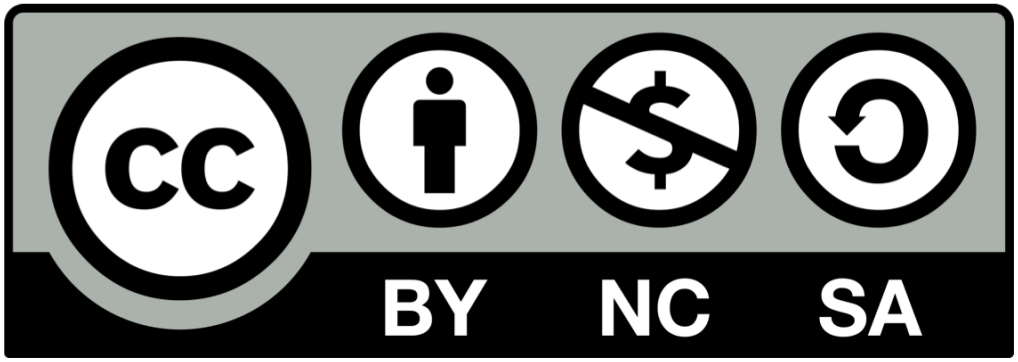
Economic Evaluation

Introduction to Economic Evaluation

TVEE
TEACHING VACCINE ECONOMICS EVERYWHERE

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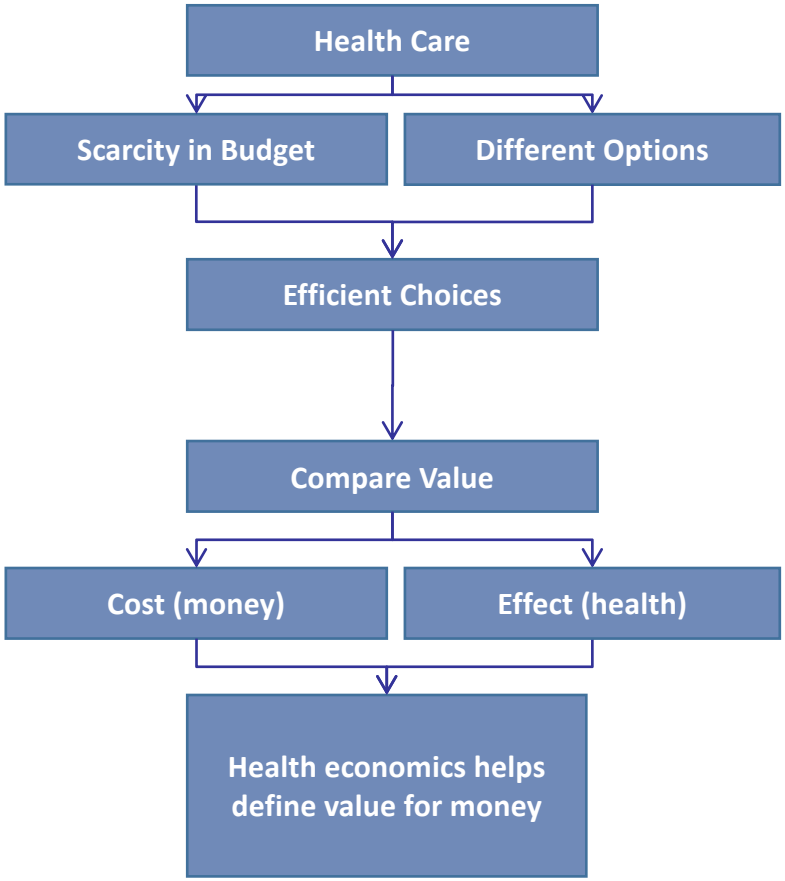
Overview

- 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

What is Health Economics?
A tool for decision makers



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

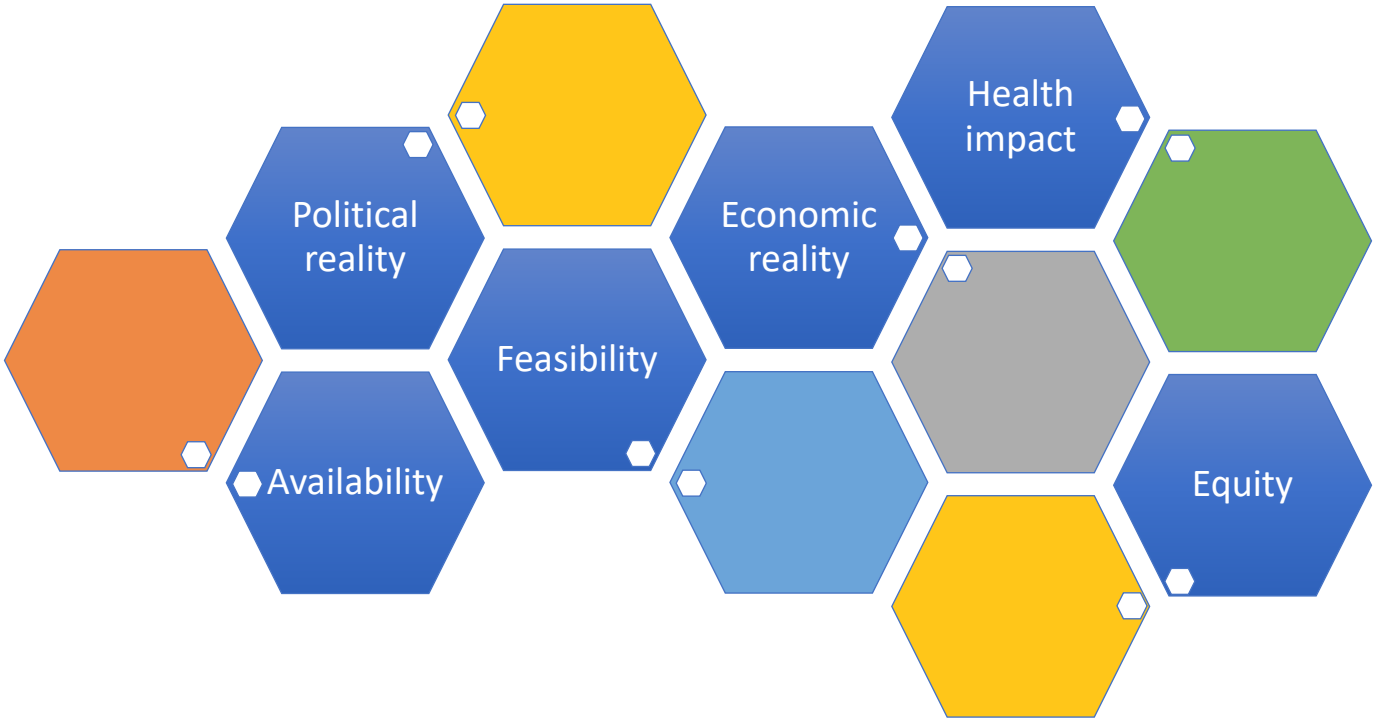
Economics and New Vaccine Introductions

- 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



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*



What do I get out of Vaccines? What do I give up?

Benefits	Alternatives	Costs	Paying the costs
•Why do I want a Vaccine? •How will it prevent the spread of infectious disease?	•Other Vaccines? •Prevention? •Education? •Infrastructure? •Doing Nothing?	•What expenses? •To Whom? •Who pays? •Unintended Consequences?	•Savings? •Return on Investment? •Prevention compared to Treatment •Reduce spending on other items?

Value For Money: *Healthcare Sector*

Benefits

Child

Family

Community

Nation

What metrics?

