Health Economic Evaluation and Public Health Decision Making

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Contents

- Health Care context
- What are Health Economic Evaluations and why are they important
- Main uses of Health Economic Evaluations in public health decision making
- A policy research experience in Latin America

Current Context

Unparallel development of new health technologies:

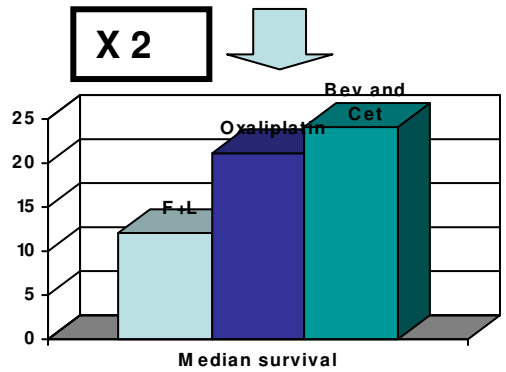
- **Drugs** *(new oncology drugs, biologicals, immunotherapy, etc)*
- **Diagnostics technologies** *(PET, multislice, etc)*
- **Devices** *(drug eluting stents, pacemakers, cardiodesfibrilators)*
- **Surgical procedures** *(surgery of obesity, laparoscopic techniques, etc.)*

In most cases this new technologies represent a **clinical benefit** (usually **small**) but also they represent an **incremental cost** for the health system (usually **large**)

The Price of Progress — Chemotherapy for Colorectal Cancer

Time	Treatment	Median survival
1960	Without chemotherapy	8 months
1960-2000	Fluorouracil + leucovorin	12 months
2000	Fluorouracil + lirinotecan+ Oxaliplatin	21 months
2004	Bevacizumab and cetuximab	+21 months(?)

*Drug costs for a patient with colorectal cancer who is 170 cm tall, weighs 70 kg, and receives chemotherapy for eight weeks

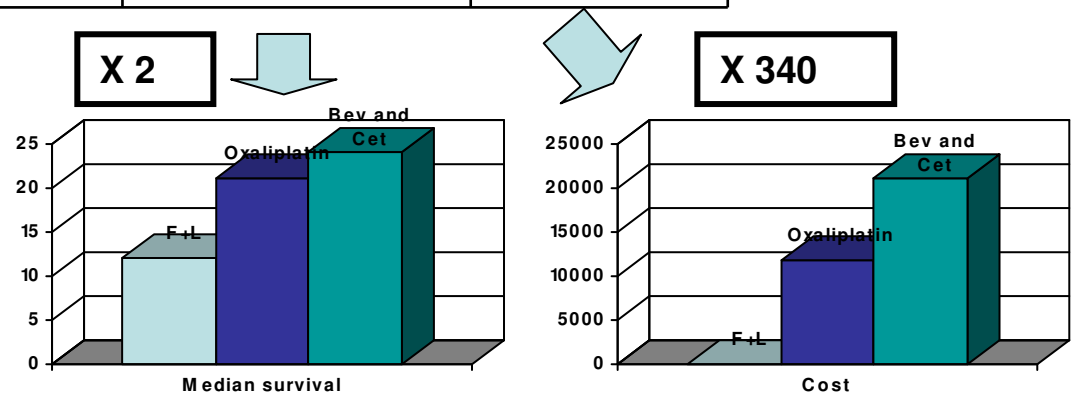


Source: Schrag D 2004. The price of progress: chemotherapy for colorectal cancer. New England Journal of Medicine. Vol 341, pp 317-19.

The Price of Progress — Chemotherapy for Colorectal Cancer

Time	Treatment	Median survival	Treatment cost*
1960	Without chemotherapy	8 months	
1960-2000	Fluorouracil + leucovorin	12 months	U$ 63
2000	Fluorouracil + lirinotecan+ Oxaliplatin	21 months	U$11,889
2004	Bevacizumab and cetuximab	+21 months(?)	U$21,033

*Drug costs for a patient with colorectal cancer who is 170 cm tall, weighs 70 kg, and receives chemotherapy for eight weeks



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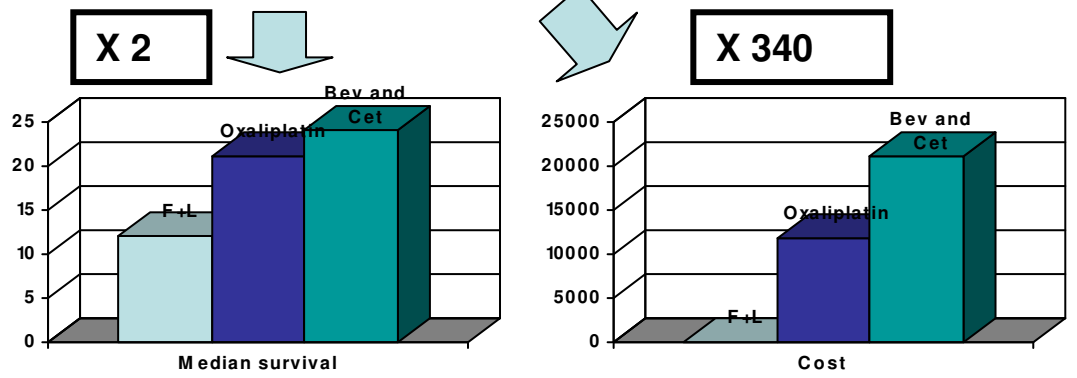
The Price of Progress — Chemotherapy for Colorectal Cancer

Time	Treatment	Median survival	Treatment cost*
	Oxaliplatin		
2004	Bevacizumab and cetuximab	+21 months(?)	U$21,033

The near-doubling of the median survival achieved over the past decade has been accompanied by a staggering 340-fold increase in drug costs — just for the initial eight weeks of treatment.

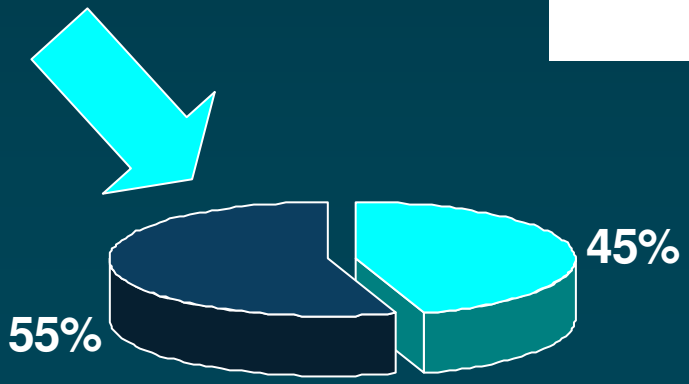
*Drug costs for a patient with colorectal cancer who is 170 cm tall, weighs 70 kg, and receives chemotherapy for eight weeks



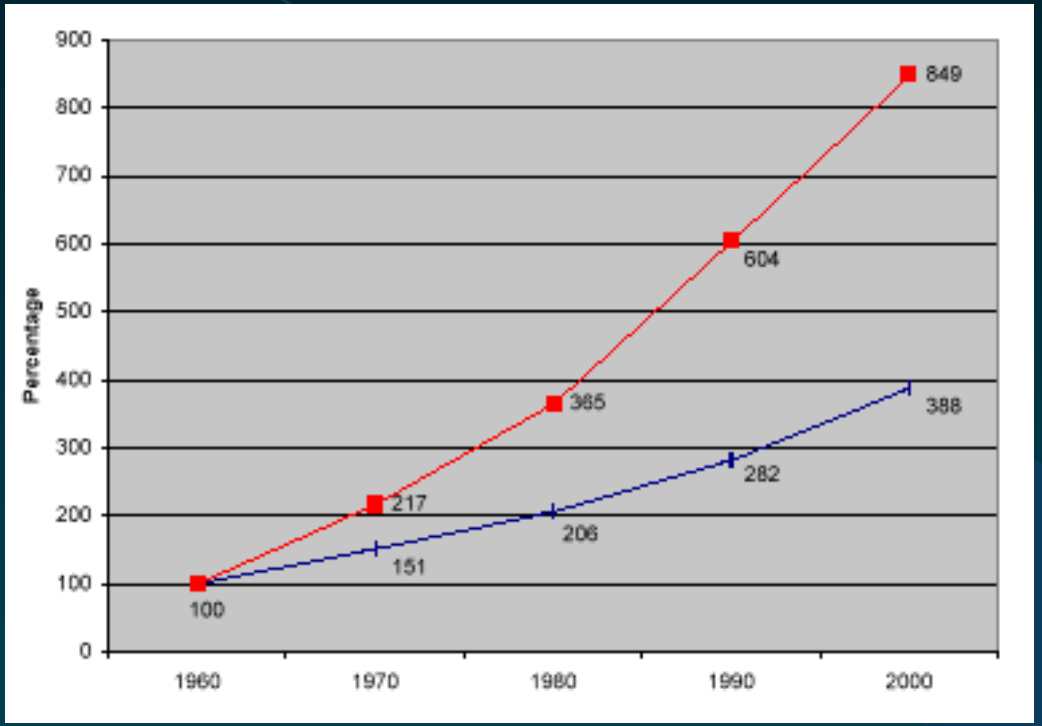
Source: Schrag D 2004. The price of progress: chemotherapy for colorectal cancer. New England Journal of Medicine. Vol 341, pp 317-19.

