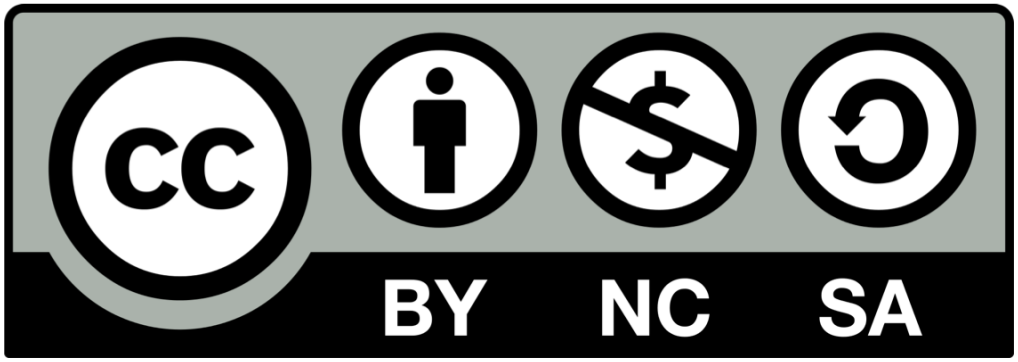
TVEE
TEACHING VACCINE ECONOMICS EVERYWHERE

Reporting and Interpreting Results of Economic Evaluation

TVEE
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Overview

- Understanding a CEA Plane
- Willingness-to-Pay Threshold
- ICER calculation, incremental ratios and dominance
- Interpreting ICER/ICUR
  - Perspective
  - Time Horizon
- Reporting Quality of Analysis
  - Impact Inventory (Second Panel)
  - CHEERS Checklist
  - QHES Assessment Instrument

Objectives

- To provide background on the rationale and importance of Decision Analysis (DA) and Cost-effectiveness Analysis (CEA)

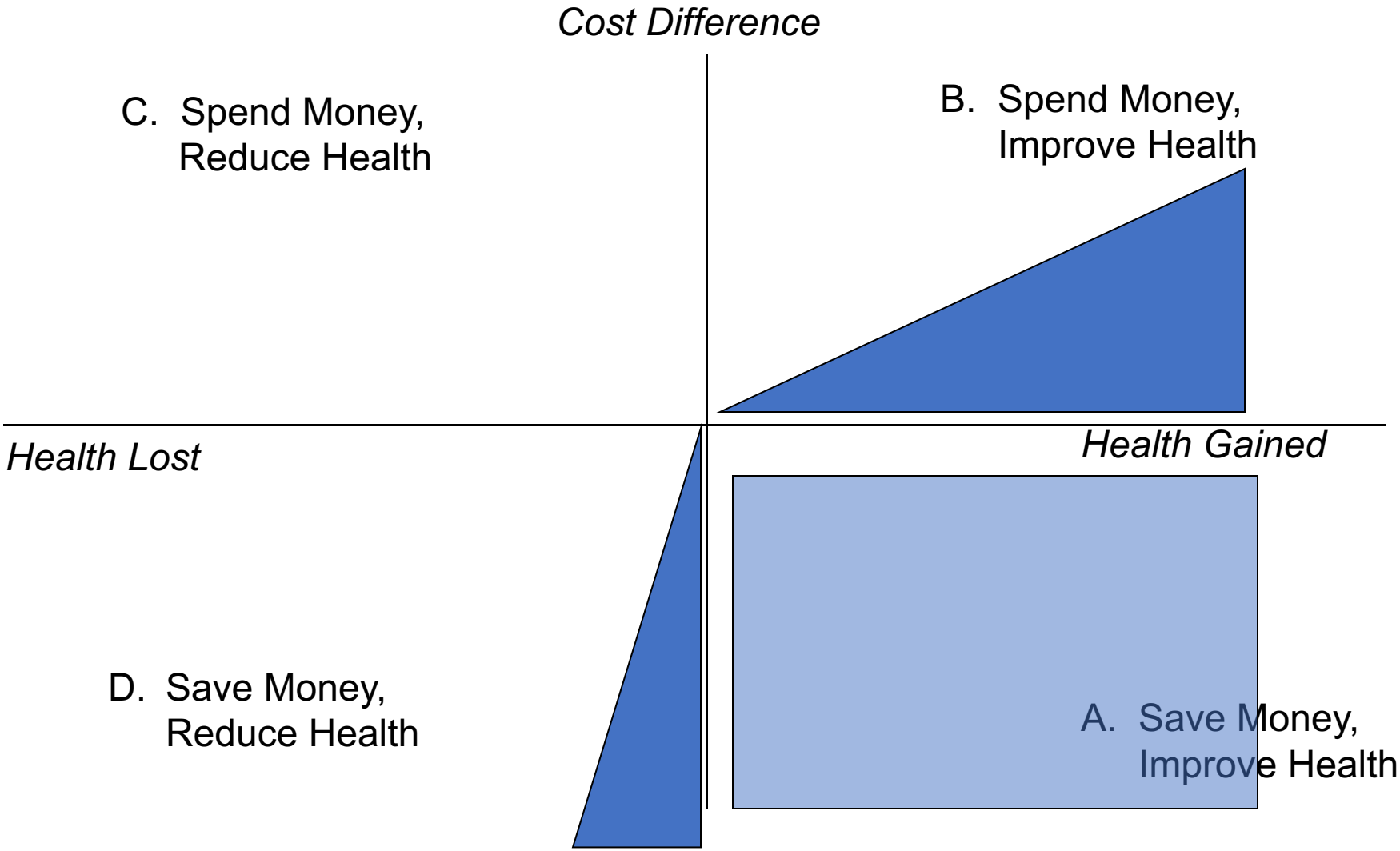
- To explain the theoretical foundations DA/CEA