Vaccine Program



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

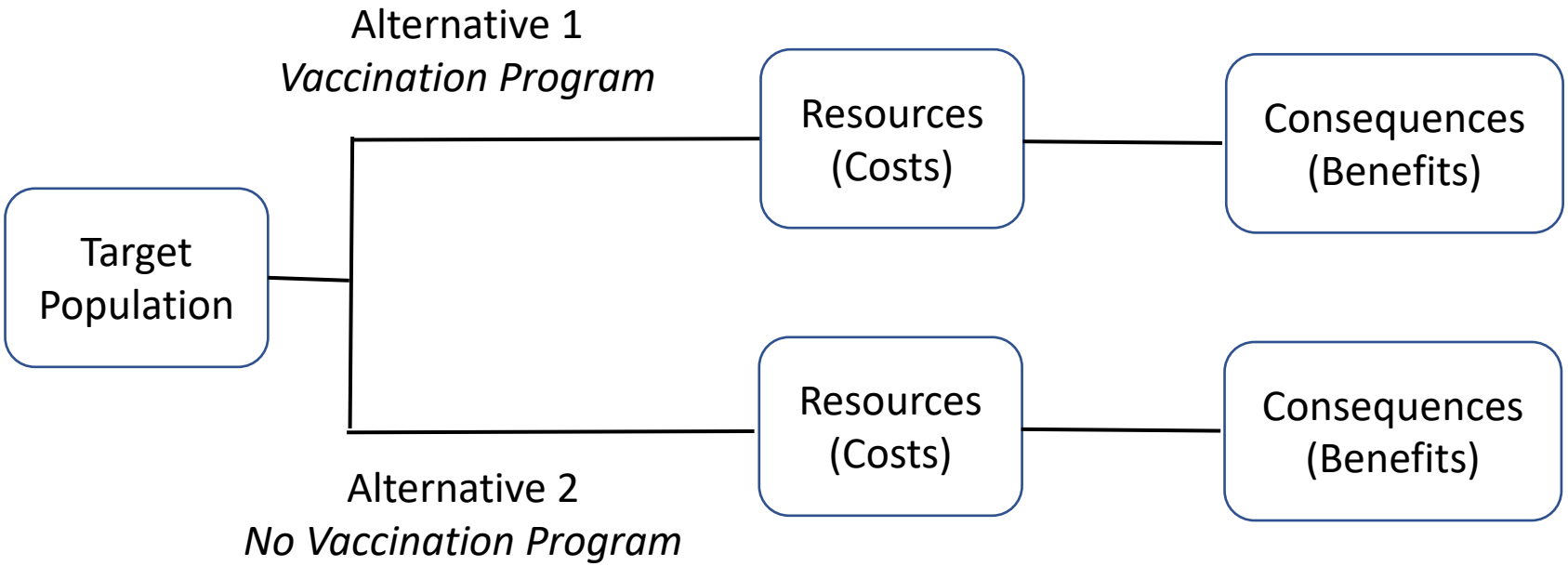
Fee for service

New taxes

NGO

Economic Evaluation In Health Care

Resources are scare – choices must be made!



Study Design

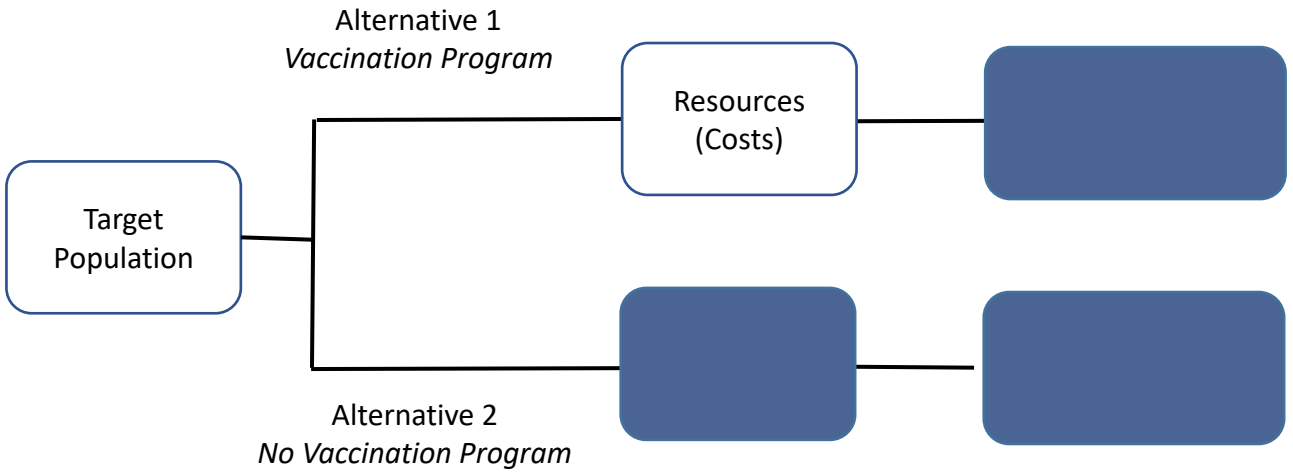
- Characteristics of the target population
- Specification of alternative programs/interventions
- Quantify resources consumed – valuation of resources
- Identification of consequences – measurement of benefit

Economic Evaluation Methods For Vaccine Care

Economic Evaluation Methods

- Cost Finding
- Cost-minimization
- Cost (burden) of Illness
- Cost-Consequence
- Cost-Effectiveness
- Cost-Benefit

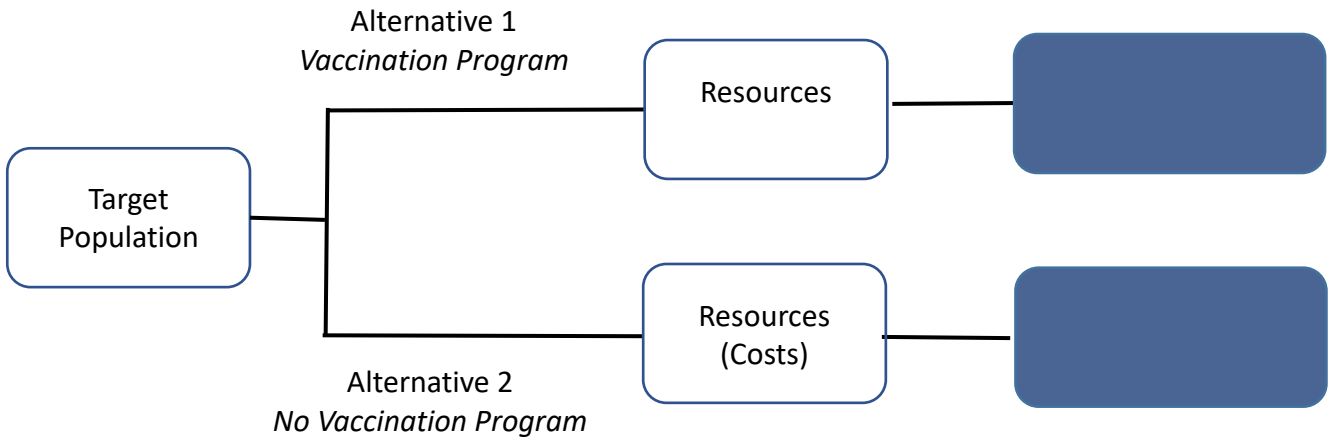
Economic Evaluation Methods
Cost Finding



Objectives:

- Identify resources consumed in the provision of a specific program or intervention
- Estimate the monetary value of these resources

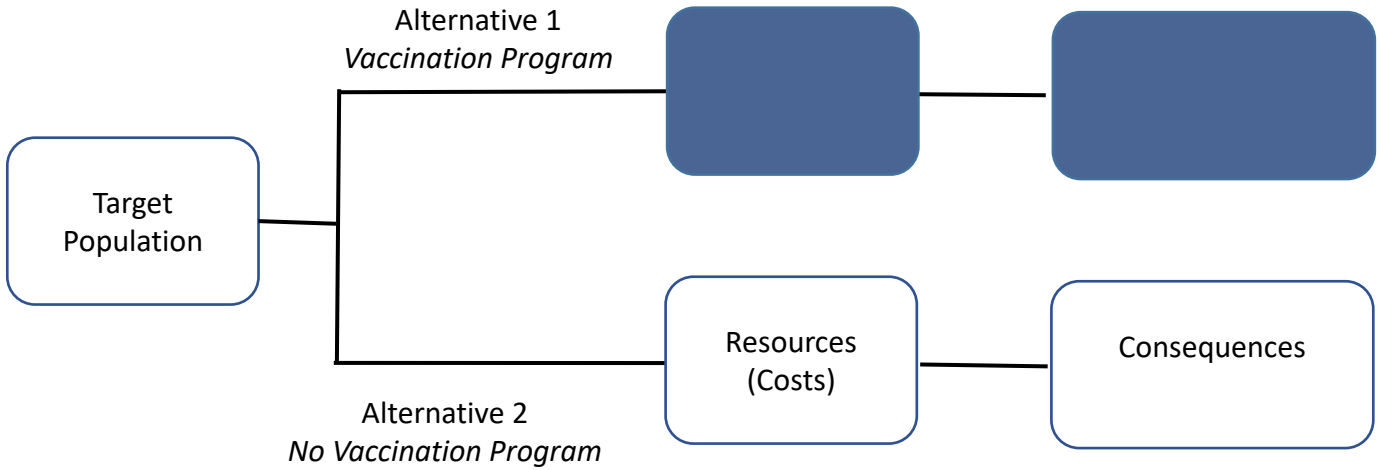
Economic Evaluation Methods
Cost-Minimization Analysis (CMA)