In a context of…..

New health technologies are estimated to be responsible for at least 50% of the rise of health care expenditures in the last years



National Health Care Expenditure Increment vs. Gross Domestic Product Increment



New (and old) health technologies are not available to all….

Impressive improvements have occurred in global health status in the past century. Unfortunately, these improvements have not been shared equally and health inequalities within and among countries are entrenched.

If all countries had the Japanese child (under-5 years of age) mortality rates, the lowest in the world, there would be only one million child deaths each year, instead of the 11 million deaths which occur now.

Seven of ten deaths in children under the age of 5 years occur in low-income countries and can be attributed to just five preventable conditions—pneumonia, diarrhoeal diseases, malaria, measles, and malnutrition; these conditions overlap and are exacerbated by poverty

Global health status: two steps forward, one step back. Kasturi Sen, Ruth Bonita. Lancet 2000; 356: 577–82

Under this scenario it becomes necessary to regulate the incorporation of new technologies. Why?

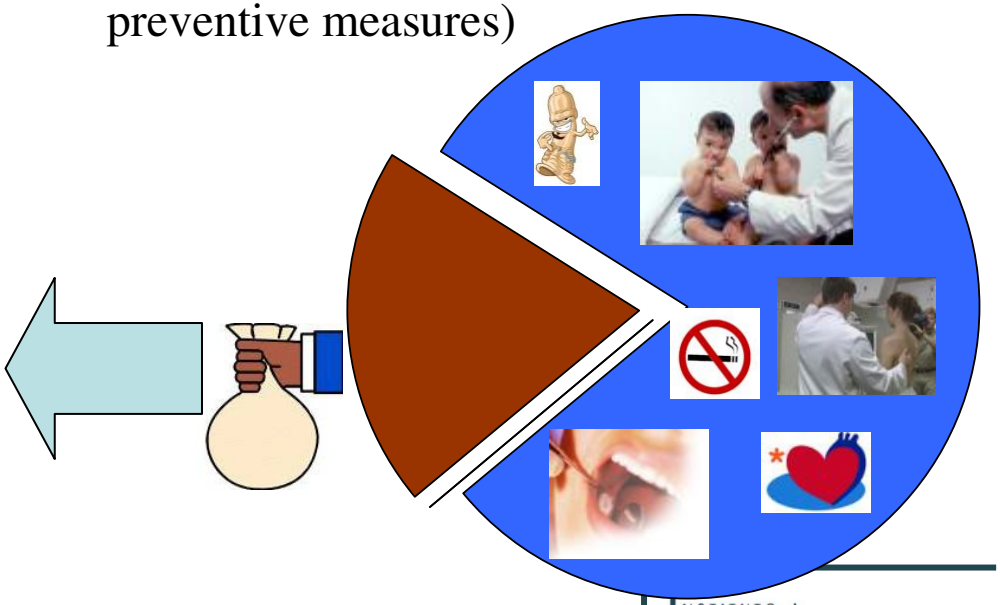
New Technologies

Drug eluting stents – Inteferon – Gefitinib – Spect – PET – Sunitinib Cetuximab – Fabry – Bevacizumab Capecitabine – Cardiodesfibrilators Letrozol – Trastuzumab Erlotinib - Irinotecan - Imatinib Gaucher – new vaccines

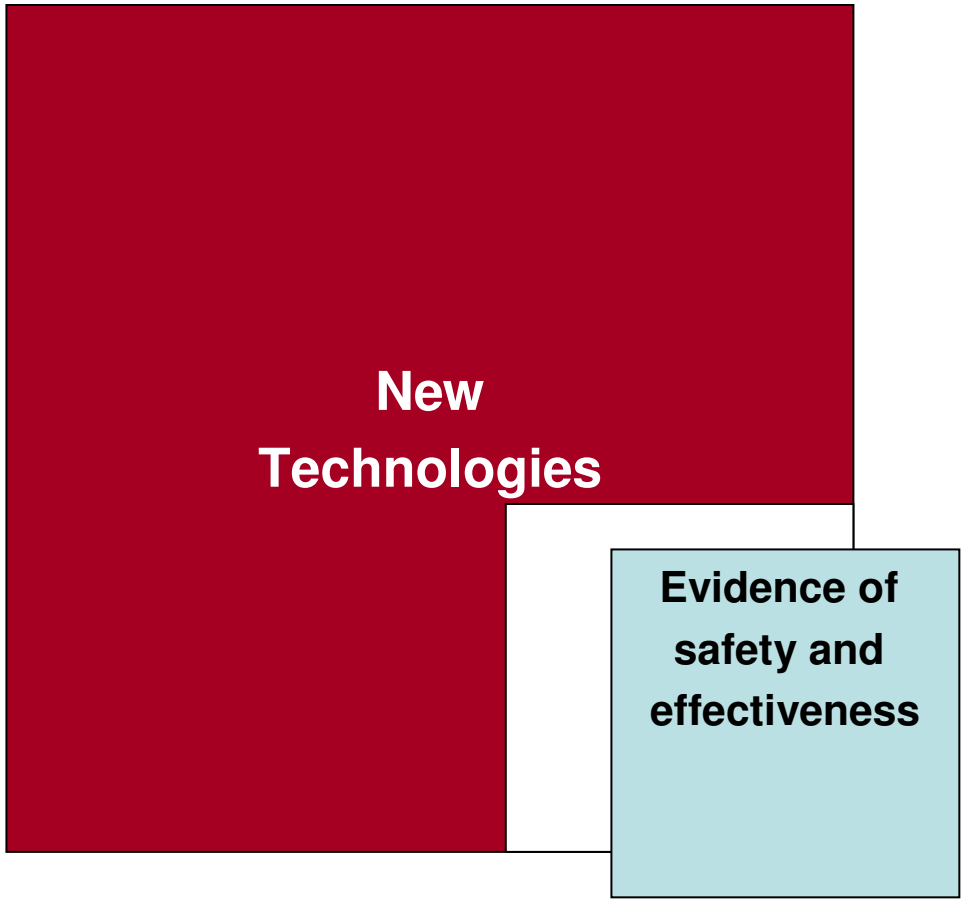
OPORTUNITY COST

Consuming a resource for one purpose means that it cannot be used for another.

Funding of new technologies can divert resources away from more effective an efficient interventions (such as preventive measures)

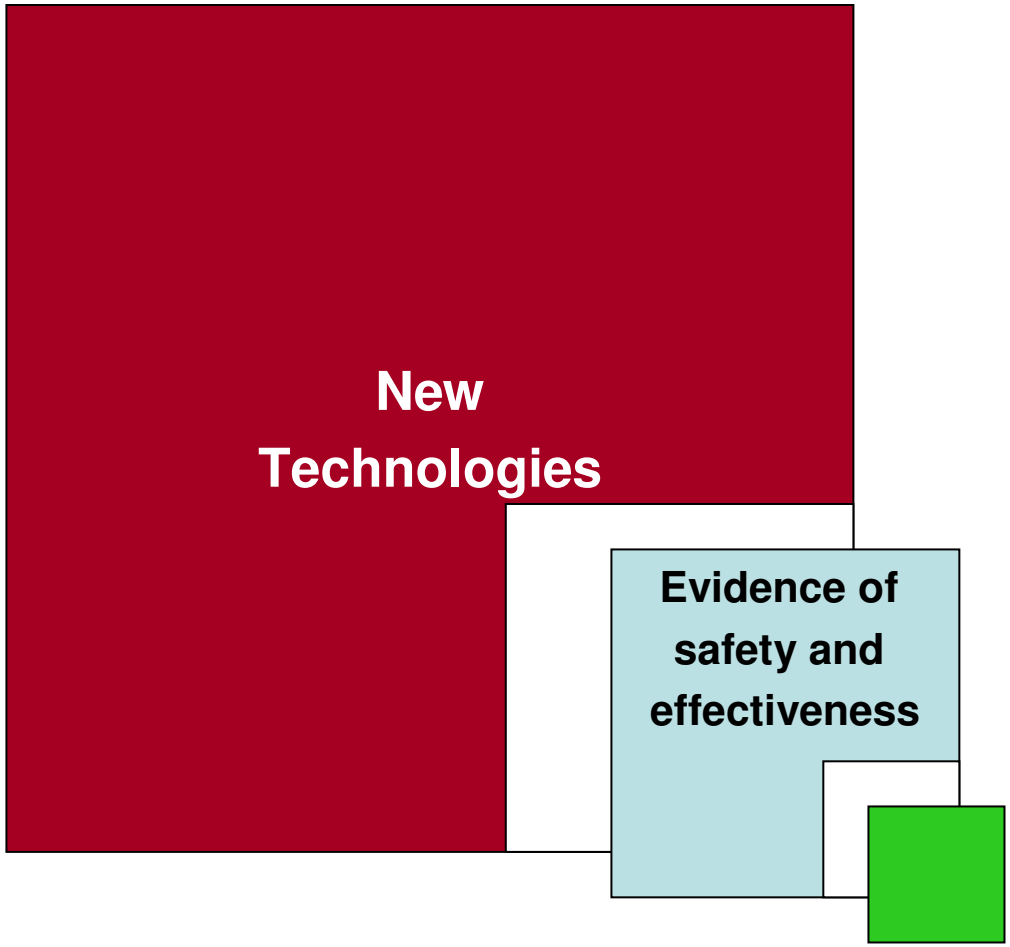


How to be prepare for this scenario?



