Systems Analysis in Public Health Education: A Call to Action

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Cost-Effectiveness Analysis in Health and Health Care

• The world of public health recommends cost-effectiveness analysis.
  • WHO
  • World Bank
  • NICE in British NHS
  • Researchers

• Analysis rooted in economic utility maximization
  • Garber and Phelps, 1996,
  • Meltzer, 1996,
  • Lee, 2008

• Usually comes with a disclaimer.
Typical Disclaimer

“...cost–effectiveness is only one criterion among many that influence decision-making in public health. When deciding to implement an intervention, efficiency must always be balanced with other criteria, including implementation capacity, feasibility and impact on poverty and equity.”*

Cost-Effectiveness Analysis is Incomplete

• Cannot handle issues of equity and distribution.
• Cannot capture real-world cost structures.
  • fit with existing vaccine schedules
  • cold-chain requirements.
• Cannot capture indirect effects.
  • fear and dread created by Ebola, leprosy.
• Cannot capture risk in health utilities.
  • QALYs, DALYs.
• Cannot deal with major paradigm shifts.
  • pandemics.
Needed: Multi-Criteria Systems Analysis

• Several techniques.
  • Analytic hierarchy process (AHP).
  • Multi-attribute utility theory (MAUT).
  • Linear programming, and more.

• Preference elicitation.
  • What is valuable?
  • Individuals and groups.

• SMART Vaccines.
  • An IOM-NAE working prototype for decision support.
  • Funded by HHS (NVPO, NIH Fogarty International Center)
  • www.nap.edu/smartvaccines
More About SMART Vaccines

• **35 attributes** are available.
  • One of which is cost-effectiveness.

• **Blends computational and value models.**
  • Ranking
  • Weighting
  • Sensitivity analysis

• **Population-specific and vaccine data.**
  • Demographics
  • Disease burden and treatment costs.
  • Vaccine product profiles.

• **SMART Scores.**
  • Unique to each user.
How cost-effectiveness and systems analysis differ.
## Attribute Selection and Weighting

### SMART Vaccines

Rank attributes in order of importance (1 = MOST IMPORTANT) and fine tune weights by adjusting sliderbar.

<table>
<thead>
<tr>
<th>Attributes Selected</th>
<th>Least Favorable</th>
<th>Most Favorable</th>
<th>Rank</th>
<th>Modify</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost-Effectiveness ($/QALY)</td>
<td>776000</td>
<td>0</td>
<td>1</td>
<td></td>
<td>52%</td>
</tr>
<tr>
<td>Disease Raises Fear and Stigma in the Public</td>
<td>no</td>
<td>yes</td>
<td>2</td>
<td></td>
<td>27%</td>
</tr>
<tr>
<td>Serious Pandemic Potential</td>
<td>no</td>
<td>yes</td>
<td>3</td>
<td></td>
<td>15%</td>
</tr>
<tr>
<td>Eradication or Elimination of the Disease</td>
<td>no</td>
<td>yes</td>
<td>4</td>
<td></td>
<td>6%</td>
</tr>
</tbody>
</table>

### Relative Weight of Attribute Differences

![Relative Weight Graph](image-url)
# Cost-Effectiveness Analysis

## SMART Vaccines

Select vaccine candidates to compare. Set attributes and scores. View SMART Score calculated for total population.

### Attributes Selected

<table>
<thead>
<tr>
<th>Attributes Selected</th>
<th>United States Vaccine Candidates: Values (Scores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost-Effectiveness ($/QALY)</td>
<td>10836 (99)</td>
</tr>
<tr>
<td>Disease Raises Fear and Stigma in the Public</td>
<td>no (0)</td>
</tr>
<tr>
<td>Serious Pandemic Potential</td>
<td>no (0)</td>
</tr>
<tr>
<td>Eradication or Elimination of the Disease</td>
<td>no (0)</td>
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### SMART Score

Legend:
- Health
- Economic
- Public
- Intangible
- Programmatic
- User-Defined

- **Assessment**
- **Weights**
- **Vaccine Profile**
- **Print**

- Flu: 52
- Rota: 48
- Pneum: 52
- HPV: 52
- Iboa: 44

![Bar chart with scores for different vaccines]
Multi-Criteria Systems Analysis

SMART Vaccines

Select vaccine candidates to compare. Set attributes and scores. View SMART Score calculated for total population.
NOTE: Orange highlighted scores have been altered in Analysis; Vaccine Profile.

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<td>10336 (99)</td>
</tr>
<tr>
<td>Disease Raises Fear and Stigma in the Public</td>
<td>no (0)</td>
</tr>
<tr>
<td>Serious Pandemic Potential</td>
<td>yes (100)</td>
</tr>
<tr>
<td>Eradication or Elimination of the Disease</td>
<td>no (0)</td>
</tr>
</tbody>
</table>

SMART Score

Legend

Health | Economic | Demographic
Public | Sci/Business | Programmatic
Intangible | Policy | User-Defined

Analysis
- Assessment
- Weights
- Vaccine Profile
- Print

INSTITUTE OF MEDICINE
NATIONAL ACADEMY OF ENGINEERING
THE NATIONAL ACADEMIES
Advisors to the Nation on Science, Engineering, and Medicine
The “Traditional Core Areas”

• Informatics
• Genomics
• Communication
• Cultural competence
• Community-based participatory research
• Global health
• Policy and law
• Public health ethics

• Strategic planning (systems analysis)
A Call to Action

Public health education needs to:

• offer courses on systems analyses.
• promote active practical use of software tools just as in engineering and business schools.
• produce leaders and analysts who understand and can create systems analyses for priority setting and program evaluation.

The time is now. The need is great.
Thank you for your attention
# A Multi-Criteria Approach

| Health Considerations | • Premature Deaths Averted per Year  
| | • Incident Cases Prevented per Year  
| | • QALYs Gained or DALYs Averted  
| Economic Considerations | • Net Direct Costs (Savings) of Vaccine Use per Year  
| | • Workforce Productivity Gained per Year  
| | • One-Time Costs  
| | • Cost-Effectiveness ($/QALY or $/DALY)  
| Demographic Considerations | • Benefits Infants and Children  
| | • Benefits Women  
| | • Benefits Socioeconomically Disadvantaged  
| | • Benefits Military Personnel  
| | • Benefits Other Priority Population  
| Public Concerns | • Availability of Alternative Public Health Measures  
| | • Potential Complications Due to Vaccines  
| | • Disease Raises Fear and Stigma in the Public  
| | • Serious Pandemic Potential  
| Scientific and Business Considerations | • Likelihood of Financial Profitability for the Manufacturer  
| | • Demonstrates New Production Platforms  
| | • Existing or Adaptable Manufacturing Techniques  
| | • Potential Litigation Barriers Beyond Usual  
| | • Interests from NGOs and Philanthropic Organizations  
| Programmatic Considerations | • Potential to Improve Delivery Methods  
| | • Fits into Existing Immunization Schedules  
| | • Reduces Challenges Relating to Cold-Chain Requirements  
| Intangible Values | • Eradication or Elimination of the Disease  
| | • Vaccine Raises Public Health Awareness  
| Policy Considerations | • Interest for National Security, Preparedness, and Response  
| | • Advances Nation’s Foreign Policy Goals  
| User-Defined Attributes | • Up to Seven Attributes |