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Norwegian Institute of Public Health

Economic evaluation of public health interventions

Implications for practices in HTA

November 30 & December 3, 2020

Norwegian Institute of Public Health I Global Health Department

Outline: Day one

- The need for health priority setting (HTA recap)
- Public health and health economics
- Economic evaluation of health interventions
  - What is an economic evaluation?
  - Types of economic evaluations
  - How is an economic evaluation conducted?
  - Choosing interventions that are cost-effective
- Challenges of economic evaluations of public health interventions
- Critical appraisal of economic evaluations
- Conclusion

Workshop objectives

Identify key areas in the economic evaluation of public health interventions

Identify linkages between priority setting, health economics and health technology assessment (HTA)

Review existing standards and processes for economic evaluation

Expected outcomes

Principles of economic evaluation and its role in Health Technology Assessment (HTA)

The role of economic evaluations for public health interventions

Key areas of the theory of economic evaluation in participants context

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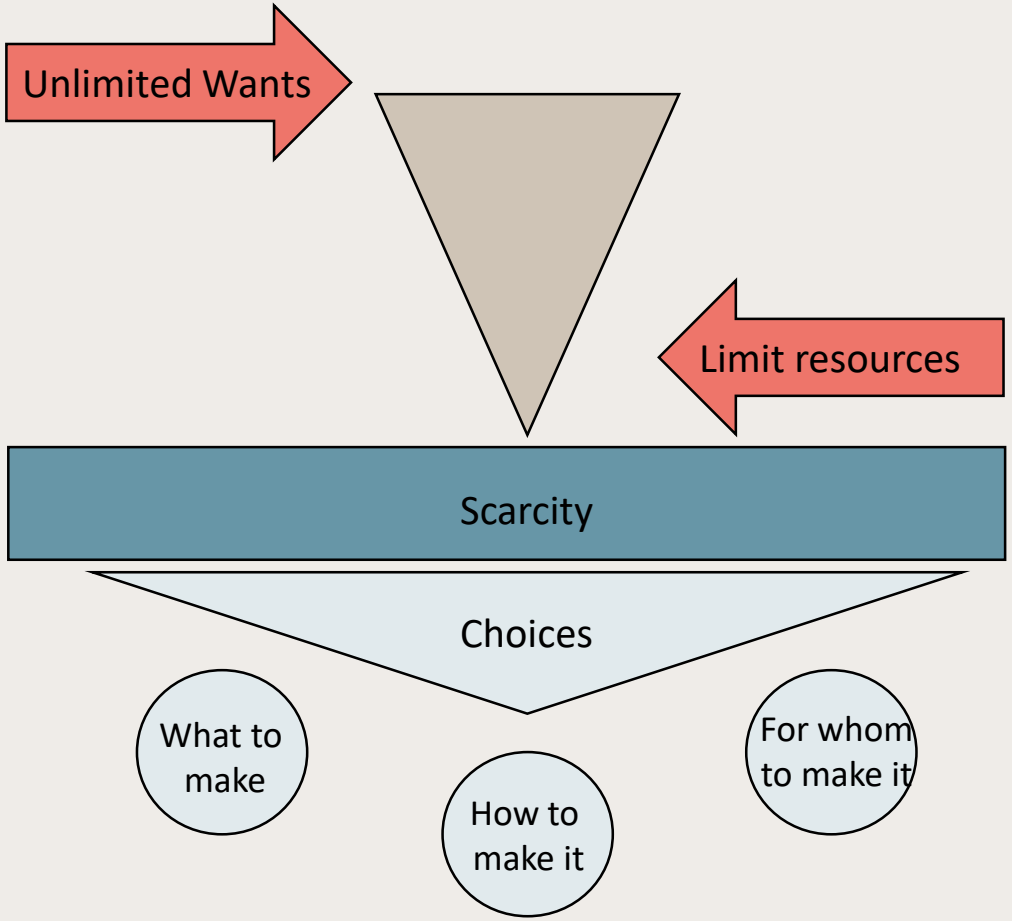
Part 1. The need for health priority setting

The fundamental economic problem



Scarcity is the fundamental economic problem that forces consumers and producers to use resources wisely.

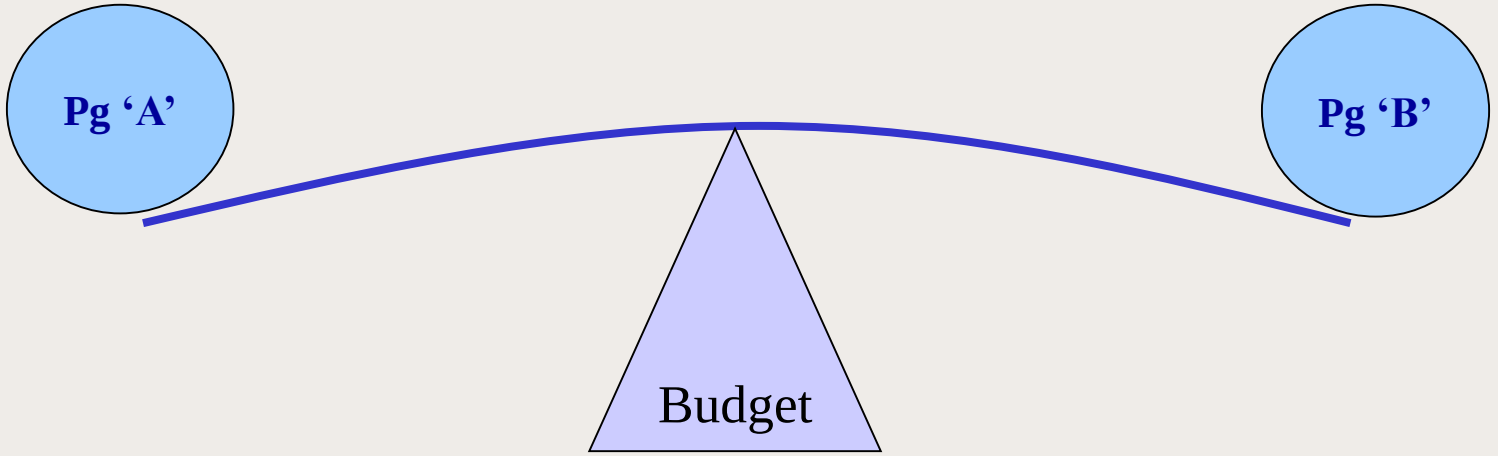
How does the concept of scarcity apply to healthcare?

The ‘Health Economic’ problem

- Unlimited healthcare “wants” with rapid growth in health expenditure.
- Insufficient health sector resources.
- Choosing between ‘wants’ we can ‘afford’ given our resource ‘budget’.

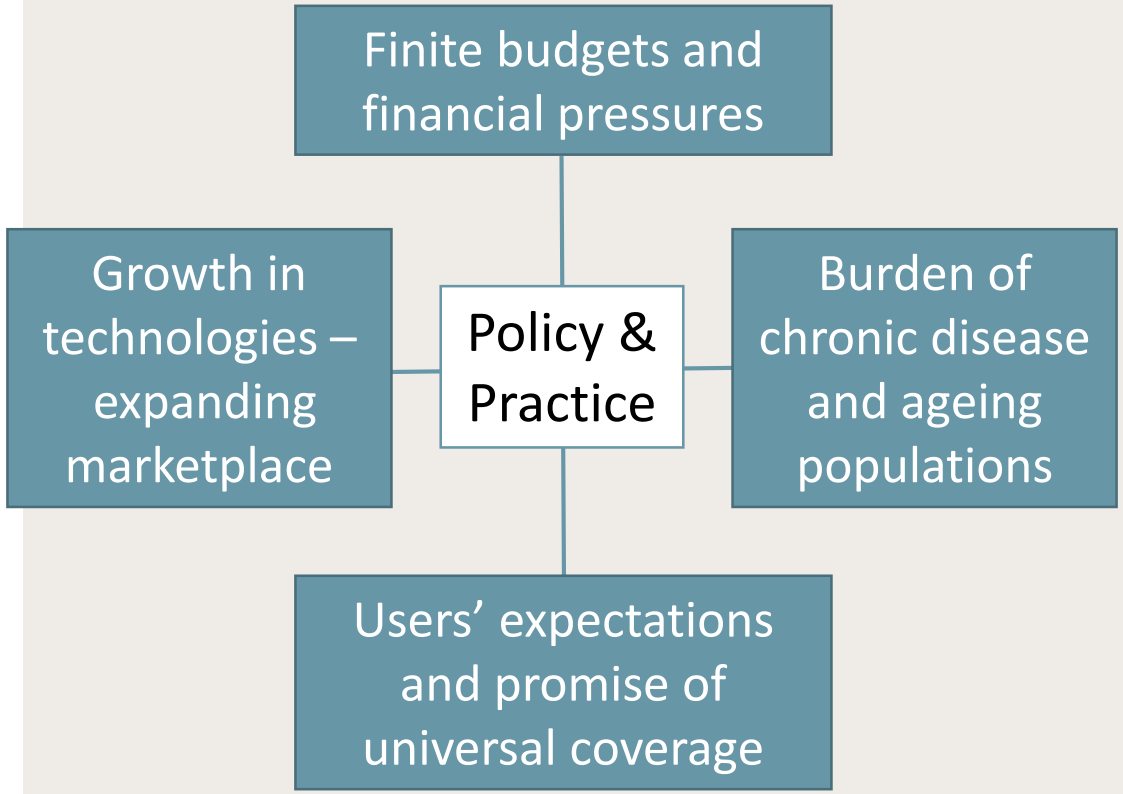
The concept of opportunity cost

- "The value of forgone benefit which could be obtained from a resource in its next-best alternative use".

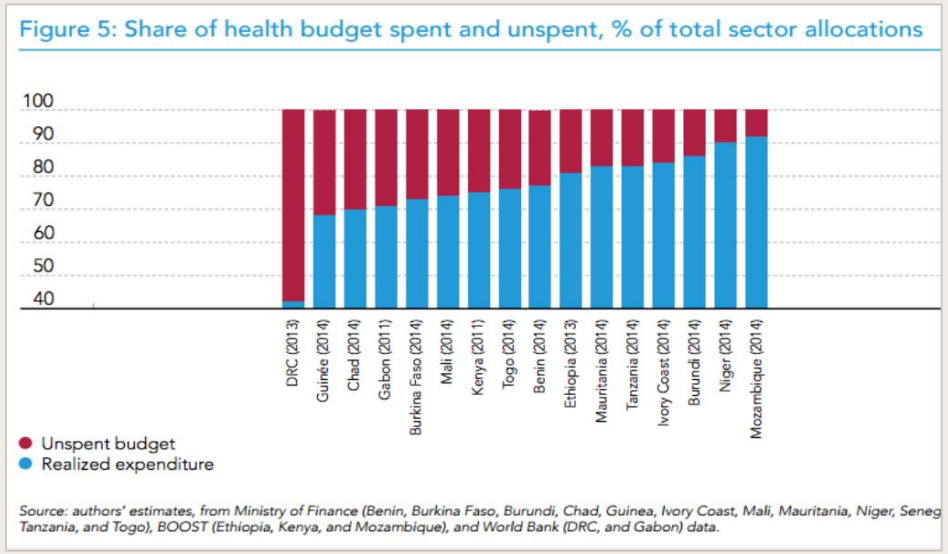


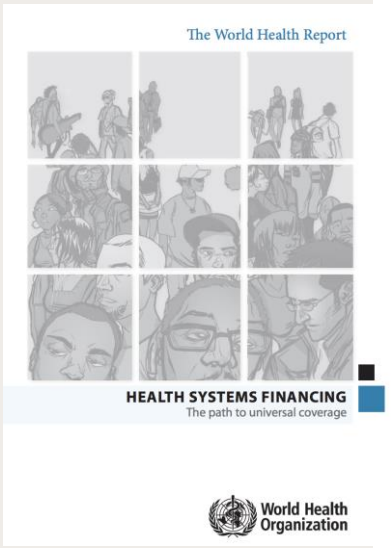
- The aim is to choose activities where benefits outweigh opportunity cost

The need for priority setting



Status quo, unfair and unsustainable: Between 20-40% of the ~$8 trillion spent annually on healthcare is wasted
Source: http://www.who.int/whr/2010/en/

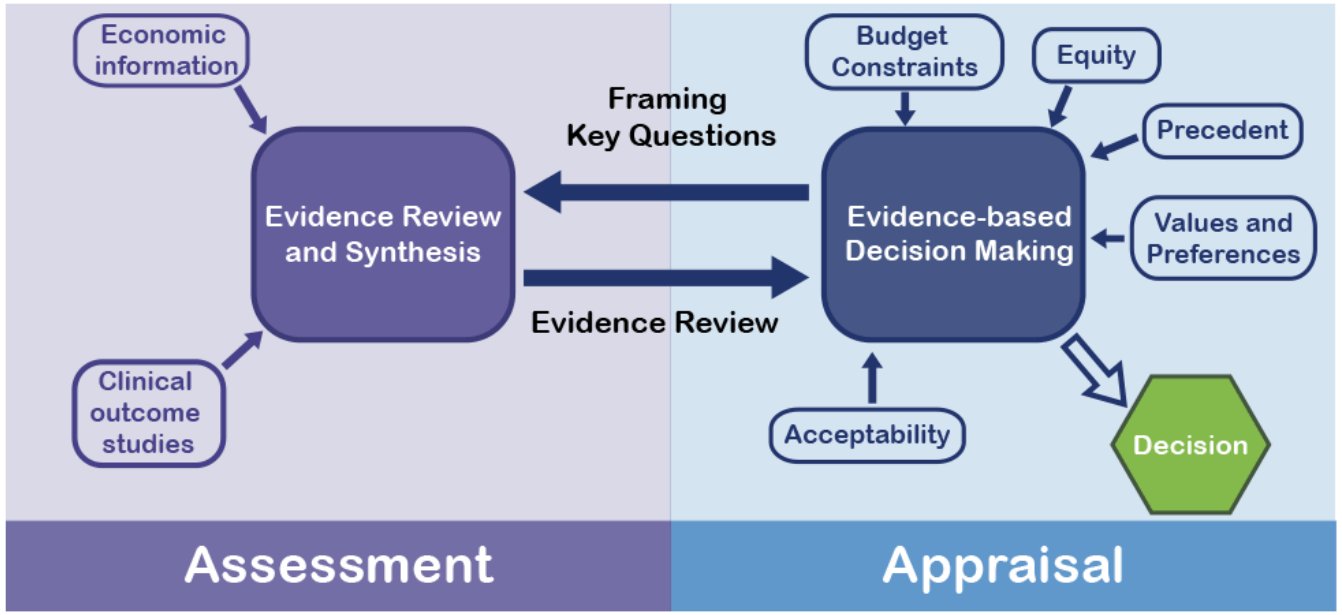




Healthcare budgets often underspent

How should we set health priorities?