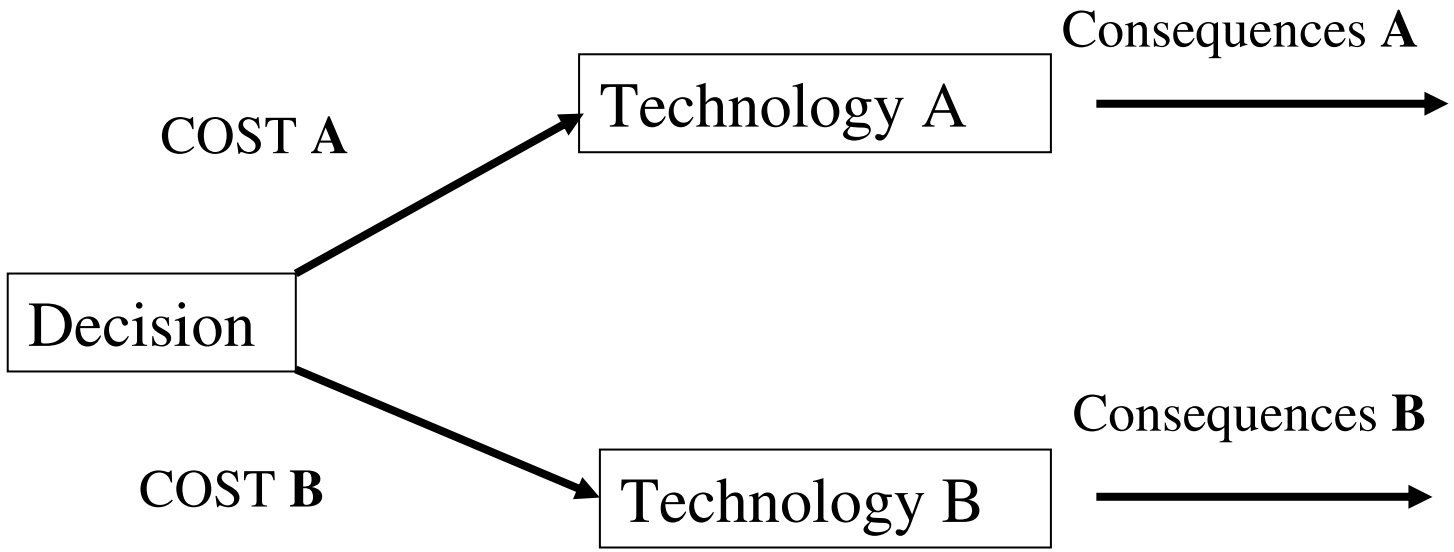
Identify those technologies with solid evidence about safety and effectiveness

How to be prepare for this scenario?



Identify those technologies that are cost-effective and can be afforded

What are Health Economic Evaluations (HEE)



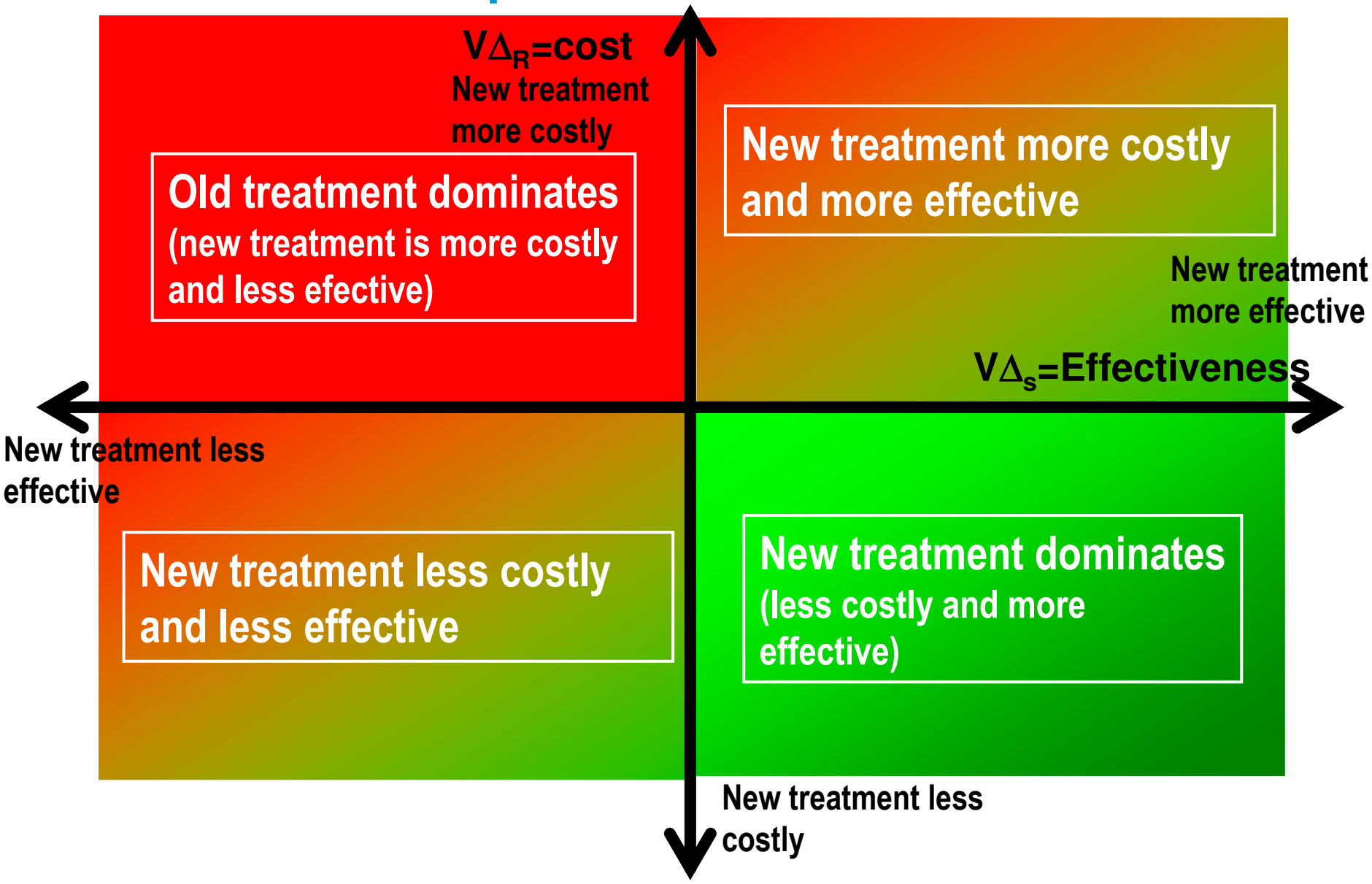
HEE always compare two or more alternatives and measure the marginal **cost** in relation to the marginal **benefit** of one alternative versus the other.

