ECONOMIC VALUE OF VACCINES

ISPOR Forum of the
Economic Value Assessment of Vaccines
Designed to Prevent Infectious Disease Task Force
Monday, May 23, 2016
Outline for the Forum

• Task Force Leadership Group Members
• Presentation of draft framework for task force report
• Remaining critical points for guidelines for cost-effectiveness analysis of vaccines
• Guidelines for additional approaches
• Budget optimization modeling
• Financial services modeling
• General discussion (25 minutes)
ECONOMIC EVALUATION OF VACCINES

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Framework for Economic Value Assessment of Vaccines: I

For any investment decision drawing upon collective resources, what do we need to know?

1. Agreed collective objective (measure of benefits)

2. Improvement in the agreed benefits from investing available resources in an investment (allocation to a sector, a healthcare program, an intervention, research, whatever..)

3. Opportunity costs of investing resources in alternatives in terms of benefits those resources could generate if used for other purposes
This raises challenging questions including the following:

1. Relating to objectives: Who defines? Can they be measured? Can they be valued? With multiple criteria how are they traded off? Can they be combined into a single measure?

2. Relating to costs: How measure? Good proxies for resource use? Whose resources? What resources? What if resources held by multiple stakeholders, perhaps with varying objectives?

3. Relating to methods: What methods may inform investments? What to do when we can’t quantify and value everything of concern? How do we handle uncertainty? What’s the role of process is allocating collective resources?
Who is responsible for the decision? What is their mandate?

Objective: Maximize socially agreed benefits, from within given constraints

Tools/methods:
General Optimization modelling (e.g. mathematical programming) to maximize objectives from within given constraints

Maximize ‘economic returns’ (depends upon the objective):
Fiscal modeling – national fiscal condition or CBA

Maximize health:
Cost-effectiveness analysis

Maximize other (combinations of) objectives: e.g. education, other outcomes: MCDA, POM

To meet the objective the chosen approach must reflect opportunity costs associated with alternative allocations of resources
Who is Assessing the Economic Value for Vaccines

- MoH
- Health Insurer
- Decision Maker/Budget Holder
- Vaccinee
- Employer
- MoF
- Donor
### Who’s decision in what context?

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<th></th>
<th>Advising</th>
<th>Buying</th>
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<td>Professionals</td>
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<td>Third party payers</td>
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<td>Worldbank</td>
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Input and Output Measures for Vaccines

- **Vaccine Price** (pre-set or determined through competitive bidding) and vaccine program costs
- **Health gain** (direct & indirect) using dynamic models
- **Better educational scores & work, fewer families in poverty trap, increased GDP/GNI, fiscal gain**
- **Disease management cost**
- **Other disease-related costs**
- **Disease-related mortality - lost QALYs/DALYs**
- **Value for Money**
- **NPV/IRR**
- **Budget impact (vaccine & Total)**
- **QoC improvements**
- **Cost-offset (Healthcare & Society)**
Methods for Assessing Economic Value of Vaccines

- Partial Optimization Modeling
- Fiscal Modeling

- General Optimization Modeling
  - CEA/ BIA
  - CBA/ROI

- MCDA
- ECEA

- Macro-Economic
Overall View of Framework

Who is assessing the Economic Value for Vaccines?
- MoH
- Health Insurer
- Employer
- Donor
- Vaccinee
- MoF

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- Cost-offset (Healthcare & Society)
- Budget Impact (Vaccine & Total)

Methods for assessing the Economic Value of Vaccines
- General Optimisation Modeling
- Partial Optimisation Modelling
- CEA/ BIA
- Fiscal Modeling
- CBA/ROI
- Macro-Economic
Summary of Draft Framework

• Framework based on the following concepts
  – Multiple decision makers/budget holders with different responsibilities
    Evaluate efficiency of funding allocations using different metrics
  – Multiple methods to develop measures relevant for decision makers

• Task Force Report will present guidelines for three methods to develop measures for vaccines of interest to different decision makers
  – Guidelines for CEA – primary method used for presentation of value for money – Task Force will produce extension of currently available vaccine-focused guidelines using Gates Reference case as the baseline
  – Guidelines for optimization modeling – additional method for presentation of value for money – Task Force will produce initial guidelines
  – Guidelines for fiscal analysis modeling – method for presentation of return on investment – Task Force will produce initial guidelines for vaccines
European Guidelines on CEA (Ultsch et al, 2015) -20 criteria

