

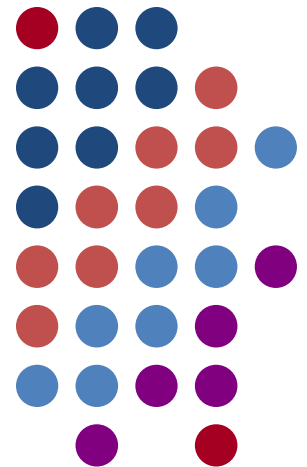
Evaluating cost effectiveness of alternative blood safety scenarios:

the search for tools that have traction

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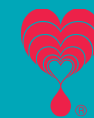


Disclosures

Research support from:

TerumoBCT

Macopharma



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Outline

COST



Budget Impact Analysis



Lifetime Cost Analysis



Net Monetary Benefits (NMB)

EFFECTIVENESS



Adverse events averted or prevented
Residual risk



Number needed to treat (NNT)

- NNB
- NNT



Risk:Benefit ratio



Net Health Benefits (NHB)

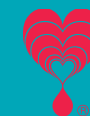


Utility

Willingness to Pay



COST : EFFECTIVENESS



Priority Setting/Decision Making in Health

- 1) Cost alone
- 2) Capacity of beneficiaries to pay
- 3) Cost-effectiveness
- 4) Horizontal equity (equality)
- 5) Vertical equity (priority)
- 6) Adequate demand
- 7) Public attitudes and expectations
- Nature of Intervention and market
- 8) Public good?
- 9) Yields externalities



Health Economics – ABO RBDM

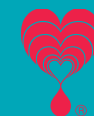
Consensus Blood Safety Recommendations

Budget Impact Analysis

- Costs that accrue or are expected to accrue when an intervention is implemented
 - Results in terms of the costs incurred or saved by adopting an intervention from the standpoint of the budgeting authority or health care decision-maker.

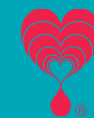
Cost Effectiveness (Utility) Analysis

- Value gained for resources spent
 - Value for money is assessed in terms of cost per quality-adjusted life-year (QALY) gained or disability-adjusted life-year (DALY) lost.



Cost Analyses

- Many different methodologies
- To implement most new interventions requires additional health care expenditures
 - Rarely a new intervention saves the health care system more than it costs to implement
 - Even in this scenario the issue is one of net savings to the overall health care system and almost never one of direct budget savings to those who implement the intervention
- We should be advocates for interventions that generate net health savings (so long as they have net positive effectiveness)
- Most interventions don't achieve this so we have to assess if the net effects are worth the cost

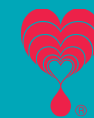


Economic Evaluation and Modeling

- 1) Cost-effectiveness analysis provides the clearest way to promote value for money in health
- 2) Involves comparative analysis of alternative courses of action
- 3) Informs key areas requiring additional knowledge/research
- 5) Assumes scarcity exists and choices have to be made between what to and what not to buy

In blood safety these analyses need reliable data on:

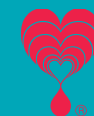
“Real” transmission risks, Epidemiology and recipient characteristics (age, survival, infectious diseases, vaccination, etc), Disease progression, Local treatment costs, etc.



