologic Evidence

- Useful tool for the diagnosis of TB disease
- CT scans can provide additional information for abnormalities that are unable to be visualized on chest x-ray
  - More expensive BUT more specific
- Abnormalities often seen in apical or posterior segments of upper lobe or superior segments of lower lobe
  - Lesions may appear anywhere in the lungs and may be cavitary
- Abnormalities seen on x-ray may be suggestive of TB disease but are NEVER diagnostic
  - May be used to exclude active pulmonary TB disease in a person with normal immune system and positive PPD or IGRA with no symptoms of disease
  - Used as a screening tool and assess the need for further testing
  - “Old” TB cannot be differentiated from active TB disease based on radiologic evidence ALONE
Treatment
Treatment (Rationale)

- Appropriate treatment is necessary to manage disease transmission
  - TB is a communicable respiratory illness that can be easily transmitted from person to person
- Often difficult for patients to continue treatment once they start feeling better
- Ensuring adherence to treatment is difficult because patients are unable or reluctant to take multiple medications for several months
- Non-adherence to treatment is a major problem in TB control
- Patient education is key to ensuring compliance to therapy
- Directly observed therapy (DOT) is utilized to ensure patients complete therapy (recommended by the CDC)
Duration of Therapy
(pansensitive organism)

- CDC MMWR “Treatment of Tuberculosis”
- Specific treatment
  - Isoniazid, Rifampin, Ethambutol, Pyrazinamide
  - Weight based dosing
  - Synergistic effect, all taken at once
- Treatment length is disease site specific
  - 6-? months
  - Penetration of antibiotics
Drug Resistance

- A drug resistant organism can be passed on from person to person
  OR
- Drug resistance can be acquired due to inappropriate treatment

- Mono-resistant
- Poly-resistant

- Multi-drug resistant (MDR) TB
  - Resistant to at least INH and RIF (or rifamycin class)
Drug Resistance

Extensively drug resistant (XDR)
- Resistant to
  - INH and RIF
  - FQN (fluroquinolones)
    - Levofloxacin and moxifloxacin
  - At least one 2nd line injectible agent
    - Aminoglycoside
      - Streptomycin, Amikacin, Kanamycin
    - Capreomycin (polypeptide – aminoglycoside “like”)

Totally drug resistant (TDR)
- Resistant to ALL 10 drugs with known activity against TB
- First case identified in Europe in 2006
  - Cases have been identified in Italy (2007), Japan (2008), Iran (2009), and India (2012)
- Also known as extremely drug resistant (XXDR)
Treatment of LTBI

- Isoniazid (6-9 months)
- Rifampin (4 months)
- INH+Rifapentine (12 weeks, directly observed)

For those patients with known exposure/close contact to a multi-drug resistant case with positive laboratory evidence of infection, prophylaxis will be determined on a case by case basis by expert TB clinicians.
Contact Investigation
Contact Investigation

- Identify and interrupt TB transmission
  - Prevent outbreaks of TB
- Ensure appropriate treatment for contacts with active TB disease or TB infection

- TB is a reportable condition in Nevada
  - NAC 441A.350 (Health care provider 24 hours)
  - NAC 441A.352 (Pharmacist two or more drugs)
May: Admitted to Hospital A and delivered Patients B & C
May-June: Visited Patients B & C in NICU
June: Patient C expired
June: Admitted to Hospital A
June: Visited outpatient clinic with fevers
June: Transferred to Hospital B by air ambulance
July: Expired, diagnosed with TB on autopsy
May-June: Visited Patients B & C in NICU
May: Admitted to Hospital A and delivered Patients B & C
Decision to Initiate a TB Contact Investigation

- Acid-fast bacilli
- Nucleic acid assay
- Approved indication for NAA
- Chest radiograph
TB Contact Investigation

- Pulmonary cases
  - With evidence of being contagious/likely contagious
- Pediatric active cases
  - To find the source
- LTBI found in a child under 2 years of age
  - Sign of recent transmission
Special Note on Pediatric Cases

- Children with active TB indicate an unidentified contagious adult/adolescent with active TB (sentinel event)
- Child unlikely to yield positive smears and cultures even with gastric aspirate
- Need source case culture results for drug sensitivities to determine child’s treatment
- Thorough contact investigation is critical to prevention further transmission!
Concentric Circle Approach to Contact Investigation for Tuberculosis

First concentric circle
(high-risk contacts and close contacts)

Wait until 8–10 weeks have passed since last exposure, then evaluate with TST

Tuberculosis.
†Tuberculin skin test.
§Latent TB infection.