- **Approach**: background, general statement, consensus, pro & con
- **Model-specific**: model type, time horizon, calibration, validation, natural history, evaluation method
- **HE-specific**: discounting, indirect cost, impact of care on QoL, perspective, QALYs, Cost
- **Vaccine-specific**: duration of efficacy, type of efficacy (symptom or infectious related), sequential or non-sequential, PP or ITT, indirect effect, target population, other externalities (- & +)
- **Sensitivity analysis**:

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<tr>
<th></th>
<th>Structure</th>
<th>Input</th>
<th>Output</th>
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<td>One-way</td>
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<td>Multi-way</td>
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<td>PSA</td>
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<tr>
<td>Scenario</td>
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</table>
WHO-guidelines (D Walker, P Beutels, R Hutubessy, 2010)

• Question to be answered
• Cost & especially cost of vaccination
• Vaccine impact
• Modelling
• Discounting
• Estimating, presenting, interpreting
• Practical use
• Other concerns (value for money or the 9 other criteria for priority setting)
Gates Reference Case, 2015

• Difficult to present generally applicable guidelines for CEA

• Reference case is more suitable: concrete example with all the different elements related to model, data-input, data-output, sensitivity analysis, perspective, a.o.

• However not vaccine specific
  – Externalities not covered
  – Population approach not selected
Areas of Focus

• Consensus on outcome result to present in order to be also comparative between models (cfr. population versus cohort)

• Discounting rules on short and long term with right justification of selection criteria

• Minimum sensitivity analysis to be developed and reported

• Outcomes selection on DALYs versus QALYs

• Choice of comparators

• Understanding the link between CEA and BIM with population models
Partial Optimization Modeling in HPV/CC

- With a fixed budget how to maximize cervical cancer (CC) reduction?
- What is the optimal mix of interventions (screening and vaccination) for a given budget to attain the objective?
- If budget increases, which intervention to select first (more screening or more vaccination)?

**Objective function:** minimize specific disease mortality

**Constraints:** maximum budget, maximum coverage

**Linear programming**

**Independent variables:** coverage of each intervention
Optimize health gain in HPV?
Optimize health gain for HPV?
Benefit of Optimization Modeling?

• Reality situation: for many MoHs their starting point is often budget allocation by discipline/specialty

• Optimization process helps defining health goals to be reached: more appealing than to define a threshold value

• Finding combinations of different options allow flexible thinking and handling within budget assignment: helps planning

• Evaluation process is simpler to monitor and to improve

• Better dialogue with ‘non-health’ –economists: can integrate OM with fiscal modelling
FISCAL HEALTH MODELING
WHO Framework: Economic consequences of poor health

How poor health impacts government’s "fiscal health"

Healthcare Costs Represent Only a Fraction of the Total Governmental Economic costs in Relation to Poor Health

Government Perspective on Disease Burden in Working - Aged Adults in the UK

<table>
<thead>
<tr>
<th>Impact on government accounts</th>
<th>Annual cost to government 2007 Billion £</th>
<th>Percentage government cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workless benefits</td>
<td>Government cost</td>
<td>29</td>
</tr>
<tr>
<td>Healthcare</td>
<td>Government cost</td>
<td>5 – 11</td>
</tr>
<tr>
<td>Foregone taxes</td>
<td>Revenue loss</td>
<td>28 – 36</td>
</tr>
<tr>
<td>Total costs to government</td>
<td></td>
<td>£62 - 76</td>
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Health has a cross-sectorial impact on government that is not considered within conventional CEA

Generational accounting framework for analyzing healthcare

The fiscal life course: Tax transfers and benefits between citizen and state
All health conditions and changes in health status have a fiscal consequence.

If Treasury were allocating healthcare resources, would treatments be prioritized differently?
Application of fiscal health modelling in healthcare

• Fiscal cost-benefit analysis (F-CBA) treats healthcare as an investment
  – Clinical benefits are translated into taxes and transfer costs to government

• Broader range of stakeholders are recognized using the fiscal health modelling approach and the cross sectorial government impact of health and investments in health
  – Particularly relevant in vaccine procurement as Ministry of Finance (MoF) often involved in process

• Defines how government benefits from investments in healthcare
Different perspectives — different costs