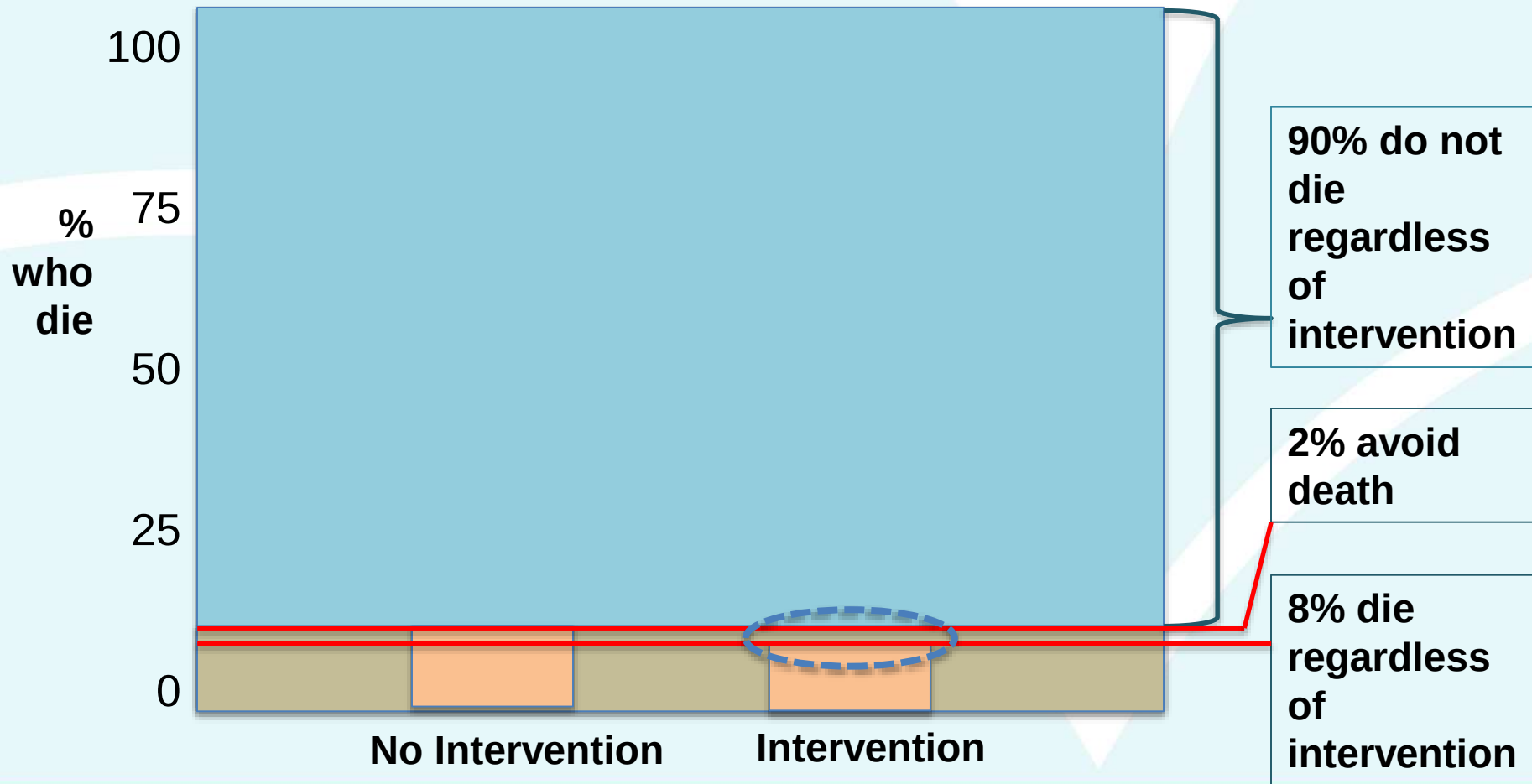
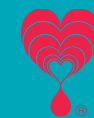
Expressing Effectiveness

Number Needed to Treat (NNT)

- NNT is a measurement of the impact of an intervention. It is the number of patients that need to be treated in order to have an impact on one person.
$$= 100/\text{Absolute Risk Reduction} = \text{NNT}$$
- NNTB – number needed to treat to benefit or NNB
 - Calculated for something with positive health impact
- NNTH – number needed to treat to harm or NNH
 - Calculated for something with a negative health impact, such as a risk factor for disease or adverse effect of an intervention



Absolute risk reduction (ARR) instead of relative risk reduction (RRR)



NNB Common Clinical Event Rates

Number Needed to Treat

Calculates the NNT to prevent one additional adverse outcome

Study Outcome

Group 1 Incidence

(Control Group)

%

Group 2 Incidence

(Experimental Group)

%

Percent

Patient-Years

Reset

Calculate

RESULTS

NNT/NNH
100

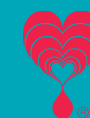
On average, 100 patients would have to receive experimental treatment (instead of control treatment) for one additional patient to NOT have the study outcome.

Equations

$$ARR = (\text{Control event rate}) - (\text{Experimental event rate})$$

$$ARR = 0.01 - 1E - 07 = 0.0099999$$

$$NNT = 1/ARR = 1/0.0099999 = 100$$



NNB with Typical Event Rates in TM

Number Needed to Treat

Calculates the NNT to prevent one additional adverse outcome

Study Outcome

Group 1 Incidence (Control Group)

%

Group 2 Incidence (Experimental Group)

%

Percent

Patient-Years

Reset

Calculate

RESULTS

NNT/NNH
111111.1

On average, 111111.1 patients would have to receive experimental treatment (instead of control treatment) for one additional patient to NOT have the study outcome.

Equations

$$ARR = (\text{Control event rate}) - (\text{Experimental event rate})$$

$$ARR = 1E - 05 - 1E - 06 = 9E - 06$$

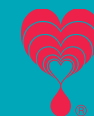
$$NNT = 1/ARR = 1/9E - 06 = 111111.1$$



Explicitly Estimated WTP in Different Countries

Country	Estimated* or Assumed WTP per QALY
UK	£23,000*
Australia	AU\$64,000*
Netherlands	€40,000
USA	US\$62,000*
Japan	JPY 5 million*

