TB Prevalence Survey
-Census, Interview and X ray-

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Census: Population & Eligibility

UN estimate vs. Local estimate: Issue in CDR and burden estimate (Total: 14 mil or 12 mil, Proportion of Children: 30% or 25%)

Need clear definition and examples: Visiting relatives, Visitors, Homeless, and Students and Factory workers in dormitory

“All slept last night”: Some community tries to hide those with sickness, while some community invites sick relatives from village nearby
Census: Confirming eligible population and asking for participation

People who basically stay in a defined area more than a month are eligible population regardless the possession of their house and their availability on the survey day (Cambodia Survey)

Proper informed consent to avoid creating fears

Example in Cambodia: Note book
Census: Confirming eligible population and asking for participation

To know population structure including children is often important especially when available population information is not reliable and when there are significant floating populations.

To assess socio-economic factors of households when included
Annex 5: Census Form (Household Registry)

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Sex</th>
<th>Relationship</th>
<th>Education Level</th>
<th>Occupation</th>
<th>Caste/Religion</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Note: When there are 12 people or more in a family, use another sheet (page 2) and fill the other sheet in (2).
Flow

Subjects

Reception (1+2)

Interview (3)

Team Leader

Sputum Examinations Registration & collection (1+1)

Not Eligible

X ray exempted

Chest X ray(1+1)

X-Ray reading (1+1)

X ray normal

Abnormal

Explanation if necessary

checking Ticket & incentive (1+1)
Reception

- Check Census list
- Fill to Survey Registry book
- Get consent
- Issue Individual survey card
- Give a “Number card”
- A chance to identify migration of non-eligible participants
  - Villagers may invite sick relatives from other village nearby
Individual or family by family interview by trained survey team health professional

However, 30-70% of S+ cases can not be detected

Interview to only a household head is not recommended
• Confirmation of demographic information
• TB related symptom and its duration
• TB history/ Current Treatment

Optional
• Health seeking behavior if TB suspects
• Others (smoking, socio-economy -----)

Home visit will be carried out to those who can’t afford to come due to illness, age etc to collect sputum specimen at least from those with TB suspected symptoms
survey site design of flow of “participants and date sheets” is a key for smooth operation

Rural village in Cambodia

Urban center, Viet Nam
• Confirmation of demographic information
• TB related symptom and its duration
• TB history/ Current Treatment
• Health seeking behavior if TB suspects (this can be done only for diagnosed TB cases when they are given Tx)

• Others (smoking, socio-economy -----)
• Interview could be a bottleneck of survey operation when you have many questions to ask. (must be tested)

• How many minutes per participant?

  example 5min x 10 p/ hr x 3 interviewers
  = 30p/hr = Capacity of X ray
## Limitation of Symptomatic Screening (CAM)

TB related symptoms and TB diagnosis

(22,160 subjects age 10 or more participated in National TB Survey)

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Symptomatics</th>
<th>No. of TB Patients diagnosed</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number (%)</td>
<td>S(+) (%) Bac(+) (%)</td>
<td>S(+) Bac(+)</td>
</tr>
<tr>
<td>Cough any duration</td>
<td>9,382 42.3%</td>
<td>74 0.8% 206 2.2%</td>
<td>91.4% 76.0%</td>
</tr>
<tr>
<td>Cough 3 weeks more</td>
<td>1,501 6.8%</td>
<td>49 3.3% 105 7.0%</td>
<td>60.5% 38.7%</td>
</tr>
<tr>
<td>Blood in sputum</td>
<td>302 1.4%</td>
<td>10 3.3% 17 5.6%</td>
<td>12.3% 6.3%</td>
</tr>
<tr>
<td>Sputum</td>
<td>6,813 30.7%</td>
<td>63 0.9% 161 2.4%</td>
<td>77.8% 59.4%</td>
</tr>
<tr>
<td>Chest pain</td>
<td>4,912 22.2%</td>
<td>48 1.0% 142 2.9%</td>
<td>59.3% 52.4%</td>
</tr>
<tr>
<td>Loss of weight</td>
<td>1,140 5.1%</td>
<td>33 2.9% 68 6.0%</td>
<td>40.7% 25.1%</td>
</tr>
<tr>
<td>Tiredness</td>
<td>3,325 15.0%</td>
<td>42 1.3% 115 3.5%</td>
<td>51.9% 42.4%</td>
</tr>
<tr>
<td>Fever</td>
<td>7,830 35.3%</td>
<td>50 0.6% 149 1.9%</td>
<td>61.7% 55.0%</td>
</tr>
<tr>
<td>Night sweat</td>
<td>1,589 7.2%</td>
<td>30 1.9% 65 4.1%</td>
<td>37.0% 24.0%</td>
</tr>
<tr>
<td>Other</td>
<td>22 0.1%</td>
<td>1 4.5% 1 4.5%</td>
<td>1.2% 0.4%</td>
</tr>
<tr>
<td>Cough 3w or Blood sputum</td>
<td>1,616 7.3%</td>
<td>50 3.1% 106 6.6%</td>
<td>61.7% 39.1%</td>
</tr>
<tr>
<td>Any symptom</td>
<td>12,902 58.2%</td>
<td>76 0.6% 229 1.8%</td>
<td>93.8% 84.5%</td>
</tr>
<tr>
<td>No symptom</td>
<td>9,258 41.8%</td>
<td>5 0.1% 42 0.5%</td>
<td>- -</td>
</tr>
</tbody>
</table>
# Limitation of Symptomatic Screening (Yangon)

