Generation and interpretation of subnational Tuberculosis burden estimates in a high burden setting - a model for Indonesia

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Early excuses

• 10 minutes is short

• Details knowingly omitted, happy to discuss at later point
Rationale – data from prevalence survey

Indonesia by region

Region
- Sumatera
- Java-Bali
- Others
Rationale – n equals 510

Indonesia by district
Basic approach – absolute incidence

The estimates of TB incident at district level based on the population size, 2017
Basic approach – incidence/100k

The estimates of TB incidence rate per 100k population at district level based on the population size, 2017
Methods - principles

• Capture more of heterogeneity, use local data

• Local participation and ownership

• Dissemination to provincial and district level

• As simple as possible

• Sum of parts fit the whole

• Generate estimate for incidence and case detection rate at district-level
Methods – model data/variables

Variable requirements

- Clear definition
- Associated with TB burden
- Variation across districts
- Available in >90% of districts

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Range</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population size</td>
<td>Number of individuals per district</td>
<td>14,000 to 5,715,000</td>
<td>Projected Population of Regency/City 2010-2020, Statistics Indonesia</td>
</tr>
<tr>
<td>Level of urbanisation</td>
<td>Proportion of population that lives in urban area</td>
<td>0% to 100%</td>
<td>National Socio-Economic Survey 2015</td>
</tr>
<tr>
<td>Living floor space</td>
<td>Proportion of individuals who live in a house with less than 8m²/person</td>
<td>1% to 96%</td>
<td>National Socio-Economic Survey 2015</td>
</tr>
<tr>
<td>Junior high school completion</td>
<td>Proportion of individuals who did not complete junior high school or less</td>
<td>46% to 97%</td>
<td>National Socio-Economic Survey 2015</td>
</tr>
</tbody>
</table>
Methods – model

- **Step 1: Regional incidence (#)**
  - Total national incidence * relative prevalence by region

- **Step 2: Variable weight for each district**
  - Multi-variable logistic regression to estimate Relative Risks (by region)
  - Weight = Relative Risk * % risk factor in that district + % without risk factor
    - (e.g. % living in urban setting * 1.72 + % not in urban area * 1)

- **Step 3: District score**
  - Product variable weights * population

- **Step 4: Distribute burden**
  - By region: incidence # * (district score/total region score)
Methods – CDR + uncertainty

• Case Detection Rate
  • Reported notifications (district) / estimated incidence

• Sensitivity analyses
  • Population only
  • Exclude 1 variable at a time

• Uncertainty
  • See discussion

• Tool runs in Excel workbook, adapted locally
### Results – Relative risks and variable weights

#### Step 2: Range of weights for population
- Sumatera: 2.2-4.8
- Java-Bali: 1.4-3.0
- Others: 1.8-3.9

<table>
<thead>
<tr>
<th>RISK FACTORS-TB ASSOCIATIONS</th>
<th>Region</th>
<th>Relative Risk</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Living in urban area</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sumatera</td>
<td>1.72</td>
<td>1.22</td>
<td>2.44</td>
<td></td>
</tr>
<tr>
<td>Java-Bali</td>
<td>1.32</td>
<td>0.93</td>
<td>1.88</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>1.30</td>
<td>0.92</td>
<td>1.82</td>
<td></td>
</tr>
<tr>
<td><strong>Living in a house less than 8m²/person</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sumatera</td>
<td>1.50</td>
<td>1.03</td>
<td>2.19</td>
<td></td>
</tr>
<tr>
<td>Java-Bali</td>
<td>1.30</td>
<td>0.83</td>
<td>2.06</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>1.15</td>
<td>0.79</td>
<td>1.65</td>
<td></td>
</tr>
<tr>
<td><strong>Not completing junior high school</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sumatera</td>
<td>1.11</td>
<td>0.78</td>
<td>1.60</td>
<td></td>
</tr>
<tr>
<td>Java-Bali</td>
<td>1.34</td>
<td>0.90</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>1.61</td>
<td>1.10</td>
<td>2.36</td>
<td></td>
</tr>
</tbody>
</table>
Results – previous incidence/100k

The estimates of TB incidence rate per 100k population at district level based on the population size, 2017
Results – incidence/100k

The estimates of TB incidence rate per 100k population at district level based on the model, 2017
Model VS. Basic approach

<table>
<thead>
<tr>
<th>Different</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;30% lower</td>
<td>5%</td>
</tr>
<tr>
<td>10-30% lower</td>
<td>18%</td>
</tr>
<tr>
<td>0-10% lower</td>
<td>2%</td>
</tr>
<tr>
<td>0-10% higher</td>
<td>13%</td>
</tr>
<tr>
<td>10-30% higher</td>
<td>55%</td>
</tr>
<tr>
<td>&gt;30% higher</td>
<td>7%</td>
</tr>
</tbody>
</table>
**Results – Case Detection Rate**

**Figure 1.** The estimated case detection rate (CDR) is the ratio of the number of facility-based reported notifications to the estimated TB incidence. Among nine districts with an estimated CDR of more than 100%, six were urban districts. Urban districts are more likely to have better quality of care, and are likely to draw TB patients from the surrounding rural districts, which is highlighted in the detailed area.
Results – Dissemination

• Input throughout process from province and selected district officials, academics

• Workshops organized by provinces
  • District targets set through between district discussions at Provincial level
  • Agreement that sum of District targets should reach Provincial target
    • Note: National target informed provincial targets

• Enabled between-district discussions
  • Artificially high CDR due to between-district TB care access
  • Distinguish facility-based and domicile-based assessment of targets (e.g. Magelang City: facility CDR=249%, domicile CDR=59%)

• Fed into development of District and Province Action Plans in line with Indonesia NSP
  • Budgetary discussions, resource allocation, intervention planning
Discussion

LIMITATIONS
• Heterogeneity only captured by limited variables to selected variables
• Relative risks based on pulmonary TB, adults only
• Limited uncertainty analysis

STRENGTHS
• Simple model: clear method of distribution of estimated incidence
• Internal consistency – association (i.e. RR) and data at district level use same definitions from the same population and time period
• Transparent: Data are publicly available - Districts can check their ‘allocation’
• Flexible: Method can easily be expanded, revised if more/new data become available
  • Planned for 2019

CONCLUSION
• Simple model can address urgent needs in highly decentralized health system for planning and monitoring of performance
• Has highlighted important variability in health system performance and utilization
• Major and necessary advance in subnational TB policy discussions
Additional thoughts (for group discussion)

• How to handle uncertainty
  • Could explore uncertainty of each parameter
  • Risk of breaking principle of ‘Sum of parts fits whole’
  • May be useful when point value is likely too low (e.g. Jakarta province).

• Link to other data/tools
  • Health system resources (MATCH)
  • Inventory study (underreporting/underdetection)

• Principle of simple model
  • Clear link between local (accepted) data and assigned burden
  • Enabled local ownership and effective dissemination

• Relax missingness requirements, e.g. imputation
  • Would reduce transparency

• Expand to childhood TB, DRTB, TB and Diabetes?
Acknowledgments

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