National TB prevalence surveys: an overview of progress since the 2016 Task Force meeting

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TB Monitoring & Evaluation
Global TB Programme
WHO
Global status of national TB prevalence surveys since 2007

25 surveys
24 countries
Surveys currently ongoing

*field operations completed
Planning to start in 2018

- Botswana
- Lesotho
- India
- Nepal
- Swaziland
Primary objective

Bacteriologically-confirmed

Pulmonary TB

15 years of more
Methodology

Cluster-based sampling
Population proportional to size
500-1000 people per cluster
Methodology

Symptom screening
Chest X-ray screening

No symptoms
Normal chest X-ray

No smear microscopy
No culture
No Xpert MTB/RIF

Symptoms or
Abnormality on chest X-ray

Smear microscopy
Culture
Xpert MTB/RIF
Methodology

86,000 enumerated
in 98 clusters
Methodology

60,000 eligible to participate
15+ years and residency criteria
Methodology

50,000 *actually* participate
(Target 85%)
Methodology

10,000 screen positive by CXR and/or symptom screening
248 bacteriologically confirmed pulmonary TB cases in participants 15+ years

Extrapolate to all forms of TB and for all ages
Estimates of TB prevalence (all ages, all forms of TB) for 25 surveys, before (in blue) and after (in red) results from national TB prevalence surveys became available since 2007.
Trends between the 2007 and 2016 surveys in the Philippines

Distribution of the estimated prevalence from the 2007 and 2016 surveys
The lack of decline in TB prevalence in the Philippines since 2007 could be explained by factors beyond the TB programme....

Health system weaknesses

Significant delays in diagnosis

Undernourishment 14% (2015)

Poverty 13% (2012)

Health insurance and social protection 4% in the poorest quintile (2013) 35% catastrophic cost (2017)
Some innovations from recent surveys
Using tablets linked to a central server
Using tablets as part of consent
Using barcodes in the field
And in the lab
Digital chest X-rays
Computer-Aided Detection of TB

Namibia (2017-2018)
Computer-Aided Detection of TB for screening (and diagnosis)

A systematic review:

- the evidence of CAD’s diagnostic accuracy is limited by the small number of studies (5) of the single commercially available CAD software (CAD4TB).
- There were also important methodological limitations to the studies and their findings had limited generalizability.

WHO provides no recommendations on using CAD for TB, in general.
Different approaches to HIV testing
Using Xpert MTB/RIF in the “field”
Other activities
Study tour of South Africa: Botswana, Lesotho and Swaziland
Publications
(since 2016)

A tuberculosis nationwide prevalence survey in Gambia, 2012
Iledayo MO Adetifa,^a Lindsay Kendall,a Adedapo Bashorun,a Christopher Linda,a Seneeh Omoike,^a David Jeffries,b Rahmatulai Maanee,c Beatrice De Arosced, William De Alordec, Catherine Bi Okiod,^a Kodjovi D Mlaga,^d Mo Ansu Kinteh,d Simon Donkor,d Bouke C de Jong,e Martin Antonid,^f & Umberto d’Alessandro^f

Prevalence of pulmonary tuberculosis in adult population of Tanzania: a national survey, 2012
M. Senkoro,^a S. Mfinanga,a S. Egwaga,a R. Mtandu,a D. V. Kamara,a D. Basra,a L. Fundikira,a A. Kalheva,a E. Utzimo,a N. Ranga,a S. G. Hinderaker,a F. van Leth^f

The effect of household poverty on tuberculosis
A. Siroka,a^* I. Law,a J. Macinko,a K. Floyd,c R. P. Banda,c N. B. Hoa,^* B. Tsolmon,a P. Chanda-Kapaata,a M. Gasane,a T. Lwinn,a M. Senkoro,a T. Tupasi,a N. A. Ponce,a

Automatic versus human reading of chest X-rays in the Zambia National Tuberculosis Prevalence Survey
J. Melendez,a R. H. H. M. Philipsen,a P. Chanda-Kapaata,a V. Sunkutu,a N. Kapata,a B. van Ginneken,a