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***

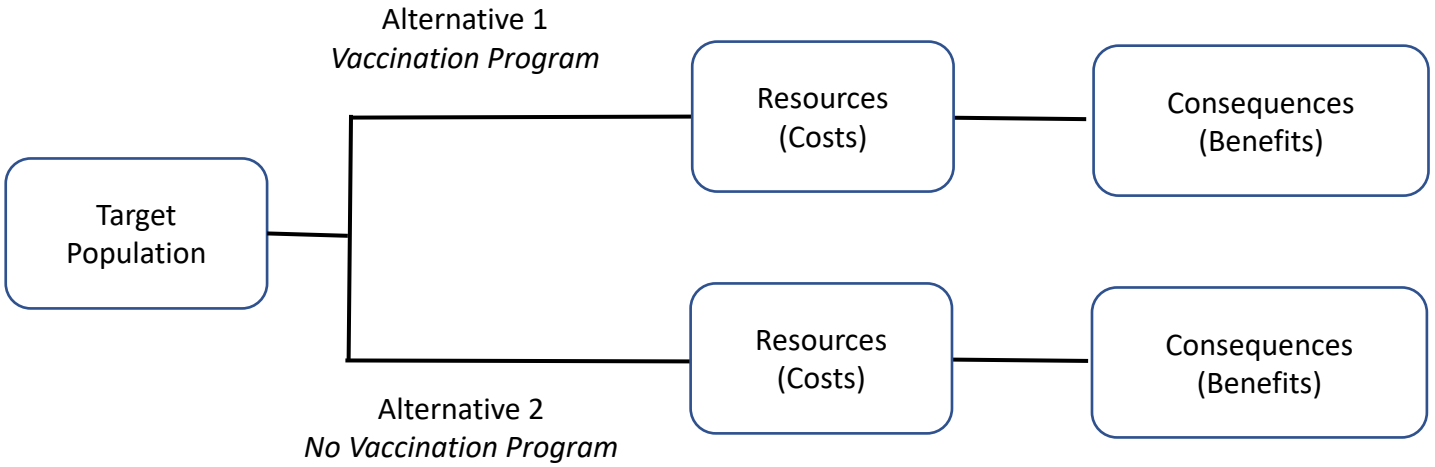
Economic Evaluation Methods
Cost (Burden) of Illness Analysis (COI)



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:

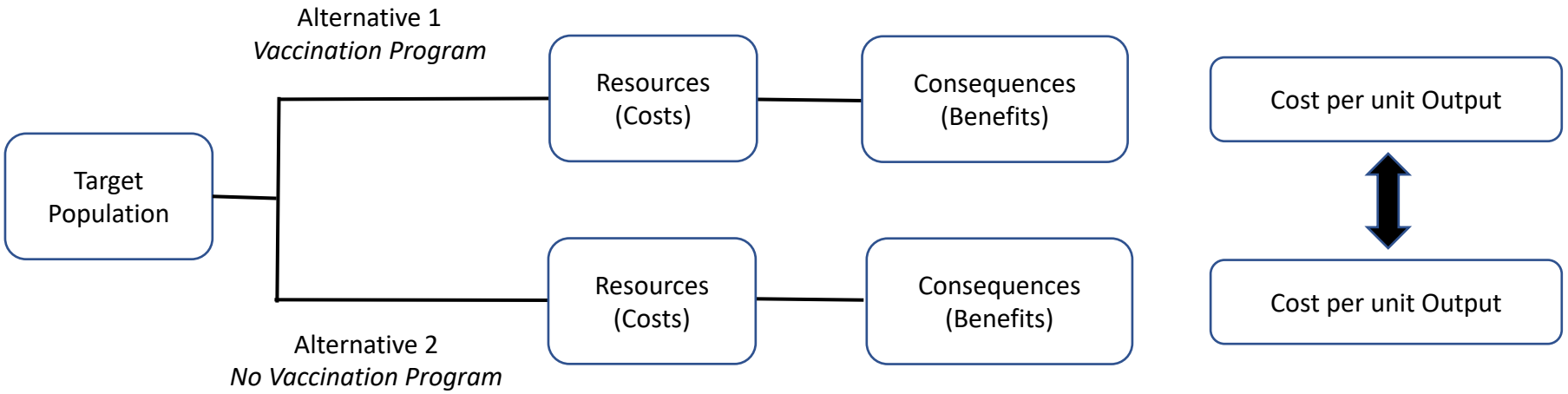
- Identify resources consumed in the provision of alternative interventions
- Estimate the cost of each alternative intervention
- Identify and quantify effects of each intervention
  - Patient and Family
  - Community
  - Health Care System
  - Nation

Potential Economic Consequences (Benefits) of A Vaccine Program

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

Barnighausen T, et al. Rethinking the benefits and costs of childhood vaccination: the example of the Haemophilus influenzae type b vaccine. Vaccine 2011; 29(13): 2371-80.

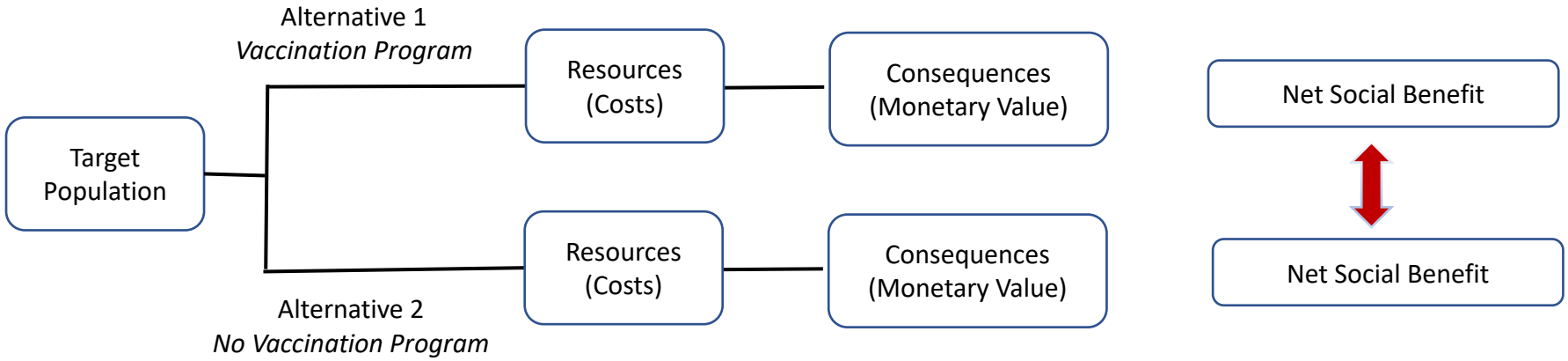
Economic Evaluation Methods
Cost - Effectiveness Analysis



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”

