Economic Evaluation

Introduction to Economic Evaluation

TVEE
TEACHING VACCINE ECONOMICS EVERYWHERE
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Overview

• Evidence base underlying vaccine introduction decisions
• Value for money
• Survey of methods for economic evaluation
• Components of a cost-effectiveness analysis
• Summary: role of economic evaluation in vaccine policy
Learning Objectives

• Define Basic Concepts of Economic Evaluation

• Understand different Methods and Tools of Economic Evaluation
Health Care is confronted with *scarcity* (limitations) in *resources* (budget)

Meanwhile *different options* exist for managing diseases (prevention vs treatment)

So *choices* have to be made between options because of budget limitations

➢ How to chose *efficiently*?

By *comparing*, but comparing what?

➢ *Value* of (new) interventions:

Value in health care is expressed in *cost* (money) and in *effect* (health)

The way to compare value rationally is by looking at *incremental* differences!

HE is therefore a tool for decision makers to make their selection *explicit*

But HE is also helpful for *equity distribution* of health care resources in the population
Economics and New Vaccine Introductions

• Economics plays important role in policy decisions to provide vaccines in the EPI

• Program managers want to know what investments would be needed for introducing a vaccine as against the benefits to be had.

• Common tools
  • Cost effectiveness analysis: “value for money” of a program relative to a feasible alternative
  • Budget impact: change in flow of funds when an organization substitutes a new program for the alternative (current) program
Choice of Whether to Invest In Vaccines is a Complex Dynamic

- Political reality
- Availability
- Feasibility
- Economic reality
- Health impact
- Equity
- Health impact
- Equity

Equity
Evidence Base – Vaccine Introduction

Clinical
- Burden of disease
- Vaccine efficacy
- Vaccine safety
- Clinical resources
- Immunization program strategy

Political
- Demand
- Acceptability
- Political benefit
- Legal issues
- Equity issues
- Ethical issues
- Conformity to similar programs in other regions

Economic
- Program cost
- Health care budget
- External funding
- Competing priorities
- *Cost-effectiveness*
Vaccine Value For Money: Consumer Decision

**Benefits**
- Why do I want a Vaccine?
- How will it prevent the spread of infectious disease?

**Alternatives**
- Other Vaccines?
- Prevention?
- Education?
- Infrastructure?
- Doing Nothing?

**Costs**
- What expenses?
- To Whom?
- Who pays?
- Unintended Consequences?

**Paying the costs**
- Savings?
- Return on Investment?
- Prevention compared to Treatment
- Reduce spending on other items?

What do I get out of Vaccines? What do I give up?
Value For Money: *Healthcare Sector*

**Vaccine Program**

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

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

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

**Paying the costs**
- Available funds
- Shift budget
- Fee for service
- New taxes
- NGO
Resources are scarce – choices must be made!

Study Design
- Characteristics of the target population
- Specification of alternative programs/interventions
- Quantify resources consumed – valuation of resources
- Identification of consequences – measurement of benefit
Economic Evaluation Methods
For Vaccine Care
Economic Evaluation Methods

• Cost Finding
• Cost-minimization
• Cost (burden) of Illness
• Cost-Consequence
• Cost-Effectiveness
• Cost-Benefit
Economic Evaluation Methods
Cost Finding

Objectives:
• Identify resources consumed in the provision of a specific program or intervention
• Estimate the monetary value of these resources
Economic Evaluation Methods
Cost-Minimization Analysis (CMA)

Objectives:
• Identify resources consumed in the provision of alternative interventions
• Estimate the monetary value of these resources
• Compare the cost of the alternative interventions
• **Identify the least costly alternative**
**Economic Evaluation Methods**  
Cost (Burden) of Illness Analysis (COI)

Objectives:
- Focus on current status of the target population without intervention
- Estimate health care resources consumed and associated costs
- Quantify “burden of Illness” with metrics such as
  - mortality (years of life lost)
  - disability (limitations on daily activity)
  - lost productivity
Economic Evaluation Methods
Cost – Consequence Analysis

Objectives:
- Identify resources consumed in the provision of alternative interventions
- Estimate the cost of each alternative intervention
- Identify and quantify effects of each intervention
  - Patient and Family
  - Community
  - Health Care System
  - Nation
# Potential Economic Consequences (Benefits) of A Vaccine Program

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health gains</td>
<td>Direct</td>
<td>Reduction in mortality/morbidity</td>
</tr>
<tr>
<td>Health care cost savings</td>
<td>Direct</td>
<td>Averted medical expenditures (outpatient visits, hospitalizations, diagnostics and treatments, transport to the facility)</td>
</tr>
<tr>
<td>Care related productivity gains</td>
<td>Indirect</td>
<td>Savings of parents’ productive time and lost wages</td>
</tr>
<tr>
<td>Outcome-related productivity gains</td>
<td>Broader</td>
<td>Improves cognition and physical development, as well as school enrollment, attendance and educational attainment</td>
</tr>
<tr>
<td>Behavior-related productivity gains</td>
<td>Broader</td>
<td>Improves child health and survival and thereby changes household choices, such as fertility and consumption choices</td>
</tr>
<tr>
<td>Community externalities</td>
<td>Broader</td>
<td>Improves health among unvaccinated community members, general economic improvement</td>
</tr>
</tbody>
</table>