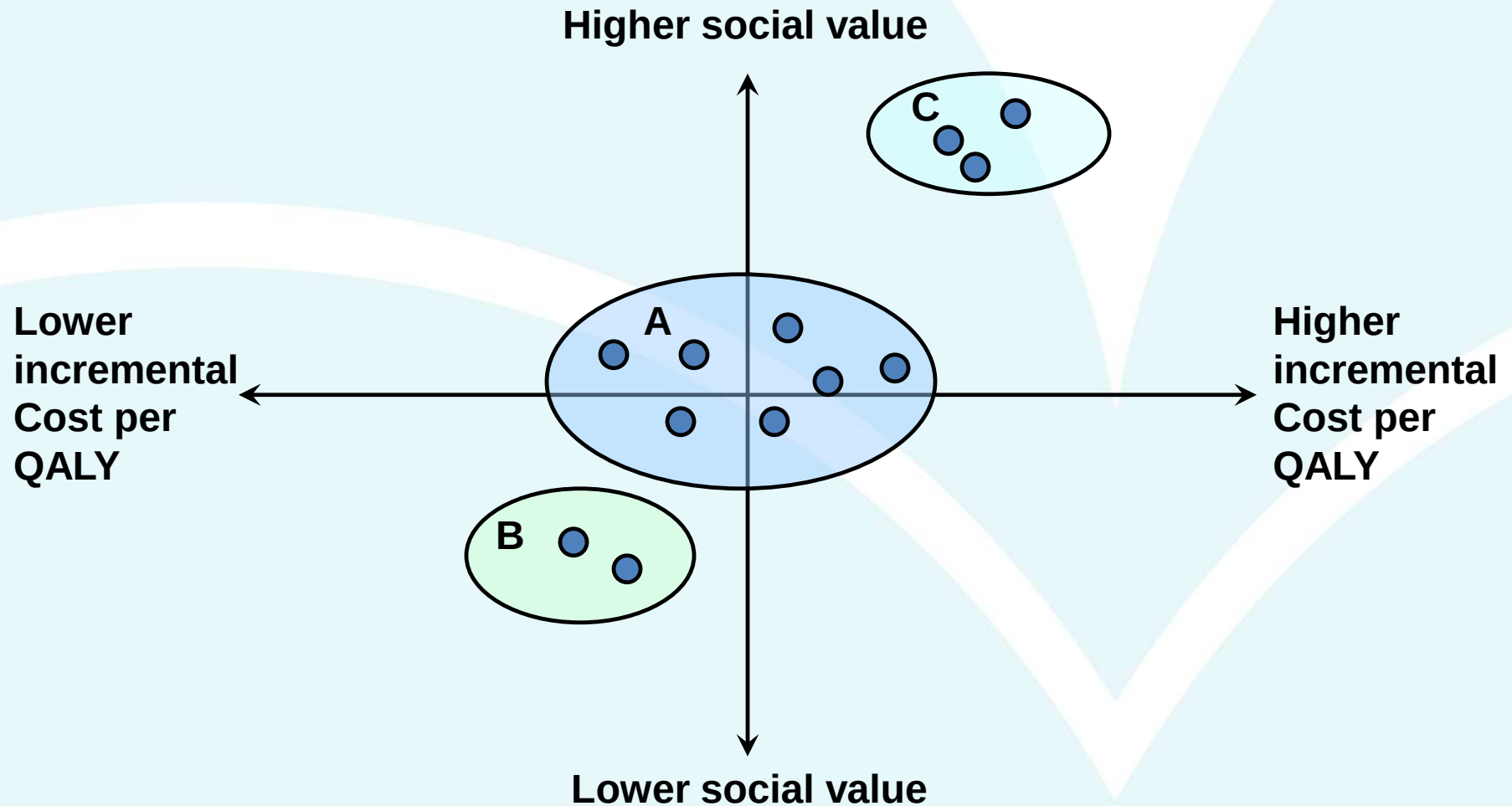
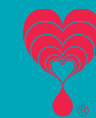
*Health Econ. 2010 Apr;19(4):422-37



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Social Value, Expectations and Cost/QALY

Willingness to Pay for Health Care Interventions



Results Reporting – Cost & Consequences Table

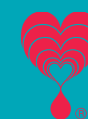
The cost-effectiveness ratio (CER), incremental cost-effectiveness ratio (ICER), cost-effectiveness acceptability curves (CEAC) or other summary measures are final interpretations that only have meaning if disaggregated costs and effects are provided

Table 3. Costs, effects and incremental cost-utility of competing strategies for PRT in Poland