$$\frac{\Delta C}{\Delta E} =$$

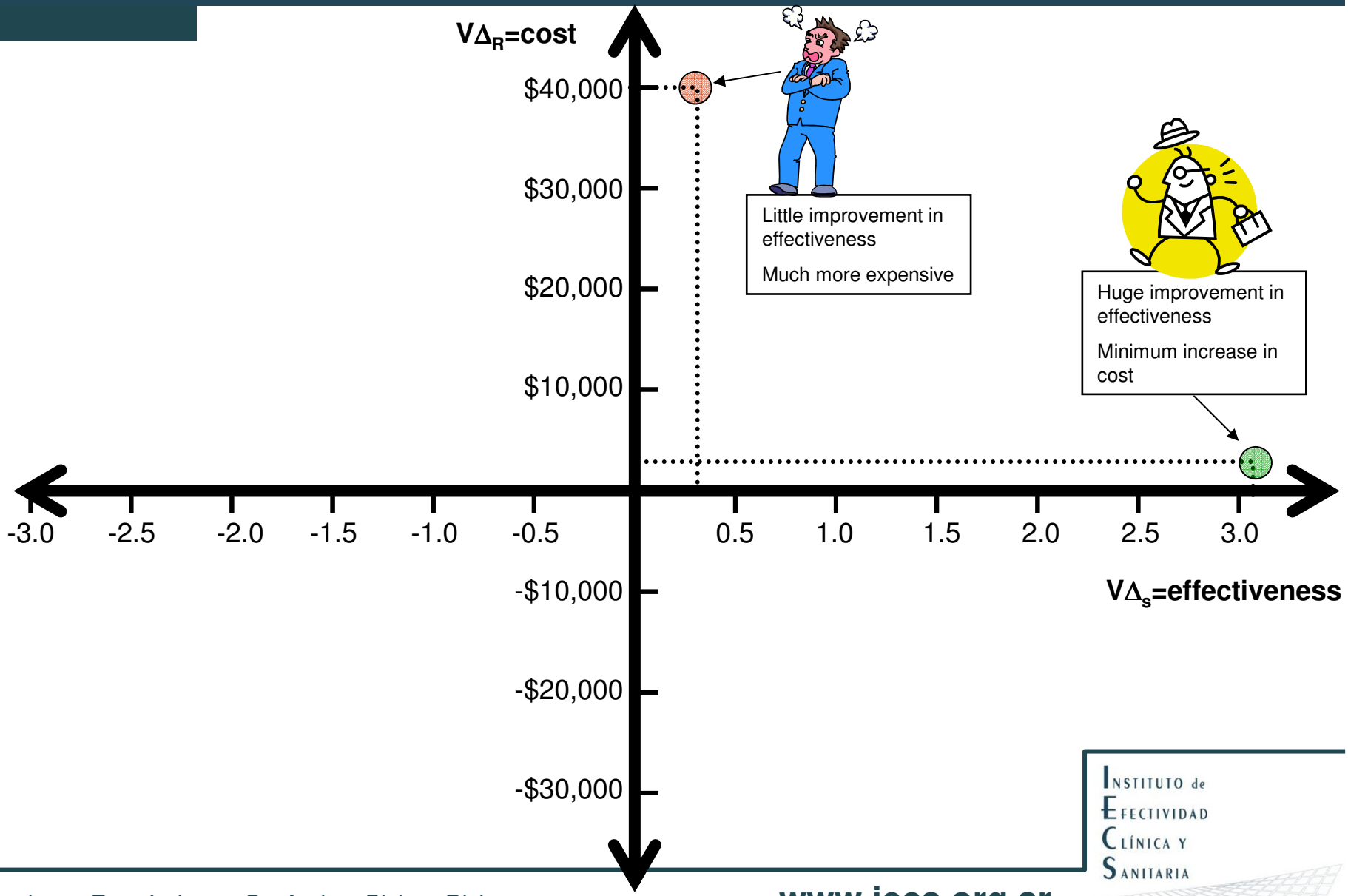
ΔC **net change in costs ($)**

ΔE **net change in effectiveness of the intervention (measured in QALY´s or other units)**

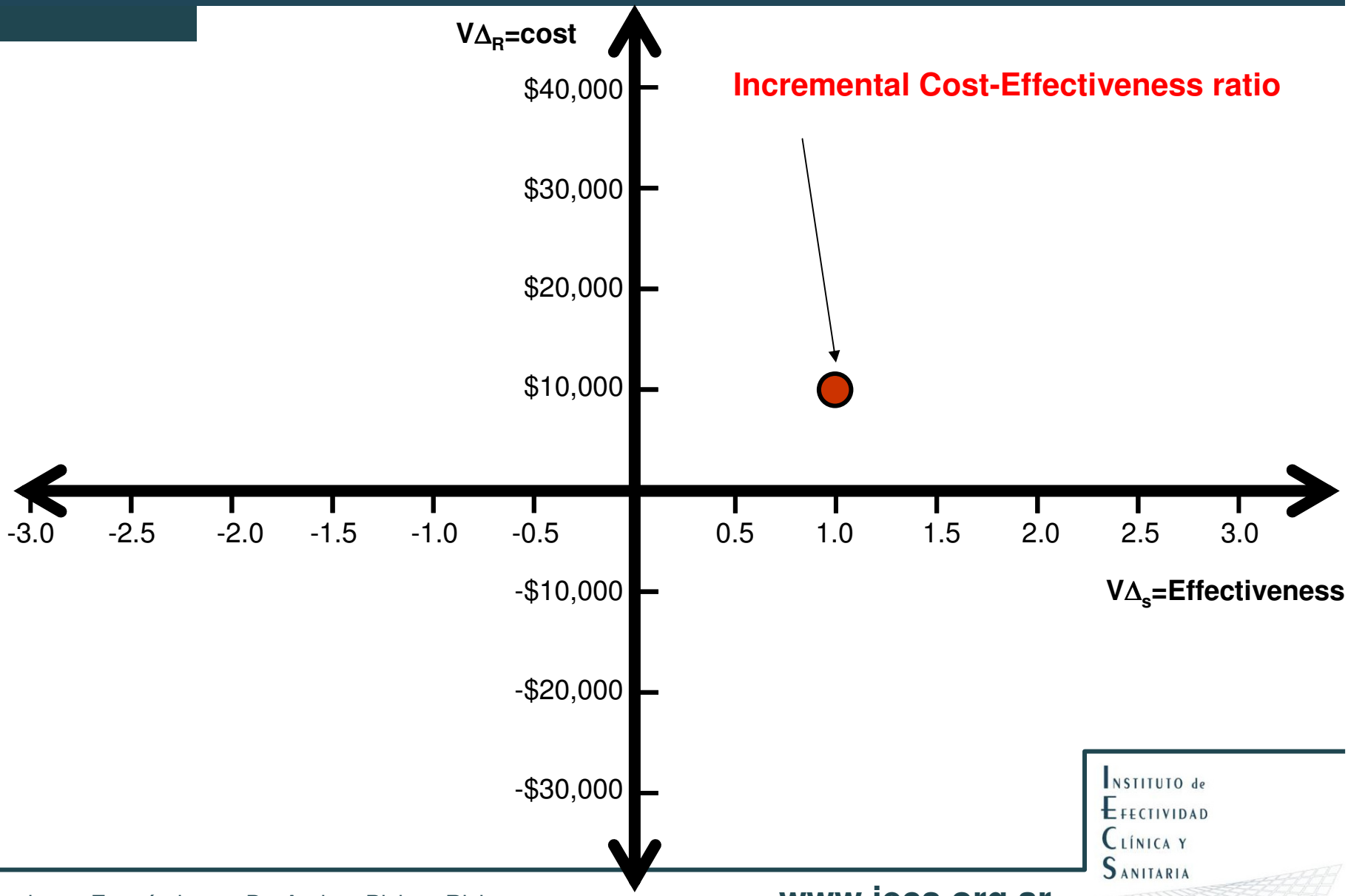
Results of an Economic Evaluation
Cost-effectiveness plane



