QUESTION: suggestions for improvements to the structure/content of the guide, or review process?
Question

Suggestions for improvements to the structure/content of the inventory study guide, or review process?
TB incidence best measured from state-of-the-art TB surveillance systems

- High TB surveillance performance includes
  - High coverage of health/social protection and quality health services to ensure case detection
  - Low level of **under-reporting**
    - = reported / diagnosed
Finding: 46% of TB cases on treatment not known to NTP
Incidence estimate accurate? Level of under-reporting?

Trends in TB burden in India

Estimated incidence

Case notifications

Rate per 100,000

**Recent inventory studies**

<table>
<thead>
<tr>
<th>CAPTURE-RECAPTURE</th>
<th>NO CAPTURE-RECAPTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>USA (2 States)</td>
</tr>
<tr>
<td>UK</td>
<td>South Korea</td>
</tr>
<tr>
<td>Egypt</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Syria</td>
<td>India (study design not recommended in WHO guidelines)</td>
</tr>
<tr>
<td>Yemen</td>
<td></td>
</tr>
<tr>
<td>Iraq</td>
<td></td>
</tr>
</tbody>
</table>
How does it work?

- Cases detected by health providers
  - NTP providers (e.g. TB dispensaries)
  - General hospitals
  - Private doctors
  - ...

- Match cases in the non-NTP provider lists with cases in the NTP list
Principles – (1) under-reporting

- Non-NTP cases
- Many detected cases not reported
- All detected cases reported
Principles – (2) incidence

Total TB cases = \( N \)

- \( N_A \): non-NTP
- \( N_{AB} \)
- \( N_B \): Reported

Reported
Assuming independence between events A and B,

\[ P(A \cap B) = P(A) \cdot P(B) \]

\[ \frac{N_{AB}}{N} = \frac{N_A}{N} \cdot \frac{N_B}{N} \]

\[ N = \frac{N_A \cdot N_B}{N_{AB}} \]
Three separate lists necessary for capture-recapture (e.g. Iraq)

1980 cases detected,
473 additional cases estimated (394–565)
Inventory study objectives

- Demonstrate that under-reporting is minimal
- Quantify the level of under-reporting
- Estimate incidence
Guidelines process (1)

- All experts involved in recent inventory studies contacted
- Guidelines initiated in May 2011
... and lots of brainstorming
Inventory study guidelines – layout

Introduction
1 – overview, what, why, where, how
2 – study design
3 – implementation
4 – record-linkage
5 – data analysis
6 – capture-recapture
Annexes
Sampling challenges

- Sampling frame not documented
- Varying number of providers and cases per sampled area
- Missed linkages
  - Areas must be self contained (necessary to estimate incidence), OR
  - NTP data must extend beyond sampled areas
  - NTP data must extend before and after the study period
TB records
closed circles = reported, open circles = not reported
4 study designs

**RETROSPECTIVE**

1. Quantify **under-reporting** and estimate **incidence using existing records** (e.g. UK, Netherlands, S. Korea)

**PROSPECTIVE**

2. **LQAS** - demonstrate that under-reporting is minimal **untested**
3. Quantify **under-reporting untested**
4. Quantify **under-reporting and estimate incidence** (e.g. Iraq)
Design 1 - retrospective

- Use existing records over say one year
- Match records from different sources, including list of reported cases
- Compute under-reporting
- Estimate incidence through capture-recapture
Design 2 - LQAS in one minute

\[
H_0 : \pi \geq p \quad \text{vs.} \quad H_a : \pi < p
\]

- Sampling of providers from a complete listing
- Prospective data collection
- Classification of providers as acceptable or not acceptable \((p < \text{lower CI bound})\)
- Classification of the level of under-reporting in the country as acceptable or not acceptable \((\text{not acceptable providers} \geq d)\)
## Findings

1 not acceptable out of 87 sampled providers

## Interpretation

Under-reporting acceptable
Sample small geographical areas, say districts
Map providers within selected areas
Enroll all providers within selected area
Collect data for say 3 months
Record-linkage with NTP data
Select large, self-contained geographical areas
Enroll all providers, at least 3 types of providers essential
Collect data for say 3 months
Record-linkage with NTP data
Capture-recapture modelling
Implementation challenges

- Providers may refuse to participate
- Providers who usually do not report TB may start reporting new cases during the study
- Legal constraints may limit the use of data with personal identifiers
Record linkage

- **Deterministic** ideal – need unique national ID number or equivalent
- **Probabilistic** more work-intensive and may lead to misclassifications
Data analysis and capture-recapture modelling

- Require an **experienced statistician**
Essential ingredients

- Case-based databases with identifiers
- Standard TB case definitions
- Budget
- Expertise
- At least 3 data sources for capture-recapture
Guidelines process (2) - Next steps

- Feedback from this meeting
- Peer-review, including statistical aspects
- WHO guidelines review committee
- Editing and layout
- Posted on STB website
- Printed book distributed
- Plan to support countries with partners

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