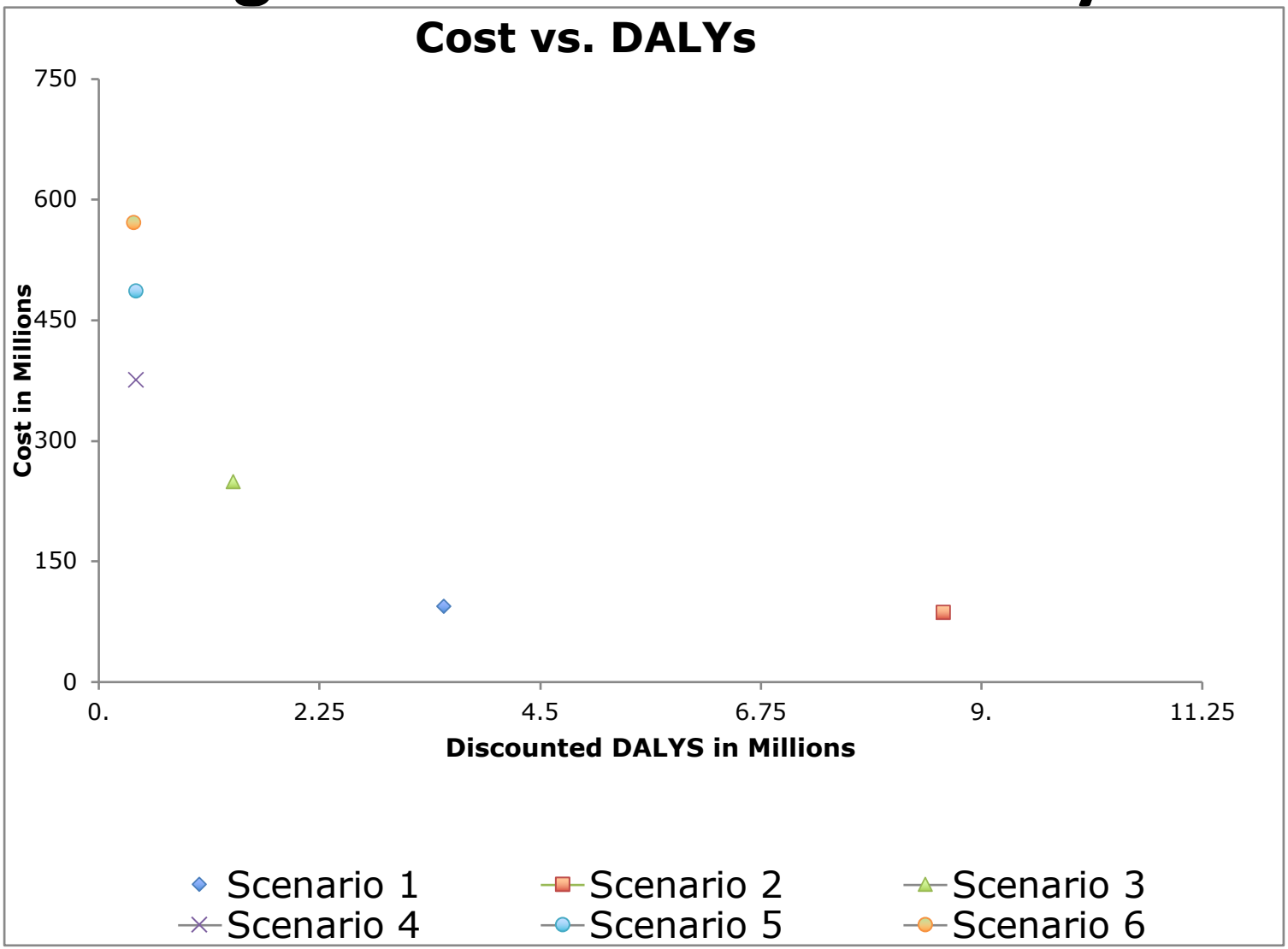
Economic Evaluation Methods
Cost - Benefit Analysis (CBA)



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

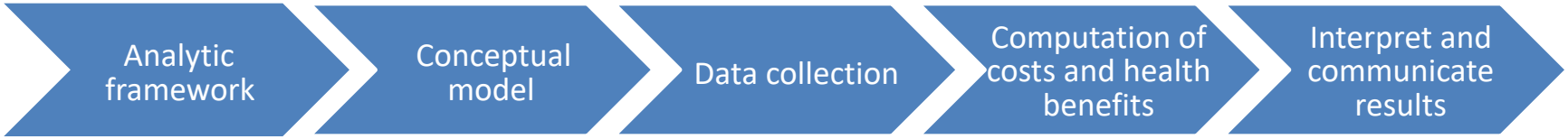


Economic Evaluation Methods
Other Methods

- 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?



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

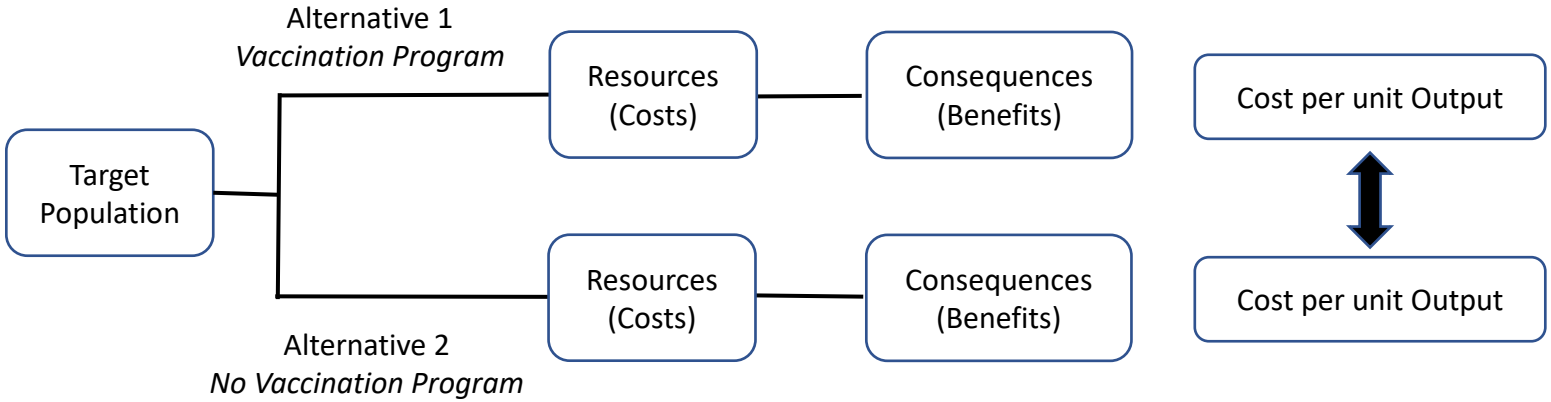
- Describe natural history of infectiou disease
- Outline event pathways leading to all outcomes of interest
- Describe the impact of the programs on outcomes

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

- Represent the conceptual model mathematically
- Define fields/ variables for each data element
- Perform computatio ns
- Consider of uncertainty