Types of Analysis

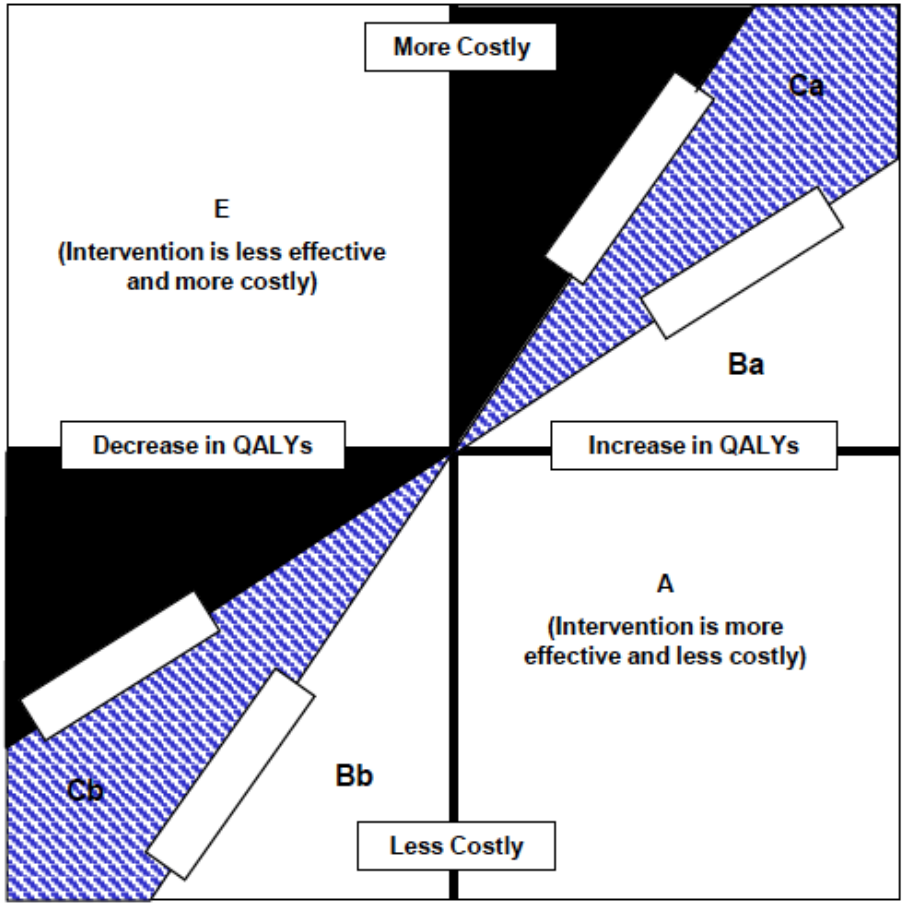
Type of Analysis	Input/Cost	Outcomes
Cost Minimization	Monetary terms ($)	Not considered
Cost-Effectiveness	Monetary terms ($)	Natural units (e.g. child mortality/morbidity)
Cost-Utility	Monetary terms ($)	Utility measures (QALYs, DALYs, etc.)
Cost-Benefit	Monetary terms ($)	Monetary terms ($) (capture wider range of benefits)