Has the contact previously completed treatment for LTBI?

Give full treatment course for LTBI

Index Patient

Home/Residence Environment

Leisure Environment

Work/School Environment

Second concentric circle
(other-than-close contacts)

TST reaction ≥5 mm?

Yes

No

Yes

No

Enter United States language identification
Identify patient
Hobby, church, clubs, or activities
Exposure settings (e.g., size
Positively positive tuberculin skin
TB Contact Investigation Approach

- Review existing information about the case
- Determine an initial estimate for the infectious period and estimate the degree of infectiousness
- Interview the case
- Review information and develop a plan for the investigation
- Refine the infectious period and degree of infectiousness
- Prioritize contacts
- Conduct field visits
- Conduct contact assessments
- Determine whether to expand or conclude an investigation
- Evaluate the CI activities

Steps not always done in sequential order
Patient A: Timeline — 2013

May: Admitted to Hospital A and delivered Patients B & C
May: Admitted to Hospital A and delivered Patients B & C

May-June: Visited Patients B & C in NICU
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- June: Transferred to Hospital B by air ambulance
- July: Expired, diagnosed with TB on autopsy
- July: Patient C expired
- May-June: Visited Patients B & C in NICU
- May: Admitted to Hospital A and delivered Patients B & C

Infectious period: March 15–death
May: Born at 24-weeks gestation and placed in Hospital A's level III neonatal intensive care unit (NICU)

June: Patient C expired

July: Patient B diagnosed with *M. bovis*, moved to NICU respiratory isolation

July: Patient A expired, autopsy-diagnosed TB

June: Patient C expired

May: Born at 24-weeks gestation and placed in Hospital A’s level III neonatal intensive care unit (NICU)
May: Born at 24-weeks gestation and placed in Hospital A’s level III neonatal intensive care unit (NICU)

June: Patient C expired

July: Patient B diagnosed with *M. bovis*, moved to NICU respiratory isolation

July: Patient A expired, autopsy-diagnosed TB

August: Patient B expired

August: Patient B expired
TB Contact Investigation

- Elicit contacts from index case
  - Household
  - Work
  - Social networks
- Prioritize contacts
  - Household
  - Children
  - Immunocompromised
  - Duration and location of contact
- If contact less than 8 weeks ago, need second test 8-10 weeks after last exposure
  - Window-period prophylaxis
    - Children
    - Immunocompromised
Hospital 1 Exposures — Patients A, B and C

Patient A

2013

March April May June July

Patient B

Patient C

NICU
Hospital 1 Exposures — Patients A, B and C

Patient A

- May Hospitalization
- NICU
- June Hospitalization

2013

March April May June July

Patient B

Patient C
Transmission Among Cluster Cases

- Contact investigation did not reveal person with active TB disease that could explain recent airborne transmission to Patient A
- Reported to have consumed unpasteurized cheese from Mexico
Transmission Among Cluster Cases

- Contact investigation did not reveal person with active TB disease that could explain recent airborne transmission to Patient A
- Reported to have consumed unpasteurized cheese from Mexico
- *M. bovis* possibly transmitted to Patient A via ingestion
Transmission Among Cluster Cases
Transmission Among Cluster Cases

Hospital A
Neonatal Intensive Care Unit (NICU)
# Hospital 1 – Overall Testing Results

<table>
<thead>
<tr>
<th>Number of HCP Contacts</th>
<th>Eligible for Testing*</th>
<th>Tested</th>
<th>Positive result n (%)</th>
<th>Conversion (TST/QFT) n (%)</th>
<th>TB Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>178</td>
<td>172</td>
<td>21 (12)</td>
<td>16 (9)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