- Using evidence to inform health priorities



EUPATI
European Patients' Academy on Therapeutic Innovation
www.eupati.eu

Adapted from Teutsch, S., Berger, M. (2005). 'Evidence synthesis and evidence-based decision making; Related but distinct processes. *Medical Decision Making*, pp. 487-489.

O'Rourke B, Oortwijn W, Schuller T; International Joint Task Group. The new definition of health technology assessment: A milestone in international collaboration. Int J Technol Assess Health Care. 2020 Jun;36(3):187-190. doi: 10.1017/S0266462320000215. Epub 2020 May 13. PMID: 32398176.

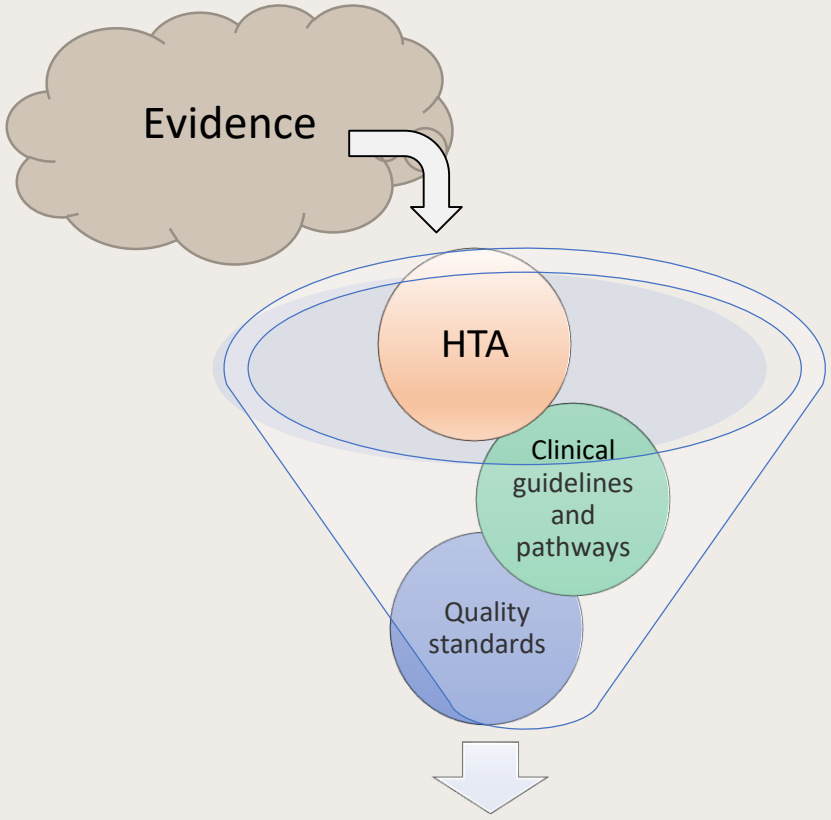
What is health technology assessment?

- "A multidisciplinary process that uses explicit methods to determine the value of a health technology at different points in its lifecycle. The purpose is to inform decision-making in order to promote an equitable, efficient, and high-quality health system." (O'Rourke, Oortwijn & Schuller; International Joint Task Group, 2020)

Steps of the HTA process	Topic selection, identification, prioritisation	HTA analysis	Appraisal and decision making	Implementation
NIPH's areas of support	• How it is organised and implemented • Principles, processes and prioritisation • Existing examples of relevant services, systems, initiatives, and networks • Consultation	• Assessment plans • Collecting evidence • Analysing and synthesising results • Technical collaboration • Discussing report recommendations	• The types of decisions to be taken, and by whom • Evidence review and appraisal • Guidelines or checklists for appraisal	• Modes of diffusion • Monitoring and evaluation

NIPH, 2020 - from https://www.fhi.no/en/qk/global-healt-collaboration/evidence-to-decisions/partnering-low-and-middle-income-countries-to-support-local-implementation--/

How HTA can inform policy and priorities



Health technology assessment (HTA) to compare clinical and cost-effectiveness of different interventions

Clinical guidelines (STGs) and pathways distilled from HTA and other evidence

Quality standards and indicators from evidence-based guidelines

Health benefits plans (HBPs), pay-for-performance, other levers (regulation, accreditation, education…)

Source: International Decision Support Initiative (iDSI)

Exercise

- Give an example of an opportunity cost.
- In what way is priority setting important for your work?

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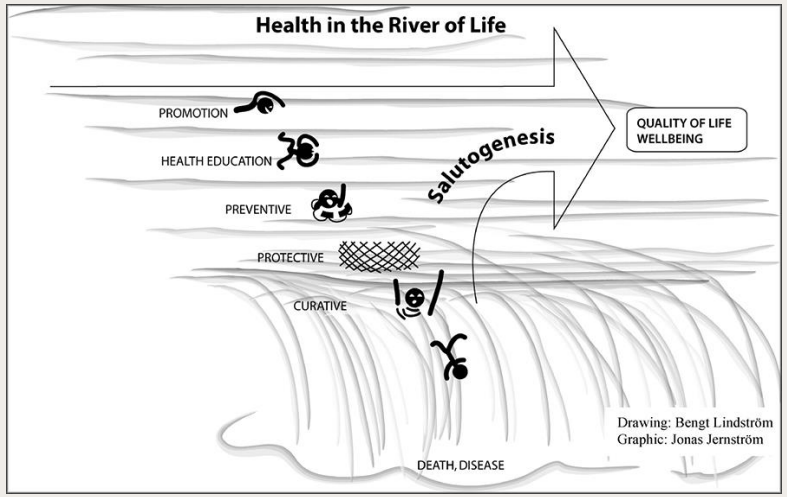
Part 2. Public Health and Health economics

What is public health?

- Definition: "the art and science of preventing disease, prolonging life and promoting health through the organized efforts of society" (Acheson, 1988)

- Aims to provide conditions for people to
  - Maintain their health
  - Improve their health and wellbeing,
  - Prevent the deterioration of their health



- Focuses on the entire spectrum of health and wellbeing, not only the eradication of particular diseases.

Acheson, E. D. (1988). On the state of the public health [the fourth Duncan lecture]. *Public Health, 102*(5), 431–437.
Image retrieved from: Eriksson M, Lindström B. A salutogenic interpretation of the Ottawa Charter, *Health Promotion International*, Volume 23, Issue 2, June 2008, Pages 190–199, https://doi.org/10.1093/heapro/dan014

Image from: https://onlinedegrees.kent.edu/college-of-public-health/public-health/community/public-health-interventions

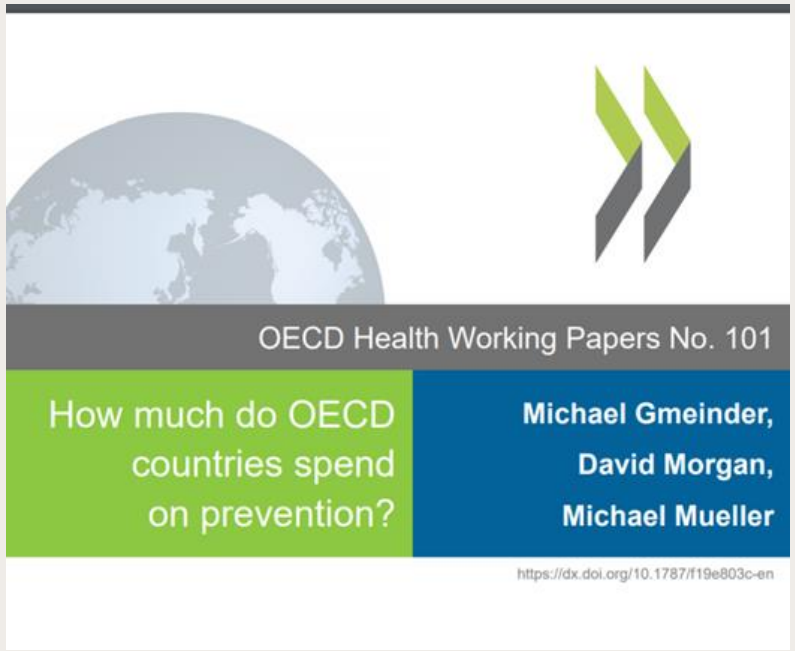
Types of public health interventions

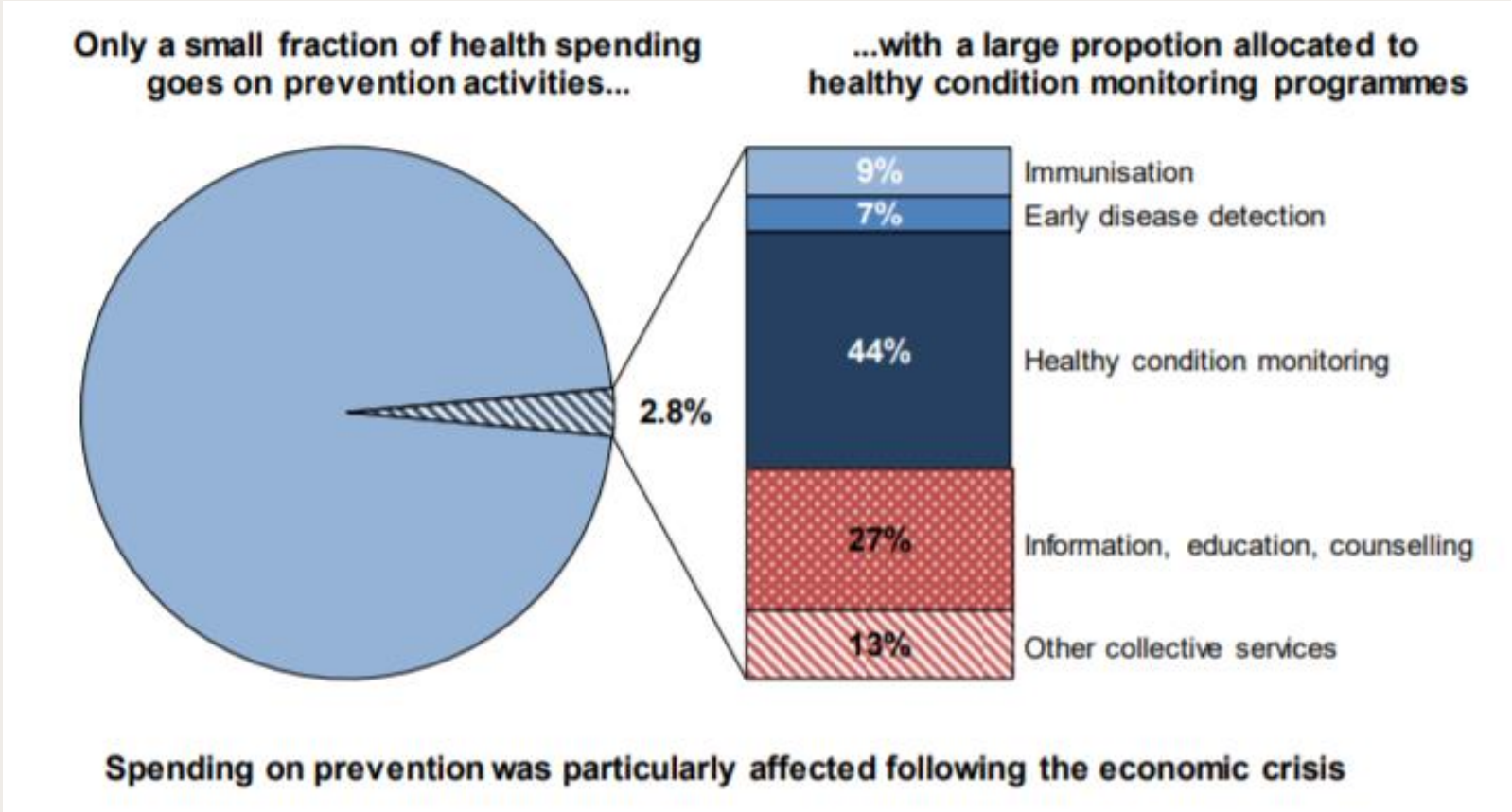
Ten greatest public health achievements from 1900 to 1999 (CDC, 1999)

- Vaccination
- Motor vehicle safety
- Safer workplaces
- Control of infectious diseases
- Decline in deaths from coronary heart disease and stroke
- Safer and healthier foods
- Healthier mothers and babies
- Family planning
- Fluoridation of drinking water
- Recognition of tobacco use as a health hazard

Centers for Disease Control and Prevention. (1999). Achievements in public health, 1900-1999: changes in the public health system. *MMWR Morb Mortal Wkly Rep*, *48*(50), 1141-7. doi:10.1001/jama.283.6.735

How much do OECD countries spend on prevention?

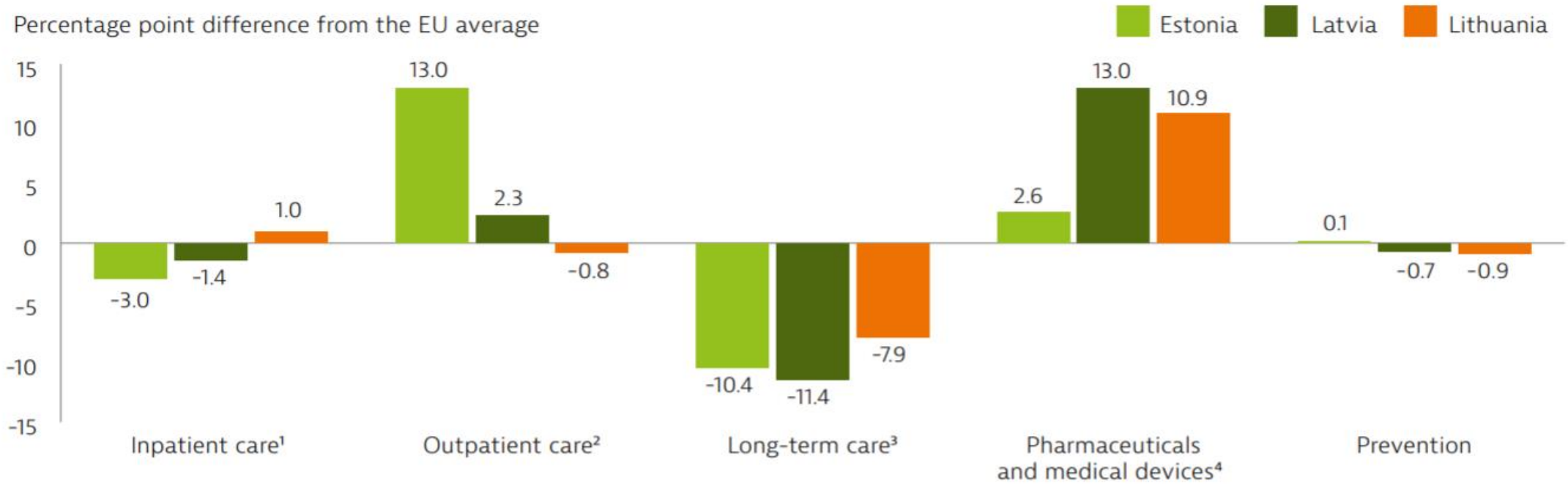




Images from: Gmeinder, M., D. Morgan and M. Mueller (2017), "How much do OECD countries spend on prevention?", *OECD Health Working Papers,* No. 101, OECD Publishing, Paris, https://doi.org/10.1787/f19e803c-en.