The adult prevalence of HIV in Zambia: results from a population based mobile testing survey conducted in 2013–2014
Rascalin Chanda-Kapaata,a Nathan Kapata,b Eveline Kinkenberg,a Njosa William,a Liwewe Mzayang,b Kabata Muzala,b Elizabeth Chiemer Kewela,b Felix Masie,y and Peter Mwaba,b

Onions and prevalence surveys: how to analyze and quantify tuberculosis case-finding gaps
W. A. Wells
United States Agency for International Development, Washington, DC, USA

Population Based National Tuberculosis Prevalence Survey among Adults (>15 Years) in Pakistan, 2010–2011
Ejaz Qadeer,a Raza Fatima,a Aasifah Yaqoob,a Sabina Tehsae,a Mehboob Ul Haq,a Abdul Ghaffoor,b Muhammad Asif,b Maajid Sattar,a Edine W. Tamerana,a

24 country profiles
Cross-cutting chapters
Status of recommendations since the 2016 Task Force meeting
1. Overall governance/oversight mechanisms for surveys

• Survey monitoring by implementers and sponsors
  – Good Clinical Practices (GCP) and Good Data Management Practices (GMDP)
  – Data Safety and Monitoring Board

• Development of a plan to create a **package of key elements** and **standard procedures** for a survey to adhere to GCP and GDMP principles within the next year

• **Funding** is required
2. Funding for report production and associated communication, dissemination and use of results

• All available published reports and papers are currently housed in an online repository

• TA providers reminding countries to include funding for communication plans include reports, dissemination activities.

• Results being used in concept notes, epidemiological reviews, national strategic plans
Reporting

• Research agencies implemented the surveys in Bangladesh, Kenya and the Philippines
  – Field operations to official release of results
    • 4 to 8 months
  – Field operations to draft (or final) report
    • 8 to 16 months
3. Replacement of sputum smear microscopy and culture with Xpert MTB/RIF (or equivalent or better molecular test)

We need more evidence!
Methodology

15+ years

Symptom screening
CXR screening

Smear
Culture

Evolving....

15+ years

Screening (digital)

Smear
Culture
Xpert MTB/RIF
Ultra is non-inferior to the Xpert MTB/RIF assay for the detection of MTB and for the detection of rifampicin resistance.
Greater use of Xpert MTB/RIF (for all those who screen positive)

<table>
<thead>
<tr>
<th>Surveys since 2016</th>
<th>Culture</th>
<th>Xpert MTB/RIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>DPRK</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td>Kenya</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Myanmar</td>
<td>✔️</td>
<td>* Ultra **</td>
</tr>
<tr>
<td>Namibia</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Philippines</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>South Africa</td>
<td>✔️</td>
<td>Ultra</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>

* Only 50% of clusters were tested with culture **two Xpert Ultra per screened positive participant
Prevalence of bacteriologically confirmed pulmonary TB by diagnostic method

Philippines 2016 survey

Xpert MTB/RIF
Culture

Prevalence per 100,000 population

Age groups (years)
15-24, 25-34, 35-44, 45-54, 55-64, ≥65
# Higher yield of Xpert MTB/RIF over culture

<table>
<thead>
<tr>
<th></th>
<th>Bangladesh</th>
<th>%</th>
<th>Kenya</th>
<th>%</th>
<th>Philippines</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total bacteriologically confirmed cases</td>
<td>278</td>
<td></td>
<td>305</td>
<td></td>
<td>466</td>
<td></td>
</tr>
<tr>
<td>Only Xpert MTB/RIF positive</td>
<td>124\textsuperscript{a}</td>
<td>45</td>
<td>90\textsuperscript{b}</td>
<td>30</td>
<td>238\textsuperscript{d}</td>
<td>51</td>
</tr>
<tr>
<td>Only culture MTB positive</td>
<td>22</td>
<td>8</td>
<td>68\textsuperscript{c}</td>
<td>22</td>
<td>69</td>
<td>15</td>
</tr>
<tr>
<td>Xpert MTB/RIF and culture positive</td>
<td>132</td>
<td>47</td>
<td>147</td>
<td>48</td>
<td>159</td>
<td>34</td>
</tr>
</tbody>
</table>