- 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

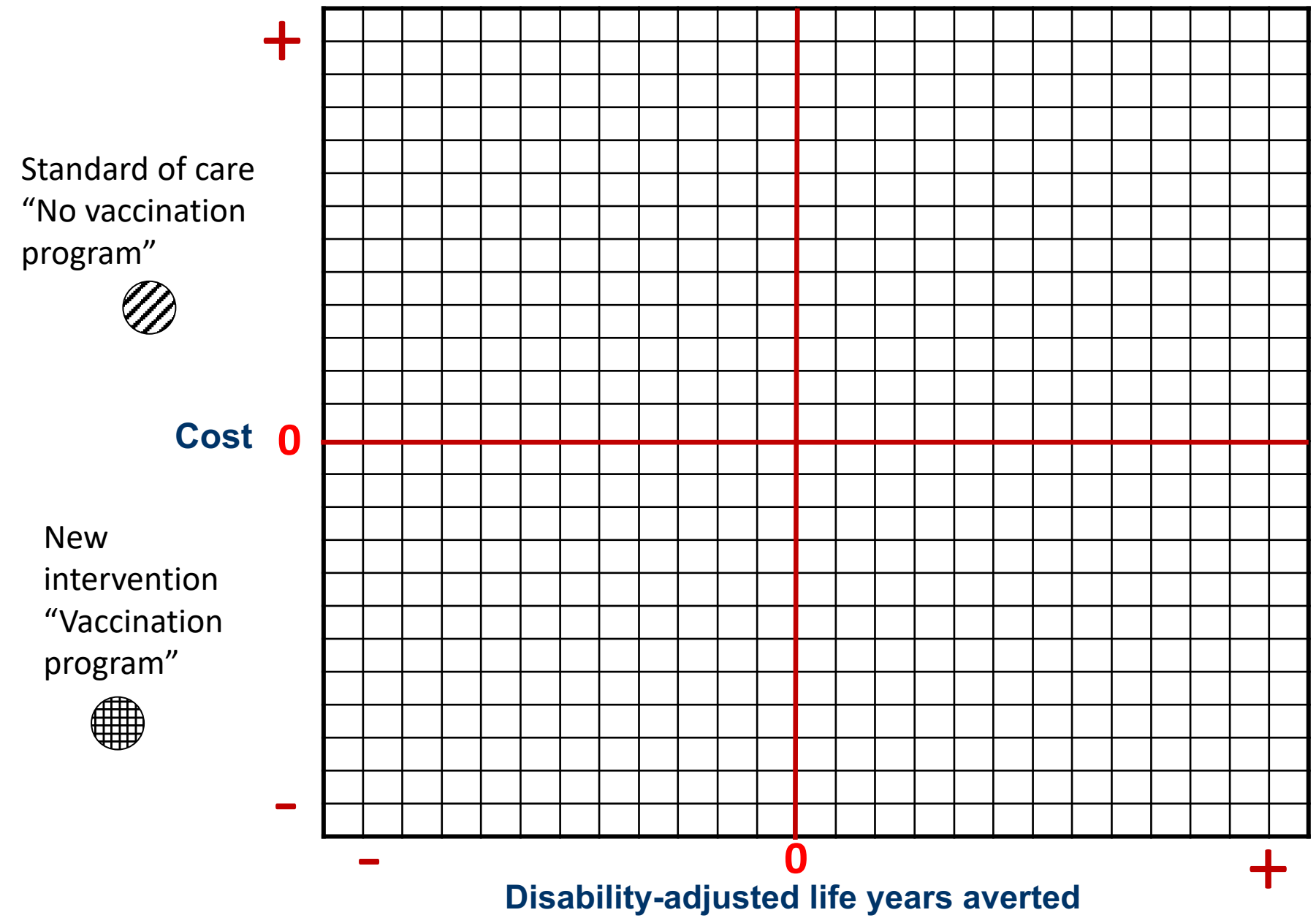
Example: Clark et. al, Hib Vaccine

Table IV. Hib vaccine impact and cost-effectiveness by state: aggregate estimates over the period 2012-2031

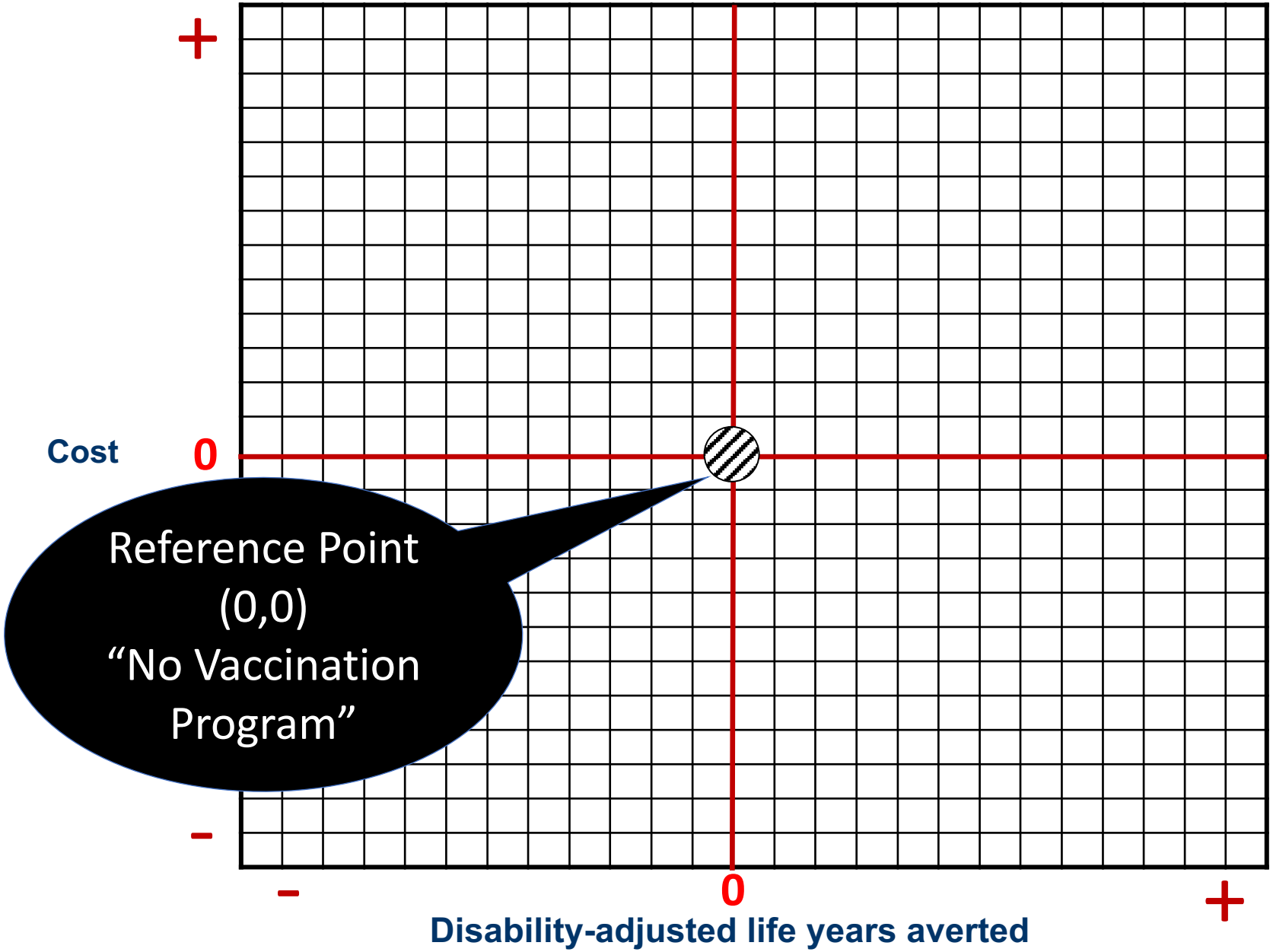
		Vaccine impact, undiscounted					Cost-effectiveness, discounted at 3%					
State	Region	Pneumonia lives saved	Meningitis lives saved	NPNM lives saved	Total lives saved	Percent of U5MR averted	Vaccine costs (millions)	Gov cost savings (millions)	Family cost savings (millions)	Total DALYs averted	US$ per DALY averted (government perspective)	US$ per DALY averted (societal perspective)
Delhi	North	278	807	34	1119	0.6%	$36	$0.6	$3.2	34470	1033	939
Haryana	North	472	1038	42	1552	0.3%	$43	$0.3	$4.9	47096	903	800
Himachal Pradesh	North	253	506	13	773	1.0%	$10	$0.3	$1.0	20314	500	453
Jammu and Kashmir	North	262	662	19	943	0.3%	$20	$0.5	$1.2	25620	777	728
Punjab	North	364	1048	41	1453	0.4%	$45	$0.4	$3.7	44145	1017	934
Rajasthan	North	2942	5492	140	8575	0.4%	$118	$3.0	$9.9	220070	524	479
Chhattisgarh	Central	6050	2315	59	8424	1.0%	$51	$2.8	$11.3	197709	245	188
Madhya Pradesh	Central	21415	7010	152	28578	1.1%	$133	$5.6	$24.4	661798	192	155
Uttar Pradesh	Central	30054	12112	364	42531	0.5%	$432	$24.6	$82.6	1040354	392	312
Bihar	East	19200	6431	179	25810	1.0%	$169	$2.4	$24.4	617964	269	229
Jharkhand	East	7482	2493	68	10043	1.2%	$62	$2.5	$7.8	237934	252	219
Orissa	East	4820	1995	60	6876	0.7%	$58	$4.7	$4.9	169599	315	286
West Bengal	East	12577	5468	147	18191	1.5%	$130	$8.3	$8.9	439363	276	256
North East*	North East	614	1170	23	1807	0.9%	$19	$0.3	$0.4	43599	420	411
Gujaret	West	2419	3793	94	6305	0.6%	$83	$1.1	$7.0	161467	506	463
Maharashtra	West	6073	7993	233	14299	1.0%	$204	$4.6	$22.2	374003	533	474
Andhra Pradesh	South	6019	7979	188	14186	1.0%	$147	$2.2	$7.7	351765	411	389
Karnataka	South	3645	4636	127	8408	0.9%	$104	$1.7	$7.1	216132	474	441
Kerala	South	662	1403	58	2123	2.0%	$51	$1.3	$3.2	64781	775	725
Tamil Nadu	South	2266	3490	107	5863	0.8%	$90	$3.1	$4.4	156945	555	526
India		127869	77840	2150	207859		$2006	$70	$240	5125128	378	331