**Economic Evaluation Methods**

**Cost - Effectiveness Analysis**

**Objectives:**
- Compare alternative programs in terms of efficiency
- “Benefit” is defined as units of output
  - example: output for an intervention that reduces mortality could be specified as “years of survival”
  - Same metric must be used for each alternative to enable comparison
- Efficiency of each alternative calculated as “cost per unit of benefit”
Economic Evaluation Methods
Cost - Benefit Analysis (CBA)

Objectives:
- Compare alternative programs in terms of net social cost
- "Benefit" is defined as the monetary value
  - All relevant consequences for each intervention must be given a specific monetary value
  - Requires assumptions for monetary value of years of survival gained, days of disability avoided
- Net social cost of a program = value of benefit – cost
- Assess a single program: worthwhile if net social benefit >0
- Compare alternative programs: which has greater net benefit?
Uganda Vaccine Case Study

Cost vs. DALYs

Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Economic Evaluation Methods

Other Methods

• Budget Impact
  • Cost of a Vaccine absorbed over a pooled risk
  • Commonly interpreted by government or vaccine payers
  • Measure of cost of intervention for all those in need to entire population in terms of “Per member per month” or “Per member per year”

• Return on Investment (ROI)
  • Long-term outlook of costs recouped from benefit
  • Vaccine cost tradeoff to medical expenses
  • Generally measured over: 5 or 10 years
What are the Components of Vaccine Cost-Effectiveness Analysis?

**Analytic framework**
- Define study questions
- Define policy audience
- Analytic Perspective(s)
- Vaccine and do-nothing comparators
- Specific programs to be analyzed
- Populations to be considered

**Conceptual model**
- Describe natural history of infectious disease
- Outline event pathways leading to all outcomes of interest
- Describe the impact of the programs on outcomes

**Data collection**
- Disease burden
- Incidence/prevalence
- Rates of fatality/sequelae
- Demography
- Vaccine Program effectiveness
- Vaccine Program costs
- Infectious Disease costs

**Computation of costs and health benefits**
- Represent the conceptual model mathematically
- Define fields/variables for each data element
- Perform computations
- Consider of uncertainty

**Interpret and communicate results**
- Use national health ministry guidelines and criteria, wherever possible
- International guidelines (e.g. WHO) and criteria provide a valuable resource
Measuring the “Output” of a Vaccine Program or Intervention

- Ideal metric combines both the quantity and quality of life as a result of the program or intervention

- **Quality adjusted life-year (QALY)** - duration of survival weighted by a factor representing consumer strength of preference for state of health during this period – more common in Western countries, recommended by U.S. cost-effectiveness panel

- **Disability-adjusted life-year (DALY)** - years lost relative to optimum survival weighted by a factor representing level of impairment – more commonly used in Vaccine economics, recommended by WHO
Cost-Effectiveness Analysis: “ICER”

“ICER” – Incremental Cost-effectiveness Ratio

\[
\text{ICER} = \frac{\text{Cost}_{\text{NEW PROGRAM}} - \text{Cost}_{\text{ALTERNATIVE}}}{\text{Output}_{\text{NEW PROGRAM}} - \text{Output}_{\text{ALTERNATIVE}}}
\]

Example - Hib conjugate vaccination in India (versus no vaccination)
“From a government perspective, cost-effectiveness ranged from $192 to $1033 per discounted DALY averted. With the inclusion of household healthcare costs, cost-effectiveness ranged from $155 to $939 per discounted DALY averted.”

Clark et al, J Pediatrics 2013;163:S60-S72
Table IV. Hib vaccine impact and cost-effectiveness by state: aggregate estimates over the period 2012-2031

<table>
<thead>
<tr>
<th>State</th>
<th>Region</th>
<th>Vaccine impact, undiscounted</th>
<th>Cost-effectiveness, discounted at 3%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pneumonia lives saved</td>
<td>Meningitis lives saved</td>
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<tr>
<td>Delhi</td>
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<td>278</td>
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<td>India</td>
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</table>

*The North East region includes Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, and Assam.*
Cost-Effectiveness Plane

Standard of care
"No vaccination program"

New intervention
"Vaccination program"

Disability-adjusted life years averted

Cost

0

+ - 0 +
Cost-Effectiveness Plane

Reference Point (0,0) “No Vaccination Program”
Interpreting the ICER (1)

Disability-adjusted life years averted

Cost

New Intervention “Vaccination Program”
Interpreting the ICER (2)

Disability-adjusted life years averted

Cost

New Intervention “Vaccination Program”
Interpreting the ICER (3)

Cost

Disability-adjusted life years averted

New Intervention “Vaccination Program”
Interpreting the ICER (4)

Cost

Disability-adjusted life years averted

New Intervention “Vaccination Program”
Decision Rules for Vaccine CEA

- Higher cost, worse outcome: Never prefer this alternative.
- Lower cost, better outcome: Always prefer this alternative.
- Higher cost, better outcome: Prefer if “Good value.”
When is an intervention “cost-effective”?

Societal maximum willingness to pay for Vaccine intervention “cost per DALY averted”
Summary
Role of economic evaluation of vaccines in health policy

**Efficiency**
Cost-effectiveness

**Affordability**
Budget Impact

**Equity**
Return on Investment
Exercise: Introduction to CEA

• Review questions in groups
• Discuss potential responses
• Respond to questions online
Discussion Questions (Quiz)

1. Compare “cost minimization analysis” and “cost-effectiveness analysis:” how are these methods similar? How are they different?

2. How is the “incremental cost-effectiveness ratio” (ICER) calculated?

3. Describe the cost-effectiveness plane

4. How can economic analysis help guide decisions about vaccine programs?