Footnotes:
\textsuperscript{a} 4 with no culture result
\textsuperscript{b} 10 with no culture results
\textsuperscript{c} 3 with no Xpert MTB/RIF result
\textsuperscript{d} 10 with no culture result
Xpert-positive, culture-negative
Recovery rate of smear-positive

<table>
<thead>
<tr>
<th>Country</th>
<th>Total smear positive</th>
<th>Culture positive (MTB)</th>
<th>%</th>
<th>Culture and/or Xpert positive</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>125</td>
<td>87</td>
<td>70</td>
<td>108</td>
<td>86</td>
</tr>
<tr>
<td>Kenya</td>
<td>146</td>
<td>111</td>
<td>76</td>
<td>126</td>
<td>86</td>
</tr>
<tr>
<td>Philippines</td>
<td>183</td>
<td>128</td>
<td>70</td>
<td>173</td>
<td>95</td>
</tr>
</tbody>
</table>

But what does Xpert-positive and culture-negative really mean?

Poor culture performance
Identifying non-viable MTB
3. Replacement of sputum smear microscopy and culture with Xpert MTB/RIF (or equivalent or better molecular test)

- **Future surveys:**
  - 2 Xpert tests only
  - Consider culture only if labs are very good

- **Repeat surveys:**
  - Use at least the same screening and diagnostic methods

- **Await South Africa, Myanmar and Viet Nam results**
One last thing....
17 countries completed a survey since the launch of the Lime Book
1. Updates to Lime book
2. Xpert® MTB/RIF (or Xpert Ultra) and culture
3. Provision of TA to countries
4. Good Clinical Practice - concept note
Prevalence survey
technical support and primary funders
End
Recovery rate of smear-positive is low (<85%)
# Philippines

<table>
<thead>
<tr>
<th></th>
<th>N</th>
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</thead>
<tbody>
<tr>
<td>Any Xpert-positive</td>
<td>397</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB</td>
<td>228</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB &amp; on Tx</td>
<td>28</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB &amp; on Tx &amp; abnormal CXR</td>
<td>24</td>
</tr>
</tbody>
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*CXR results: 1 other, 3 unknown

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</tr>
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<tr>
<td>Any Xpert-positive</td>
<td>397</td>
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<tr>
<td>Any Xpert-positive &amp; culture not TB</td>
<td>228</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB &amp; on Tx</td>
<td>52</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB &amp; on Tx &amp; abnormal CXR</td>
<td>46</td>
</tr>
</tbody>
</table>

*CXR results: 1 other, 5 unknown
## Bangladesh

<table>
<thead>
<tr>
<th>Description</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Xpert-positive</td>
<td>256</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB</td>
<td>120</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB &amp; on Tx</td>
<td>7</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB &amp; on Tx &amp; abnormal CXR</td>
<td>7</td>
</tr>
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<td>Any Xpert-positive</td>
<td>256</td>
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<tr>
<td>Any Xpert-positive &amp; culture not TB</td>
<td>120</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB &amp; on Tx (current and past)</td>
<td>25</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB &amp; on Tx (current and past) &amp; abnormal CXR</td>
<td>23</td>
</tr>
</tbody>
</table>

*CXR results: 2 normal*
### Kenya

<table>
<thead>
<tr>
<th>Condition</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Xpert-positive</td>
<td>90</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB</td>
<td>80</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB &amp; on Tx</td>
<td>11</td>
</tr>
<tr>
<td>Any Xpert-positive &amp; culture not TB &amp; on Tx &amp; abnormal CXR</td>
<td>10</td>
</tr>
</tbody>
</table>

*1 was CXR result “other”*
Main topics to be updated in the Lime book

- Readdress in the context of the End TB Strategy
- Given the increasing use of molecular based diagnostics specially to replace smear and culture
  - Update case definitions
  - Update bacteriology chapter
- Digital chest X-ray
  - Draft consumer guide for the purchase of digital chest X-ray
  - Use of CAD
- Digital data management including database template
- Small area estimation methodology
- Adherence to Good Clinical Practice and Good Data Management Practises
- Include method to extrapolate survey-derived prevalence to “all forms, all ages” prevalence
- TA monitoring checklists
- Communication – template for report writing