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

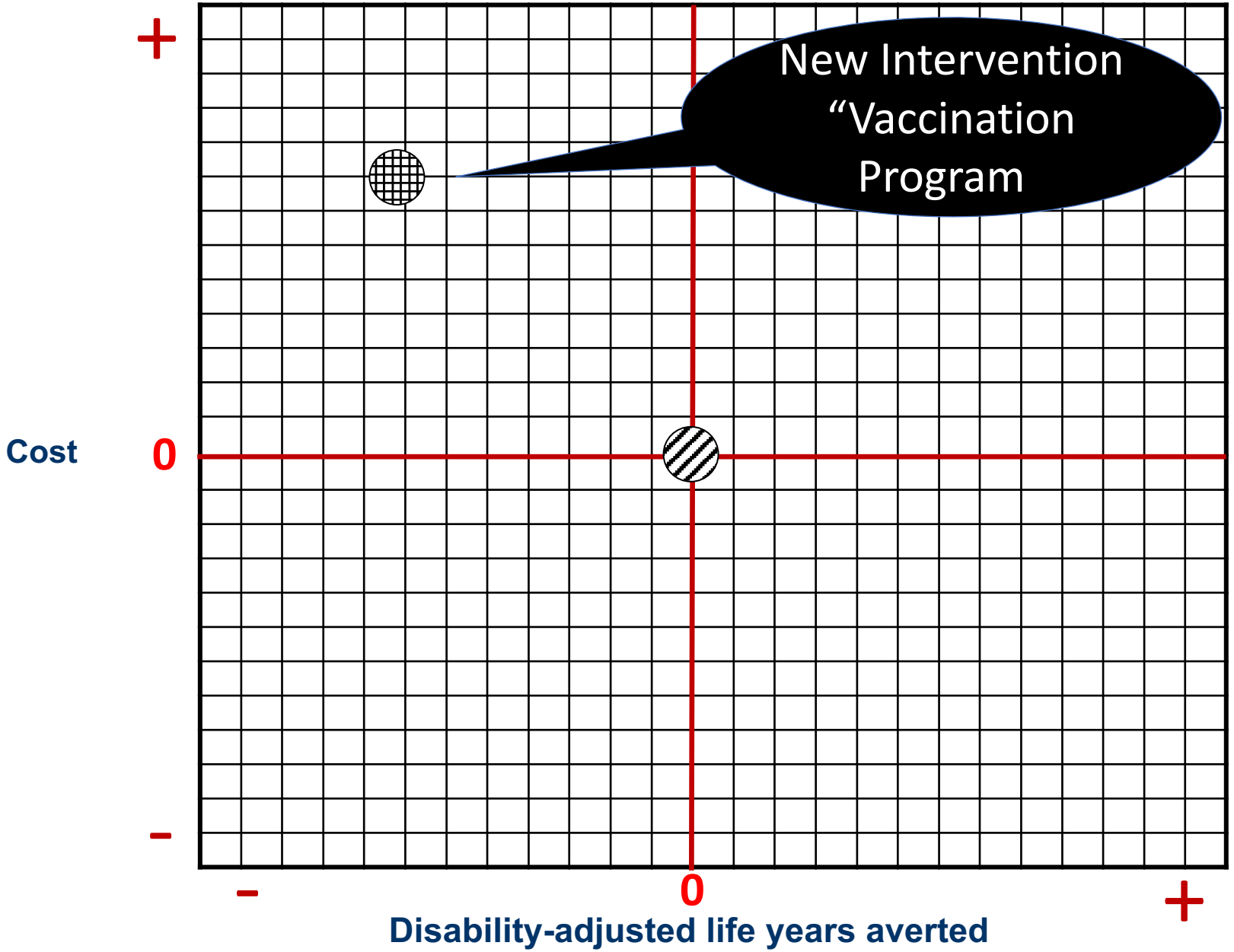
Cost-Effectiveness Plane



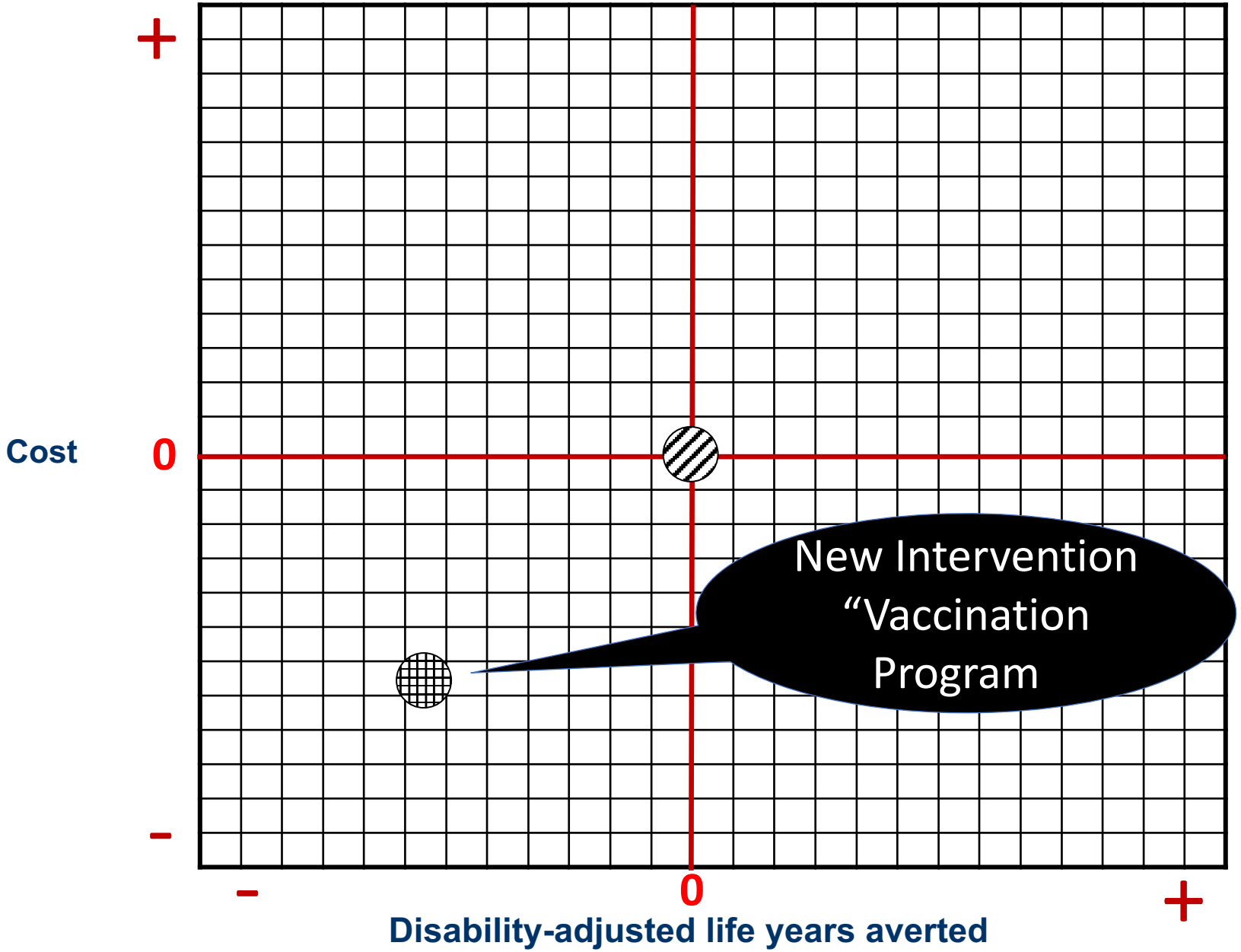