UNDERSTANDING THE COST-EFFECTIVENESS ANALYSIS (CEA) PLANE

Four Regions in Space



Grades for Adoption of New Vaccines



A: Compelling evidence for adoption

B: Strong Evidence

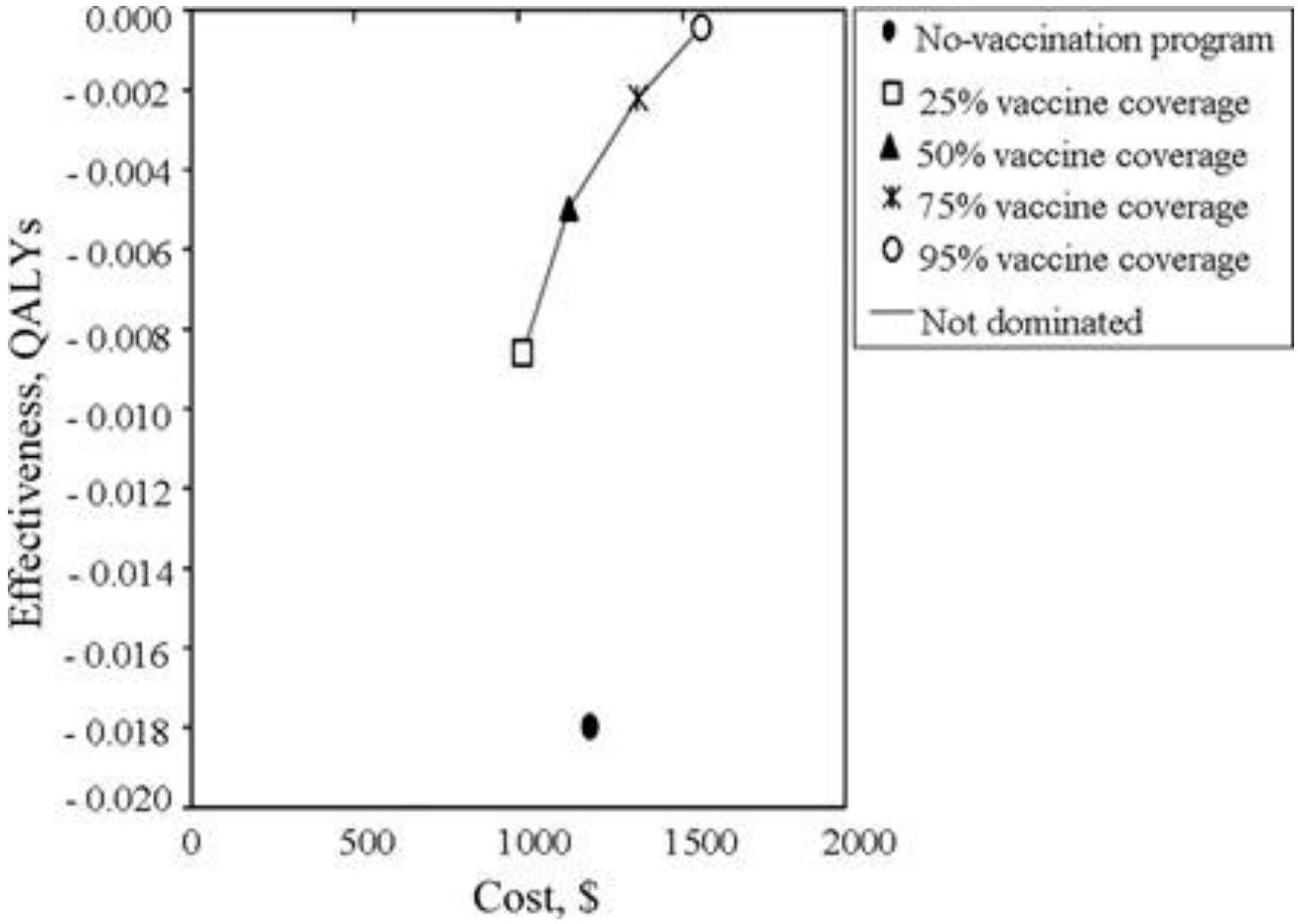
C: Moderate

D: Weak

E: Compelling evidence for rejection