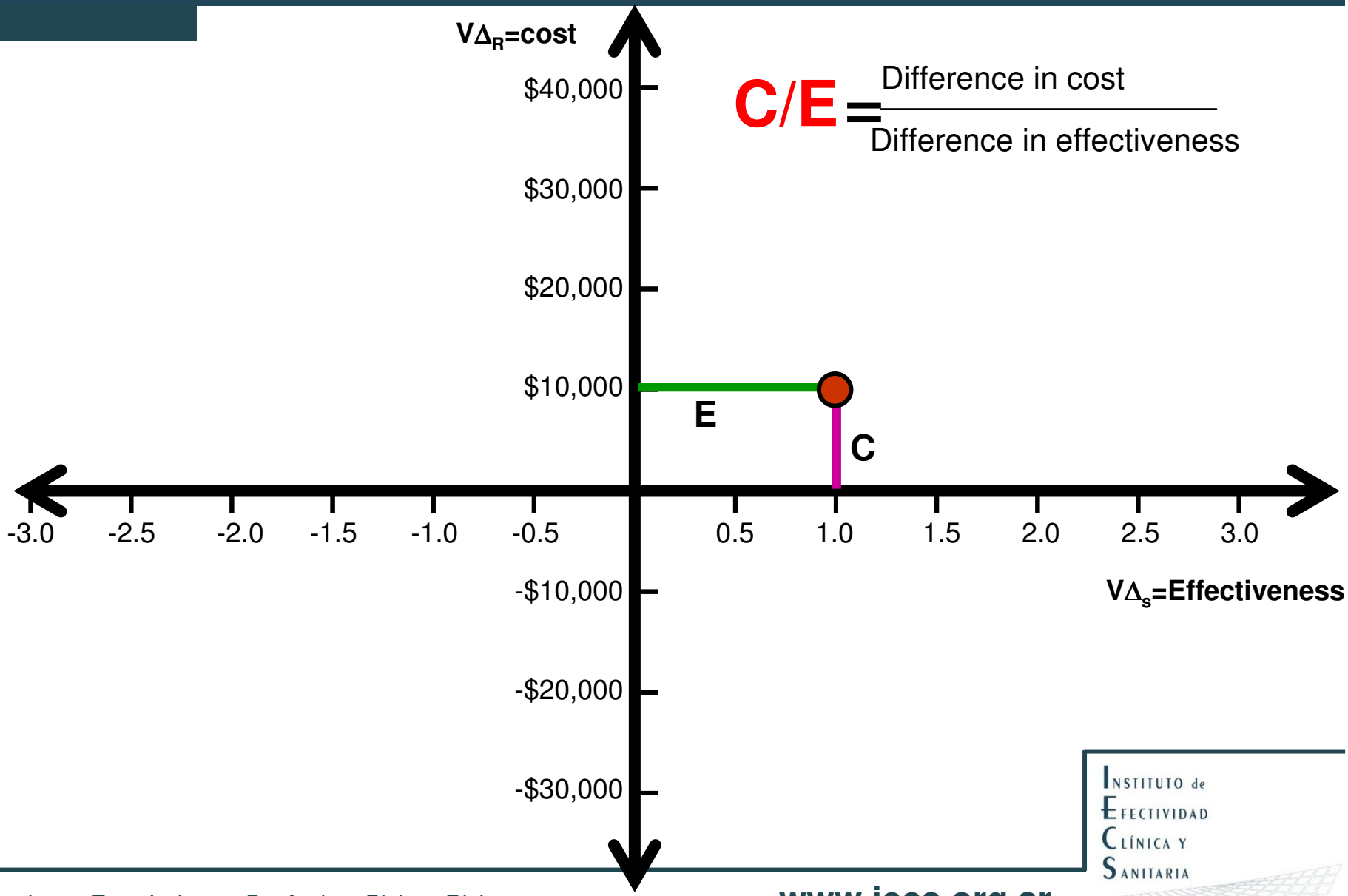
Cost-effectiveness plane



Incremental Cost-Effectiveness ratio

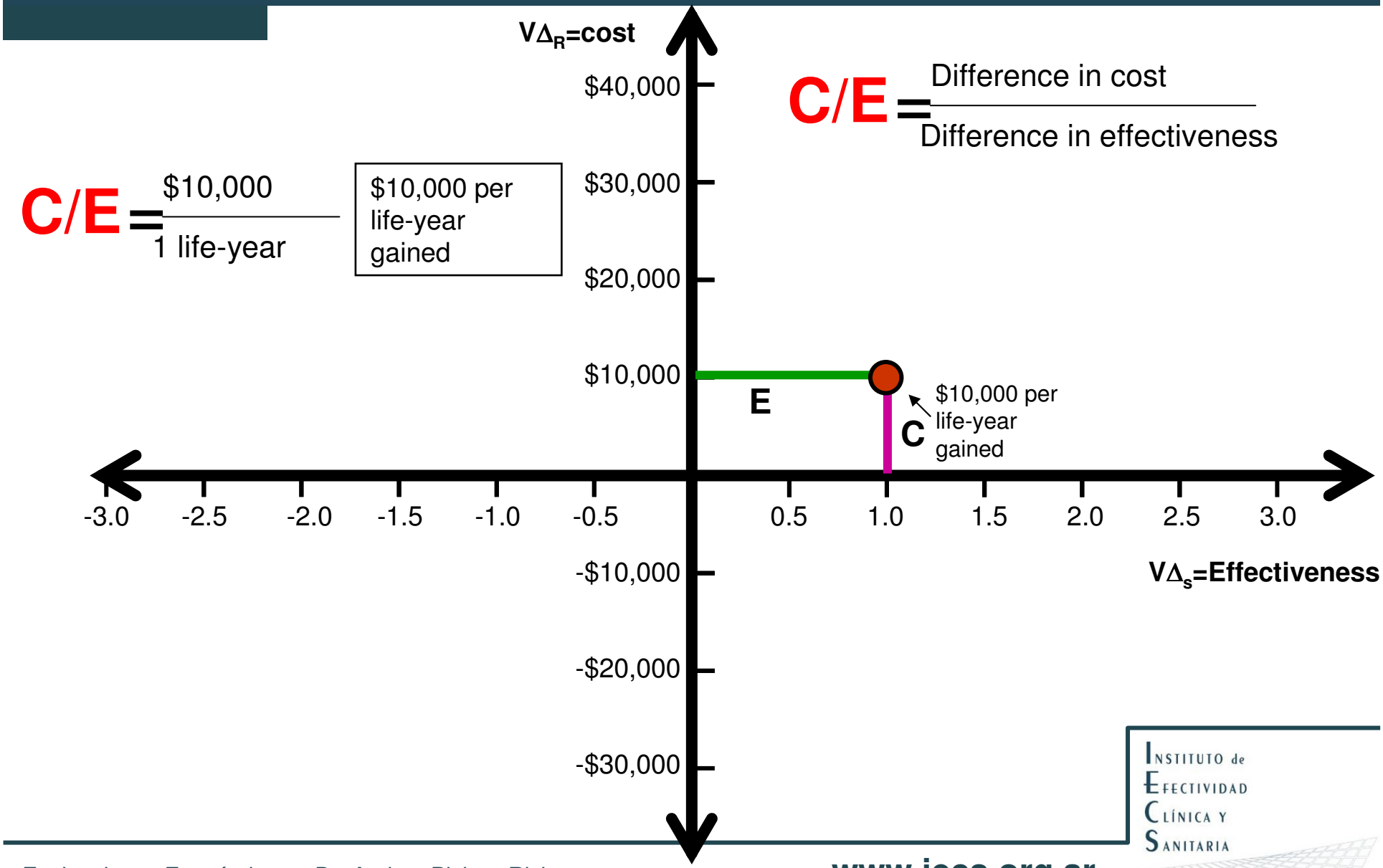


Incremental Cost-Effectiveness ratio

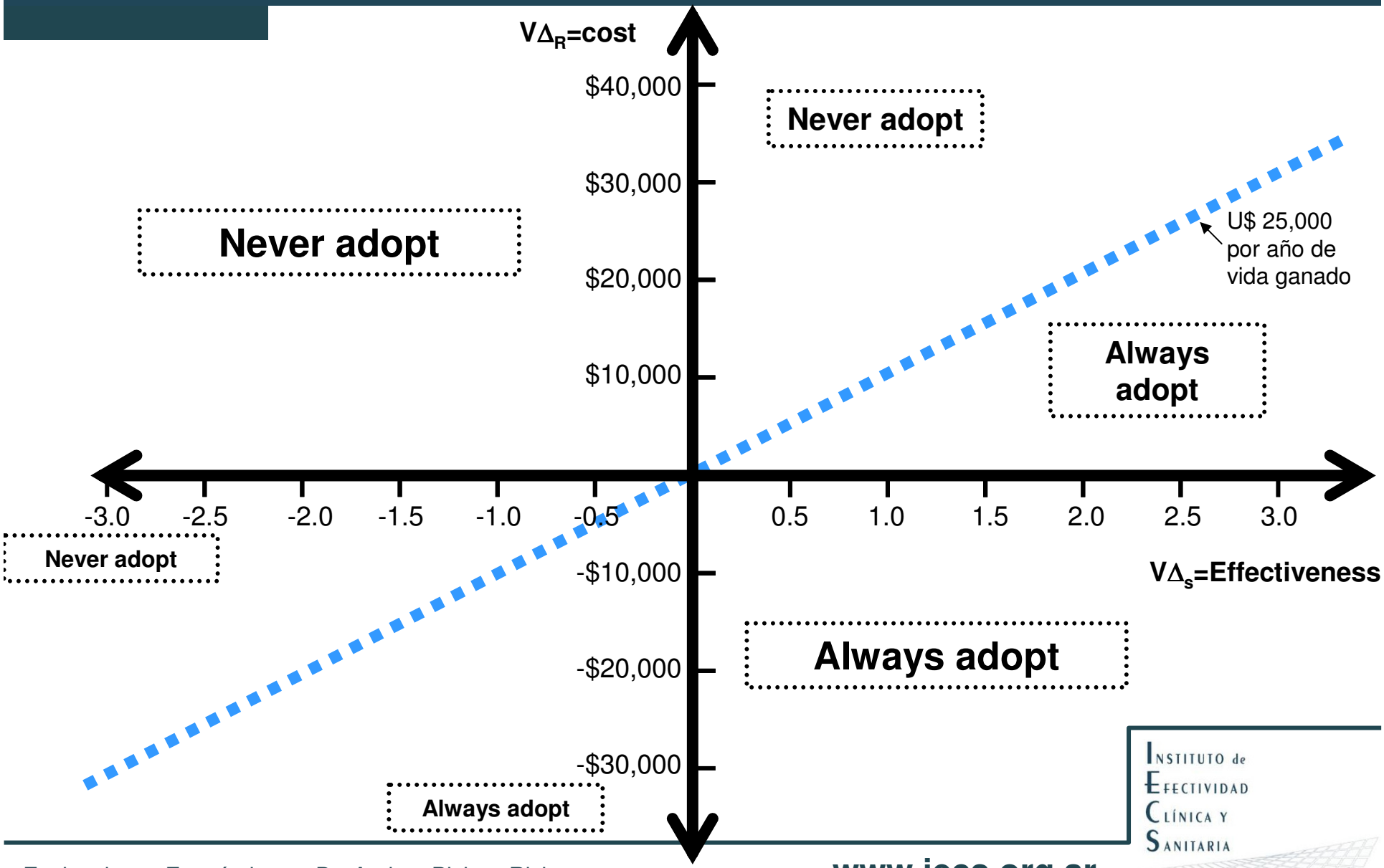


$$C/E = \frac{\text{Difference in cost}}{\text{Difference in effectiveness}}$$

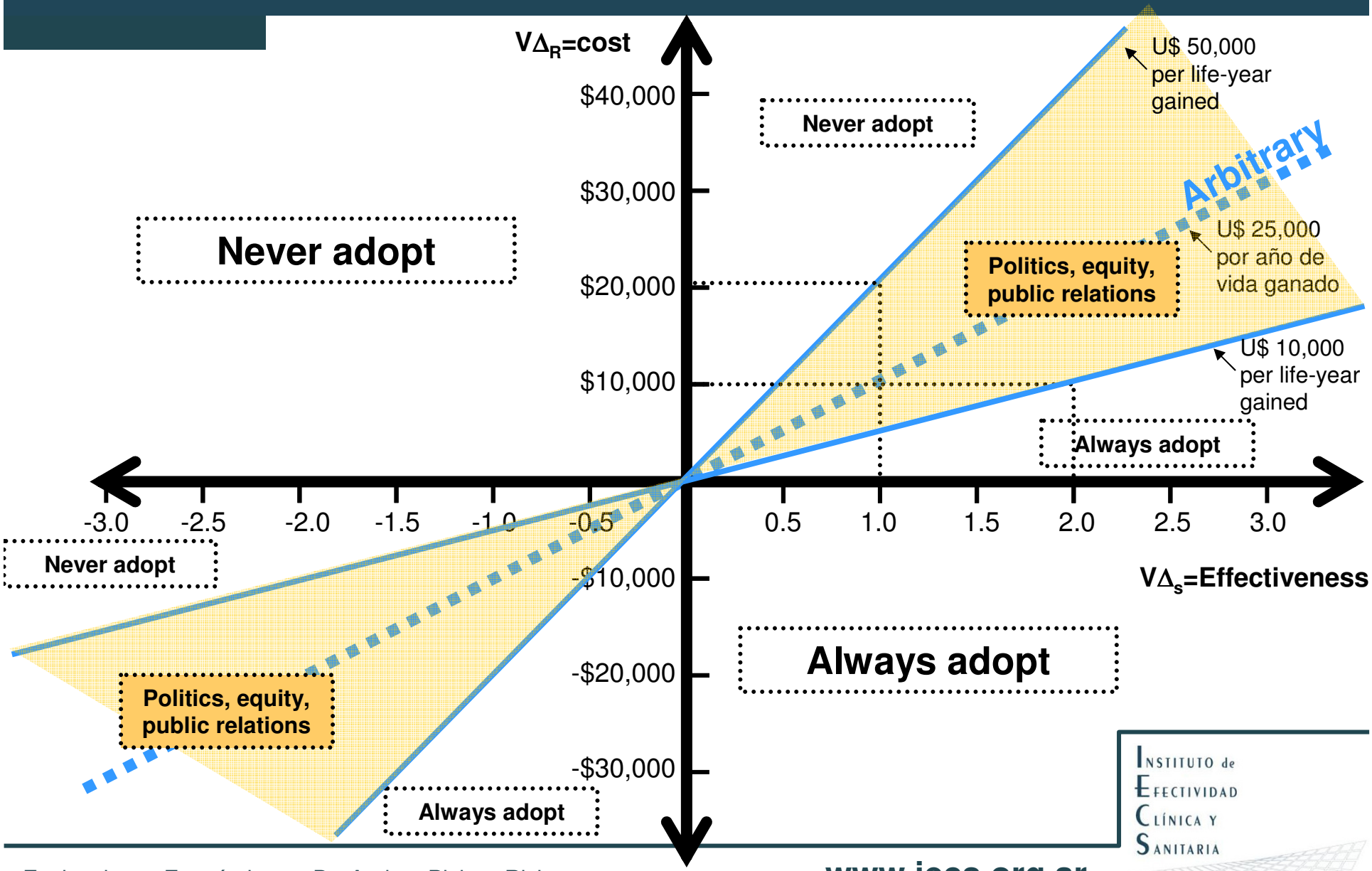
Incremental Cost-Effectiveness ratio



Cost-effectiveness and decision making



Cost-effectiveness and decision making



ICER y aprobación

Table I. Incremental cost per additional life-year gained league table

Number	Incremental cost per additional life-year gained at 1998/1999 prices ($AU)	PBAC decision
1	5517	Recommend at price
2	8374	Recommend at price
3	8740	Recommend at price
4	17 387	Recommend at price
5	18 762	Recommend at price
6	18 983	Recommend at price
7	19 807	Recommend at lower price
8	22 255	Recommend at price
9	26 800	Recommend at price
10	38 237	Recommend at price
11	39 821	Recommend at price
12	42 697	Reject
13	43 550	Reject
14	43 550	Defer
15	43 550	Recommend at price
16	56 175	Reject
17	57 901	Recommend at price
18	63 703	Reject
19	71 582	Recommend at price
20	75 286	Recommend at price
21	85 385	Recommend at lower price
22	88 865	Reject
23	98 323	Reject
24	229 064	Recommend at lower price
25	231 650	Reject
26	256 950	Reject

$AU = Australian dollars. The average interbank exchange rate to US dollars for 1998/1999 was 0.63772 (range 0.68760 to 0.54850); **PBAC** = Pharmaceutical Benefits Advisory Committee.

Table II. Incremental cost per additional quality-adjusted life-year (QALY) gained league table

Number	Incremental cost per additional QALY gained at 1998/1999 prices ($AU)	PBAC decision
1	4690	Recommend at price
2	5244	Recommend at price
3	8570	Recommend at price
4	10 530	Recommend at price
5	13 121	Recommend at price
6	17 937	Recommend at lower price
7	21 225	Recommend at price
8	24 343	Recommend at price
9	133 337	Reject

$AU = Australian dollars. The average interbank exchange rate to US dollars for 1998/1999 was 0.63772 (range 0.68760 to 0.54850); **PBAC** = Pharmaceutical Benefits Advisory Committee.

Source: George *et al.* *PharmacoEconomics* 2001; 19(11): 1103-1109.

Cost-effectiveness and decision making: the '4th hurdle' in reimbursement regulation