Cost-Effectiveness Plane



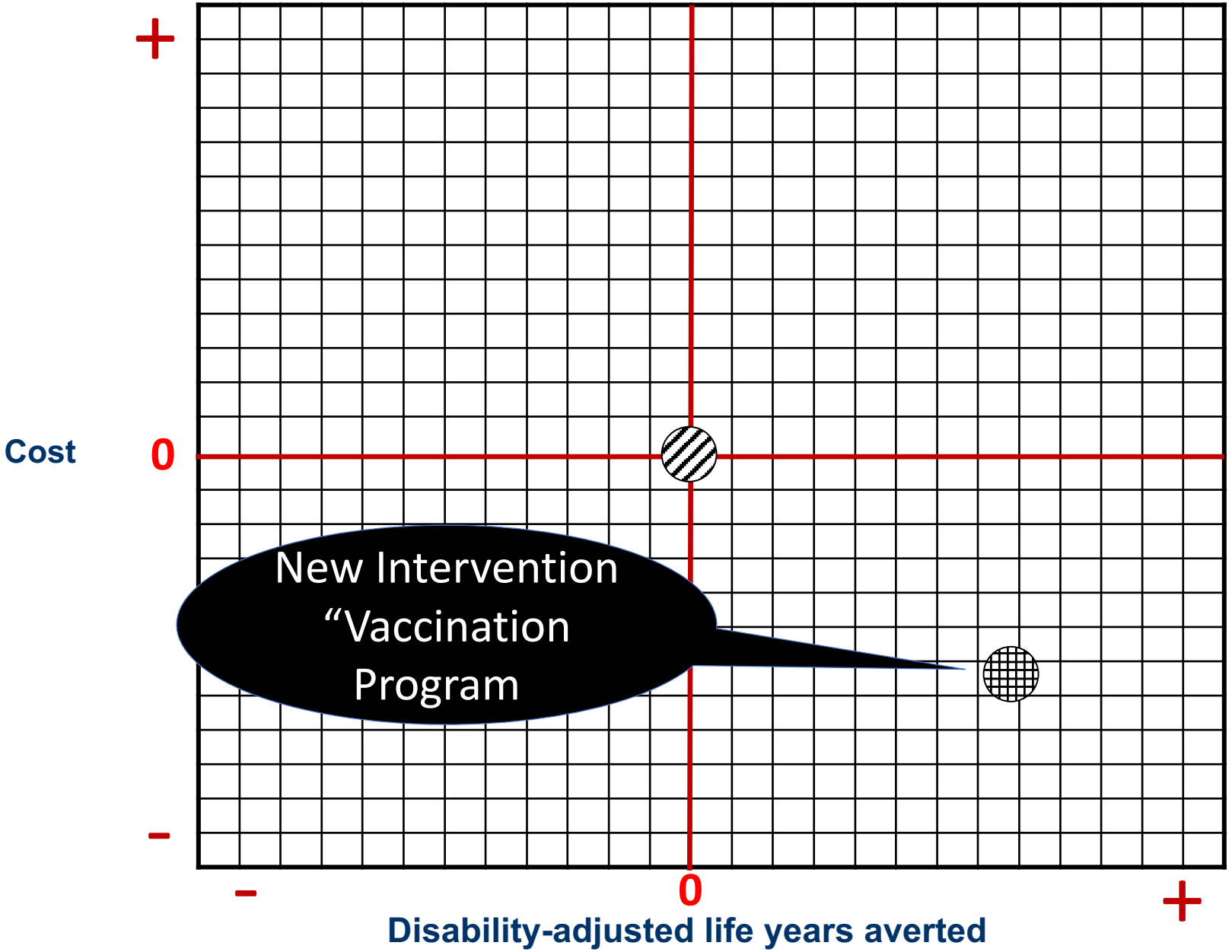
Interpreting the ICER (1)



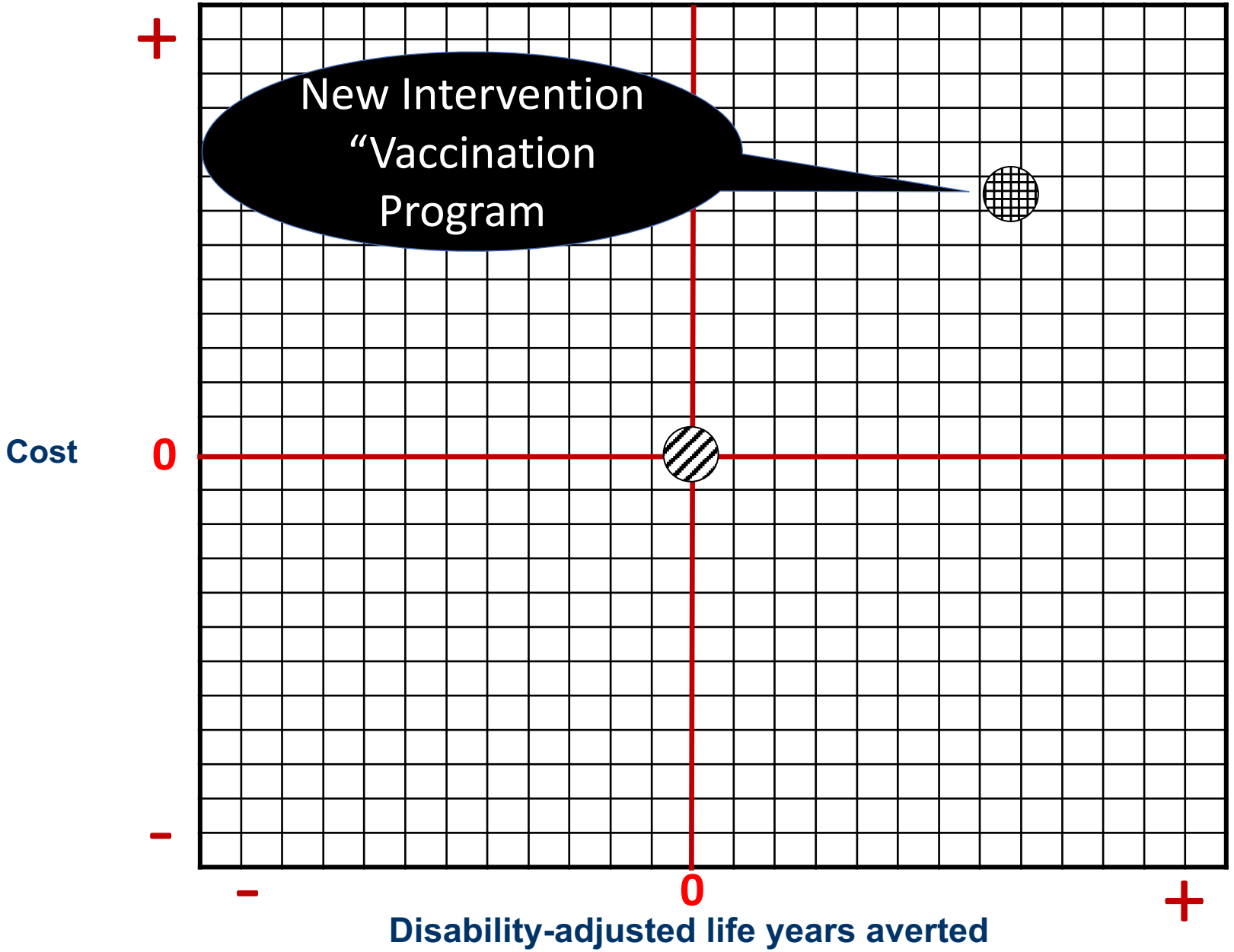
Interpreting the ICER (2)