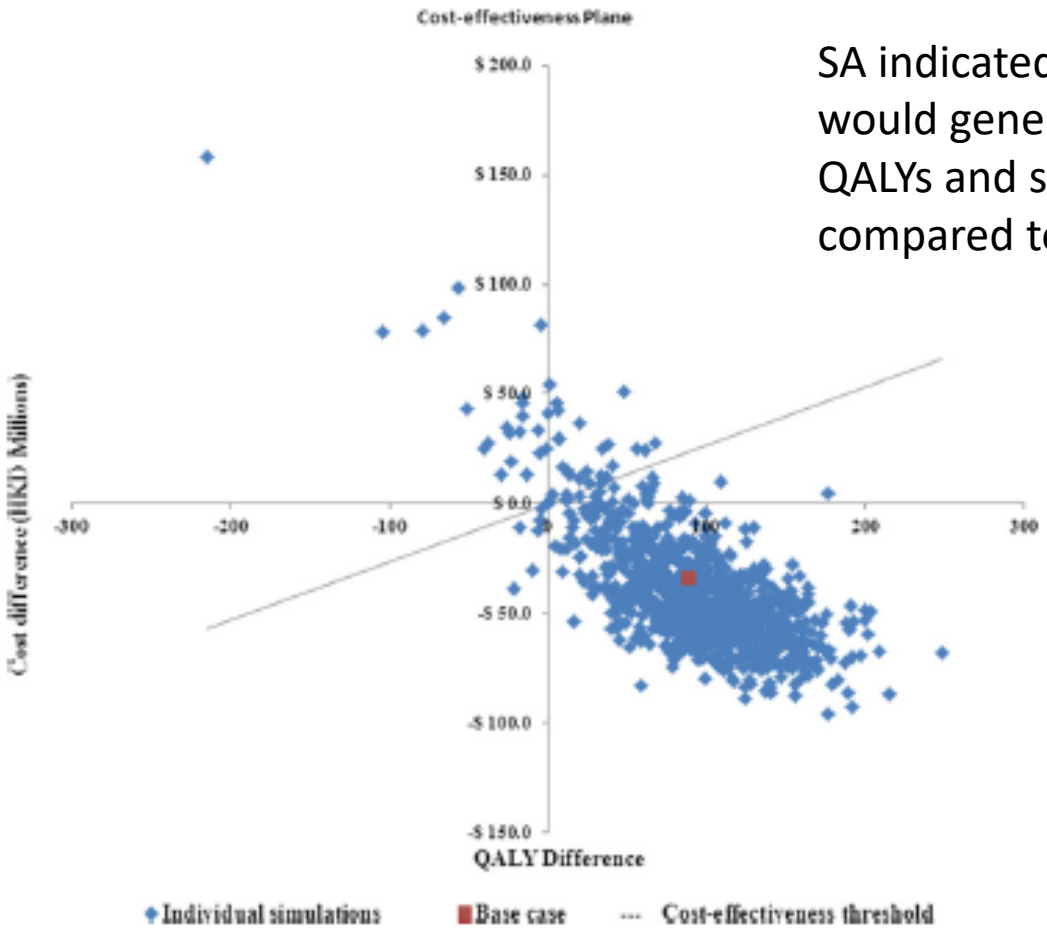
Laupacis, Andreas, et al. "How attractive does a new technology have to be to warrant adoption and utilization? Tentative guidelines for using clinical and economic evaluations." CMAJ: Canadian Medical Association Journal 146.4 (1992): 473.

