Tuberculosis Risk Assessment for Facility Residents and Staff

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Tuberculosis Testing: Statutes

- Tuberculosis (TB) testing is required for residents of public facilities and, upon hire, for staff.
- Statutes:
  - Chapter DHS 132 Nursing Homes
  - Chapter DCF 250 Family Child Care Centers
  - Chapter DCF 54 Child-Placing Agencies
  - Chapter DCF 57 Group Foster Care for Children
  - Chapter DHS 75 Community Substance Abuse Service Standards
  - Chapter DHS 83 Community-Based Residential Facilities
  - Chapter DHS 88 Licensed Adult Family Homes
  - Chapter DHS 134 Facilities Serving People with Developmental Disabilities

Goals of This Presentation

- Explain Risk-based Testing
  - Why it is the best way to test for TB in Wisconsin.
  - How to do it.
  - How to interpret your results.
  - How to decide when to treat.
  - How to decide when to retest.
What Are We Testing For?

- TB infection: evidence that the body's immune system has responded to *Mycobacterium tuberculosis* complex.
- Test does NOT tell us if there is disease; additional evaluation is necessary if test is positive.
- NO need for isolation or work restriction in case of positive test, UNLESS person has pulmonary symptoms.

How Do We Test?

- Tuberculin skin test
  - Insertion of a mixture of more than 200 antigens to many mycobacteria under the skin.
  - Relies on an intact immune system for response.
  - Response is measured as induration (swollen NOT red), in millimeters, across the arm.
  - CAN have a positive test due to BCG vaccine.
  - DOES respond to non-tuberculous mycobacteria such as *M. avium, M. fortuitum*.

- Interferon gamma release assays (IGRAs; blood test; Quantiferon Gold™ or T-Spot™)
  - Draw a 5 ml tube of blood and send it to the lab.
  - Tests six (6) antigens relatively specific to *M. tuberculosis*.
  - Relies on an intact immune system for response.
  - Cannot have a positive test due to BCG vaccine.
Risk-based vs. Routine Testing

- Wisconsin is a low TB incidence state.
- Many areas of the state have not had a case of TB disease in years.
- Repeat testing in a low incidence area results in many false positive tests – and associated unnecessary treatment for TB infection.
- Risk-based testing recommended by CDC since 2005.

Who’s at Risk for TB Infection?

- Close contacts of persons known or suspected to have active tuberculosis;
- Foreign-born persons from areas that have a high incidence of active tuberculosis (e.g., Africa, Asia, Eastern Europe, Latin America, and Russia);
- Persons who visit areas with a high prevalence of active tuberculosis, especially if visits are frequent or prolonged;
- Residents and employees of congregate settings whose clients are at increased risk for active tuberculosis (e.g., correctional facilities, long-term care facilities, and homeless shelters);

Who’s at Risk for TB Infection?

- Health-care workers who serve clients who are at increased risk for active tuberculosis;
- Populations defined locally as having an increased incidence of latent *M. tuberculosis* infection or active tuberculosis, possibly including medically underserved, low-income populations, or persons who abuse drugs or alcohol; and
- Infants, children, and adolescents exposed to adults who are at increased risk for latent *M. tuberculosis* infection or active tuberculosis.
How Do We Measure TB Risk?

- Risk at work
- Risk at home/personal factors
- Risk in social life

Risk at Work

- Presence of persons with known TB disease
- Presence of persons who MAY have TB but who haven’t been tested
  - New admissions and/or staff
  - Readmissions who have been exposed to TB while away
  - Visitors and family
  - Temporary staff

Risk at Home/Personal

- Foreign-born
- Live with foreign-born, or frequent visits from foreign-born
- Symptomatic, but thought to be caused by other factors (allergies, colds, flu)
- Medical history
- Immunosuppressed
- Knows/has known someone with TB disease
Risk in Social Life

- Work/volunteer history – has worked where there were TB patients
- Social gatherings in higher incidence areas
- Drug/alcohol abuse
- Visits to TB-endemic areas, particularly if working in clinics or living with local residents

How to Evaluate These?

- Educate as to TB risk factors
- Questionnaire for staff and residents
- Knowledge of risk factors and assessment of all new staff and residents by program manager

Why Is Too Much Testing a Bad Thing?

- The more you test in a low prevalence area, the more likely you are to get FALSE positive results.
- Likelihood of this is a function of positive predictive value, negative predictive value, sensitivity, specificity.
- A quick overview of all of the above.
Definition of Terms

Sensitivity: ability to correctly identify the people WITH the disease.

Specificity: ability to correctly identify people WITHOUT the disease.

These do not change with disease prevalence.

Definition of Terms

Positive predictive value: how good the test is at identifying those who truly ARE positive.

Negative predictive value: how good the test is at identifying those who DON’T have disease.

These DO change with disease prevalence.

Doing the Math

Example taken from “Understanding sensitivity and specificity with the right side of the brain” by Tze-Wey Loong, BMJ. 2003 September 27; 327(7417): 716–719.

