The Economic Benefits of Vaccines
Moving beyond traditional methods

Vaccinology 2018
Dagna O. Constenla, PhD
Director, Health Economics & Finance,
International Vaccine Access Center (IVAC)
Associate Scientist, International Health
Johns Hopkins Bloomberg School of Public Health (JHBSPH)
Disclosure

Grants from:
• Bill & Melinda Gates Foundation
• Gavi
• Pfizer

Consultant fees and travel:
• Bill & Melinda Gates Foundation
• Merck & Co.
Background

• Routine immunization considered to be among the most cost-effective investments
  
  • According to former WHO Director General, Dr. Margaret Chan, “vaccines are among the most CE public health interventions and one of the best buys you can get for your bucks”
  
• Many new vaccines available now with many more in the pipeline
• These won’t cost the cents per dose the routine vaccines do
• Decision-makers require information regarding their value
Value for money: consumer decision example (car purchase)

**Benefits**
- a) Why do I want a new car?
- b) How will it improve my life?

**Costs**
- a) What expenses?
- b) When paid?

**Alternatives**
- a) Used car?
- b) Public transport?
- c) Ride sharing?

**Paying the costs**
- a) Savings?
- b) Reduce spending on other items?
- c) Work more?

*What do I get? What do I give up?*
Value for money: health sector example

**Benefits**
- Child
- Family
- Community
- Nation
- What metrics?

**Alternatives**
- Status quo (no new program)
- Polyvalent vaccine
- Treatment

**Costs**
- Vaccine
- Personnel
- Supply chain
- Cost to patient & family

**Paying the costs**
- Available funds
- Shift budget
- Fee for service
- New taxes
- NGO

https://www.health-e.org.za/2014/03/10/shots-dark-vaccines-south-africa/
What is economic evaluation?

“Economic evaluation is the *comparative* analysis of alternative courses of action in terms of both their costs *and* their consequences.”

(Drummond et al. 2005)
# Types of economic evaluations

<table>
<thead>
<tr>
<th>Method</th>
<th>Costs</th>
<th>Outcomes</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Technical (what HC to provide?)</td>
</tr>
<tr>
<td>CMA</td>
<td>Monetary terms ($,£,¥,..)</td>
<td>Outcomes are equivalent</td>
<td>Yes</td>
</tr>
<tr>
<td>CEA</td>
<td>Monetary terms ($,£,¥,..)</td>
<td>Natural units</td>
<td>Yes</td>
</tr>
<tr>
<td>CUA</td>
<td>Monetary terms ($,£,¥,..)</td>
<td>QALY, DALY*</td>
<td>Yes</td>
</tr>
<tr>
<td>CBA</td>
<td>Monetary terms ($,£,¥,..)</td>
<td>Monetary terms ($,£,¥,..)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

CMA: cost minimization analysis; CEA: cost-effectiveness analysis; CUA: cost-utility analysis; CBA: cost-benefit analysis

* Reflects individual and societal preferences or utility
When is a vaccine cost-effective?

- **Theoretical approach**: compile country-specific CE league (ranking) table and fund interventions in order of CE until the budget is exhausted
  
  - reveals the maximum acceptable ICER, i.e. benchmark (also referred to as the ceiling ratio)
  
  - Is the vaccine among the interventions funded?

- **Pragmatic approach**: use an established benchmark

---

jhsph.edu/ivac
Established benchmark

• Following the recommendation of the Commission on Macroeconomics and Health, WHO uses the following categories:
  • $ per DALY averted < GNI per capita = highly CE
  • $ per DALY averted 1-3 * GNI per capita = CE
  • $ per DALY averted > 3 * GNI per capita = not CE

$22 – 100 per DALY
From wealth to health

The traditional story

• Income and health directly support better health because wealthier people can afford the resources that protect and improve health
  - Better nutrition
  - Better access to clean water
  - Better sanitation
  - Better psycho-social resources like community recreation facilities

Attributed to Jeffrey Sachs
From health to wealth

The rest of the story

• Good health promotes savings and investment
• Live longer and more to save
• Improved productivity
• Greater returns from education
• A demographic dividend*
  Economic growth potential resulting from shifts in population’s age structure (share of the working-age population is larger than the non-working-age share of the population)
• A demographic transition from large to small families

* United Nations Population Fund
## Valuing vaccines – old paradigm

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Type of benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow</td>
<td>Health gains: reduction in mortality through vaccination</td>
</tr>
<tr>
<td></td>
<td>Health care cost savings: Savings of medical expenditures because vaccination</td>
</tr>
<tr>
<td></td>
<td>prevents illness episodes</td>
</tr>
<tr>
<td></td>
<td>Care-related productivity gains: Savings of parents’ productive time because</td>
</tr>
<tr>
<td></td>
<td>vaccination avoids the need for taking care of a sick child</td>
</tr>
</tbody>
</table>