How much do OECD countries spend on prevention?

Figure 11. Allocation of resources across health services in Lithuania differs substantially



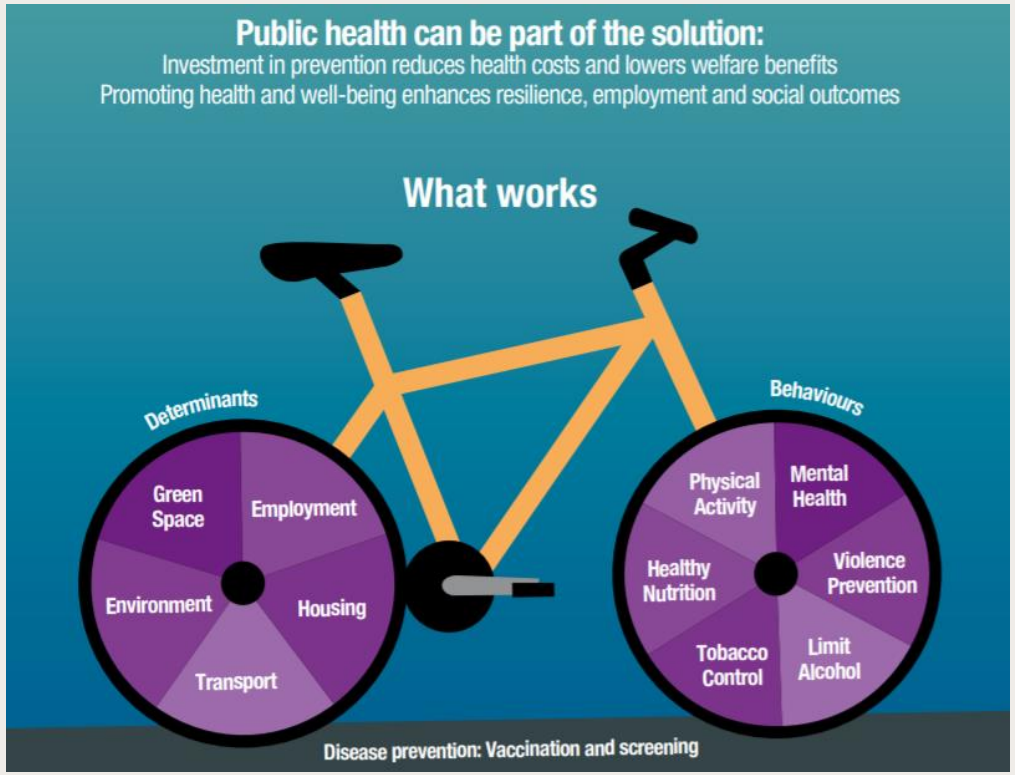
Note: Administration costs are not included. 1. Includes curative-rehabilitative care in hospital and other settings; 2. Includes home care; 3. Includes only the health component; 4. Includes only the outpatient market.
Sources: OECD Health Statistics 2019, Eurostat Database (data refer to 2017).

OECD/European Observatory on Health Systems and Policies (2019), *Lithuania: Country Health Profile 2019*, State of Health in the EU, OECD Publishing, Paris/European Observatory on Health Systems and Policies, Brussels, https://doi.org/10.1787/35913deb-en.

Why is prevention seemingly low priority?

- Limited data on cost-effectiveness of public health interventions
  - Economic evaluations are complex, as they take into account both direct health costs and indirect social costs
- Concerns about upfront costs and the intangibility of outcomes lead to a lack of action
  - The length of time to receive a return on investments

The case for investing in public health



- High costs of ill health in Europe
  - Tobacco use reduces overall national incomes by up to 3.6%
  - Cardiovascular diseases and cancers cost Europe up to €169 billion and €124 billion respectively annually
- Preventive interventions are highly cost-effective
  - E.g: Salt regulation, sin taxes (SSB/tobacco), healthy lifestyle
- Small investments promise large gains to health, economy and other sectors.

World Health Organization (2014). The Case For Investing In Public Health. *A public health summary report for EPHO 8*. WHO Regional Office for Europe. https://apps.who.int/iris/handle/10665/170471

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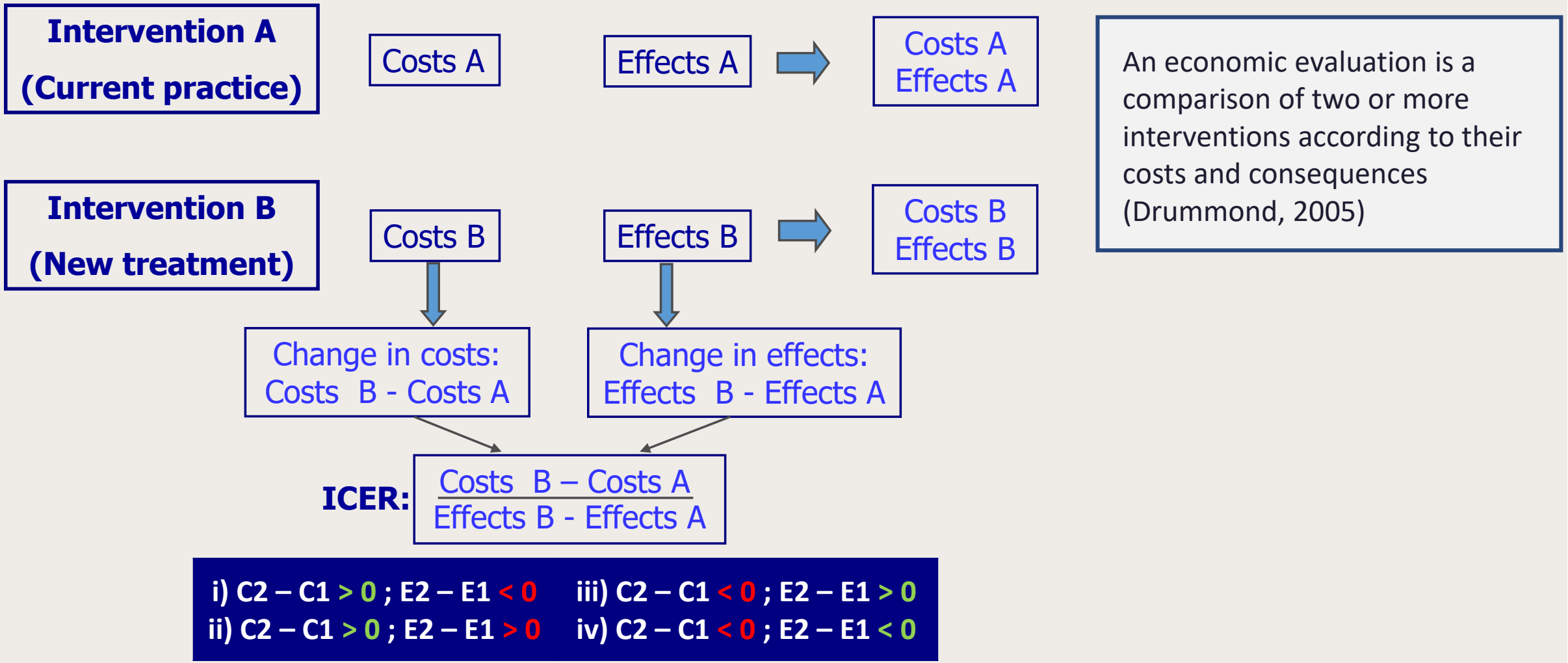
Part 3. Economic evaluation of health interventions

What is an economic evaluation?



An economic evaluation is a comparison of two or more interventions according to their costs and consequences (Drummond, 2005)

Types of economic evaluations

Type of study	Measurement/valuation of costs in both alternatives	Identification of consequences	Measurement/valuation of consequences
Cost-minimization (CMA)	Monetary units	None – identical in all aspects	**Least cost alternative**
Cost-effectiveness analysis (CEA)	Monetary units	Single common effect, but different magnitude e.g. LYs gained, disability days saved	**Cost per unit of consequence e.g. cost per LY gained**
Cost-utility analysis (CUA)	Monetary units	Single or multiple effects, not necessarily common. Valued as utility (QALY, DALY)	**Cost per unit of consequence e.g. cost per QALY**
Cost-benefit analysis (CBA)	Monetary units	Single or multiple effects, not necessarily common. Valued in monetary units e.g. WTP	**Net cost-benefit ratio**

Figure adapted from: Hoch, J., & Dewa, C. (2005). An Introduction to Economic Evaluation: What's in a Name? *The Canadian Journal of Psychiatry, 50*, 159 - 166.

Choice of study design

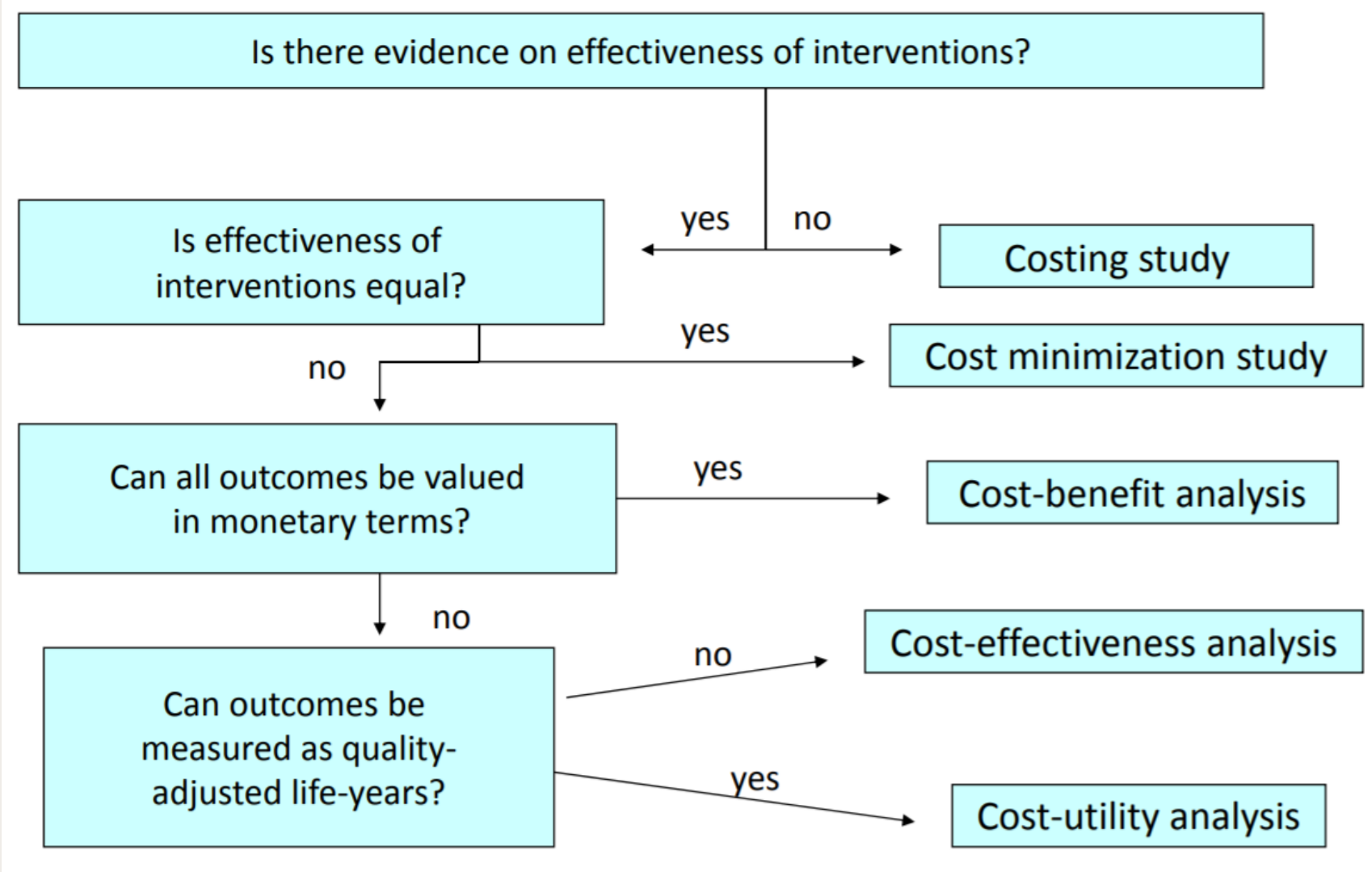
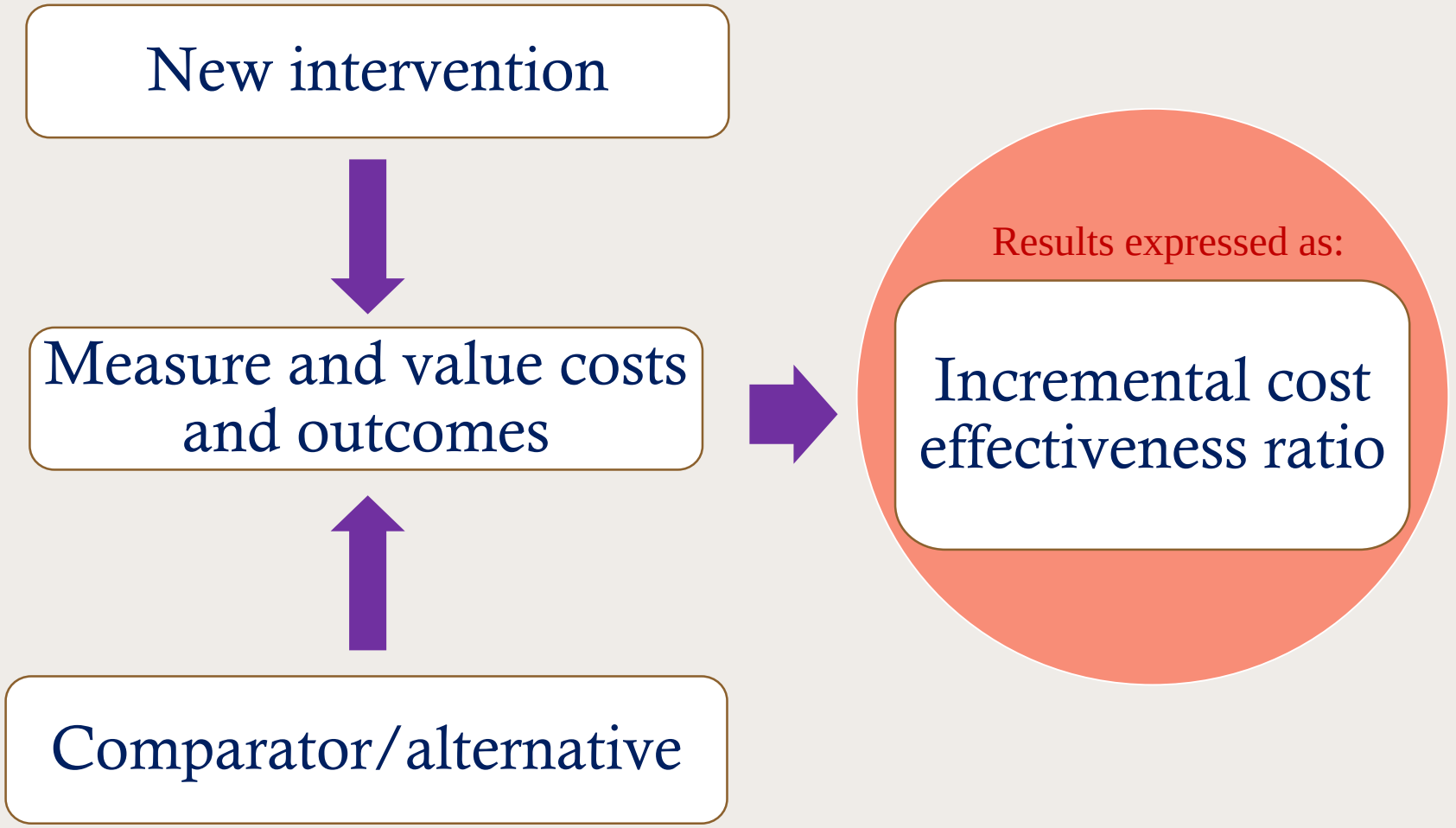


