Screening strategies and case definitions

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At the end of this presentation

Participants know

- The available screening strategies and the advantages and disadvantages
- Definition of a prevalent case of TB
- Other definitions used in TB prevalence surveys
Available testing methods
Testing methods: Questionnaire
Testing methods: Chest radiography
Testing methods: Laboratory tests
What do we want to measure?
All pulmonary TB
All pulmonary TB

Culture+ PTB
All pulmonary TB

Culture+ PTB

ZN smear+ PTB

All pulmonary TB
Questionnaire
TB symptoms
Chest radiography
CXR suspect of TB
Questionnaire and chest radiography
CXR suspect of TB

TB symptoms
## Agreement between chest X-ray and symptom screening for the 29 bacteriologically positive TB cases

<table>
<thead>
<tr>
<th>TB-related abnormalities on chest X-ray</th>
<th>No, n</th>
<th>Yes, n</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough ≥ 2 weeks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Haemoptysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>19</td>
<td>22</td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Weight loss</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Any symptoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>26</td>
<td>29</td>
</tr>
</tbody>
</table>
Screening strategy 1

The identification of all smear- and/or culture-positive individuals

Symptom screening
Chest X-ray screening
Sputum smear examination
Culture examination

Disadvantages:
- High cost
- Significant demand for laboratory capacity

N.B. Not all culture positive cases will be identified due to limited sensitivity of the culture method
TB symptoms

CXR suspect of TB

Cases identified
Screening strategy 2

Symptom screening
Chest X-ray screening
Sputum smear examination

No symptoms
Normal chest X-ray
Negative smear

No culture

Symptoms or
Abnormal chest X-ray or
Positive smear

Culture

Disadvantages:
- Not all individuals with culture-positive pulmonary tuberculosis will be identified through symptom assessment, chest X-ray examination, or sputum smear screening
- High number of smear examinations
Screening strategy 3

- Symptom screening
- Chest X-ray screening

- No symptoms
  - Normal chest X-ray
    - No smear microscopy
      - No culture
    - Smear microscopy
      - Culture

Assumption:
- Those without abnormalities during screening do not have smear or culture positive tuberculosis
TB symptoms

CXR suspect of TB

Missed

Cases identified
Screening strategy 4

Symptom screening
Sputum smear examination

Disadvantage:
- Since culture is not performed species identification cannot be done and non-TB mycobacteria cannot be ruled out
CXR suspect of TB

TB symptoms

Cases identified
Cases identified

Auramine+ PTB

Culture+ PTB

ZN smear+ PTB

All pulmonary TB
## Summary: Screening procedures for identifying bacteriologically confirmed pulmonary TB

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Identified cases</th>
<th>Missed cases</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy 1: Questionnaire, chest X-ray, smear examination and culture of all eligible individuals</td>
<td>all S(+), all C(+)</td>
<td>None</td>
<td>Very intensive lab and chest X-ray requirements</td>
</tr>
<tr>
<td>Strategy 2: Screening by questionnaire, chest X-ray and smear examination</td>
<td>all S(+), most C(+)</td>
<td>S(-) sym(-) cxr(-)</td>
<td>Very intensive lab requirements</td>
</tr>
<tr>
<td>Strategy 3: Screening by questionnaire and chest X-ray</td>
<td>most S(+), most C(+)</td>
<td>S(+, ) sym(-) cxr(-) S(-) C(+) sym(-) cxr(-)</td>
<td>Most common screening method</td>
</tr>
<tr>
<td>Strategy 4: Smear examination of all eligible individuals</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(−) = normal chest X-ray, S(+) = smear-positive, S(−) = smear-negative, sym(−) = no symptom
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.
Additional considerations (1)

Screening populations for suspects substantially reduces the number of individuals who are asked to provide sputum (± 10% of the total surveyed population)

- More attention to those who need to provide sputum
  - Technique of producing sputum
  - Motivation
  - Tracing

- Less laboratory examinations
Additional considerations (2)

The number of sputum samples to be collected

- Most TB control programmes require the examination of three sputum samples
- **First** sputum identifies 77-94% of smear positives, **second** sputum provides additional 12-15%, **third** sputum provides additional 0.8-8%

Additional considerations (3)

Type of sputum samples

- TB control programmes collect two spot samples and one morning sample
- Spot specimens may be easier to collect than morning specimens
- Morning samples often result in a higher positivity rate than spot samples
### Measurement definitions of a positive test result

**Acid-fast bacilli positive:** At least one acid-fast bacilli in 100 immersion fields.

**Culture positive:**
- **Solid media:** Culture with at least five colonies after the maximum incubation period for the applied culture method. One to four colonies may be considered a positive culture result if the patient has TB-relevant symptoms or chest radiographs suggestive of TB, or both.
- **Liquid media:** Culture in which the growth indicator has turned positive or when visible growth occurs before a predefined period depending on the method used. If the growth indicator turns positive or visible growth occurs after a prolonged period the culture may be considered positive if the patient has TB-relevant symptoms or chest radiographs suggestive of TB, or both.

**AND**

The culture should test positive for niacin production and nitrate reduction and susceptibility to paranitrobenzoic acid in order to identify *M. tuberculosis*.

**OR**

A DNA-based methodology like reversed line blot should identify *M. tuberculosis*.

**Chest X-ray positive:** Radiographic abnormalities consistent with pulmonary tuberculosis.
Case definitions (WHO)

**Smear-positive pulmonary tuberculosis case:** One or more initial sputum smear examinations positive for acid fast bacilli by microscopy.

**Culture-positive pulmonary tuberculosis case:** At least one culture-positive for *Mycobacterium tuberculosis*.

**Bacteriologically confirmed pulmonary tuberculosis case:** Smear-positive or culture-positive pulmonary tuberculosis case.
Case definitions (WHO)

**Smear-positive pulmonary tuberculosis case:** One or more initial sputum smear examinations positive for acid fast bacilli by microscopy.

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Type of TB cases

**New case:** Patient who has never previously had treatment for tuberculosis or who has taken antituberculosis drug for less than a month.

**Case on treatment:** Patient who is currently being treated with anti-tuberculosis drugs.

**Relapse case:** Patient who was previously declared cured or who has completed treatment but with a new episode of bacteriologically positive (smear or culture) tuberculosis.

**Default case:** Patient whose treatment was interrupted for two consecutive months or more after at least one month of treatment.

**Failure case:** Patient who completed five months or more of treatment but who remained, or again became, bacteriologically positive (smear or culture).

**Case detected outside the survey:** Individual eligible for inclusion in the survey who is found with TB at a health-care facility (separately from the survey examinations) during or after the survey.
### Definite case / possible case / not a case

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Chest X-ray</th>
<th>Bacteriology</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>
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</tr>
<tr>
<td>+</td>
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<td>-</td>
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</tr>
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<td>no</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>+</td>
<td>definite</td>
</tr>
</tbody>
</table>

* If culture results are available and show Mycobacteria other than tuberculosis the individual should not be considered a definite case.
Recommended

- Screening using chest X-ray and symptoms
- Collection of morning and spot sample
- Smear examination and culture