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC200860/

- Prevalence of disease: 30% of the population.
- Test a random 100 people (since we never test EVERYBODY).
Prevalence of disease in the population

Testing the Population

Results of Testing

- Correctly identified 24 of 30 with disease, so sensitivity = 24/30 or 80%

- Correctly identified 56 of 70 without disease, so specificity = 56/70 or 80%
Predictive Values

- Positive predictive value is the chance that a positive test result will be correct; here it is 24 true positives out of 38 positive results, so \( \frac{24}{38} = 63\% \)

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC200804/

Predictive Values

- Negative predictive value is the chance that a negative test result will be correct; 56 true negatives of 62 negative results = 90%

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC200804/

Changes with Disease Prevalence

- Those are the results with 30% disease prevalence; 1/3 of the population has the disease.
- What happens when only 10% of the population has the disease?

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC200804/
Disease Prevalence 10%

- Sensitivity = 80%
- Specificity = 80%
- Positive predictive value
  \[ \frac{8}{26} = 31\% \]
- Negative predictive value
  \[ \frac{72}{74} = 97\% \]

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC200804/

Conclusion

- As the prevalence of the disease goes down, the positive predictive value (chance of getting a true positive test) goes down, and the chance of getting a true negative test goes up.

What Does This Have to do With TB?

- The prevalence of TB in Wisconsin is between 0.7 and 4%, depending on where you live.

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<thead>
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<th></th>
<th>TST</th>
<th>T-Spot</th>
<th>QFT-GIT</th>
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<td>Sensitivity</td>
<td>95</td>
<td>91</td>
<td>84</td>
</tr>
<tr>
<td>Specificity</td>
<td>85</td>
<td>88</td>
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**Interpreting Test Results**

- Does this mean that a QFT drawn on a person from China who has cough, weight loss, and night sweats is likely to be falsely negative?
  - **NO** – a person with risk factors is not representative of the general population, so positive tests in persons with risk factors are more likely to be true positives.

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**Implications for TB Testing**

- Testing people in low-prevalence areas will result in a lot of false positive tests
- Positive tests have implications – required follow-up testing, costs (in dollars, in work, in worry)
- Therefore, testing on the basis of actual risk for TB is preferred in low-prevalence areas.
Assessing Risk

- Employees: questionnaire, education
  - Issues:
    - Characteristics of your workforce;
    - TB stigma;
    - Ignorance.

- Residents: Use risk factor list (next slides)
  - Although there is little TB in Wisconsin, the last generation of those routinely exposed to TB is now in our assisted living and longterm care facilities.

Who is at Risk to Become Infected with TB?

Risk factors - Medical
- Fibrotic changes or “old healed TB” on CXR
- HIV infection
- Diabetes mellitus
- Chronic renal failure
- Gastrectomy or jejunoileal bypass
- Immunosuppressive therapy (including immunomodulators for arthritis)
- Pulmonary silicosis
- Hematologic disorders such as leukemia or lymphoma
- Malignant neoplasms such as carcinoma of the head or neck

Risk Factors: Non-medical
- Age ≤ 5 years
- Residence or occupation in high-risk congregate settings
- History of previous complete or partial treatment for TB
- Birth in a country having a high TB prevalence/incidence
- Children or adolescents with parents born in a country with a high prevalence of TB cases
- Socioeconomic predictors: Low income, Inner-city residence, Migrant labor, Drug and/or alcohol abuse, Homeless
- Exposure to a known case of tuberculosis
The Major Factors for TB Disease in Wisconsin are
- Foreign-born and/or
- Direct contact to someone with TB disease

Once You Test, What Do You Do With the Results?
- Handouts
  - Positive TST – What Next?
  - Positive IGRA – What Next?
- Local public health and state TB program happy to assist with interpretation and decisions
- Test with intent to treat positives – not much benefit in random TB testing result

Treatment for TB Infection
- Treat those most likely to progress from infection to disease.
- Treatment available free from local public health if necessary.
- Usually covered by insurance.
- Three separate regimens available (12 week, 4 month, 9 month), plus custom regimens if persons unable to take the most common medications.
Who’s At Risk to Progress to Active TB Disease? (1)

Persons at increased risk for progression of infection to active tuberculosis include:

- persons with human immunodeficiency virus (HIV) infection;
- infants and children aged <5 years;
- persons who are receiving immunosuppressive therapy such as tumor necrosis factor–alpha (TNF-α) antagonists, systemic corticosteroids equivalent to ≥15 mg of prednisone per day, or immune suppressive drug therapy following organ transplantation;
- persons who were recently infected with M. tuberculosis (within the past 2 years);
- persons with a history of untreated or inadequately treated active tuberculosis, including persons with fibrotic changes on chest radiograph consistent with prior active tuberculosis;

Who’s At Risk to Progress to Active TB Disease? (2)

Persons at increased risk for progression of infection to active tuberculosis include:

- persons with a history of untreated or inadequately treated active tuberculosis, including persons with fibrotic changes on chest radiograph consistent with prior active tuberculosis;
- persons with silicosis, diabetes mellitus, chronic renal failure, leukemia, lymphoma, or cancer of the head, neck, or lung;
- persons who have had a gastrectomy or jejunoileal bypass;
- persons who weigh <90% of their ideal body weight;
- cigarette smokers and persons who abuse drugs or alcohol; and
- populations defined locally as having an increased incidence of active tuberculosis, possibly including medically underserved or low-income populations.

Repeat Testing

- How often should testing be repeated?
  - Low-prevalence area:
    ▪ Known exposure
  - Higher-prevalence area:
    ▪ May do annual, may do every three years, may do every six months
Special Cases

- Travel to endemic area
  - Test just before leaving
  - Test 10 weeks after return OR earlier if any symptoms are present

Questions?

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