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Costs</th>
<th>Accounting for economic benefits</th>
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<tbody>
<tr>
<td>Health service</td>
<td>Health service costs</td>
<td>No</td>
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<tr>
<td>Societal</td>
<td>Health service costs, Patient costs, Indirect costs</td>
<td>Lost wages, Who really benefits: individuals, corporations, government?</td>
</tr>
<tr>
<td>Government i.e. fiscal</td>
<td>Health service costs, Non-disease related health costs, Family allowances, Education costs, Disability, Pension costs</td>
<td>Lost tax revenue for government: i. Income taxes, ii. Consumption taxes, iii. Corporate taxes, iv. Excise taxes</td>
</tr>
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</table>

Health service and societal perspectives are often divorced from fiscal reality of government finance.
## Fiscal model evidence requirements

<table>
<thead>
<tr>
<th>Category</th>
<th>Variables</th>
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</thead>
<tbody>
<tr>
<td>Demographic</td>
<td>Life tables; age-pyramid of the current male and female population</td>
</tr>
<tr>
<td>Epidemiological</td>
<td>Age-specific incidence, morbidity and mortality of each HPV-related disease</td>
</tr>
<tr>
<td>Clinical</td>
<td>Vaccine efficacy in reducing the incidence of HPV-related disease and disease attributable mortality</td>
</tr>
<tr>
<td>Health economic</td>
<td>Direct medical costs of disease; cost of immunization</td>
</tr>
<tr>
<td>Fiscal</td>
<td>Direct and indirect tax and National Insurance contributions; government transfers (allowances, benefits, social protection)</td>
</tr>
<tr>
<td>Microeconomic</td>
<td>Age-specific earnings; discounting rate; cost inflation; wage growth</td>
</tr>
</tbody>
</table>
Interpretation of fiscal health modelling

- Fiscal health models are based on generational accounting framework used to measure intertemporal fiscal impact of government policies.
- Fiscal health modelling can be thought of as a cost-benefit analysis conducted from the perspective of government.

<table>
<thead>
<tr>
<th>Costs to government</th>
<th>Benefits to government</th>
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<tbody>
<tr>
<td>• Lost tax revenue for government due to changes in morbidity / mortality</td>
<td>• Increases in tax revenue to government attributed to changes in morbidity / mortality or events avoided</td>
</tr>
<tr>
<td>Increased transfer costs attributed to changes in morbidity / mortality</td>
<td>• Decreased government transfer costs</td>
</tr>
</tbody>
</table>
Analytic outputs

- Gross taxes
- Net taxes
- Transfer costs (aggregated and disaggregated)
- Benefit cost ratio
- Net present value of investment
Application of fiscal modeling in resource allocation

• Broader range of stakeholders involved with funding decisions for vaccines
• Illustrates sustainability associated with investment decisions
• In context of development economics the method highlights the relevance of domestic revenue generation i.e. taxes
# Relevance of fiscal messages to stakeholders

| Governments (Treasuries and/or MoF) | • Interested in the sustainability of public finances in the short and long run  
• Public debts/deficit key in their political agenda  
• Cross-sectorial allocators of scarce resources  
• Payers of the “payers”  
• Involved in vaccination decisions |
|-----------------------------------|-----------------------------------------------------------------------------------|
| Payers/ budget holders           | • Mainly interested in achieving technically efficient allocations within a health care budget as well as ensuring affordability and reasonable budget impact  
• Fiscal messages may be complementary to current CEA/BI messages |
| Physicians                       | • Simple and concise messages for supporting vaccination  
• Fiscal methodologies originate from financial analyses that citizens daily do |
| Patients/ advocacies             | • Political messages to advocate the value of prevention and the need for additional investment as a means of sustaining long-term economic growth |
**Health service and societal perspectives are divorced from fiscal reality of government finances**

<table>
<thead>
<tr>
<th>Analytic input</th>
<th>Economic evaluation</th>
<th>Analytic weakness</th>
</tr>
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</table>
| Transfers      | Ignore transfers    | • Transfers represent actual fiscal costs incurred by government  
                 |                     | • Opportunity cost of transfers  
                 |                     | • Transfers paid for by current and future generations which can impair economic growth  
                 |                     | • Transfer of intergenerational debt transfer to future generations could be inequitable.  |
| Taxes          | Ignore taxes        | • Changes in population health status influences economic growth which in turn influences tax revenue earned by governments  |
- Sign up as Review Group Member
- Join ISPOR Special Interest Groups
- Need ISPOR membership number
- Business card to Theresa or email
- ttesoro@ispor.org