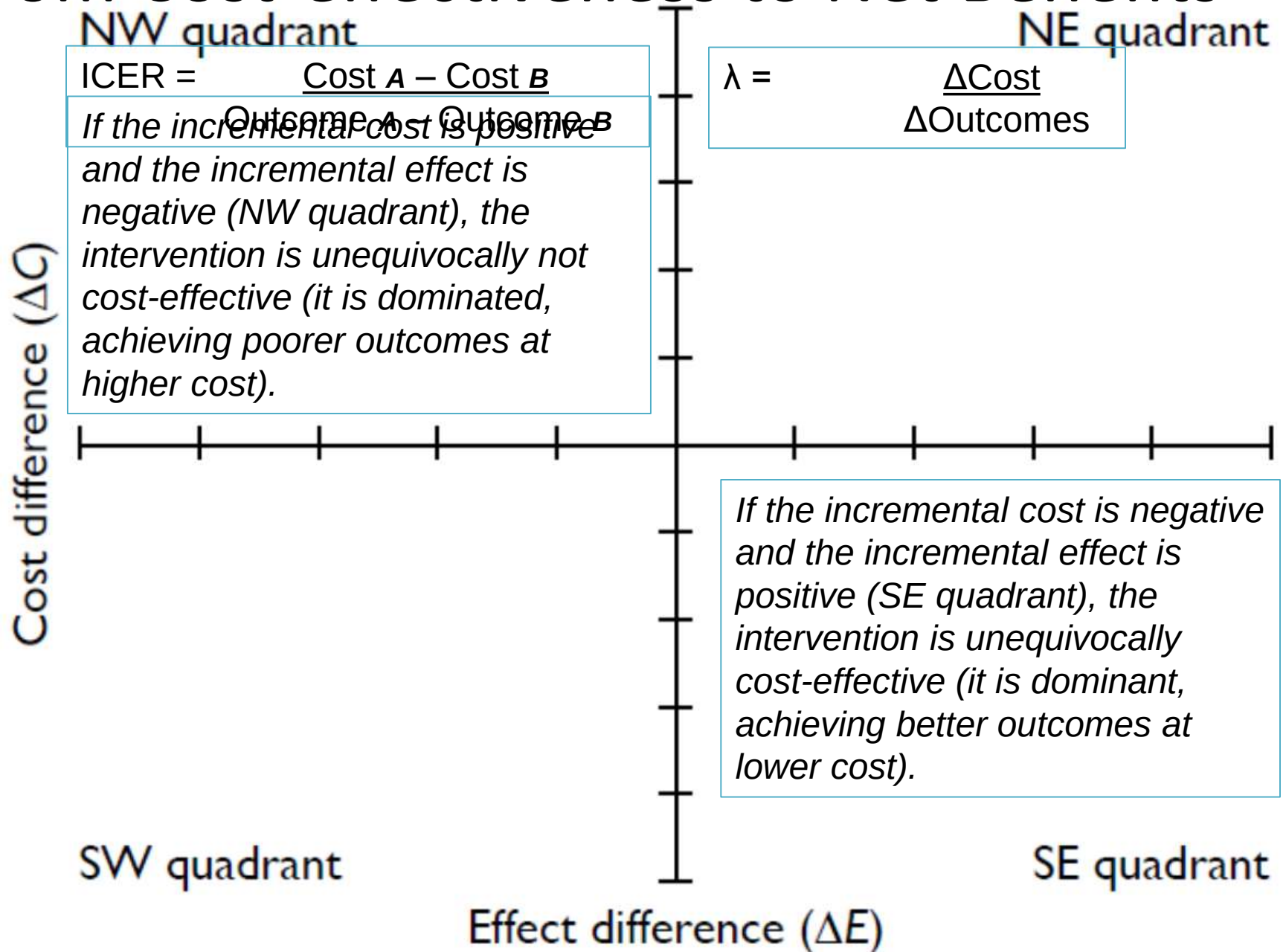
	Current screens	Versus P-PRT (reference case)	Versus PP-PRT	P-PRT versus PP-PRT
Total costs, PLN	53.69	90.15	113.63	
Total effects, QALY	7.5970195	7.5970339	7.5970610	
Incremental costs, PLN		36.46	59.94	23.48
Incremental effectiveness, QALY		0.0000143 (7.5)	0.0000414 (21.7)	0.0000271 (14.2)
ICER, PLN/QALY*		2,595,000	1,480,000	883,000
95% CI approximation*		1,801,000–3,672,000	1,032,000–2,121,000	621,000–1,238,000
ICER, EUR/QALY*		610,000	348,000	208,000
ICER, PPP\$/QALY*		1,380,000	787,000	470,000

*ICER values and credible intervals rounded to the nearest thousand.

QALY = quality-adjusted life years (converted to QALM = quality-adjusted life minutes); P-PRT = plasma PRT; PP-PRT = platelets and plasma PRT; PPP\$ = adjusted to USD using purchasing power parities index (1.86 for the country of Poland in 2009).



From Cost-effectiveness to Net Benefits



From Cost-effectiveness to Net Benefits

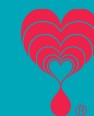
If *both* the incremental cost and the incremental effect are negative (SW quadrant) or *both* the incremental cost and the incremental effect are positive (NE quadrant) no unequivocal statements can be made.

Determining whether the intervention is cost-effective depends on a threshold value (λ), defined as the maximum amount society is willing to pay for an incremental health gain or, equivalently, as the minimum amount society is willing to accept for foregoing an incremental health gain.

$$\text{Net Monetary Benefits (NMB)} = \lambda \times \Delta\text{Outcomes} - \Delta\text{Cost}$$

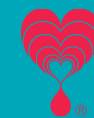
$$\text{Net Health Benefits (NHB)} = \Delta\text{Outcomes} - \frac{\Delta\text{Cost}}{\lambda}$$

The incremental net benefit (regardless of the scale) provides an unambiguous decision rule, although this implies knowledge of the threshold value (λ), which has been a subject of considerable debate