Image retrieved from: Levin C. (2013). Economic Evaluation for Global Health Programs. University of Washington. tinyurl.com/j0hzp3oe

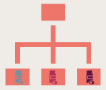
Framework of an economic evaluation



Key steps in an economic evaluation study

Step 1: Define the problem and objective

Step 2: Identify and describe the alternatives



Step 3: Decide on the analytic time horizon

Step 4: Define the perspective of the cost-analysis

Step 5: Identify, measure and value resources (costing)

Step 6: Identify and measure outcomes

Step 7: Base case analysis to combine costs and outcomes

Step 8: Conduct sensitivity analysis

Step 9: Reporting

Step 1: Framing the study question

- Consider an economic evaluation of a vaccination program. As an analyst you will need to **clearly define the scope of the evaluation**
- The evaluation scope will **determine the costs and health benefits** considered relevant for inclusion in the analysis
- Key factors to consider:

Define the **population**

Specify **alternatives** to be compared

The **perspective** of the evaluation

The relevant **outcome**

Pictures from telanganatoday, Freepik, and the New York Times https://static01.nyt.com/images/2019/08/28/multimedia/28-parenting-timing-breastfeeding/28-parenting-timing-breastfeeding-videoSixteenByNineJumbo1600.jpg

Example: framing the study question

What is the cost-effectiveness of quadrivalent vs trivalent seasonal influenza vaccines in the elderly Lithuanian population from the viewpoint of the society?

Parameter	Description
Population	65+
Comparators	Vaccine vs Vaccine • Quadrivalent • Trivalent
Perspective	Societal
Outcome	Measure of cost-effectiveness, e.g. incremental cost per dose/cost per quality adjusted life year

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Step 2: Identifying the alternatives

- Alternatives are comparators for which costs and effects of the new intervention are compared
- Comparators should accurately reflect the study question

For a new vaccine,

- The most relevant comparator is the current form of treatment for an infectious disease where the vaccine does not exist
  - Standards of care for different patient groups with the infection
  - Doing nothing to treat the condition if treatment technologies do not exist, or are not financially viable to provide in low-income areas
- Other comparators could include
  - Best available alternatives, e.g. as represented by clinical guidelines or low-cost alternative
  - Alternative levels of scope and intensity for the new intervention
  - Other interventions competing for resources from same national budget (Vaccine vs Education; Vaccine for disease A vs disease B)

Example: identifying alternatives

Cost and benefits of new hepatitis b virus (HBV) vaccine can be compared against:

Do-Nothing

- Not vaccinating against HBV **and not** treating cases
- Not vaccinating against HBV but treating cases

Alternative levels or scope for the new intervention

•Universal childhood HBV vaccination with a birth dose with/without treating remaining cases

•Vaccinating only health workers against HBV with or without treating remaining cases

Non-HBV options competing for same resources

- Introducing another vaccine, e.g. Rotavirus
- Extending coverage of an existing vaccine programme

Source: TVEE - http://immunizationeconomics.org/tvee-ee

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Step 3: Determine the time horizon

- The time horizon – the duration over which health outcomes and costs are calculated
- Depends on the nature of the disease, intervention and study objective
- Longer time horizons are mostly applicable to chronic conditions
- Shorter time horizons may be appropriate for some acute conditions
- Time horizons should be long enough to capture streams of health and economic outcomes
- The same time horizon should be used for both costs and health outcomes.

Example: Seasonal influenza time horizon

What is the appropriate time horizon for a CEA of seasonal influenza?

Assumptions

- Vaccine manufactured in spring/ summer with flu strains predicted to be prevalent in the coming season
- Most individuals vaccinated early fall/ early winter
- Trying to prevent influenza incidence in the fall, winter, and early spring
- All of the above events occur within one year
- Is that the relevant time horizon?

Person gets influenza

- Most patients will be symptomatic, recover, and go on with their lives
- Time horizon = 1 year

But there could be complications

- Pneumonia
- Mortality
- What are the implications?

Mortality

- If immediate mortality is the only complication, then all events and effects would be within a year.
- Time horizon = 1 year

Pneumonia

- Can last much longer than influenza
- Can have long- term negative impacts on quality of life
- Time horizon may be longer than 1 year

Source: TVEE - http://immunizationeconomics.org/tvee-ee

Exercise: Define a question for a public health intervention

- In your group, choose a public health topic of interest
  - Define a problem
  - Identify the alternative interventions to solve this problem
  - Frame a research question for an economic evaluation
  - Decide on an appropriate time horizon for the economic evaluation

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Step 4: Study perspective

- The viewpoint adopted when deciding which types of costs and health benefits are to be included in an economic evaluation
- Determined by the context of the study, persons or institutions affected by outcome of interest, and those that bear the costs of the intervention
- Important to separate costs borne by different stakeholders such as providers, payers, patients, and others to allow analysis from different perspectives.
- Range of perspectives included in the analysis depends on availability of data, resources, and time to conduct the study

Types of perspectives

- **Healthcare sector (payer + patient + provider)**
- **Societal (population-level, including government)**
- **The patient**
- **Family caregiver (proximal to the patient)**
- **The provider**
- **Payer, both public and private parties**
- **Employer (e.g. employee-based health insurance)**
- **Government**
- **Manufacturers and distributors of products**

Example: Study perspective

Costs and benefits considered for selected perspectives

Societal perspective

- Medical costs borne by third-party payers and paid out-of-pocket by patients
- Time costs of patients in seeking and receiving care
- Time costs of informal (unpaid) caregivers
- Transportation costs
- Effects on future productivity and consumption
- Other costs and effects outside the health care sector

Health sector perspective

- Include all costs and benefits impacting a system of providers, payers and patients.
- Do not consider impact outside of the health system (e.g. long-term value to patients)
- Based on Direct Medical Costs reimbursed by a third party
- Can include out-of-pocket costs to the patient
- Can include current and future costs as a result of a pathway of care

Patient perspective

- Fees for consultation
- Bed day charges at the health facility
- Expenses on medicines, diagnostic tests,
- Travelling expenses to the health facility for the patient and accompanied persons for treatment,
- Amount spent on meal / food taken while waiting for treatment
- Time loss of the patient and the accompanied persons for seeking treatment
- Informal caregiving
- Pain and suffering

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Step 5: Estimating intervention costs

Value the use of *scarce* resources needed to produce a certain health effect

$$\text{ICER} = \frac{\text{Value of change in use of health care resources} + \text{Value of change in use of non-health care resources} + \text{Value of change in use of patient time for treatment} + \text{Value of change in use of family caregiver time} + \text{Value of change in patient productivity (work)}}{\text{Change in Output (e.g. quantity and quality of life QALY - DALY}}$$

Weighing the sacrifices against the gains of the intervention to determine the relative desirability of such intervention

Source: TVEE - http://immunizationeconomics.org/tvee-ee

Opportunity vs. accounting costs

- **Opportunity costs** is the value of the next best alternative that is foregone when another alternative is chosen
    - Volunteer (unpaid) nursing students who help out during vaccination campaigns
    - Unused vaccine refrigerator space that will be occupied by inventory of a new vaccine
- Includes explicit and implicit costs
    - Explicit costs are costs that involve a spending or disbursement of money
    - Implicit costs are costs that do not involve an outlay of cash

- **Accounting costs** would be counted from a financial (bookkeeping) perspective, but would not be counted as an opportunity cost in an economic analysis
    - Duties, tariffs, and taxes are an example of what economists call a **transfer payment** where money changes hands, but no resource is consumed and no net societal opportunity is lost
    - In this case, aside from the cost of collecting the tax, no resources are consumed by the tax

Source: TVEE - http://immunizationeconomics.org/tvee-ee

Examples of different types of costs

Category of Cost	Examples
Health care resources	• Hospital, ambulatory care, home care • Medications, bed days, procedures • Tests, ancillary services, professional fees, facilities • Time patients' spend during treatment and medical care
Non-health care resources	• Childcare • Transportation
Patient time for treatment	• Patient time waiting for medical care • Patient time receiving medical care
Family caregiver time	• Family time • Uncompensated caregiver time
Patient productivity	• Patient's lost or impaired ability to work due to morbidity • Patient's lost productivity due to premature mortality

Costs of vaccine delivery

Variable Costs

Item	Capital	Recurrent
Vaccine doses	Capital items last > 1 year	Recurrent items consumed within 1 year
Supplies		
Labor		
Fuel		
Patient time		

Fixed Costs

Item	Capital	Recurrent
Clinic space	Capital items last > 1 year	Recurrent items consumed within 1 year
Overhead		
Surveillance		
Cold chain		
Social mobilization		
Training		

Source: TVEE - http://immunizationeconomics.org/tvee-ee

How choice of perspective affects costs

Cost		Perspective			
		Societal	Insurer/ Payer	Employer	Patient/ Client
	Direct medical	Yes	Yes	Yes	Yes
	Direct non-medical (e.g. transportation, day care)	Yes	No	No	Yes
	Indirect (e.g. time lost from work)	Yes	No	Yes	Yes
	Intangible (e.g. pain and suffering)	Yes	No	No	Yes

Exercise: Continue your health-project

- Define the costs associated to your intervention for the different perspective...
  - Patients
  - Health providers
  - Society
  - ...

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Step 6: Estimating health outcomes

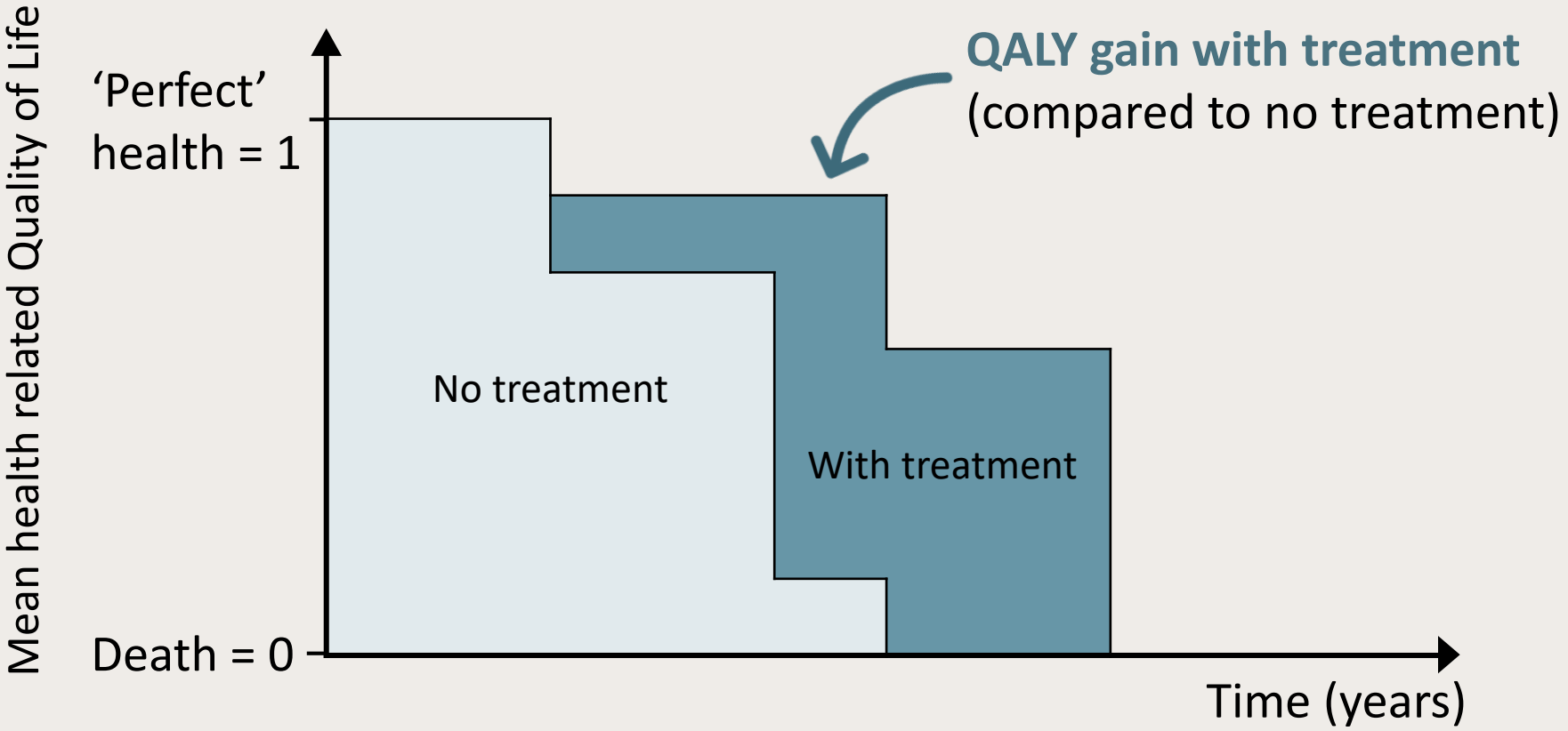
Health measures

- Mortality
  - Deaths averted
  - Life year gained
- Morbidity
  - Prevalence and incidence of a diseases
  - Clinical measure of morbidity (e.g. high blood pressure)
- Disease-specific measures
  - Disease profiles (e.g. chronic respiratory distress questionnaire)
- Generic health measures