X-ray TB diagnosis also missed 10-20% of prevalent cases

<table>
<thead>
<tr>
<th>Symptom</th>
<th>No</th>
<th>%</th>
<th>Sm+</th>
<th>Cul+</th>
<th>Sm+</th>
<th>Cul+</th>
<th>Sm+</th>
<th>Cul+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any duration of cough</td>
<td>4,016</td>
<td>21.4%</td>
<td>35</td>
<td>24</td>
<td>0.9%</td>
<td>0.6%</td>
<td>60.3%</td>
<td>45.3%</td>
</tr>
<tr>
<td><strong>cough &gt;= 3 wks</strong></td>
<td>387</td>
<td>2.1%</td>
<td>9</td>
<td>7</td>
<td>2.3%</td>
<td>1.8%</td>
<td><strong>15.5%</strong></td>
<td><strong>13.2%</strong></td>
</tr>
<tr>
<td>Sputum</td>
<td>4,116</td>
<td>21.9%</td>
<td>32</td>
<td>22</td>
<td>0.8%</td>
<td>0.5%</td>
<td>55.2%</td>
<td>41.5%</td>
</tr>
<tr>
<td>Heamoptysis</td>
<td>86</td>
<td>0.5%</td>
<td>2</td>
<td>3</td>
<td>2.3%</td>
<td>3.5%</td>
<td>3.4%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Weight Loss</td>
<td>1,234</td>
<td>6.6%</td>
<td>16</td>
<td>9</td>
<td>1.3%</td>
<td>0.7%</td>
<td>27.6%</td>
<td>17.0%</td>
</tr>
<tr>
<td>Fever</td>
<td>548</td>
<td>2.9%</td>
<td>9</td>
<td>4</td>
<td>1.6%</td>
<td>0.7%</td>
<td>15.5%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Chest Pain</td>
<td>3,153</td>
<td>16.8%</td>
<td>18</td>
<td>14</td>
<td>0.6%</td>
<td>0.4%</td>
<td>31.0%</td>
<td>26.4%</td>
</tr>
<tr>
<td><strong>Cough &gt;= 3wks and/or Heamoptysis</strong></td>
<td>456</td>
<td>2.4%</td>
<td>10</td>
<td>8</td>
<td>2.2%</td>
<td>1.8%</td>
<td>17.2%</td>
<td>15.1%</td>
</tr>
<tr>
<td>Any symptom</td>
<td>7,727</td>
<td>41.1%</td>
<td>45</td>
<td>29</td>
<td>0.6%</td>
<td>0.4%</td>
<td>77.6%</td>
<td>54.7%</td>
</tr>
<tr>
<td>CXR TB suspect</td>
<td>2160</td>
<td>11.5%</td>
<td>52</td>
<td>43</td>
<td>2.4%</td>
<td>2.0%</td>
<td><strong>89.7%</strong></td>
<td><strong>81.1%</strong></td>
</tr>
<tr>
<td>Any CXR shadow</td>
<td>3,231</td>
<td>17.2%</td>
<td>58</td>
<td>51</td>
<td>1.8%</td>
<td>1.6%</td>
<td><strong>100.0%</strong></td>
<td><strong>96.2%</strong></td>
</tr>
<tr>
<td>All Participants</td>
<td>18,809</td>
<td>100.0%</td>
<td>58</td>
<td>53</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.3%</td>
</tr>
</tbody>
</table>
Why X-ray?
Difficult to examine sputum from all
X ray is relatively safe, simple and sensitive method of screening
Physicians and technicians are often very familiar with X-ray exam

