Introducing new TB diagnostics for those living with HIV: consequences for the South African health budget

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Starting point

• In South Africa 2009, 58% of the people diagnosed with TB were also HIV positive
• For persons living with HIV, TB can be quickly fatal (globally leading killer for those with HIV (19% of deaths))
• Yet, the diagnosis of TB in those with HIV is complex
• Conventional ‘point of care’ tests (smear microscopy) are not very sensitive for those with HIV. Other tests take time (culture)/ can be expensive, with many TB suspects not returning for results.
• New diagnostic Xpert MTB/RIF has much higher sensitivity, is quicker - potential for point of care use
• It also provides a signal for MDR-TB (Rif resistance)

First potential ‘game changer’ for TB control for many years (since SC regimens/MDR-TB treatment)

Results and lessons learned using economic analysis

- Initial decision modelling
- Global recommendation
- Country roll-out – South Africa

=> Use of economic data during the process
Background – Cost-effectiveness

- Decision analytic cohort model (Treeage Williamstown USA)
- Two scenarios: Xpert replaces smear microscopy, or in addition to smear microscopy
- 10,000 TB suspects including patients with S+ and S- pulmonary TB
  - Presenting with prolonged cough with or without systemic or other symptoms suggestive of pulmonary TB – as in field trial
- Separately for:
  - new and previously treated patients
  - HIV- and HIV+ patients
  - RIF-resistance/MDR
- Three countries (SA, India, Uganda)
Model Parameterisation

- Test cost data (all TB test costs) empirical
- WHO choice estimates and literature sources treatment cost estimates
- Test performance from clinical trial sites


- Cohort pathway probabilities (ie initial default, default before diagnosis, adherence, return to system) literature based and assumptions
- Monte Carlo probabilistic sensitivity analysis
- A wide range of one and two sensitivity analysis for main assumptions
Incremental Cost Effectiveness Ratio (Cost per DALY) (US$2010)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Cost per DALY</th>
<th>ICER compared to base case, mean</th>
<th>ICER compared to ‘in addition to,’ mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Case</td>
<td>69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In addition to smear</td>
<td>78</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>Replacement of smear</td>
<td>85</td>
<td>138</td>
<td>582</td>
</tr>
</tbody>
</table>

Xpert MTB/RIF as a replacement of smear microscopy is predicted to be a highly cost-effective intervention at a willingness to pay threshold well below GDP per capita.

Policy Impact

1. Policy decisions
   - WHO recommendation to adopt Xpert
   - South Africa committed to roll-out Xpert
   - Global concern about budgetary implications (MDR-TB) and whether effectiveness could be achieved in practice (laboratory feasibility, health systems response)
Limitations of global exercise

• But influenced by the extent to which Xpert can to address loss to follow up (health systems/quality/patient costs) and the unit costs of diagnosis and treatment

• Technical and programmatic recommendation

• Does not providing sufficiently detailed data for financing at the country level
XTEND/XPHACTOR project

Step-wedged (random clusters of facilities) pragmatic trial

To measure the effectiveness of Xpert MTB/RIF in reducing early mortality in TB suspects – DURING ROLL-OUT.

To examine the effect of Xpert MTB/RIF availability on health care worker investigation practice (and changes in HR/ fixed resource capacity use)

To estimate the incremental cost per life saved and DALY averted from improved TB suspect outcomes from a provider and client perspective

To estimate the population-level impact of Xpert MTB/RIF roll-out using transmission modelling.

To examine screening/ triage in populations in HIV treatment and care
Preparation for roll-out and trial

- Estimate the resource requirements of scaling up Xpert MTB/RIF in South Africa over a five year period
- Two groups asked – HE²RO/UCT – existing planning model and cohort model
- In doing so, access to locally available data to better assess data gaps in the current knowledge in respect of Xpert MTB/RIF population level costs and affordability
- Strengthen links with policy makers
- Provide recommendations in terms of data collection and modeling during XTEND and beyond.
Methods

- ASSA and TB incidence data used to establish population in need.
  - TB incidence based on static epidemic.
  - Suspect population from TB smear positives (limited)
- Model adjusted to newly available treatment, laboratory and other national data – plus confirmed algorithm
- Treatment/ MDR-TB cost impact
- Economies of scale (limited)
- 2 scale-up scenarios (case detection) - and extensive sensitivity analyses
Mean cost per suspect and case diagnosed US$ 2011

- **Gradual scale-up - PE Xpert cost**
- **Rapid scale-up - PE Xpert cost**
- **Gradual scale-up - high Xpert cost**
- **Rapid scale-up - high Xpert cost**
## Predictions – Case detection increases at historical trends

<table>
<thead>
<tr>
<th>Years</th>
<th>2011</th>
<th>2015</th>
<th>% increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of suspects</td>
<td>1,878,274</td>
<td>1,992,897</td>
<td>6%</td>
</tr>
<tr>
<td>Diagnostic costs (US$)</td>
<td>73,014,526</td>
<td>116,525,404</td>
<td>60%</td>
</tr>
<tr>
<td>Treatment costs (US$)</td>
<td>533,679,235</td>
<td>636,933,809</td>
<td>19%</td>
</tr>
<tr>
<td>Total costs (US$)</td>
<td>606,693,762</td>
<td>753,459,213</td>
<td>24%</td>
</tr>
<tr>
<td>TB cases detected</td>
<td>311,751</td>
<td>364,129</td>
<td>17%</td>
</tr>
<tr>
<td>MDR TB cases detected</td>
<td>8,357</td>
<td>15,769</td>
<td>89%</td>
</tr>
</tbody>
</table>
**Predictions — case detection expands from 2010 SA policy**

<table>
<thead>
<tr>
<th>Years</th>
<th>2011</th>
<th>2015</th>
<th>% increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of suspects</td>
<td>1,996,829</td>
<td>2,716,664</td>
<td>36%</td>
</tr>
<tr>
<td>Diagnostic costs (US$)</td>
<td>81,971,174</td>
<td>158,844,305</td>
<td>94%</td>
</tr>
<tr>
<td>Treatment costs (US$)</td>
<td>575,234,259</td>
<td>868,251,082</td>
<td>51%</td>
</tr>
<tr>
<td>Total costs (US$)</td>
<td>657,205,433</td>
<td>1,027,095,387</td>
<td>56%</td>
</tr>
<tr>
<td>TB cases detected</td>
<td>335,142</td>
<td>496,370</td>
<td>48%</td>
</tr>
<tr>
<td>MDR TB cases detected</td>
<td>9,653</td>
<td>21,495</td>
<td>123%</td>
</tr>
</tbody>
</table>

High-end estimate may be significantly reduced, if MDR-TB treatment costs can be reduced.
Policy implications

• In 2010/11 and 2011/12, health spending is projected to be US $14.4 billion and US $16 billion respectively, with around 5.2% of the total health budget was spent on TB in 2010/11
• Top-end 2.5% increase in SA health budget
• Joint presentation of both studies estimates
• Discussions with MoF - affordable in current fiscal climate
• Key issue remains is lives saved during roll-out (MoF aware of health systems limitations).
• MDR-TB costs less of a concern.
Questions remaining

- Direct effects in real world setting (pragmatic trial) – TB/HIV mortality
- Patient cost savings
- Effect of Xpert roll-out on transmission
- Costs (and models) of MDR-TB treatment
- Costs of TB treatment and diagnostics taking into account changing capacity (recent price reductions)
- Impact on ART costs
- Screening for those accessing HIV care and treatment
Thank you

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