Measuring health with Quality Adjusted Life Years (QALYs)

- The QALY is an index of health calculated by adjusting years of life by some fraction representing the quality of life enjoyed in those years
- Requires two key assumptions
  - People can trade-off length of life vs. quality of life
    e.g. 1 QALY = 2 years with 50% QoL for one person
  - Each year of 'healthy' life is of equal value for all
    e.g. 1 QALY = 6 months of healthy life for two people

The QALY is a comparative measure



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Discounting

- Discounting is the process of adjusting future costs and outcomes of health interventions to represent their “present value”
- People generally value future costs and effects less than current costs and effects
- The value of future costs and effects diminishes the more distant in the future they occur
- Thus economic evaluations need to discount (costs and benefits), i.e. adjust the value of costs and benefits for the time at which they occur

Calculating present value (PV)

Present Value = Future cost / ((1+discount rate)^{t})

Where t is number of years in the future.

e.g. The PV of getting €300 in 5 years time when the discount rate is 5%

PV = €300/((1+0.05)^{t}) = €300/1.28 = €235

Suggested Reference Case discount rate for LMICs currently 3%

Step 7: Combine costs and effectiveness

$$\frac{(\text{Total cost}_A - \text{Total cost}_B)}{(\text{Total QALY}_A - \text{Total QALY}_B)} = \frac{\text{Difference}_{\text{cost}}}{\text{Difference}_{\text{QALY}}}$$

- Incremental cost effectiveness ratio (ICER) for treatment A compared to treatment B
- CBA – net benefit (occasionally benefit to cost ratio)
- CMA – incremental costs only
- CEA and CUA – incremental cost effectiveness ratio

Example DVT diagnosis……

(Drummond, et al., 2015, p. 39)

	Cost (US$)	Outcome (no of correct diagnoses)	Ratio of cost to outcome ($ per correct diagnoses)
Programme 1 IPG (alone)	321,488[A]	142[B]	[A/B]2,264
Programme 2 IPG plus venography	603,552[C]	201[D]	[C/D]3,003
Increment P2 over P1	[C-A]282,064	[D-B]59	[(C-A)/(D-B)]4,781

Diagnostic strategies for DVT – cost per correct diagnoses
P1 = impedance plethymography (IPG)
P2 = IPG + out patient venography.

Drummond, M. F., Sculpher, M. J., Claxton, K., Stoddart, G. L., & Torrance, G. W. (2015). *Methods for the economic evaluation of health care programmes*. Oxford university press.

Exercise

	Cost (£)	Outcome (QALYs)	Ratio
Programme 1 (standard)	10^{A}	2^{B}	
Programme 2 (new)	48^{C}	4^{D}	
Increment P2 over P1			

Exercise - Answer

	Cost (£)	Outcome (QALYs)
Programme 1 (standard)	10[A]	2[B]
Programme 2 (new)	48[C]	4[D]

Key steps in an economic evaluation study

Step 1: Define the problem and objective

Step 2: Identify and describe the alternatives

Step 3: Decide on the analytic time horizon

Step 4: Define the perspective of the cost-analysis

Step 5: Identify, measure and value resources (costing)

Step 6: Identify and measure outcomes

Step 7: Base case analysis to combine costs and outcomes

Step 8: Conduct sensitivity analysis

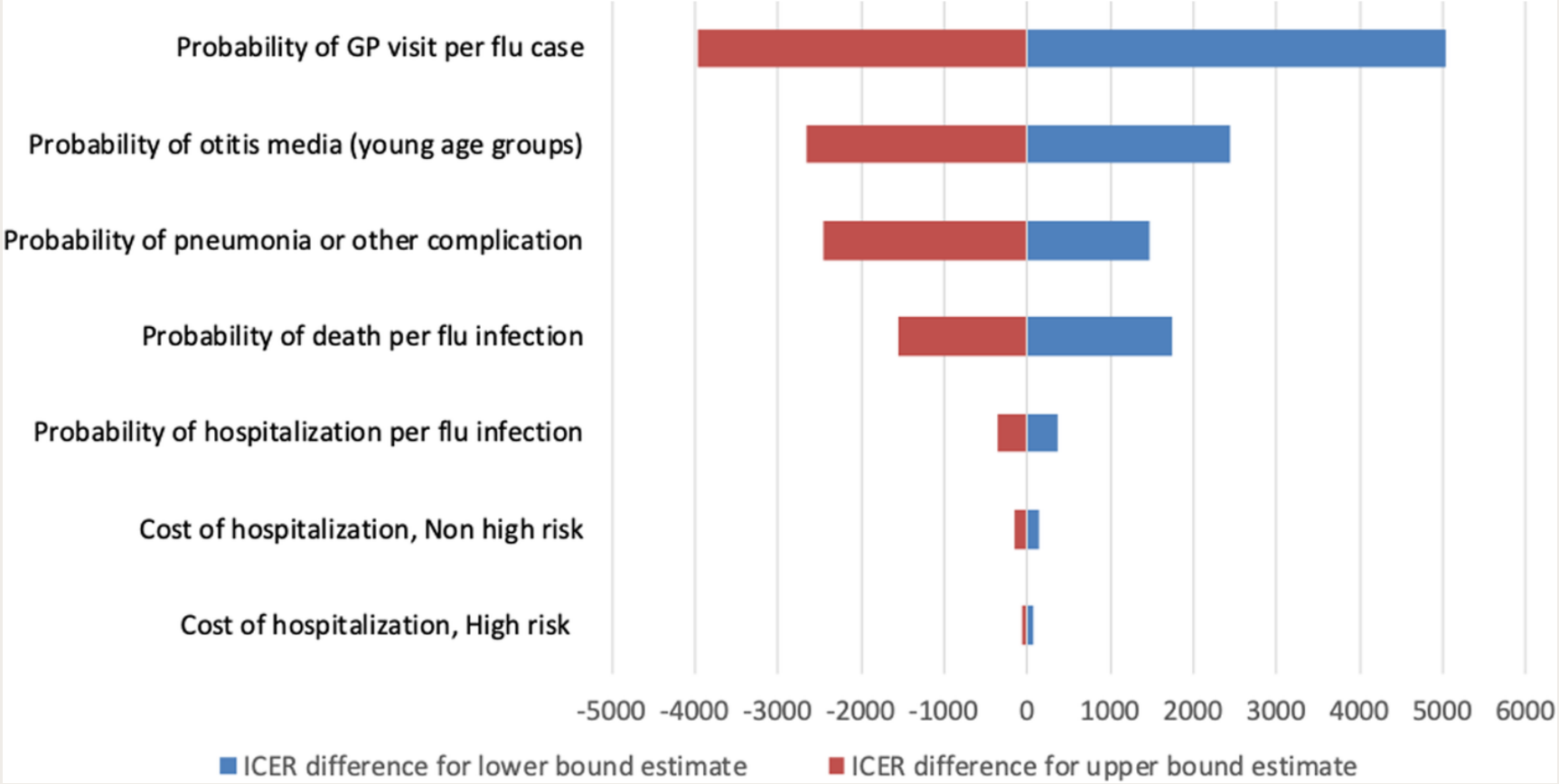
Step 9: Reporting

Step 8: Sensitivity analysis

- Used to assess the level of confidence associated with the conclusion of an economic evaluation
- Done by varying key assumptions to see the impact on the result
- Types of sensitivity analyses
  - One way – Input parameters are varied one by one
  - Multi-way – more than one parameter is varied at the same time
  - Probabilistic – a stochastic approach taken to produce a distribution of outputs based on distributions of input parameters

Example: Results of a one-way sensitivity analysis

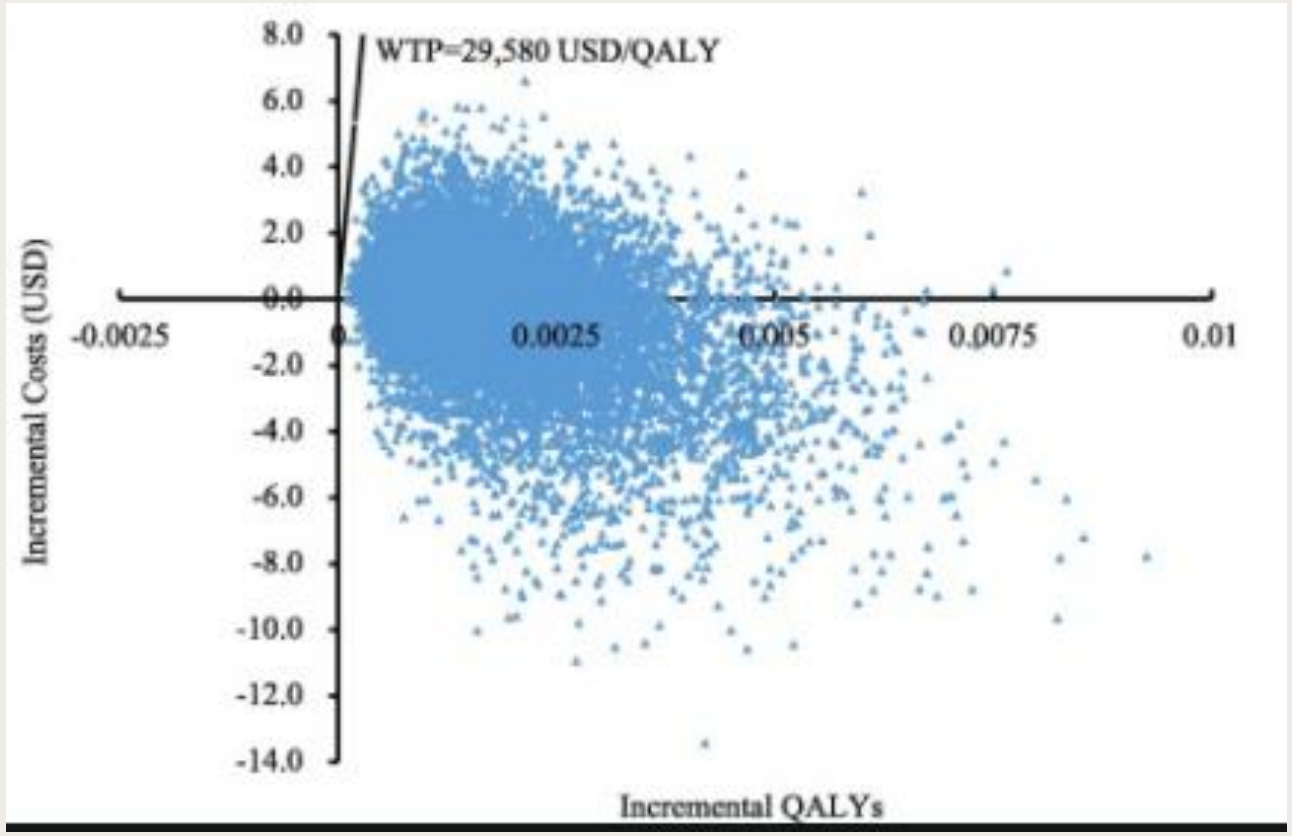
Tornado-Diagram: CEA of quadrivalent influenza vaccine in Brazil



Crépey, P., Boiron, L., Araujo, R.R. et al. Impact of quadrivalent influenza vaccines in Brazil: a cost-effectiveness analysis using an influenza transmission model. BMC Public Health 20, 1374 (2020). https://doi.org/10.1186/s12889-020-09409-7

Example: Results of a probabilistic sensitivity analysis

CEA of quadrivalent vs. trivalent influenza vaccine in China



Jiang, M., Li, P., Wang, W., Zhao, M., Atif, N., Zhu, S., & Fang, Y. (2020). Cost-effectiveness of quadrivalent versus trivalent influenza vaccine for elderly population in China. *Vaccine, 38(5)*, 1057–1064. https://doi.org/10.1016/j.vaccine.2019.11.045

