Guidelines for TB prevalence surveys

Geneva, December 2007

Philippe Glaziou
<table>
<thead>
<tr>
<th>Country</th>
<th>Screen</th>
<th>N</th>
<th>C(+)</th>
<th>S(+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>CXR</td>
<td>64,713</td>
<td>142</td>
<td>60</td>
</tr>
<tr>
<td>Philippines</td>
<td>CXR</td>
<td>21,960</td>
<td>124</td>
<td>47</td>
</tr>
<tr>
<td>China</td>
<td>CXR+PPD+ symptoms</td>
<td>365,097</td>
<td>584</td>
<td>447</td>
</tr>
<tr>
<td>Cambodia</td>
<td>CXR+ symptoms</td>
<td>22,160</td>
<td>271</td>
<td>81</td>
</tr>
<tr>
<td>Indonesia</td>
<td>symptoms</td>
<td>50,154</td>
<td>48</td>
<td>80</td>
</tr>
<tr>
<td>Eritrea</td>
<td>none</td>
<td>18,152</td>
<td>-</td>
<td>15</td>
</tr>
</tbody>
</table>
Objectives

Determine point-prevalence of TB
- Prevalence of S(+) TB
- Prevalence of C(+) TB
- Prevalence of symptoms
- Prevalence of CXR abnormalities

• Assess trends in prevalence
• Additional studies of risk factors and health care-seeking behavior
Testing methods

1. Assessment of symptoms by questionnaire
2. Chest radiography
3. Laboratory tests
Screening strategy 1

1. Symptom screening
2. Chest X-ray screening
3. Sputum smear examination
4. Culture examination

High Prevalence of Tuberculosis in Previously Treated Patients, Cape Town, South Africa


Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 13, No. 8, August 2007
Screening strategy 3

Symptom screening
Chest X-ray screening

No Symptoms
Normal chest X-ray

No smear microscopy
No culture

Symptoms or
Abnormal chest X-ray

Smear microscopy
Culture
Screening strategy 4

1. Symptom screening
2. Sputum smear examination
Different screening methods

**Chest X-ray** screening underestimated the prevalence of smear positive tuberculosis by
18% (Gothi et al., 1976)
29% (Datta et al., 2000)
50% (Fourie and Austoker, 1981)

**Symptoms** screening underestimated the prevalence of smear positive tuberculosis by
37% (Gothi et al., 1976)

No fixed ‘correction factor’ that can be used to estimate the true prevalence from the prevalence obtained by using a screening method.
Screening procedures for identifying bacteriologically confirmed pulmonary tuberculosis

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Identified Cases</th>
<th>Missed Cases</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy 1</td>
<td>all S(+)</td>
<td>None</td>
<td>Very intensive lab and CXR requirements</td>
</tr>
<tr>
<td>Strategy 2</td>
<td>all S(+)</td>
<td>S(-) C(+) sym(-) CXR(-)</td>
<td>Very intensive lab requirements</td>
</tr>
<tr>
<td>Strategy 3</td>
<td>most S(+)</td>
<td>S(+) sym(-) CXR(-); S(-) C(+) sym(-) CXR(-)</td>
<td>Most common screening method</td>
</tr>
<tr>
<td>Strategy 4</td>
<td>all S(+)</td>
<td>S(-) C(+)</td>
<td>May be considered where infrastructure is very limited</td>
</tr>
</tbody>
</table>

C(+) = culture-positive, CXR = chest X-ray, CXR(-) = normal chest X-ray, S(+) = smear-positive, S(-) = smear-negative, sym(-) = no symptom
Survey design

• Cluster sampling
  – PPS
  – Stratification:
    • to increase sampling efficiency, and/or
    • to provide estimates by strata

• Eligible:
  – ≥15yr old
  – e.g.: slept in the household night before
  – Provided informed consent
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>CXR</th>
<th>Bacterio</th>
<th>Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>no</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>+</td>
<td>definite</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>-</td>
<td>possible</td>
</tr>
<tr>
<td>-</td>
<td>+</td>
<td>+</td>
<td>definite</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>definite</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
<td>-</td>
<td>No</td>
</tr>
<tr>
<td>-</td>
<td>+</td>
<td>-</td>
<td>no</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>+</td>
<td>Definite</td>
</tr>
</tbody>
</table>
Sample size

<table>
<thead>
<tr>
<th>Prevalence per 100 000</th>
<th>Sample Size*</th>
<th>Cluster Size*</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>212 974</td>
<td>4259</td>
</tr>
<tr>
<td>100</td>
<td>106 434</td>
<td>2129</td>
</tr>
<tr>
<td>150</td>
<td>70 920</td>
<td>1418</td>
</tr>
<tr>
<td>200</td>
<td>53 164</td>
<td>1063</td>
</tr>
<tr>
<td>300</td>
<td>35 407</td>
<td>708</td>
</tr>
<tr>
<td>400</td>
<td>26 529</td>
<td>531</td>
</tr>
</tbody>
</table>

* Assumptions: 25% precision, design effect 1.3, 25% eligible cases missed, 50 clusters.
**Example:** Cambodia survey with 42 clusters of 30,000 subjects with screening by direct X-ray

Total cost: $550,000 (staff salaries excluded)
Capital Investment: $120,000
Consumables: $60,000
Training: $30,000
Field Operation: $120,000
Other Local Cost (including central unit operation): $60,000
Post-survey Events: $30,000
Second-Hand X-ray van (donation): $50,000 equivalent
Technical Assistance (6 person-months): $80,000
Marginal cost:
$3,000 – $4,000 per cluster with 700 – 750 participants
($4 – $6 per participant)
$2 – $3 to add a participant to an existing cluster
Survey Organization

- Steering Committee
  - Data Monitoring Centre
    - Monitors
  - Technical Advisory Group
    - Survey Coordinator
      - Medical Director
        - Central
          - Lab
          - CXR
          - Data Manager
          - Logistics
        - Field
          - Team Leader
          - Team Leader

CXR = chest X-ray
Implementation steps

1. Identify investigators and partner agencies
2. Develop protocol with budget
3. Pilot-test methods and tools
4. Amend protocol based on pilot test
5. Procurement and implementation
6. Monitor the survey
7. Analyze and disseminate results
Other aspects covered in the guidelines

- Monitoring
- Lab and chest X-Ray quality assurance
- Data management, reporting
- Safety
- Ethical aspects
- Data analysis
- Determinants of TB disease, other measurements: HIV, drug resistance
Limitations

• Estimates in subpopulations
• TB in children
• Extrapulmonary TB
• No measure of incidence
• High cost US$ 4-25 / person surveyed
Assessing Tuberculosis Prevalence through Population-based Surveys

Assessing tuberculosis prevalence through population-based surveys provides guidance on prevalence surveys of TB disease and is intended for TB experts and advisers at national and international levels, and investigators involved in prevalence surveys. Data collected through standard methods in a well-defined study population can help in assessing the performance of TB control programmes, provide information for planning, and assess trends of the disease burden over time.

PDF format

Tuberculosis Control in the Western Pacific Region - 2007 Report

The 2007 report on tuberculosis (TB) control in the WHO Western Pacific Region presents data on disease burden and case notifications in 2005, and treatment outcomes for patients registered in 2004. This report also includes information on the current state of