Australia

Ontario

The Netherlands

Norway

Portugal

Finland

United Kingdom

+

+

- Mandatory use of economics in decision making

Cost-Effectiveness of smoking cessation interventions in Seven Latin American Countries

Country	Institution
Argentina	**Instituto de Efectividad Clínica y Sanitaria**
Argentina	**Universidad Nacional de Tucumán**
Bolivia	**Universidad Mayor de San Andrés (UMSA)**
Brasil	**Universidade Federal do Rio de Janeiro**
Chile	**Universidad de la Frontera**
Colombia	**Pontificia Universidad Javeriana**
México	**Instituto Mexicano del Seguro Social/ Facultad de Medicina UNAM**
Peru	**Universidad Peruana Cayetano Heredia**

FUNDING

1) *International Clinical Epidemiology Network (INCLEN Trust)*
2) *Initiative for Cardiovascular Health Research in the Developing Countries (IC-Health) – WHO*
3) *International Development Research Centre (IDRC), Canadian Tobacco Control Research Initiative (CTCRI), American Cancer Society (ACS), Cancer Research UK, Institut National du Cancer France, Department for International Development UK (DFID).*

Cost-Effectiveness of smoking cessation interventions in Seven Latin American Countries

Objective:
To evaluate the cost-effectiveness of smoking cessation interventions (SCI) in seven Latin American countries

Methods:
A first order Monte Carlo, or probabilistic microsimulation of individual patients was built, incorporating the natural history, costs and quality of life impact of the main tobacco-related diseases: coronary and non-coronary heart disease, cerebrovascular disease, COPD, pneumonia/influenza, lung cancer as well as 9 other neoplasms. The model incorporated background quitting rates (2.5% per year) and background relapsing rates (30% in the first 5 years after quitting). The public health perspective and a base-case discount rate of 5% were used.

Cost-Effectiveness of smoking cessation interventions in Seven Latin American Countries

Results (1):

The validation showed adequate internal validity, with all simulated events rates falling within ±10% of the source publications. R^2 between predicted and observed values ranged from 0.758 to 0.999. External validation showed an excellent correlation between published data and model results.