Key steps in an economic evaluation study

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Step 9: Reporting

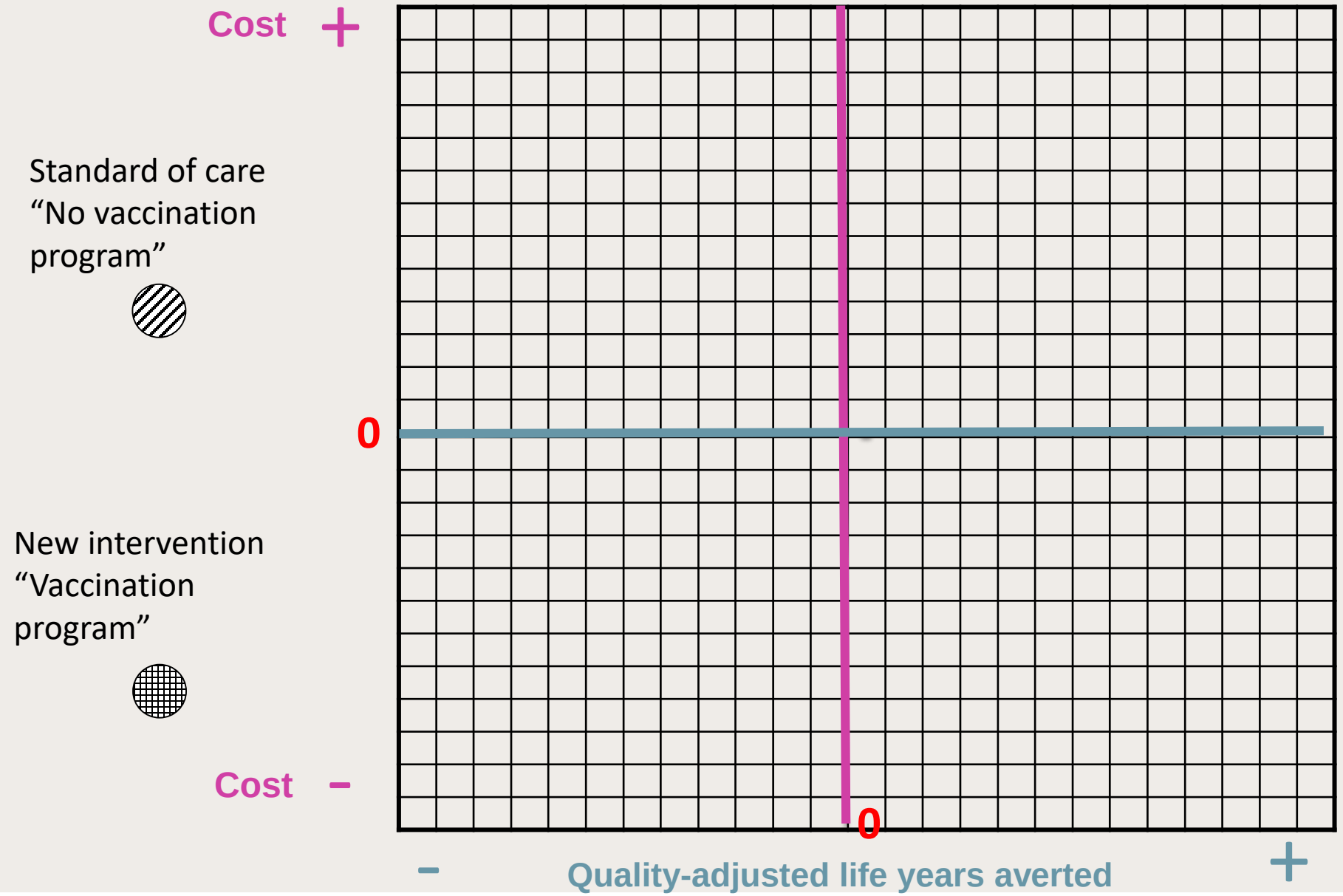
Recap: Combine costs and effectiveness

Interpreting results – I: Recap of the ICER

$$\frac{(\text{Total cost}_A - \text{Total cost}_B)}{(\text{Total QALY}_A - \text{Total QALY}_B)} = \frac{\text{Difference}_{\text{cost}}}{\text{Difference}_{\text{QALY}}}$$

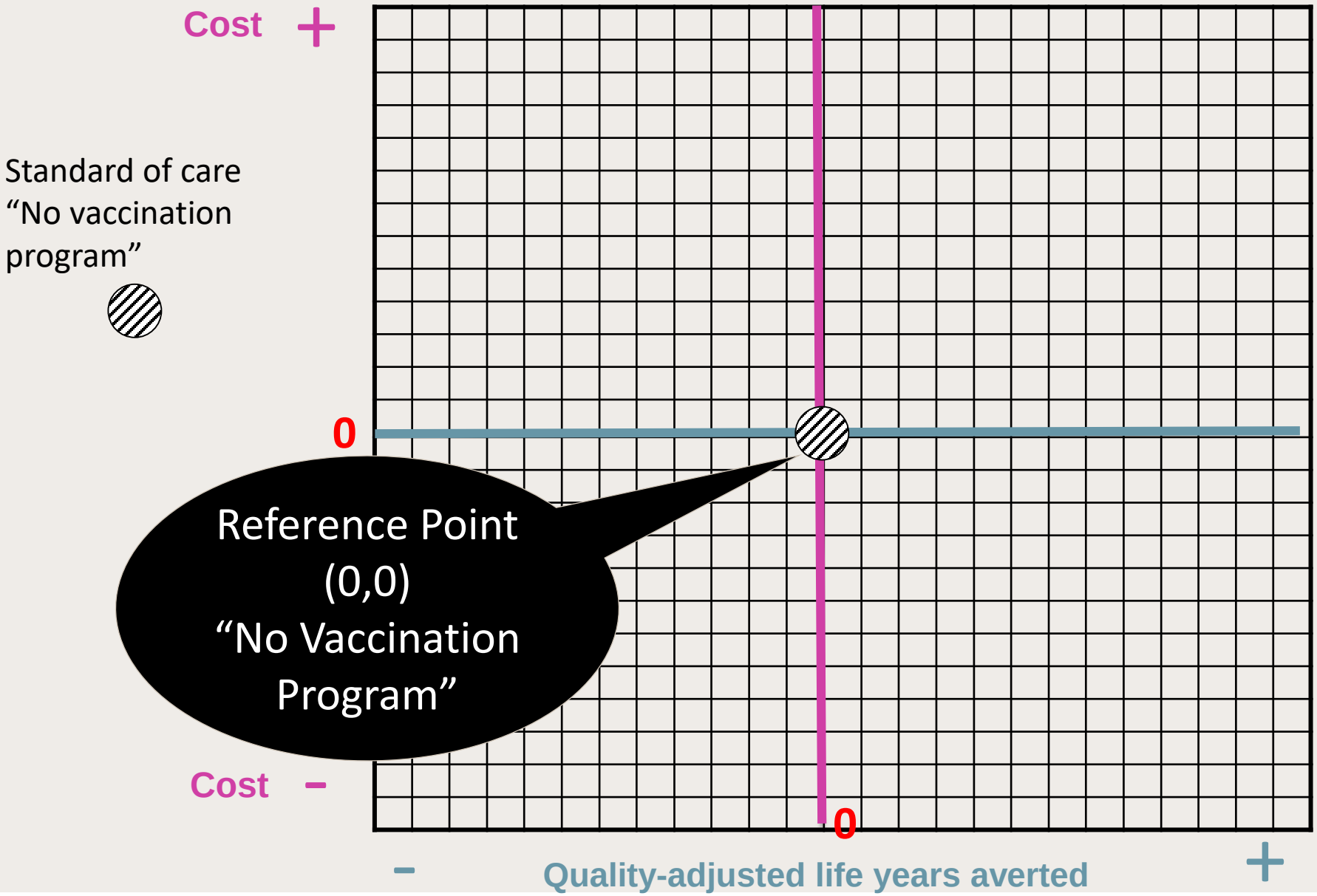
- Results of a cost-effectiveness analysis are summarised an ICER – a measure of the additional cost per unit of health gain
- ICERs can be represented visually using the incremental cost-effectiveness plane

Cost-Effectiveness Plane



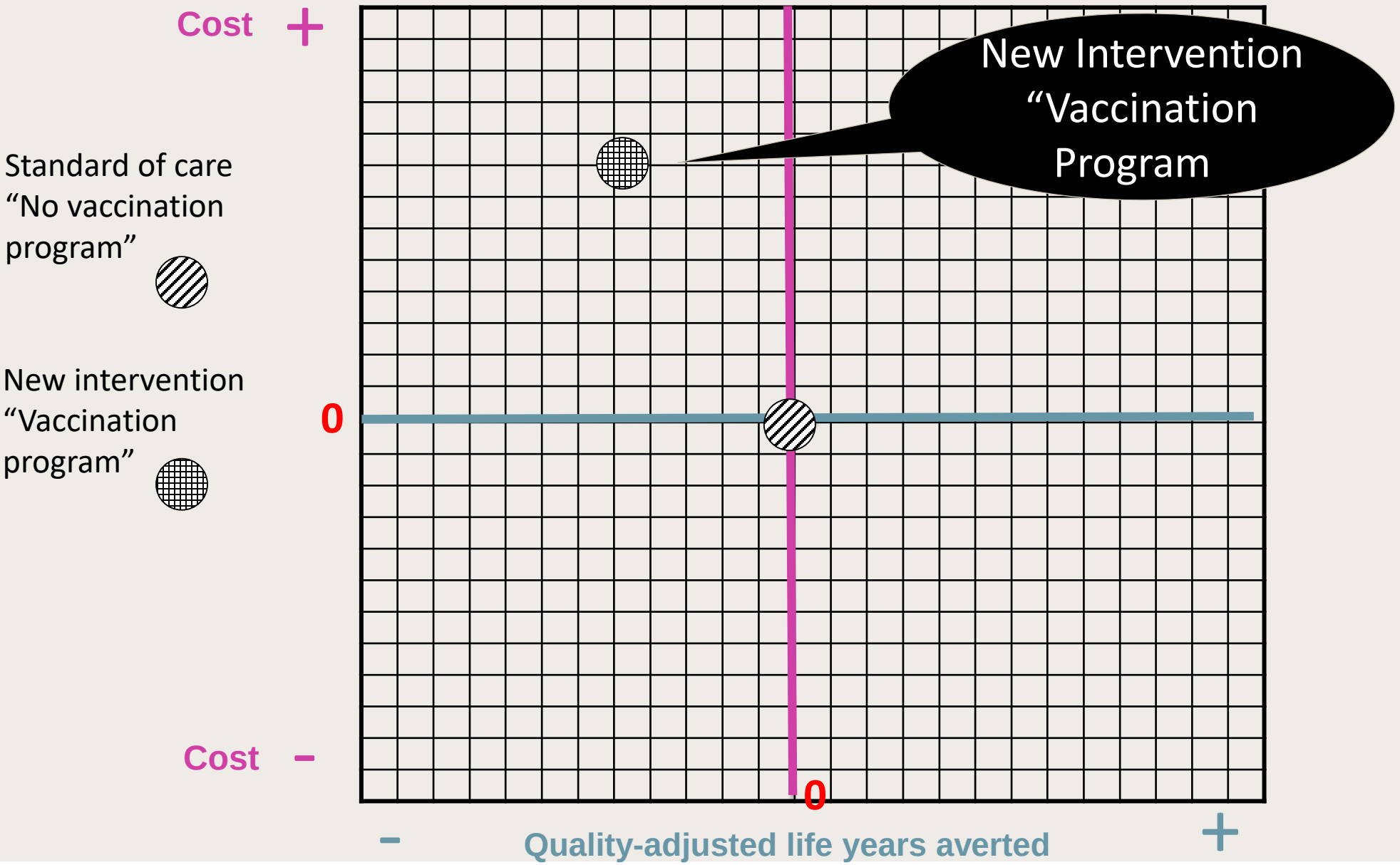
Source: TVEE - http://immunizationeconomics.org/tvee-ee

Cost-Effectiveness Plane



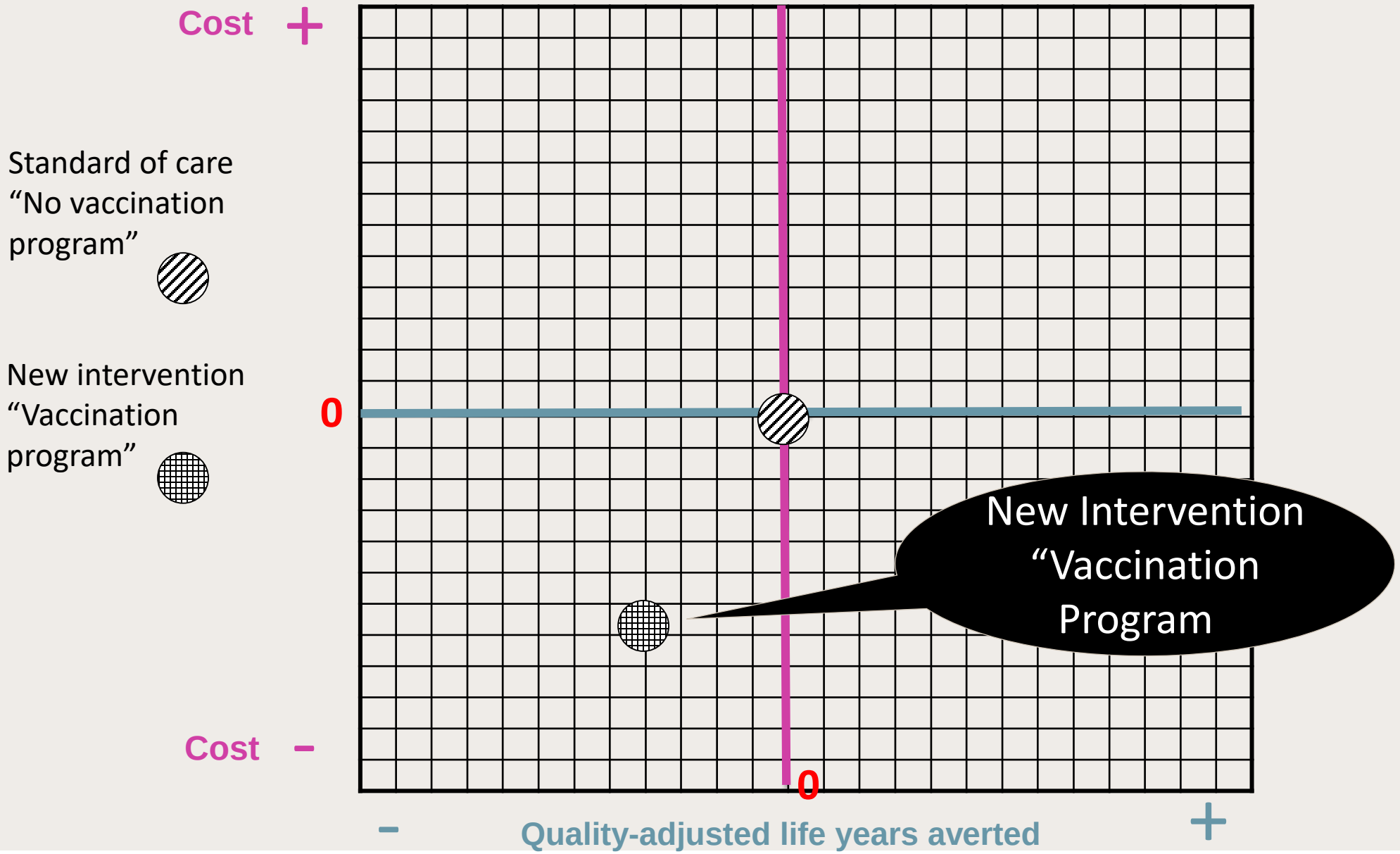
Source: TVEE - http://immunizationeconomics.org/tvee-ee

Interpretation ICER (I)