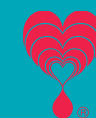
Net Monetary Benefits

NMB (€)	Δ Effectiveness	Threshold Value (λ)	Δ Costs
400	0.01	50000	100
-97.5	0.00005	50000	100
-50	0.00005	1000000	100
4900	0.005	1000000	100
4995	0.005	1000000	5

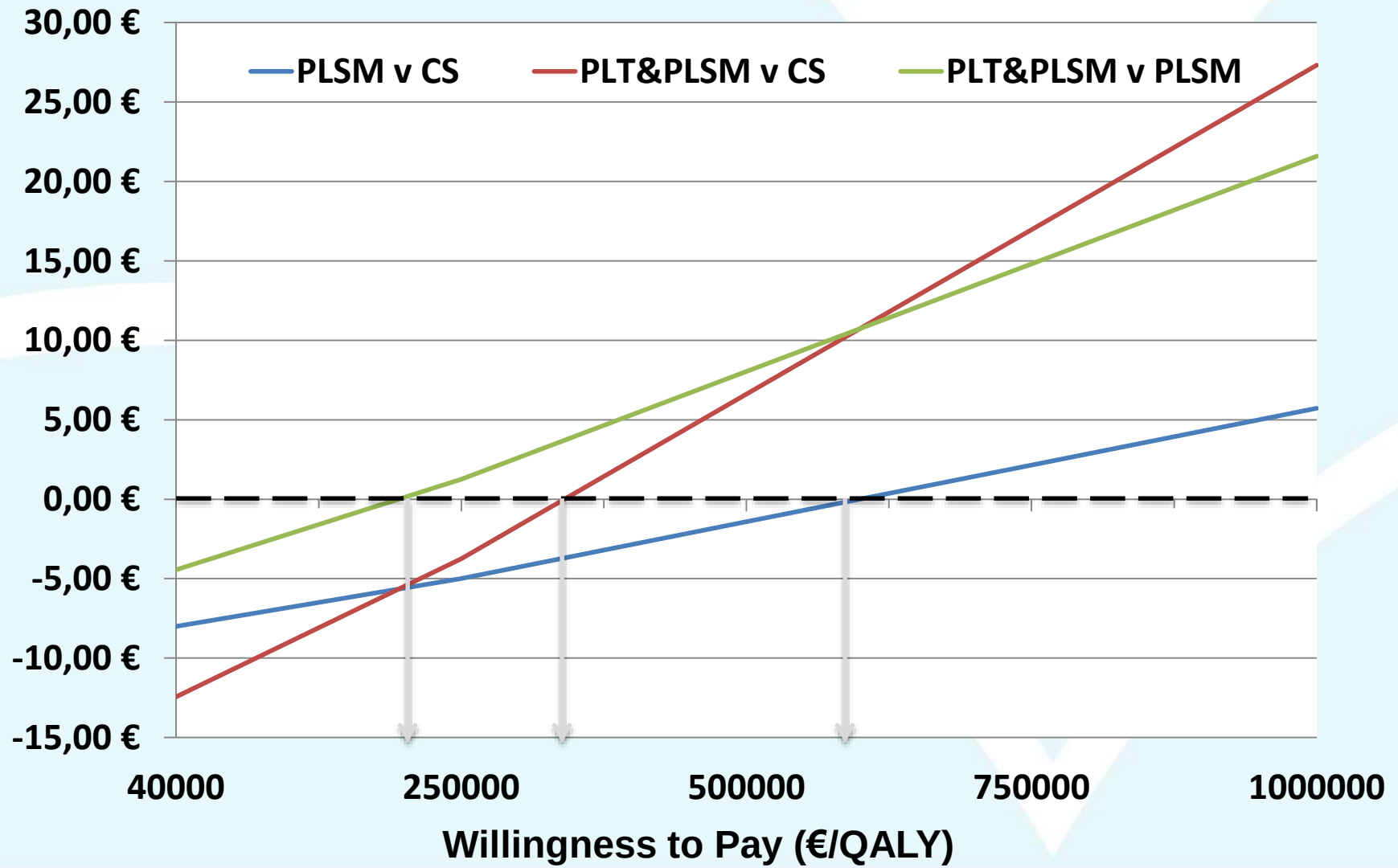
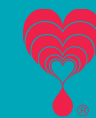