*28 HCP with past positive TB tests were not eligible for testing and were evaluated with symptom screen and chest radiograph; none were found to have TB disease
## Stratified Conversion Rates

<table>
<thead>
<tr>
<th>Exposure Grouping</th>
<th>Job Title</th>
<th>Number Tested</th>
<th>Conversion</th>
<th>Conversion</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stratified</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>May Hospitalization</strong></td>
<td>All</td>
<td>21</td>
<td>0 —</td>
<td>0 —</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RN</td>
<td>21</td>
<td>7 (33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RT</td>
<td>4</td>
<td>1 (25)</td>
<td>8 (16)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MD</td>
<td>5</td>
<td>0 —</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>18</td>
<td>0 —</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>June Hospitalization</strong></td>
<td>RN</td>
<td>48</td>
<td>3 (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RT</td>
<td>18</td>
<td>5 (28)</td>
<td>8 (8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MD</td>
<td>29</td>
<td>0 —</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>8</td>
<td>0 —</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Possible Contact with Patients A, B, and C</strong></td>
<td>NICU Staff</td>
<td>172</td>
<td>16 (9)</td>
<td></td>
<td></td>
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</tbody>
</table>
### Stratified Conversion Rates

#### Exposure Group

<table>
<thead>
<tr>
<th>Patient A Contacts</th>
<th>Hospitalization</th>
<th>NICU Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MD</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>RN</td>
<td>RT</td>
</tr>
<tr>
<td></td>
<td>MD</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>Other</td>
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</table>

#### Conversion Rates

<table>
<thead>
<tr>
<th></th>
<th>Tested</th>
<th>Conversion</th>
<th>Stratified Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Patient A Contacts</td>
<td>21</td>
<td>7 (33)</td>
<td>8 (16)</td>
</tr>
<tr>
<td>Hospitalization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN</td>
<td>48</td>
<td>3 (6)</td>
<td>8 (8)</td>
</tr>
<tr>
<td>RT</td>
<td>18</td>
<td>5 (28)</td>
<td></td>
</tr>
<tr>
<td>MD</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>18</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>172</td>
<td>16 (9)</td>
<td></td>
</tr>
</tbody>
</table>

- NICU Respiratory Therapists reported changing Patient B & C’s ventilator tubing and being ‘sprayed by mist from the tubing’
- No masks worn during these procedures
Contact Investigation Findings

- Health care associated transmission of TB
  - Occurred in the NICU
  - Active TB in NICU respiratory therapist (with DNA match)
  - Recent TB infection in other staff members

- Overall, RNs and RTs had higher rates of TB infection than other HCP
- Among NICU staff, RTs had a higher rate of TB infection than nurses
Summary

- TB is one of the world’s deadliest diseases
- Worldwide over 1.3 million deaths from TB in 2012
- Worldwide 2+ billion people are infected
- MTB is transmitted via respiratory droplets from person to person
- Diagnosis of disease can be done via the following tests: PPD skin test, IGRA, chest x-ray, sputum smears and culture
Summary

- Treatment of LTBI will reduce incidence
- Duration of therapy for anti-tuberculosis treatment is based on resistance patterns of the organism as well as site of disease
- Patients may be resistant to treatment adherence
  - Directly observed therapy (DOT) will assist with compliance and is the standard for care
- Appropriate therapy is imperative to decreasing the incidence of acquired drug resistance
Summary

- Appropriate PPE should be worn around confirmed or suspected TB cases
- Timely notification of public health is needed to interrupt transmission
- In lieu of truly effective vaccine, timely identification of active cases and treatment of LTBI is the only way to decrease future cases
- When in doubt contact the local health authority in your area
THINK TB!

Recognize positive signs and symptoms of tuberculosis. Early diagnosis and treatment reduces spread. Contact your Health Department or Physician for more information.
Special Thanks

- Kaci Hickox, CDC EIS Officer
- CDC EpiAID Team
- Staff at the Southern Nevada Health District Tuberculosis Treatment and Control Clinic

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