Conceptual framework for improving the measurement of TB incidence using surveillance data

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Framework

Data reliability and coverage:
- Reports complete
- No dups, no misclassified
- Data internally consistent
- Data externally consistent

Changes over time:
- Measure time-changes in notifications
- Assess changes in case-finding
- Assess changes in TB determinants

Trends in incidence:
- Trends in notifications reflect trends in incidence
- capture re-capture onion model
  cross-validation

Incidence:
- notifications ≈ incidence

Entry point to evaluate IMPACT
- UPDATED estimates
- CERTIFIED

IMPROVE surveillance system
A framework to answer which questions?

1. Do changes in notifications reflect changes in incidence? *If not,*
   - to what extent changes in case finding efforts reflect changes in notifications?
   - to what extent do trends in notifications and trends in incidence differ?

2. Do notifications in a given year reflect incidence for that year? *If not,*
   - what is the estimated case detection rate?
Before the two questions can be answered, what should we first check?

1. **completeness** of notification data and other quality checks
   - are all reports complete and compiled?

2. **internal consistency**
   - is there more sub-national variability in notification rates than expected?
   - is there more variability over time than expected?
   - is laboratory diagnosis of documented quality?

3. **external consistency**
   - are proportions and rates consistent with current knowledge on TB epidemiology?
Completeness

• Are all expected reports
  – Available? (counts of quarterly reports)
  – Complete? (no missing data)
  – Consistent? (with reports of other quarters)
  – Compiled?
Completeness of reporting

![Graph showing completeness of reporting](image)

- **Number of cases**
- **Number of received reports**

- **Legend:**
  - Red circles: Number of reported cases
  - Black line: Number of received reports
Double counting

• Double counting cases?
  – National case-based information system with unique identifiers to avoid duplicates?
  – Transferred cases only reported by transferring-out unit?
## Removing duplicates in Brazil (2005)

<table>
<thead>
<tr>
<th>dups</th>
<th>new cases</th>
<th>incidence rate</th>
<th>change (%)</th>
<th>Cured (%)</th>
<th>change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>before</td>
<td>after</td>
<td>before</td>
<td>after</td>
<td>before</td>
</tr>
<tr>
<td>19,064</td>
<td>81,330</td>
<td>74,113</td>
<td>44.2</td>
<td>40.2</td>
<td>-9.7</td>
</tr>
</tbody>
</table>

See methods in:
Misclassifications

• Are case definitions consistent with WHO definitions?

• Is laboratory performance satisfactory?
  – Microscopy units with satisfactory EQA results (no major error AND less than 3 minor errors) > 90% of all units
  – If culture used, positive growth in untreated smear positives > 90%
## Internal consistency

<table>
<thead>
<tr>
<th></th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent change in national rates from previous report</td>
<td>$\left</td>
</tr>
<tr>
<td>Distribution of notified numbers by admin area</td>
<td>Poisson</td>
</tr>
<tr>
<td>Evaluated for treatment outcome match notifications of previous year</td>
<td>&gt;95% evaluated</td>
</tr>
</tbody>
</table>
Over-dispersion of s(+) notification rates by province in Venezuela

Test for over-dispersion of Poisson data: $p < 10^{-5}$
## External consistency

<table>
<thead>
<tr>
<th></th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>% smear positive (HIV-)</td>
<td>$40 \leq x \leq 45$</td>
</tr>
<tr>
<td>s(+) / suspects (lab)</td>
<td>$0.05 \leq x \leq 0.25$</td>
</tr>
<tr>
<td>% extra-pulmonary</td>
<td>$10 \leq x \leq 20$</td>
</tr>
<tr>
<td>sex ratio (M/F)</td>
<td>$1.5 \leq x \leq 2$</td>
</tr>
</tbody>
</table>
Consistency of % s(+) and % male reporting in Morocco

Do trends in notifications reflect trends in incidence?

1. Changes in case finding and reporting efforts? Assess changes in:
   - Policies on TB reporting (health sector reform)
   - Policies on case finding
   - Policies on childhood TB diagnosis and reporting
   - Numbers of diagnostic and treatment units
   - S(+) / suspects (lab)
   - Staffing numbers
   - NTP budget expenditures
   - Contribution of non-NTP providers
Do trends in notifications reflect trends in incidence?

2. Changes in factors influencing TB incidence?
   - HIV
   - Migration
   - Macroeconomic indicators:
     - GDP per capita
     - % below poverty line, % homeless
   - Health indicators: IMR
   - Disasters and wars
Do trends in notifications reflect trends in incidence?

3. Epidemiological patterns consistent with current knowledge on TB epidemiology?
   - Increasing mean age of cases when incidence declines
   - Changes in overall notifications consistent with predicted impact of HIV on incidence
   - Changes in age-specific notifications consistent with predicted impact of HIV on incidence
Age-specific rates consistent with declining transmission in Morocco

If completeness, internal and external consistency criteria meet standards,

1. Is geographical coverage of NTP 100%?
2. Do all providers and labs report cases to NTP?
3. Do all suspects access care and are they diagnosed?
4. Do recent trends in notifications reflect recent trends in incidence?
5. Are notification data cross-validated using other sources (mortality)

If yes to 1-5, then notifications provide a reasonable empirical estimate of incidence (CDR > 90%)
If notifications ≠ incidence,

assess case detection rate indirectly from notifications (see table 4 policy paper)
- expert opinion
- capture re-capture
- studies of drug consumption
- linkage with vital registration systems
- KAP surveys of health seeking behaviour

... or using other indirect methods and sources of data (prevalence surveys, mortality)
Benchmarks

Classify surveillance data into:

- **Good quality**, pass all tests
- **Intermediate quality**, fail some tests
  Provide recommendations for improvements
- **Insufficient quality**, fail most tests
  Provide recommendations for extensive improvements
Next steps

- Refine tests and benchmarks
- Field test prototype tool
- Sensitivity analysis (several country datasets)
- Finalize tool
- Publish framework
Question to the meeting

1. What does the Task Force think about the proposed framework?

2. What steps should be undertaken, and approaches explored, to successfully complete and implement the framework?
   - how to work with countries that likely meet criteria for "certification" and which ones should be part of a field-testing process for the framework tool?

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