Net Health Benefits

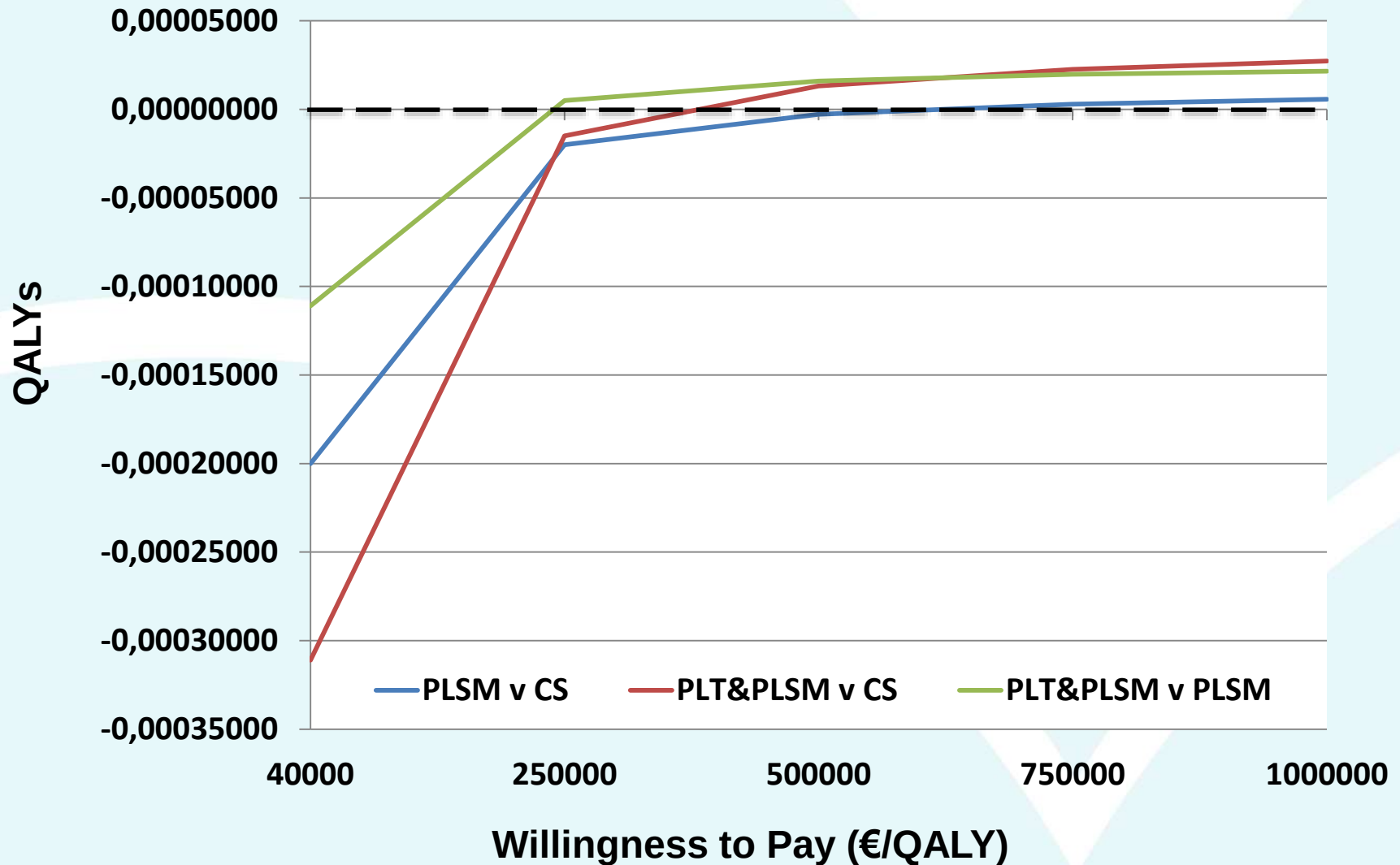
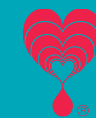
NHB (QALYs)	– Δ Costs	Threshold Value (λ)	Δ Effectiveness
0.0075	-100	50000	0.01
-0.00195	-100	50000	0.00005
-0.00005	-100	1000000	0.00005
0.004900	-100	1000000	0.005
0.004995	-5	1000000	0.005



Net Monetary Benefits for PRT

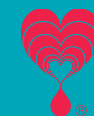


Net Health Benefits for PRT



Net Benefits Framework

- Willingness to pay: Using the ICER method the role of WTP is often opaque. Using the NMB method the analysis is entirely descriptive and allows the decision maker to identify their preferred option based on their own explicit WTP threshold.
- Impact of cost and effect on uncertainty: NMB analysis reveals that costs have a relatively larger impact on CE results at low WTP values (due to the NMB line shifting up or down). However, at high WTP values changes in effectiveness have a relatively larger impact on CE results (due to the magnified effect of changes in slope on NMB at high WTP values).





Risk Based Decision Making Project

Health Economic and Outcomes

Objective: To compare the cost-utility of HIV, HBV and HCV donation screening in a list of countries with similar HDIs