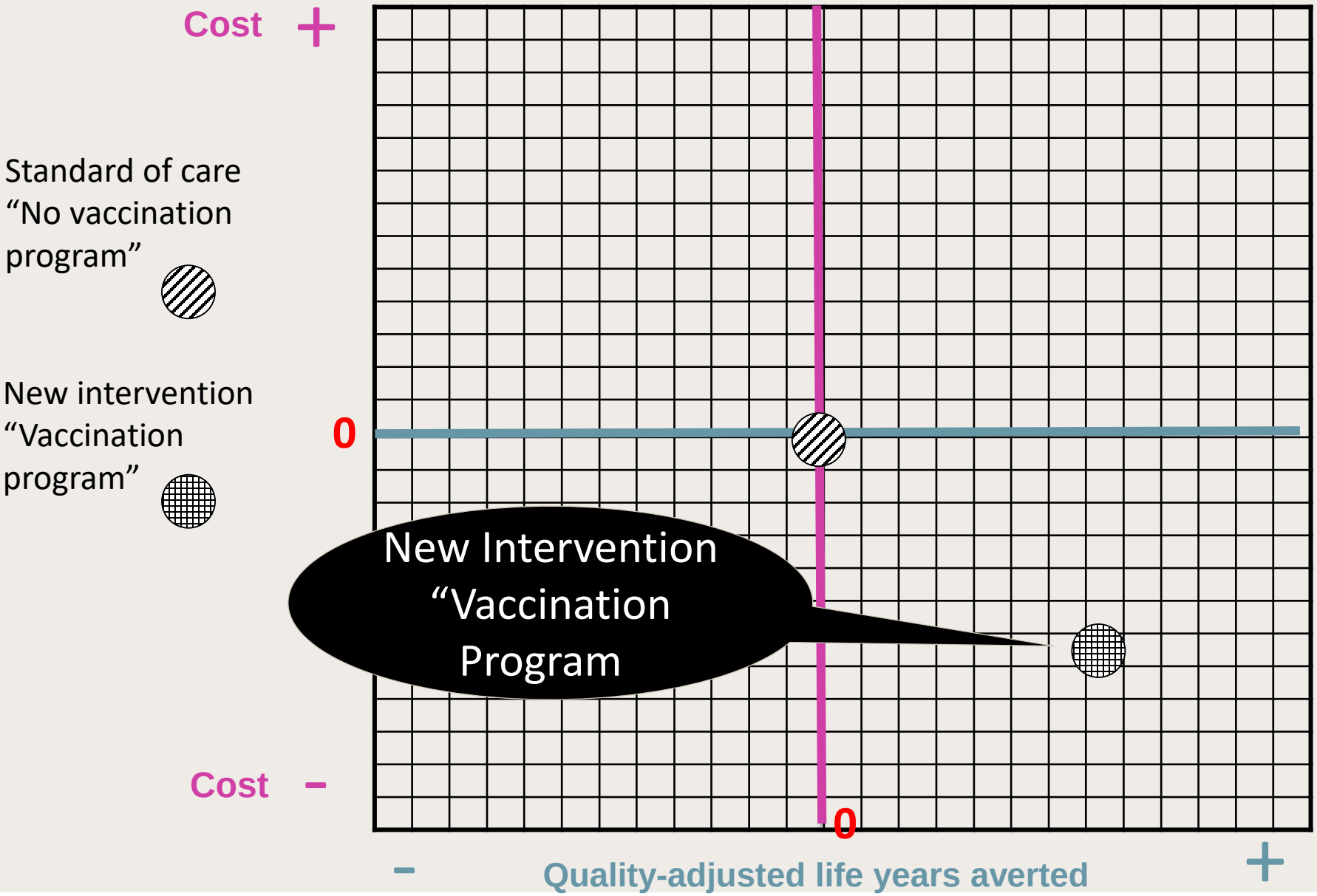
Source: TVEE - http://immunizationeconomics.org/tvee-ee

Interpretation ICER (II)



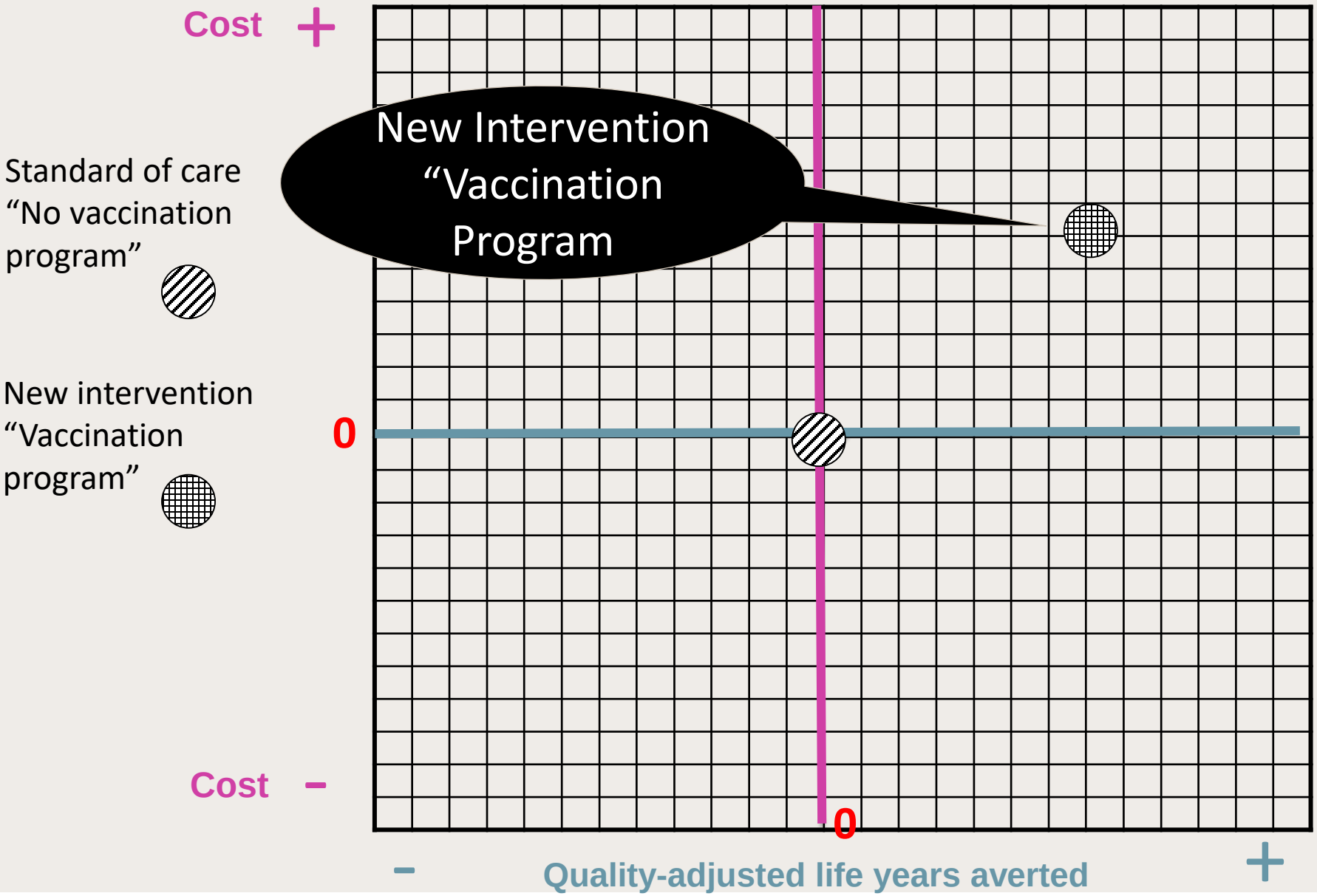
Source: TVEE - http://immunizationeconomics.org/tvee-ee

Interpretation ICER (III)



Source: TVEE - http://immunizationeconomics.org/tvee-ee

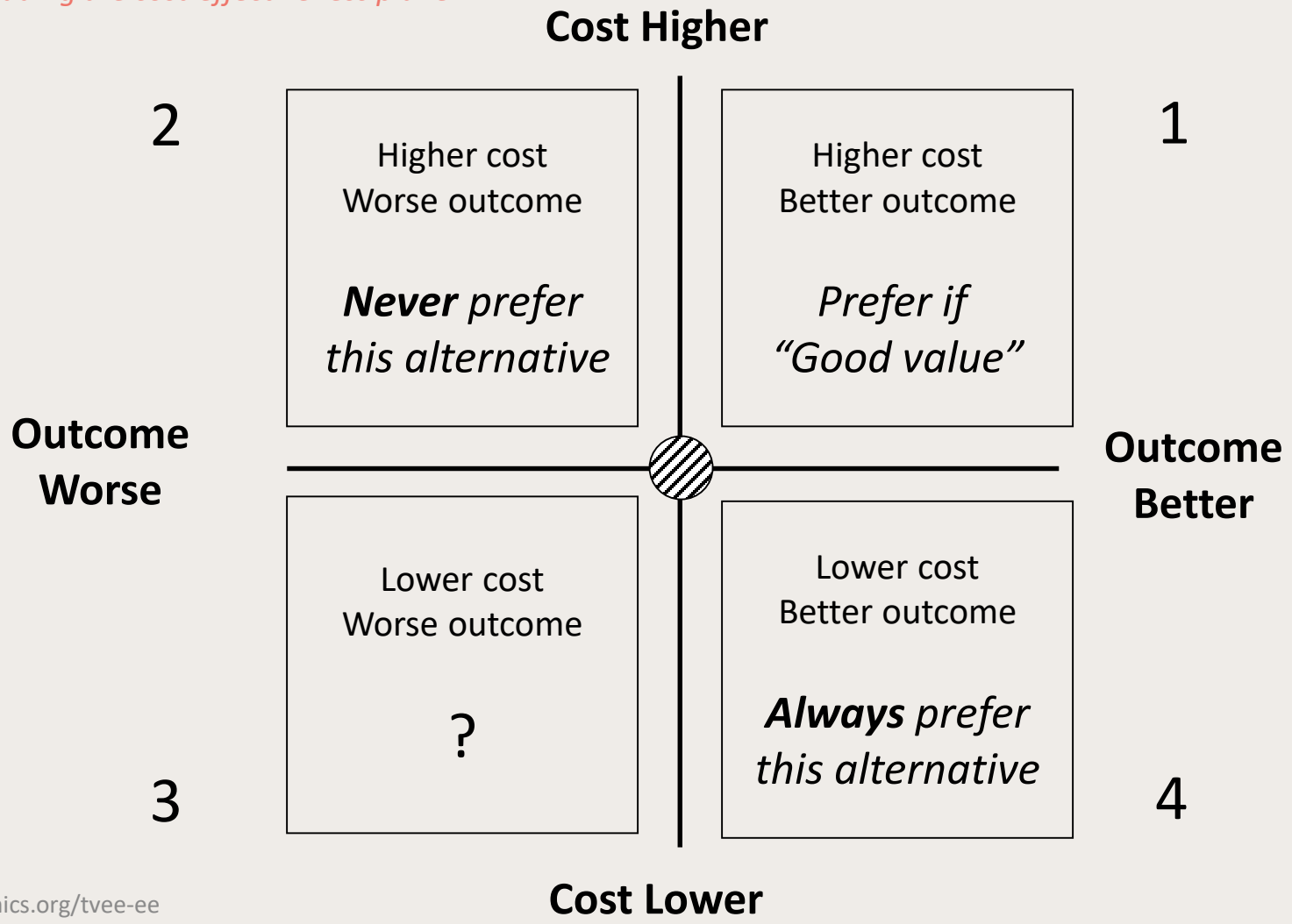
Interpretation ICER (IV)



Source: TVEE - http://immunizationeconomics.org/tvee-ee

Decision rules for cost-effectiveness analysis

Intepreting results – II: Reading the cost-effectiveness plane



Source: TVEE - http://immunizationeconomics.org/tvee-ee

Dominance

Intepreting results – III: Dominance

- The simplest and least controversial decision rule
- When comparing two interventions, one intervention is said to dominate the other if it is more effective and less costly

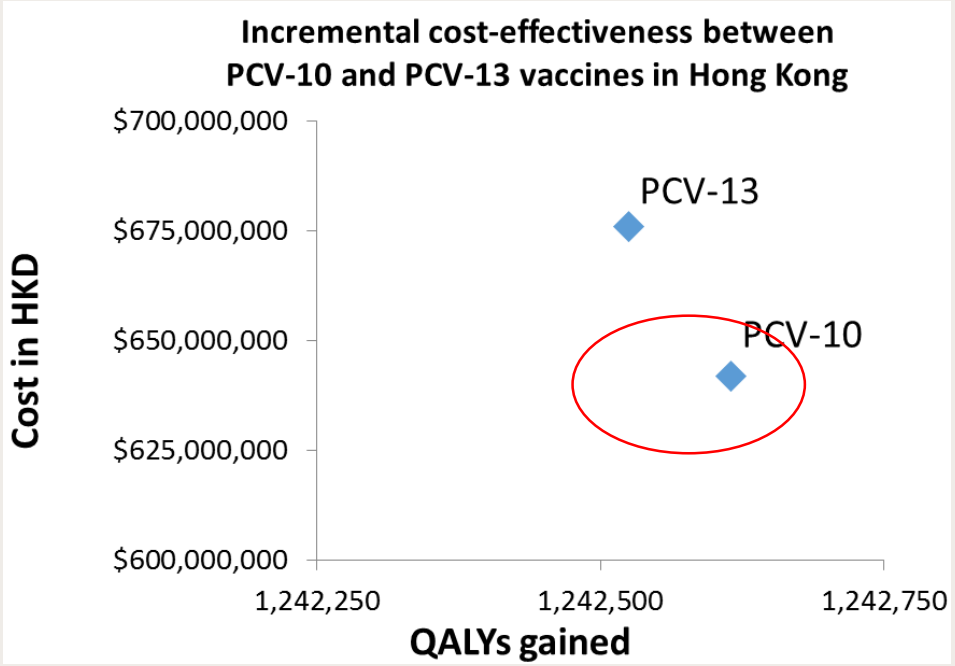


Image adapted from: Lee, K. K., Wu, D. B. C., Topachevskyi, O., Delgleize, E., & DeAntonio, R. (2013). The health economic impact of universal infant vaccination with the 10-valent pneumococcal nontypeable Haemophilus influenzae protein D conjugate vaccine as compared with 13-valent pneumococcal conjugate vaccine in Hong Kong. *Value in health regional issues*, 2(1), 64-74.