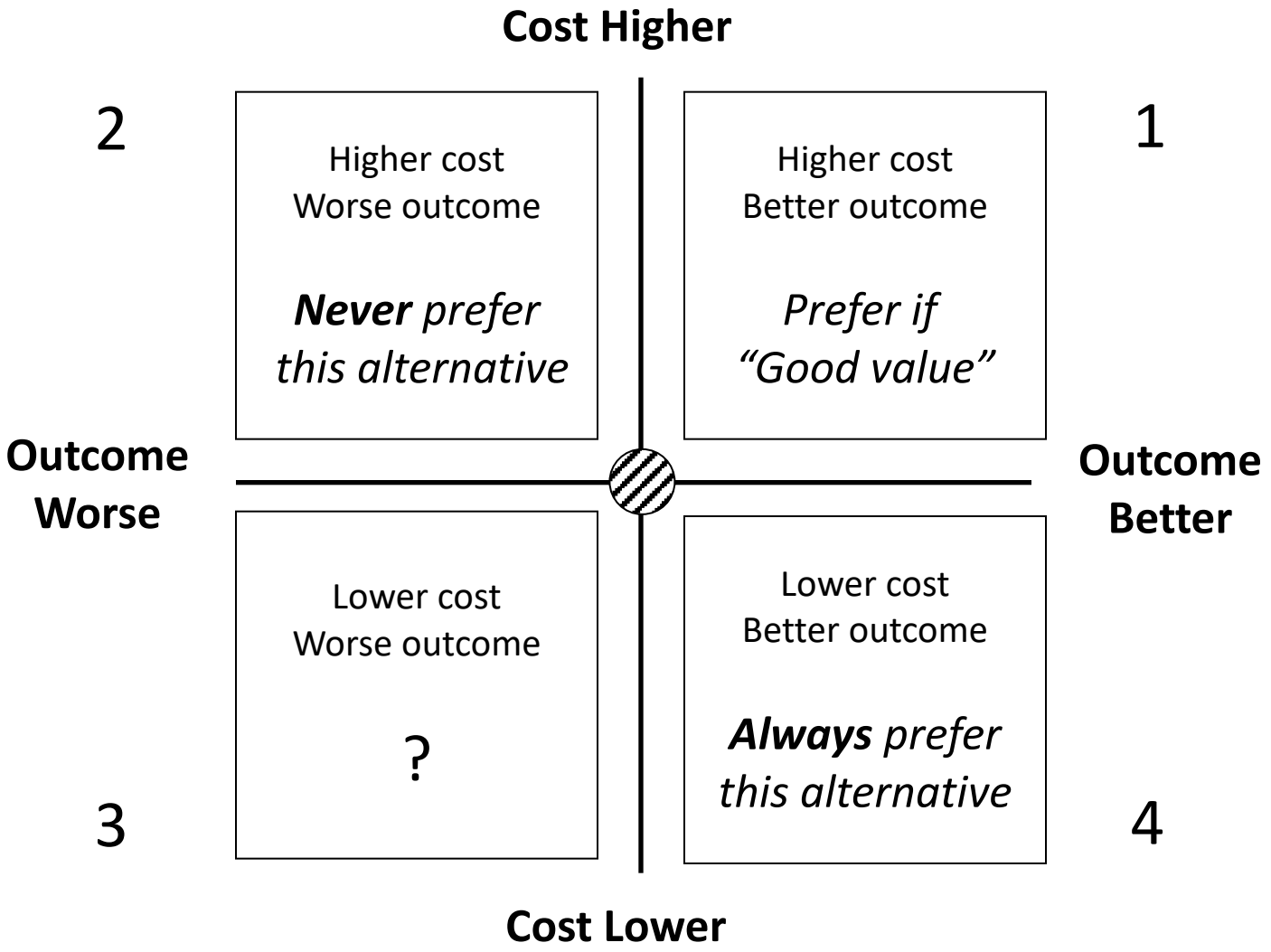
Interpreting the ICER (3)



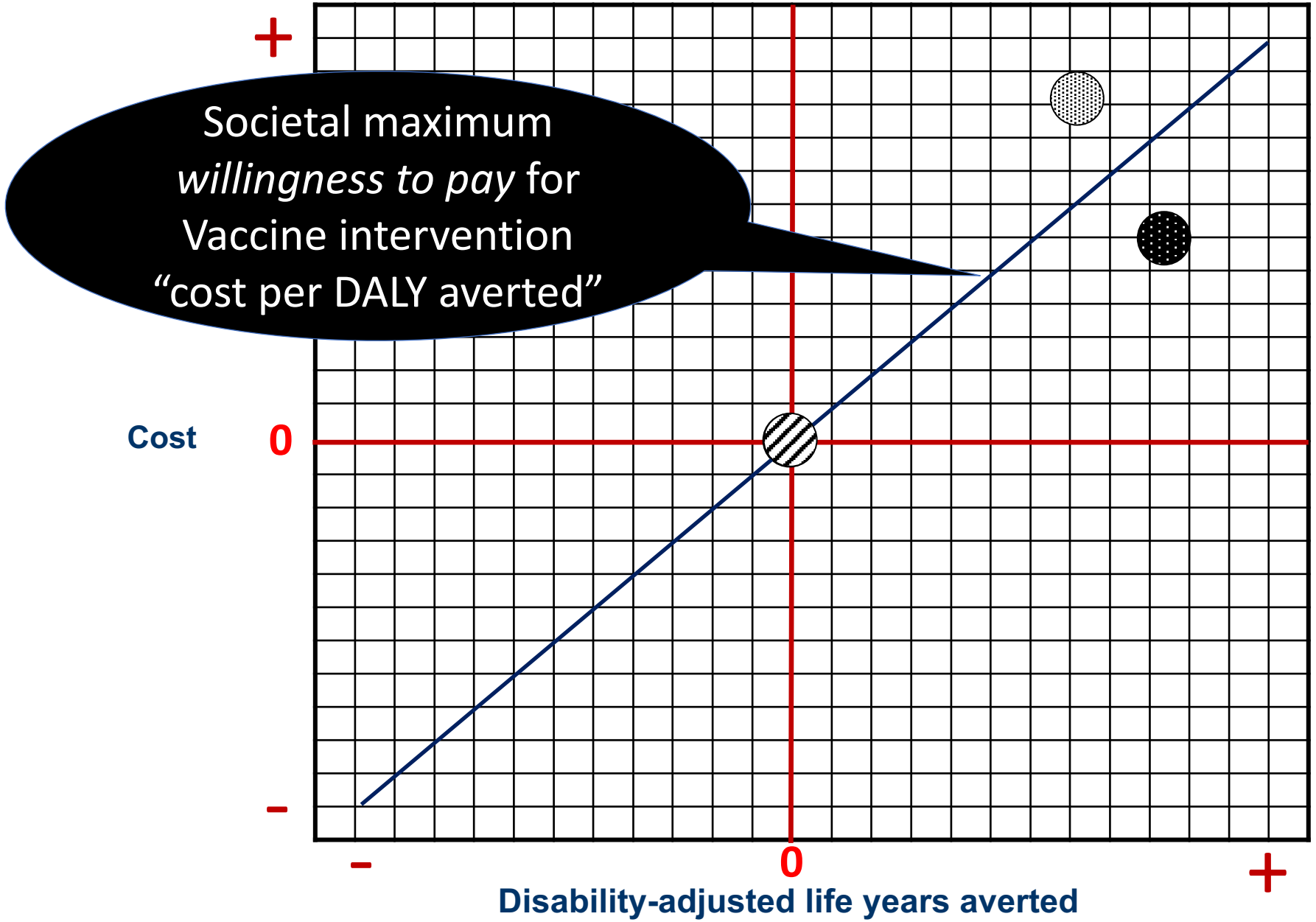
Interpreting the ICER (4)



Decision Rules for Vaccine CEA



When is an intervention “cost-effective”?

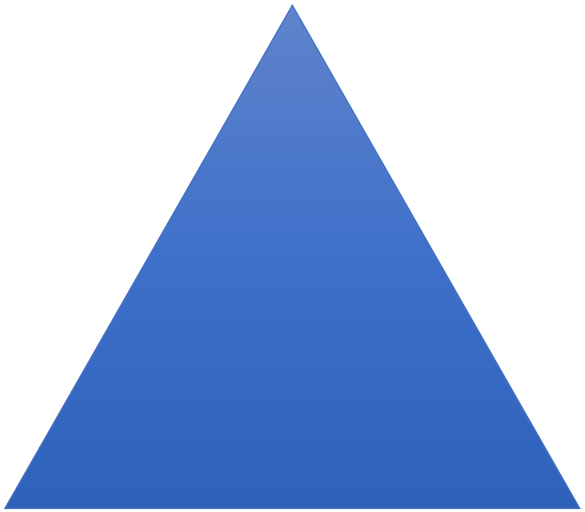


Summary

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?