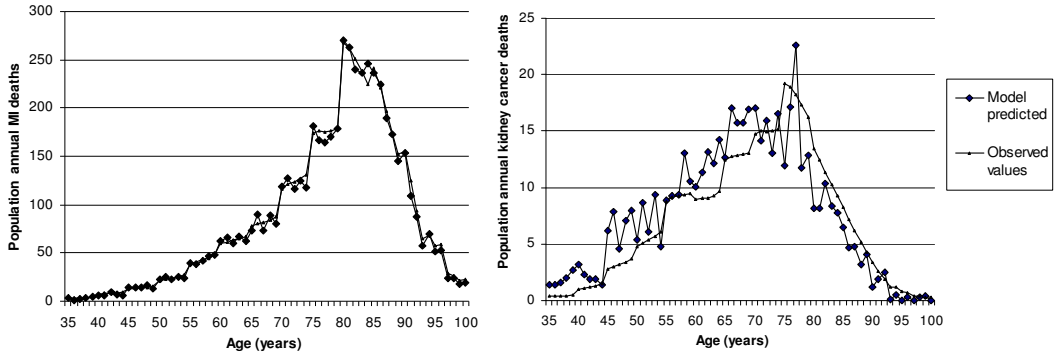


Figure 1. Calibration: Annual number of deaths predicted by the model in Argentina for each age strata compared to the 2005 Argentinean national vital data (35) in two selected conditions: (a) Myocardial Infarction (females); (b) Kidney cancer (males)

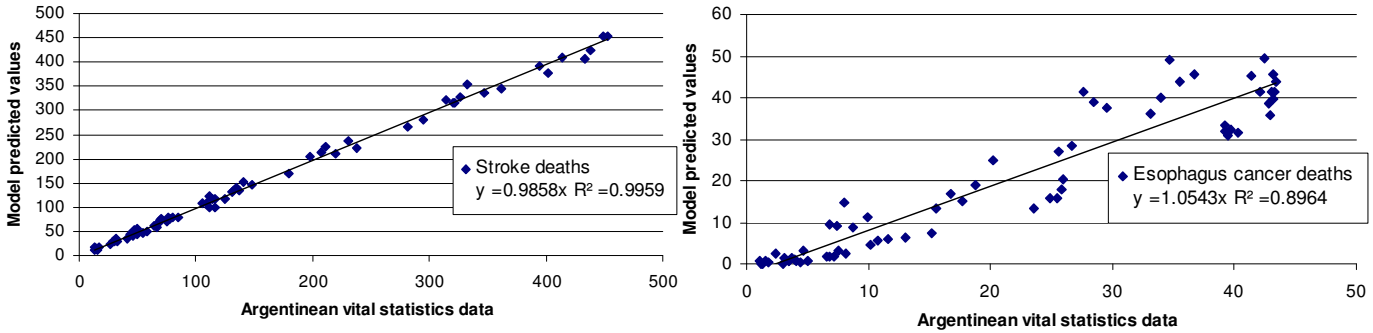
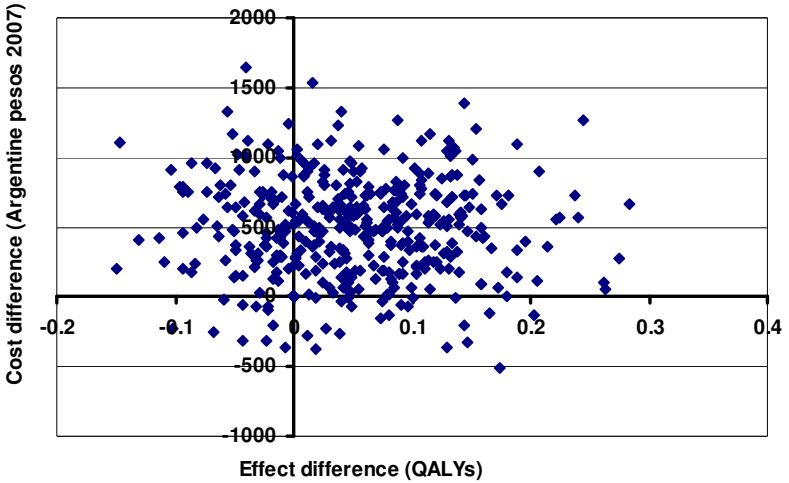


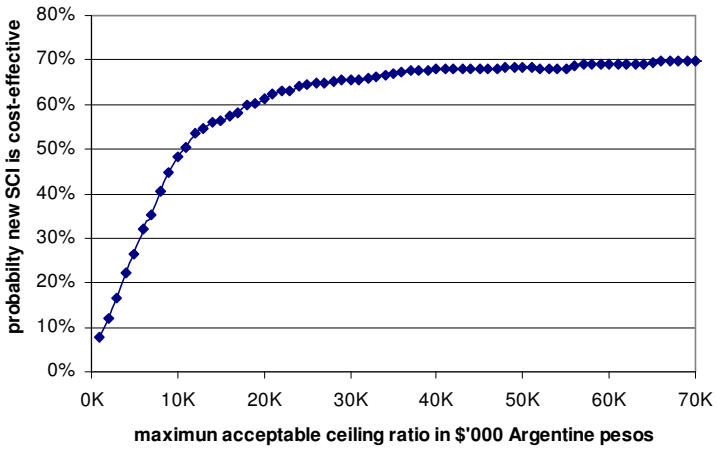
Figure 2. Correlation plot of model predicted versus reported age specific deaths in two selected conditions: (a) Stroke (females); (b) Esophageal cancer (males). The gradients of regression lines (*y*) and the correlation coefficients (*R2*) are reported in each graph. Reference population: Argentina 2005.

Cost-Effectiveness of smoking cessation interventions in Seven Latin American Countries

Results (2):

Predicted life years, QALYs and health care costs were calculated for continuing smokers and for quitters at different ages, both for males and females in each of the countries. Incremental Cost per QALY were calculated for different sets of interventions and target populations in each of the participant countries.





(a) Cost effectiveness plane of cost- and effect-related differences between two Smoking Cessation Interventions (SCI). SCI-A: cost $472, effectiveness: 15% smoking cessation rate at one year; SCI-B: cost $1.254, effectiveness: 23% smoking cessation rate at one year - Argentine pesos 2007. Preliminary results for 500 simulated cohorts of 5000 50-year-old male smokers after one quit attempt. Discount rate for costs and effects: 5%. (b) Cost-effectiveness acceptability curve showing the probability that SCI-B is cost-effective as compared to SCI-A over a range of values for the maximum acceptable ceiling ratio.

New EE projects in LatinCLEN

- **Distance Learning Course in Health Technology Assessment**
  - IECS: www.iecs.org.ar
  - Funding: Global Health Leadership Award (CIDA – IDRC)

- **Economic Evaluation of new oncology drugs**
  - LatinCLEN units from ARGENTINA – BOLIVIA – CHILE – PERU
  - Funding: Global Health Leadership Award (CIDA – IDRC)

- **Economic Evaluation of a neumococal vaccine**
  - LatinCLEN units: ARGENTINA – CHILE – PERU - MEXICO

Summary

- **Without good evidence, uptake & spread of technologies likely to be influenced by range of social, financial & institutional factors, and not produce healthiest outcomes for most efficient use of resources**

- **HTA and EE potentially plays a major role in evidence-based policy making.**

- **Last decade has seen an increasing international trend towards healthcare systems use HTA (and cost effectiveness) in order to assist pricing, reimbursement and technology access decisions**

- **Number of challenges currently face HTA**
  - Harmonisation & transferability
  - Transparency, openness & fairness
  - Engagement of the stakeholders/public

- **Thank you!**

Contact:
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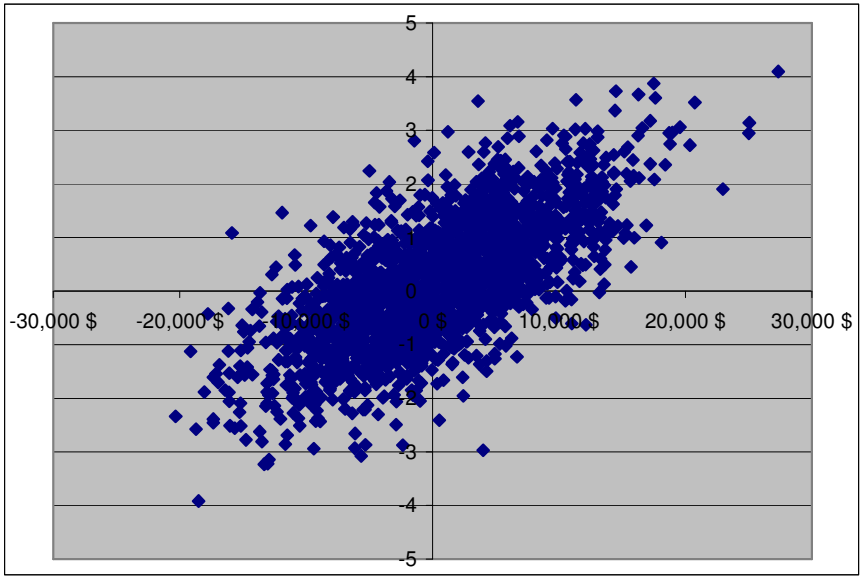
Resultados de Costo-efectividad de Intervenciones