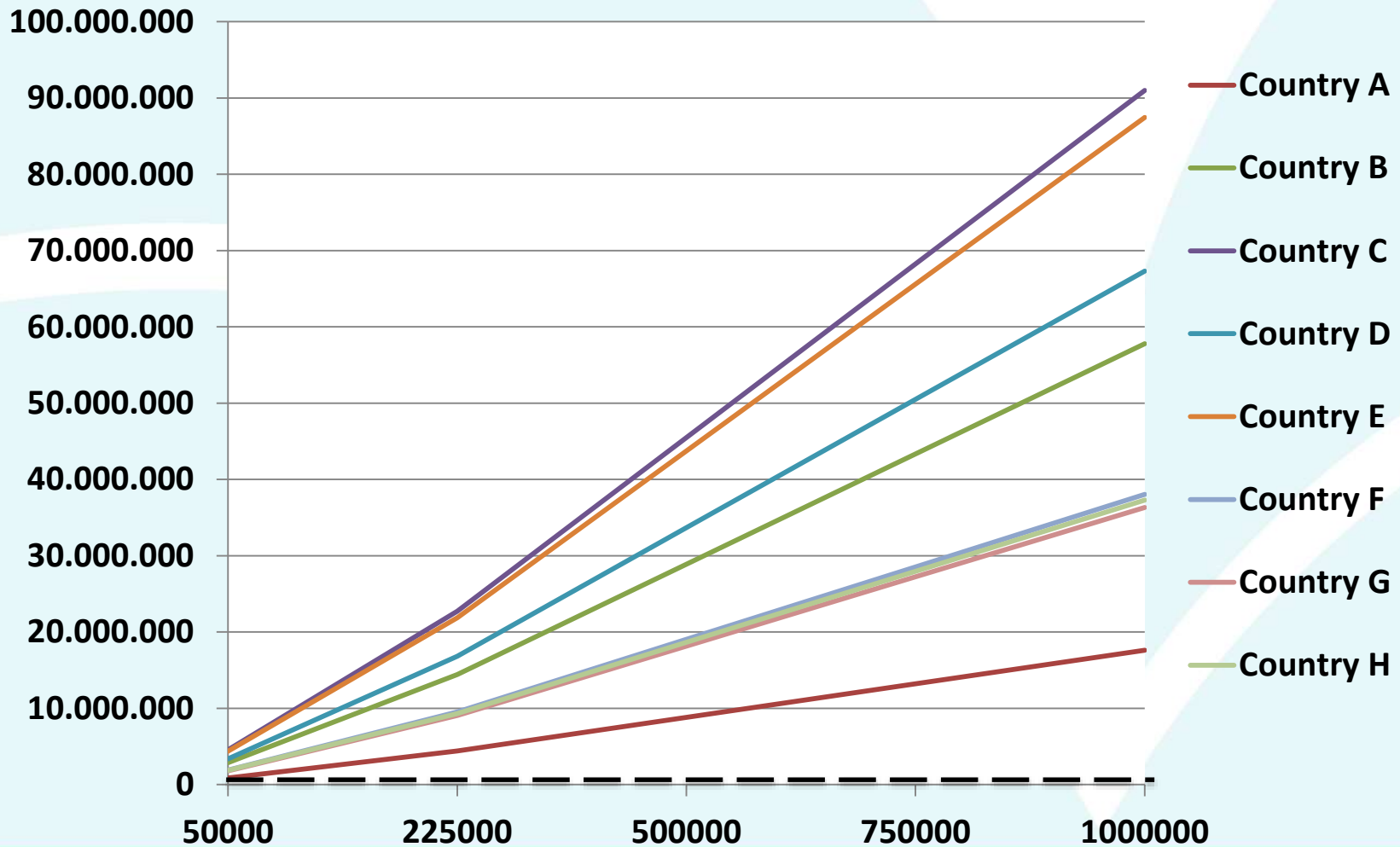
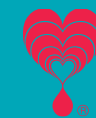
Participants: **Australia, Canada, Denmark, Finland, France, Netherlands, UK, USA**

- Are patterns of similar cost-effectiveness/utility ratios evident?
- What aspects may exhibit substantial differences?
- Are there broader patterns with respect to blood safety for HIV, HBV, and HCV that can be discerned?

ABO Project Results: Cost and Consequences

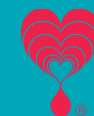
Country	QALYs gained		Net Costs (\$ x 1000)		Cost-utility ratio (\$ x 1000 per QALY)		
	Sero	Sero + NAT	Sero	Sero + NAT	Sero vs no screen	NAT vs no screen	NAT vs Sero
Country A	1.37	1.38	178	399	130	160	13,839
Country B	2.97	2.98	-23	22	-8	15	9,176
Country C	3.14	3.16	223	584	71	114	20,749
Country D	3.62	3.63	160	340	44	50	18,179
Country E	3.74	3.75	65	209	17	38	13,124
Country F	4.73	4.75	78	227	16	32	7,819
Country H	6.88	6.89	-52	114	-8	24	14,158
Country G	9.03	9.08	1	255	0	28	4,615

Net Health Benefits of Combined Serology + NAT per 100,000 Donations Screened



COST : EFFECTIVENESS

- Small adverse event rates are best assessed by number needed to treat
- The WTP for blood safety interventions in any setting remains unanswered by formal assessment
- Costs of interventions are most relevant near traditional WTP threshold values
- Small adverse event rates drive cost-effectiveness at higher WTP values



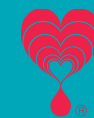
Summary

- CEA contributes information for blood safety decision making by establishing a common denominator
 - Across diseases ★
 - Across settings (much harder to achieve because of different WTP thresholds)
- Can be used to choose between competing alternatives
 - There remain no good examples for this in blood safety
 - Analyses are usually seen (in error) as independent from one another
- The ICER model may not be the appropriate analytical perspective for blood safety
 - Budget Impact
 - Net Benefits Framework and WTP