Sensitivity
• “TB suspect”: 60-80%
• “any abnormality”: - 97% even in high HIV setting (South Africa)
Constraints

- Capital Cost
- Running Cost
- Logistics: Transportation, Electricity
- Human Resources: Physician, Technicians

However, it is definitely a strong incentive for local people
Exclusion criteria

• **Known Pregnancy (early stage)**
  – However, usual X ray is safe
    • Amount of radiation by Chest x-ray is less than that of natural/environmental exposure during a intercontinental flight
    • Focusing not to radiate abdomen

• Physically difficult
• Rejected
Experience in Cambodia

3,217 Smear negative subjects  202 C+

Symptom + X ray – (1032):  8  0.8%

Symptom+ X ray + (381):  55  14.4%

Symptom- X ray+ (1804):  139  7.7%

X ray findings of 81 S(+) cases

TB compatible with cavity  60

TB compatible (non cavity)  17

Healed TB  4 (1)

No abnormality  0 (2)
X ray screening

Don’t diagnose at the screening, take sputum from any abnormality in lung and/or mediastinum. After the pilot studies, single calcification round shape nodule of a vessel size, dullness of CP angle and scar shadow only with line shadows, emphysema, bulla and Goiter were excluded. Judgments by Specialists are often wrong
Modern MMR (100mmx100mm)

- Economical and handy
- Easy screening
- Time gap between examination and report due to the development process
- Risk to develop hundreds films at once
- More radiation
- Less availability of films and accessories in market

The most popular method in the past prevalence surveys with X-ray
X-ray and results on the spot

• No time gap between screening and sputum collection
• At least first sputum can be collected under professional supervision
• Reassessment of the interview: history, current treatment etc. (people can’t hide the disease)
• Additional diagnostic evidence for single specimen positive

Combination of “symptom screening” and “Chest-X ray with screening results on the spot” is the most recommended method
Developing Film on the Spot
Quality Direct X-ray is Available in Villages
How many X rays/ hr ?

• X ray machine capacity
  – Conventional  60/ hr,    Digital Direct 90/hr

• Auto processor
  – 25-40 /hr

• Human factor (changing dresses etc.)
  – Most of the people are taken X-ray for the first time
  – 25-30/hr   150-180/ day might be reasonable
Digital Chest-Xray

- Immediate result without film processor/water
- No stock space for films
- Easy data management

- Capital cost
- Still sensitive to bumpy road

(Reading system in a mobile digital X-ray unit, digital X-ray car)
However technology improves, and price becomes affordable

Two different system

- Use Imaging plate like film, and read imaging plate by a reader machine (can use conventional X-ray)
- Direct detector (whole unit together)
Take X ray as usual but with an IP in a cassette not with a film.
Direct detector to get image

- No imaging plate
- Direct detection of X ray as signals
- Reconstructed image to PC or image reader
- Still price and maintenance are concerns
- Manufactures don’t guarantee field use
Survey in Viet Nam
Price

- Portable X-ray (full size) with accessories $8,000-15,000
- Portable auto processor $3,000-6,000
- Digital IP reader unit $30,000-$50,000
- Digital Direct Image Unit $100,000- ?

Viet Nam spent $1M for 3 digital X ray mobile units (WB), while other operational cost for the survey was $0.7M

Note: Market price is changing quickly
Flow of X rays

- Eligibility screening
- ID on cassette if conventional (or put in PC if digital)
- Taking X-ray
- Developing film (processing image)
- **Screening reading**: Intentional over-reading
- Result (special arrangement if some findings that need urgent intervention: pneumothorax, massive pneumonia etc.)
- **Central reading** (Quality assurance and re-Classification) *Should be separately recorded
- Diagnostic (case) Panel
Central Teams

• Central reading:
  – QA of field reading
    • “All” or “all abnormal + 10-20% normal”
  – Classification
  – Medical advise if necessary

• Diagnostic panel: case or not
Quality assurance

• Quality of Field reading
• Quality of X-ray film (readable?)

Quality control
should be done by field technicians,
physicians and team leaders routinely