PACIENTES DE 55 AÑOS sin ANTECEDENTE DE IAM PREVIO, 2,000 100:100 todos fumadores que intentan año 1: RR 1.5 costo 600

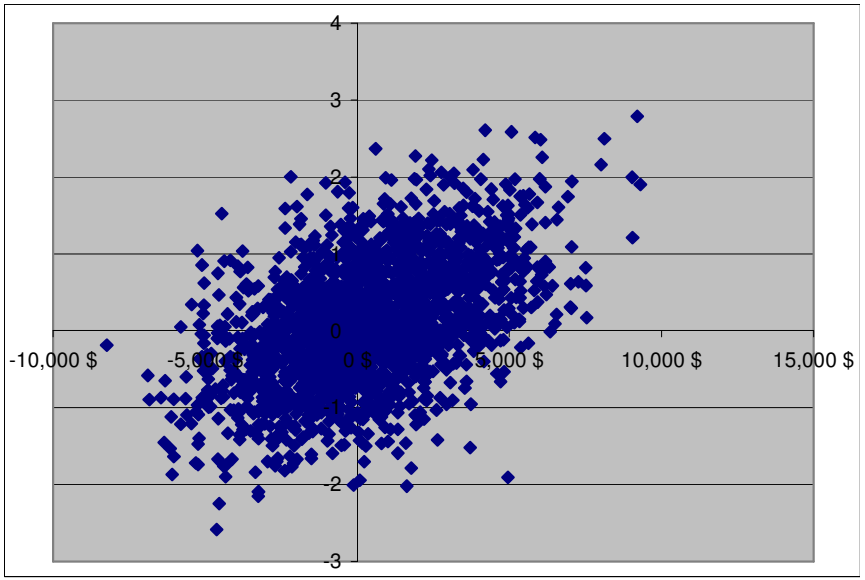


SIN DESCONTAR

CE:	**1,938 $**

	Dif COSTOS	*Dif QALYs*
Promedio	352 $	0.18
Min:	-20,311 $	- 3.91
Max:	27,365 $	4.10
De:	6995.0034	1.18

n=	100



DESCONTADOS

CE:	**3,019 $**

	Dif COSTOS	*Dif QALYs*
Promedio	379 $	0.13
Min:	-8,241 $	- 2.59
Max:	9,300 $	2.79
De:	2625.3621	0.80

Ejemplo: como pueden tomarse las decisiones

Problema: Alta mortalidad infantil

Presupuesto: $3,000,000

¿Cómo utilizarlo de la mejor manera posible?

Ejemplo: como pueden tomarse las decisiones

Problema: Alta mortalidad infantil

Presupuesto: $3,000,000

1. Hacer lo primero que le viene a la cabeza y después ir viendo (total por ahora tiene plata) o Hacer lo mismo que se hizo siempre y si hay algo más de presupuesto…..hacer lo primero que le viene a la cabeza.

2. Analizar las alternativas….y elgegir según "…a mi me parece.."

Intervención
Agua potable
Vacunación
Atención médica
Nutrición
Deportes
Vivienda
Hierro y vitaminas
Alta complejidad

Ejemplo: como pueden tomarse las decisiones

Problema: Alta mortalidad infantil

Presupuesto: $3,000,000

3. Analizar los Costos y las Consecuencias de cada estrategia

Intervención	Efecto	Costo
Agua potable	20	$ 520,000
Vacunación	10	$ 850,000
Atención médica	16	$ 2,600,000
Nutrición	15	$ 450,000
Deportes	0.5	$ 75,000
Vivienda	12	$ 1,100,000
Hierro y vitaminas	3	$ 200,000
Alta complejidad	1.5	$ 400,000

¿Cómo elegir?

Ejemplo: como pueden tomarse las decisiones

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¿Cómo elegir?

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Elegimos las más efectivas hasta que se nos acabe el dinero

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Alta complejidad	1.5	$ 400,000
Deportes	0.5	$ 75,000

Logramos reducir en 36 puntos la mortalidad infantil a un costo anual de $3,120,000

Ejemplo: como pueden tomarse las decisiones

Problema: Alta mortalidad infantil

Presupuesto: $3,000,000

4. Calcular la costo-efectividad de cada estrategia

Intervención	Efecto	Costo	C/E
Agua potable	20	$ 520,000	
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Atención médica	16	$ 2,600,000	
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Vivienda	12	$ 1,100,000	
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Ejemplo: como pueden tomarse las decisiones

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Atención médica	16	$ 2,600,000	
Nutrición	15	$ 450,000	
Deportes	0.5	$ 75,000	
Vivienda	12	$ 1,100,000	
Hierro y vitaminas	3	$ 200,000	
Alta complejidad	1.5	$ 400,000	

Ejemplo: como pueden tomarse las decisiones

Problema: Alta mortalidad infantil

Presupuesto: $3,000,000

4. Calcular la costo-efectividad de cada estrategia

Intervención	Efecto	Costo	C/E
Agua potable	20	$ 520,000	$ 26,000
Vacunación	10	$ 850,000	$ 85,000
Atención médica	16	$ 2,600,000	
Nutrición	15	$ 450,000	
Deportes	0.5	$ 75,000	
Vivienda	12	$ 1,100,000	
Hierro y vitaminas	3	$ 200,000	
Alta complejidad	1.5	$ 400,000	

Ejemplo: como pueden tomarse las decisiones

Problema: Alta mortalidad infantil

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4. Calcular la costo-efectividad de cada estrategia

Intervención	Efecto	Costo	C/E
Agua potable	20	$ 520,000	$ 26,000
Vacunación	10	$ 850,000	$ 85,000
Atención médica	16	$ 2,600,000	$ 162,500
Nutrición	15	$ 450,000	$ 30,000
Deportes	0.5	$ 75,000	$ 150,000
Vivienda	12	$ 1,100,000	$ 91,667
Hierro y vitaminas	3	$ 200,000	$ 66,667
Alta complejidad	1.5	$ 400,000	$ 266,667

Ejemplo: como pueden tomarse las decisiones

Problema: Alta mortalidad infantil

Presupuesto: $3,000,000

4. Calcular la costo-efectividad de cada estrategia

Intervención	Efecto	Costo	C/E
Agua potable	20	$ 520,000	$ 26,000
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Deportes	0.5	$ 75,000	$ 150,000
Atención médica	16	$ 2,600,000	$ 162,500
Alta complejidad	1.5	$ 400,000	$ 266,667

Ejemplo: como pueden tomarse las decisiones

Problema: Alta mortalidad infantil

Presupuesto: $3,000,000

4. Hacer un análisis de costo-efectividad de las estrategias

Elegimos las más costo-efectivas hasta que se nos acabe la plata

Intervención	Efecto	Costo	C/E
Agua potable	**20**	**$ 520,000**	**$ 26,000**
Nutrición	**15**	**$ 450,000**	**$ 30,000**
Hierro y vitaminas	**3**	**$ 200,000**	**$ 66,667**
Vacunación	**10**	**$ 850,000**	**$ 85,000**
Vivienda	**12**	**$ 1,100,000**	**$ 91,667**
Deportes	0.5	$ 75,000	$ 150,000
Atención médica	16	$ 2,600,000	$ 162,500
Alta complejidad	1.5	$ 400,000	$ 266,667

Logramos reducir en 60 puntos la mortalidad infantil a un costo anual de $3,120,000

Vale la pena pensar en costo-efectividad……

Problema: Alta mortalidad infantil

Con las estrategias **1 y 2** quien sabe que habría pasado.

Intervención	Efecto	Costo
Agua potable	**20**	**$ 520,000**
Atención médica	**16**	**$ 2,600,000**
Nutrición	15	$ 450,000
Vivienda	12	$ 1,100,000
Vacunación	10	$ 850,000
Hierro y vitaminas	3	$ 200,000
Alta complejidad	1.5	$ 400,000
Deportes	0.5	$ 75,000

Beneficio: reducción en **36** puntos
Costo: **$3,120,000 ($86,666/punto)**

Intervención	Efecto	Costo	C/E
Agua potable	**20**	**$ 520,000**	**$ 26,000**
Nutrición	**15**	**$ 450,000**	**$ 30,000**
Hierro y vitaminas	**3**	**$ 200,000**	**$ 66,667**
Vacunación	**10**	**$ 850,000**	**$ 85,000**
Vivienda	**12**	**$ 1,100,000**	**$ 91,667**
Deportes	0.5	$ 75,000	$ 150,000
Atención médica	16	$ 2,600,000	$ 162,500
Alta complejidad	1.5	$ 400,000	$ 266,667

Beneficio: reducción en **60** puntos
Costo: **$3,120,000 ($52,000/punto)**