Source: Bärnighausen et al. 2010
## Valuing vaccines – new paradigm

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Type of benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Narrow</strong></td>
<td>Health gains: reduction in mortality through vaccination</td>
</tr>
<tr>
<td></td>
<td>Health care cost savings: Savings of medical expenditures because vaccination prevents illness episodes</td>
</tr>
<tr>
<td></td>
<td>Care-related productivity gains: Savings of parents’ productive time because vaccination avoids the need for taking care of a sick child</td>
</tr>
<tr>
<td><strong>Broad</strong></td>
<td>Outcome-related productivity gains: Increased productivity because vaccination improves cognition and physical strength and school enrolment, attendance and attainment</td>
</tr>
<tr>
<td></td>
<td>Behavior-related productivity gains: Benefits accruing because vaccination improves child health and survival and thereby changes household choices (e.g., fertility, consumption choices)</td>
</tr>
<tr>
<td></td>
<td>Community externalities: Benefits accruing because vaccination improves outcomes among unvaccinated community members</td>
</tr>
</tbody>
</table>

Source: Bärnighausen et al. 2010
Effect of childhood vaccination on scores of language, math and IQ test in Cebu, The Philippines

- Cebu Longitudinal Health & Nutrition Survey since 1983
- Filipina mothers and their children born in 1983-4 followed up
- Vaccination records and scores in language, math & IQ at age 10 years
- Large and significant effect of routine vaccination on test scores, raising them on average by about 0.5 standard deviations
- One standard deviation gain in cognitive test scores raises earnings by about 8%
Effect of childhood measles vaccination on school enrolment in Matlab, Bangladesh

- Intensive measles vaccination program introduced in two areas of Matlab in 1982 and 1985
- Children vaccinated against measles before one year of age are 9% more likely to attend school
- Each year vaccination is delayed decreases the probability of school enrollment by 2.4%
- Each year of schooling increases wages by 9.7%
Examples of the long-term impact of childhood health and nutrition and other interventions


Field et al. (2009) showed that iodine supplementation improved educational attainment in Tanzania.

Lucas (2010) and Cutler et al. (2010) found that malaria interventions that protect young children can increase cognitive test scores and educational attainment.

Guzman et al. (2010) in their INCAP longitudinal nutrition studies at the community level showed that protein-rich supplement given to preschool children improved growth and cognition and decreased morbidity and mortality.
Lifetime earnings trajectory

Income of unskilled/unschooled worker
Lifetime earnings trajectory: with schooling

Income of unskilled/unschooled worker

Extra earnings due to schooling

School-related costs

Fixed costs
Variable costs

Age: 0 13 20 30 40 50 60

$
Lifetime earnings trajectory: with childhood vaccination

1. Better cognitive development
2. Fewer missed school days
3. Less long-term disability

Extra earnings due to schooling
Income of unskilled/unschooled worker

Fixed costs
Variable costs
Full cost of vaccination

School-related costs

13
20
30
40
50
60
Age: 0
Work
Retire

Bloom et al. 2005
Usefulness of economic evaluations

• Economic evaluation has been neither necessary nor sufficient to a decision to introduce vaccines
• CBA of Hib vaccination in Israel was able to influence decision-making only after “luck” brought it to attention of treasury personnel
• ROI Health Affairs paper (2016) have been cited consistently by the Ministerial Conference on Immunization in Africa and others, which has helped to redouble efforts and commitment of strong, sustainable and inclusive immunization programs
• Why has formal use of economic evaluations in vaccine decision-making been limited?

Projected immunizations (10 antigens) yield a net return about 16 times greater than costs over the decade (2011-20)

Saving in healthcare costs, lost wages and productivity due to illness
## Understanding resistance to economic evaluation

<table>
<thead>
<tr>
<th>Decision-makers do not understand the approach?</th>
<th>Decision-makers do not trust the approach?</th>
<th>Decision-makers perceive the approach to lack relevance?</th>
<th>Decision-makers do not trust the motives of economic evaluations?</th>
<th>Decision-makers recognize that the approach tends to create winners and losers</th>
<th>What do you think?</th>
</tr>
</thead>
</table>

[jhsph.edu/ivac](jhsph.edu/ivac)
Too reliant on assumptions?

• A physicist, a chemist and an economist are stranded on an island with nothing to eat. A can of soup washes ashore. The physicist says, “Let’s smash the can open with a rock.” The chemist says, “Let’s build a fire and heat the can first.” The economist says …

• … “Let’s assume we have a can-opener.”

Attributed to Paul Samuelson
Potential solutions to sub-optimal use of economic data

• Train and support decision-makers in use of methods and models
  • BMGF grant to PAHO to generate CE data (http://new.paho.org/provac/)
  • BMGF grant to AMP and IVI to establish or strengthen National Immunization Technical Advisory Groups (http://www.sivacinitiative.org/)
  • BMGF grant to JHU to develop and deploy training material in vaccine economics, costing, and financing for immunization policy makers in GAVI-eligible countries (http://immunizationeconomics.org/courses/)
• Adopt methodologies and presentation formats that decision-makers understand
• Develop demand for training
• Sustain a community of alumni, students and teachers everywhere there is need
Summary

• As more vaccines become available decision-makers will require economic data

• Economic evaluation is not an exact science although adherence to guidelines would improve comparability

• In today’s economic climate, we should consider adopting a broader perspective to fully capture the value of vaccines

• But we need to improve the use and usefulness of economic evaluations
The fourth hurdle requires real world evidence
Thank you