Cost-effectiveness of conjugate typhoid vaccination: a preliminary analysis

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  – Vaccine and vaccination strategies
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Background: cost-effectiveness analysis

- Part of IVI’s typhoid global investment case study
- Builds on disease burden and economic burden work
- Uses standard set of assumptions across developing countries
- Estimated by UN sub-regions
UN regions included in the analysis
assumptions

ASSUMPTIONS
Vaccine introduction assumptions

- Vaccine is introduced in high (>100/100,000) and medium incidence (10~100/100,000) countries
- Targeted to high-risk population (*Urban slums and rural area without improved water*)
- The reference population is that of 2010
- Vaccination is in campaign mode and completed in 2010
Vaccine characteristics

• Assumed Vi conjugate vaccine characteristics
• 1-3 doses with and without catch-ups
• Duration of protection: 14 years
• Efficacy: 90% on 1st year
• Efficacy waning: exponential decay

• Separate analysis will be conducted for ViPS and Ty21a based on known characteristics
Vaccination strategies: Vi conjugate vaccine

Routine campaign

High incidence countries

- 2 doses: At 9mt, 6yrs

Medium incidence

- 3 doses: 9, 18 mt & 6 yrs

Catch-up campaign

- 1 dose: At 6 yrs
Vaccination coverage assumptions

• Dose at 9 month: MCV1 100% coverage
• Dose at 6 years: MCV2 75% coverage
• DTP 1 to DTP 2 dropout rate was used to estimate MCV2 incase data unavailable
• Based on WHO report
Costs assumptions

• Total Vi-conjugate per dose = $2.33 per dose
  – Vi-conjugate = $1.50 per dose + 15% FIC = $1.73 per dose
  – Delivery = $0.60 per dose (from WHO cMYP costing manual for campaigns)

• Estimate would be improved later

• Wastage = 10%

• Discounting = 3%
IVI estimations

IVI ESTIMATIONS
High and medium incidence countries

Surveillance site

Typhoid incidence (overall populations)
- Low (<10/100,000 per year)
- Medium (10-100/100,000 per year)
- High (>10/100,000 per year)
- Limited/Outdated data

* Not adjusted for blood culture sensitivity
### Disease burden (2010)

<table>
<thead>
<tr>
<th>Region</th>
<th>Median no. of cases</th>
<th>Median no. of Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>3,977,170</td>
<td>37,892</td>
</tr>
<tr>
<td>Asia</td>
<td>8,353,453</td>
<td>38,983</td>
</tr>
<tr>
<td>Latin America</td>
<td>143,005</td>
<td>667</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12,473,628</strong></td>
<td><strong>77,542</strong></td>
</tr>
</tbody>
</table>
Economic burden (2010)

* In international dollars
RESULTS
Population targeted for vaccination

<table>
<thead>
<tr>
<th>Category</th>
<th>No. of countries</th>
<th>Population in target age (Millions)</th>
<th>High risk population (Millions)</th>
<th>Vaccinated dose 1 (Millions)</th>
<th>Vaccinated dose 2 (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High incidence countries</td>
<td>57</td>
<td>64.9</td>
<td>23.8</td>
<td>17.9</td>
<td>12.6</td>
</tr>
<tr>
<td>Medium incidence countries</td>
<td>36</td>
<td>14.1</td>
<td>2.3</td>
<td>1.7</td>
<td>0</td>
</tr>
</tbody>
</table>

High incidence countries (2.7 billions)  Medium incidence countries (0.67 billions)
### Vaccination impact*

<table>
<thead>
<tr>
<th></th>
<th>Averted cases</th>
<th>Averted deaths</th>
<th>Averted DALYs</th>
</tr>
</thead>
<tbody>
<tr>
<td>High incidence countries</td>
<td>2,461,317</td>
<td>8,122</td>
<td>256,899</td>
</tr>
<tr>
<td>Medium incidence countries</td>
<td>21,723</td>
<td>72</td>
<td>2,446</td>
</tr>
<tr>
<td>Total</td>
<td>2,483,040</td>
<td>8,194</td>
<td>259,345</td>
</tr>
</tbody>
</table>

*Estimated till 2030, no herd protection considered
Costs (in millions, $ 2010)

- Vaccination cost COI averted Net cost
  - High incidence countries
    - $78.71
    - $4.27
    - $2.73
    - $1.53
  - Medium incidence countries
    - $140.71
    - $62.00
Cost-effectiveness (cost per DALY)

North Africa
Rest of Africa
Latin America
South East Asia
East Asia
South Central Asia

High incidence countries
Medium incidence countries
Very cost effective threshold

Cost saving
Next steps

- Uncertainty interval estimation
- Cost-effectiveness of other vaccination strategies
- Incorporating herd effect into cost-effectiveness based on IVI dynamic disease transmission model
- Cost-effectiveness of ViPS and Ty21a vaccines
- Vaccination strategy expansion pathway analysis
Conclusions: ViCV

• Targeting high incidence countries with two doses and medium incidence countries with one dose of ViCV would be cost-saving to cost-effective.

• These are preliminary results, findings may change with change in assumptions.
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