Thank you for your attention

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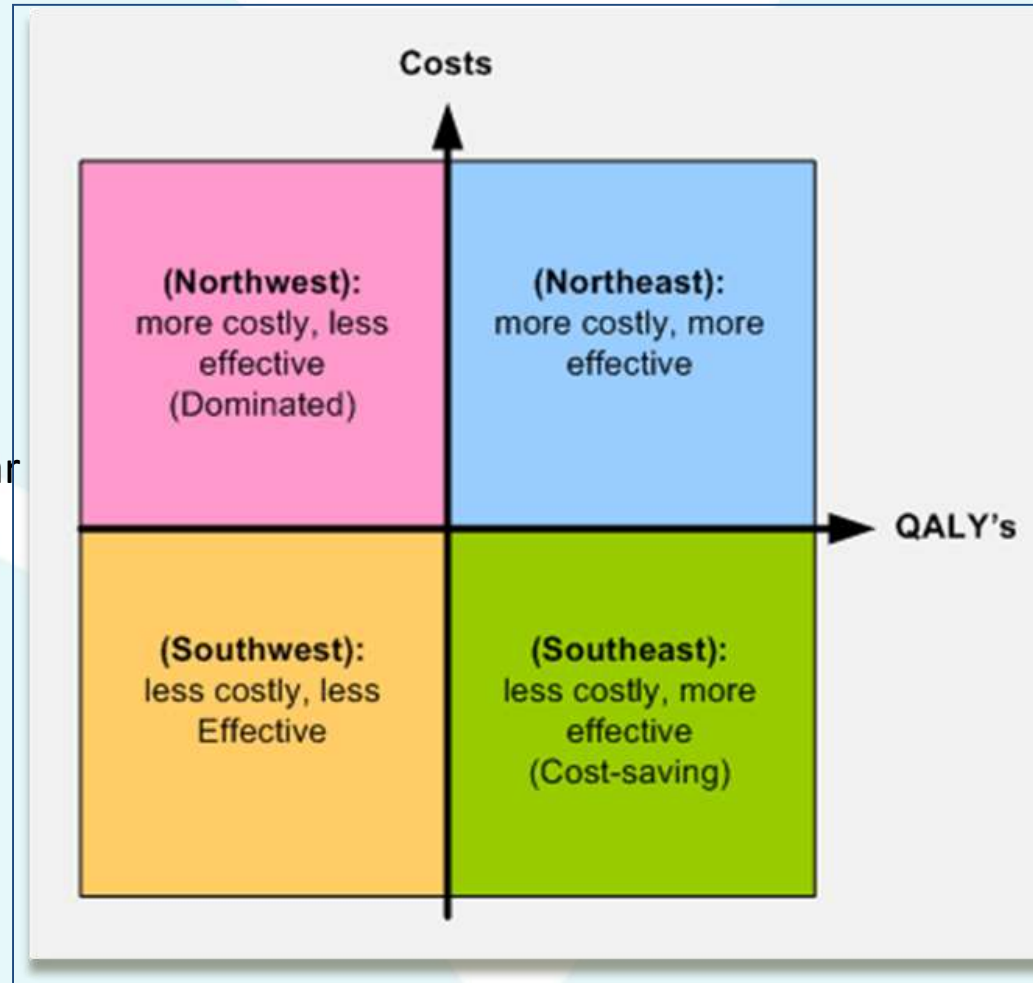
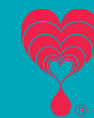
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Economic Evaluation and Modeling

- Basic model comparing 2 interventions

$$\text{ICER} = \frac{\text{Cost A} - \text{Cost B}}{\text{Outcome A} - \text{Outcome B}}$$

- Cost-Effectiveness and Utility vs. Cost-Benefit
- Threshold considerations
 - US\$50,000/quality-adjusted life year
 - WHO suggests: 3 x GDP (~\$120k/QALY for US)
 - Interaction between cost-effectiveness, disease burden, available funds, and other factors
- Capturing influential parameters and uncertainty
 - 1-way
 - Probabilistic (Monte Carlo simulation)



Net Benefits Framework

- Decision making: The net benefit method simplifies the decision making process by rendering it a simple maximization problem. This makes identifying the cost-effective option conceptually more straightforward than under the ICER method where a decision maker must identify the greatest ICER with a value below their WTP threshold.
- Multiple comparator analyses: There is no need to rank order options or to eliminate dominated and extendedly-dominated options in conducting a CE analysis. With the net benefit method a CE analysis consists of calculating NMB for all options plotted across a range of reasonable WTP values.
- Ability to rank CE of options: The NMB method allows options to be easily ranked at a given WTP threshold from most cost-effective to least cost-effective. This may be particularly useful when some options included in an analysis are not available in a particular geographic region or when it is necessary to offer providers and patients treatment alternatives.