Strong Dominance

Intepreting results – IV: Strong Dominance

- It is important to also put results in tables
  - Lining up alternatives in order by costs helps to make it obvious that the higher cost alternatives are associated with lower effectiveness

Alternative	Cost	QALYs
PCV-10	$641,860,544	**1,242,615**
PCV-13	**$675,994,429**	1,242,525

PCV-10 has lower costs & higher QALYs compared to PCV-13

Source: TVEE - http://immunizationeconomics.org/tvee-ee

Choosing cost-effective interventions

Intepreting results – V: Using the concept of dominance

- Dominance can be used to identify which strategy is cost effective (for single intervention and comparator)
- Or which should be eliminated from consideration (for more than two interventions)
- Where there is no dominance, willingness to pay thresholds can be used to aid decisions

Willingness to pay (WTP) thresholds

Intepreting results – VI: WTP

- The ceiling ICER beyond which interventions are not considered to be cost-effective.
- Reflects the maximum value decision makers attach to health benefits
- More simply, represents the budget constraint faced by decision-makers.
- Three general approaches for identifying thresholds:
  - Based on % per capita GDP (most common)
  - Based on % per capita national incomes
  - Based on benchmark interventions
  - Based on league tables.

Willingness to pay thresholds

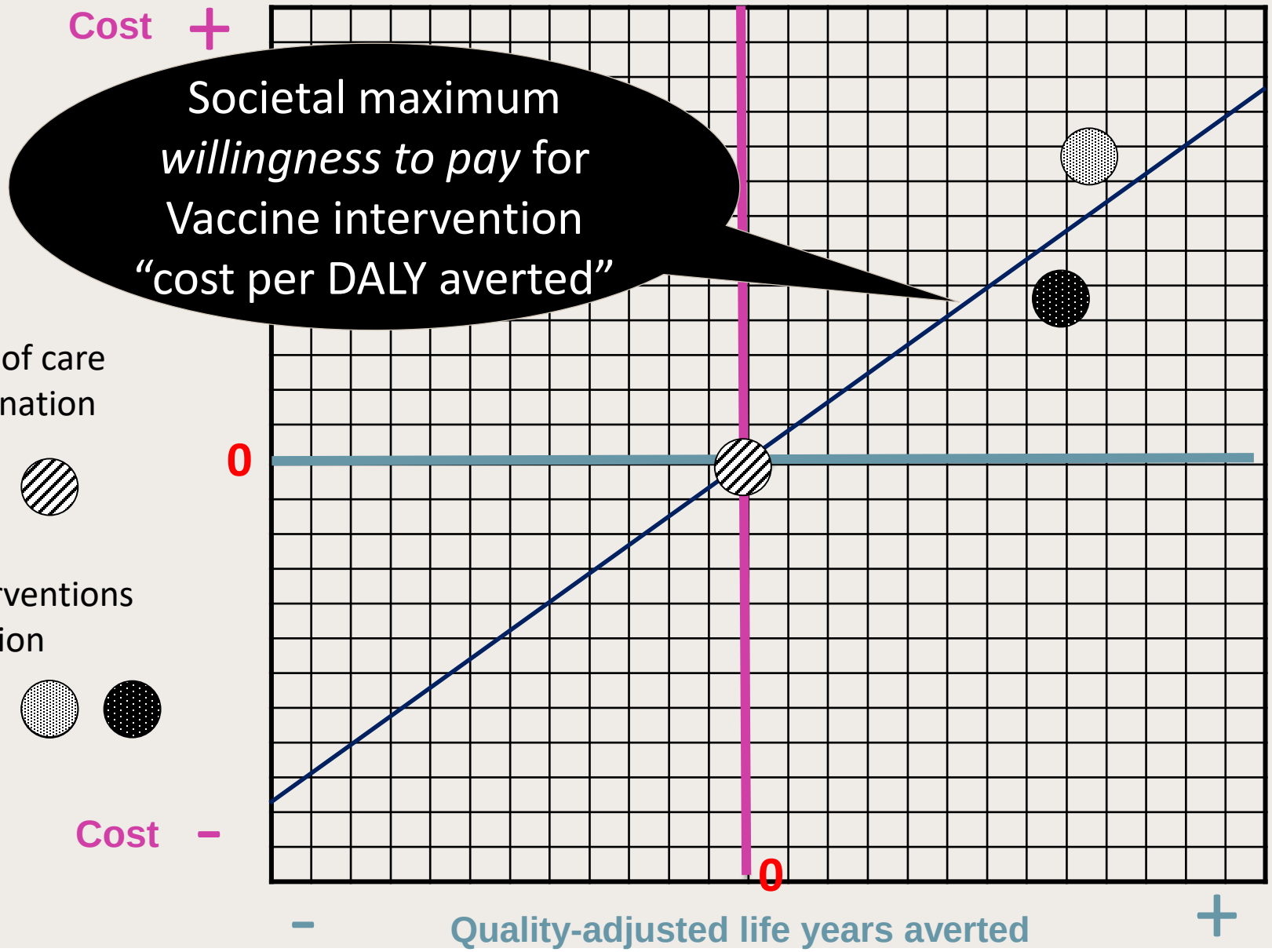
Intepreting results – VI: WTP

- Under WHO-CHOICE recommendations:
  - if the ICER (valued in DALYs averted) is between the GDP per capita and 3 times the GDP per capita => cost-effective
  - if the ICER (valued in DALYs averted) is less than the GDP per capita => very cost-effective
- Common U.S. WTP thresholds:
  - $50,000/QALY to $150,000 per QALY
  - Some Economists argue patients are willing to pay 1x-3x of annual income
  - Could the increase in WTP be related to Pharmaceutical Pricing indices?
- U.K. – results of NICE appraisals in May 2002

Cost per QALY	Accepted	Restricted	Rejected
< £20K	15	3	2
£20-30K	4	5	1
> £30K	3	4	4

Adapted from (pg.28): Towse, A. & Pritchard, C. & Devlin, N. eds, 2002. Cost-Effectiveness Thresholds: Economic and ethical issues, *Monographs, Office of Health Economics*, number 000473, January.

Willingness to pay - When is an intervention “cost-effective”?



Source: TVEE - http://immunizationeconomics.org/tvee-ee

Exercise: Cost-effectiveness plane

Group discussion

- How is the “incremental cost-effectiveness ratio” (ICER) calculated?
- Describe the cost-effectiveness plane
- How can the cost-effectiveness plane help guide decisions about vaccine programs?

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Part 5. Challenges of economic evaluations of public health interventions

Four main challenges

1 Attribution of effects

- Often targeted at populations or communities rather than specific individuals.
- Impact over long time periods.
- Difficult to undertake RCTs for comparing relevant alternatives.

2 Measuring & valuing outcomes

- Standard health gain measurements (i.e. QALYs) may be inadequate.
- It may be necessary to measure the effect on individuals not directly targeted by the intervention.
- Non health benefits are also important

3 Incorporating equity considerations

4 Identifying intersectoral costs and consequences

Source: Suhrcke M, 2015. Economic evaluation of public health interventions (PowerPoint Slides).

Critical appraisal of economic evaluations

- Critical appraisal is *"the process of assessing and interpreting scientific research results by systematically analysing their validity, clinical and statistical significance, and clinical relevance"*

- Why Appraisal?
  - Growing number of published studies
  - Opportunity cost from decision-making based on poor/misleading studies is high
  - RCTs have strict rules for data collection, nowadays data can come from other sources...

- Checklists aid the appraisal process & optimize transparency

HTAi-INAHTA. HTA Glossary: Critical Appraisal (accessed: December, 2020) : http://htaglossary.net/critical-appraisal
Burls, A. (2014). *What is critical appraisal?*. Hayward Medical Communications.

Checklist for the appraisal of economic evaluation studies

- Several checklists exist...*
  - 10 or 36-items Drummond Checklist
  - CHEERS
  - Jefferson (BMJ) Checklist
  - Consensus on Health Economic Criteria (CHEC)-list
  - Philips checklist
  - Quality of Health Economic Studies (QHES) checklist

→

- Consolidated Health Economic Evaluation Reporting Standards
  - 24 items over 6 categories:
    - Title and Abstract
    - Introduction
    - Methods
    - Results
    - Discussion
    - Other

* Watts, R. D., & Li, I. W. (2019). Use of Checklists in Reviews of Health Economic Evaluations, 2010 to 2018. *Value in Health*, *22*(3), 377-382.
Husereau D, Drummond M, Petrou S, et al. Consolidated health economic evaluation reporting standards (CHEERS)—explanation and elaboration: a report of the ISPOR Health Economic Evaluations Publication Guidelines Good Reporting Practices Task Force. *Value Health*. 2013;16(2):231-250.

CHEERS - Part I

Section/Item	no	Recommendation
Title and abstract		
Title Abstract	1	Identify the study as an economic evaluation, or use more specific terms such as ``cost-effectiveness analysis``, and describe the interventions compared.
	2	Provide a structured summary of objectives, perspective, setting, methods (including study design and inputs), results (including base case and uncertainty analyses), and conclusions.
Introduction		
Background and objectives	3	Provide an explicit statement of the broader context for the study.
		Present the study question and its relevance for health policy or practice decisions.

Slide 81-85 adapted from: Husereau D, Drummond M, Petrou S, et al. Consolidated health economic evaluation reporting standards (CHEERS)—explanation and elaboration: a report of the ISPOR Health Economic Evaluations Publication Guidelines Good Reporting Practices Task Force. Value Health. 2013;16(2):231-250.

Section/Item	no	Recommendation
Methods		
Target Population and Subgroups	4	Describe characteristics of the base case population and subgroups analyzed including why they were chosen.
Setting and Location	5	State relevant aspects of the system(s) in which the decision(s) need(s) to be made.
Study Perspective	6	Describe the perspective of the study and relate this to the costs being evaluated.
Comparators	7	Describe the interventions or strategies being compared and state why they were chosen.
Time Horizon	8	State the time horizon(s) over which costs and consequences are being evaluated and say why appropriate.
Discount Rate	9	Report the choice of discount rate(s) used for costs and outcomes and say why appropriate.
Choice of Health Outcomes	10	Describe what outcomes were used as the measure(s) of benefit in the evaluation and their relevance for the type of analysis performed.
Measurement of Effectiveness	11a	Single Study-Based Estimates: Describe fully the design features of the single effectiveness study and why the single study was a sufficient source of clinical effectiveness data.
	11b	Synthesis-based Estimates: Describe fully the methods used for identi-fication of included studies and synthesis of clinical effectiveness data.
Measurement and Valuation of Preference-Based Outcomes	12	If applicable, describe the population and methods used to elicit preferences for outcomes.

CHEERS Part - III

Section/Item	Item No	Recommendation
Estimating Resources and Costs	13a	Single Study-based Economic evaluation: Describe approaches used to estimate resource use associated with the alternative interventions. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs.
	13b	Model-based Economic Evaluation: Describe approaches and data sources used to estimate resource use associated with model health states. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs.
Currency, Price Date and Conversion	14	Report the dates of the estimated resource quantities and unit costs. Describe methods for adjusting estimated unit costs to the year of reported costs if necessary. Describe methods for converting costs into a common currency base and the exchange rate.
Choice of model	15	Describe and give reasons for the specific type of decision-analytic model used. Providing a figure to show model structure is strongly recommended.
Assumptions	16	Describe all structural or other assumptions underpinning the decision-analytic model.
Analytic Methods	17	Describe all analytic methods supporting the evaluation. This could include methods for dealing with skewed, missing or censored data, extrapolation methods, methods for pooling data, approaches to validate or make adjustments (e.g., half-cycle corrections) to a model, and methods for handling population heterogeneity and uncertainty.

CHEERS - Part IV

Section/Item	Item No	Recommendation
Results		
Study parameters	18	Report the values, ranges, references and if used, probability distributions for all parameters. Report reasons or sources for distributions used to represent uncertainty where appropriate. Providing a table to show the input values is strongly recommended.
Incremental costs and outcomes	19	For each intervention, report mean values for the main categories of estimated costs and outcomes of interest, as well as mean differences between the comparator groups. If applicable, report incremental cost-effectiveness ratios.
Characterizing Uncertainty	20a	Single study-based economic evaluation: Describe the effects of sampling uncertainty for estimated incremental cost, incremental effectiveness and incremental cost-effectiveness, together with the impact of methodological assumptions (e.g. discount rate, study perspective).
	20b	Model-based economic evaluation: Describe the effects on the results of uncertainty for all input parameters, and uncertainty related to the structure of the model and assumptions.
Characterizing Heterogeneity	21	If applicable, report differences in costs, outcomes or cost-effectiveness that can be explained by variations between subgroups of patients with different baseline characteristics or other observed variability in effects that are not reducible by more information.

CHEERS - Part V

Section/Item	Item No	Recommendation
results		
Study Findings, Limitations, Generalizability, and Current Knowledge	22	Summarize key study findings and describe how they support the conclusions reached. Discuss limitations and the generalizability of the findings and how the findings fit with current knowledge.
Other		
Source of Funding	23	Describe how the study was funded and the role of the funder in the identification, design, conduct and reporting of the analysis. Describe other non-monetary sources of support.
Conflicts of Interest	24	Describe any potential for conflict of interest among study contributors in accordance with journal policy. In the absence of a journal policy, we recommend authors comply with International Committee of Medical Journal Editors' recommendations

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Ending Day 1

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Economic evaluation of public health interventions

Implications for practices in HTA – Day 2

November 30 & December 3, 2020

Exercise: Appraisal of a paper

- In break out groups
  - Read the paper individually and as a group
  - Use CHEERS checklist to appraise the paper
  - Present your findings

Incredible Years parenting programme: cost-effectiveness and implementation

Rhiannon Tudor Edwards, Carys Jones, Vashti Berry, Joanna Charles, Pat Linck, Tracey Bywater and Judy Hutchings

Rhiannon Tudor Edwards is Professor at Centre for Health Economics and Medicines Evaluation, Bangor University, Bangor, UK.
Carys Jones is based at Centre for Health Economics and Medicines Evaluation, Bangor University, Bangor, UK.
Vashti Berry is Senior Research

Abstract

Purpose – *There is growing interest in the economic evaluation of public health prevention initiatives and increasing government awareness of the societal costs of conduct disorder in early childhood. The purpose of this paper is to investigate the cost-effectiveness of the Incredible Years (IY) BASIC parenting programme compared with a six-month waiting list control.*

Design/methodology/approach – *Cost-effectiveness analysis alongside a pragmatic randomised controlled trial of a group-parenting programme. The primary outcome measure was the Strengths and Difficulties Questionnaire (SDQ), a measure of child behaviour.*

Findings – *The IY programme was found to have a high probability of being cost-effective, shifting an additional*

Thank you for your attention

Recommended citation for this presentation:

Chola L, Heupink LF, Peacocke E, Sæterdal I (2020). Economic evaluation of public health interventions [PowerPoint slides]. Norwegian Institute of Public Health, Oslo.

More about the departement: https://www.fhi.no/en/qk/global-healt-collaboration/evidence-to-decisions/partnering-low-and-middle-income-countries-to-support-local-implementation--/