Example 1
Efficiency Curve/ Efficient Frontier



Greer, A., & Fisman, D. (2011). Use of Models to Identify Cost-effective Interventions: Pertussis Vaccination for Pediatric Health Care Workers. *P EDIATRICS*. doi:10.1542/peds.2010-0796

Example 2: PCV-10 vs. PCV-13



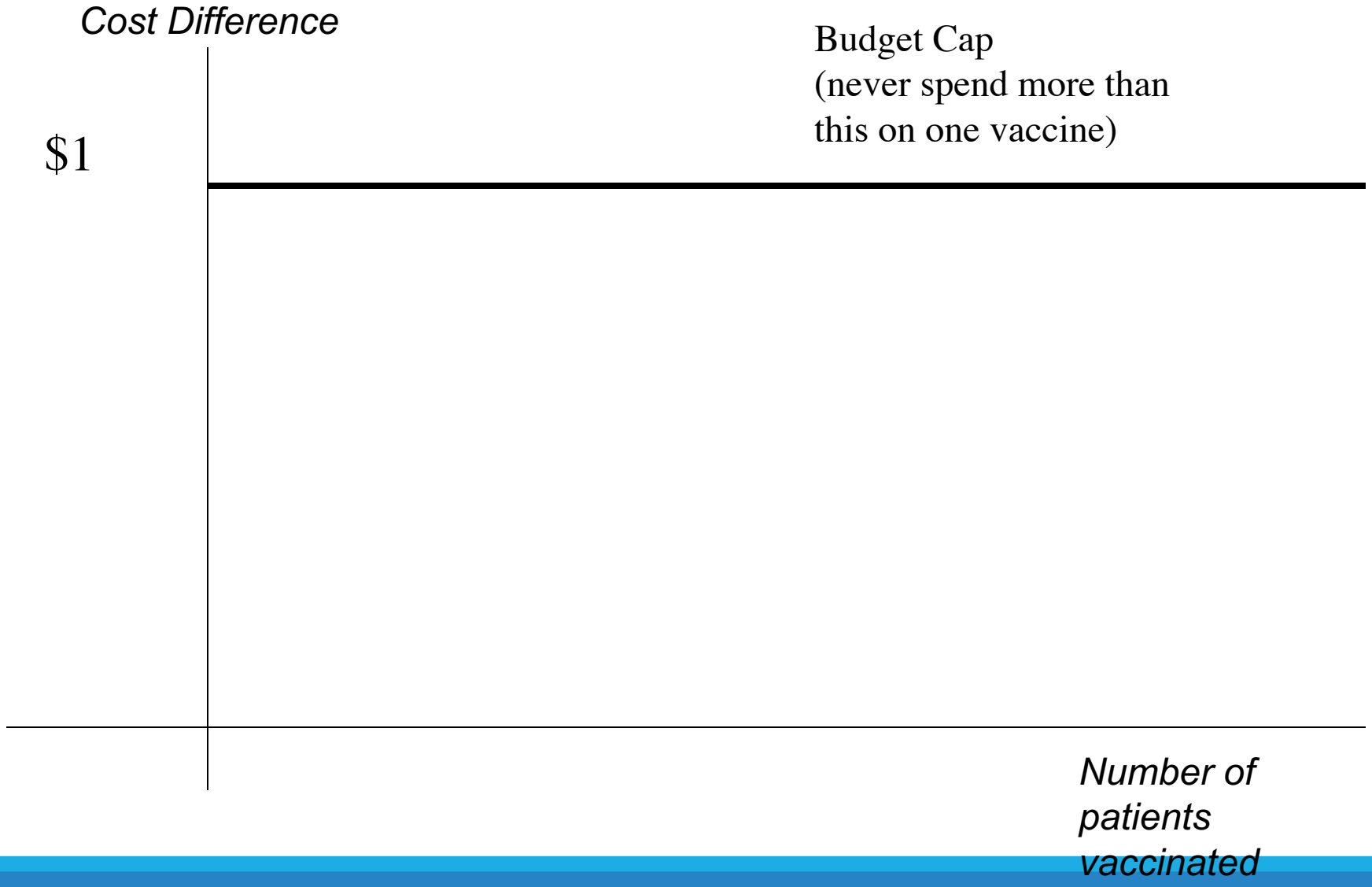
SA indicated that PCV-10 would generate more QALYs and save costs compared to PCV-13

Fig. 5 – Probabilistic sensitivity analysis PCV-10 versus PCV-13 in Hong Kong. WHO highly cost-effectiveness threshold for Hong Kong is less than GDP per capita (Hong Kong GDP per capita is HKD 266,026) [38,40]. GDP, gross domestic product; HKD, Hong Kong dollars; PCV-10, pneumococcal nontypeable *Haemophilus influenzae* protein D conjugate vaccine; PCV-13, 13-valent pneumococcal conjugate vaccine; QALY, quality-adjusted life-year; WHO, World Health Organization.

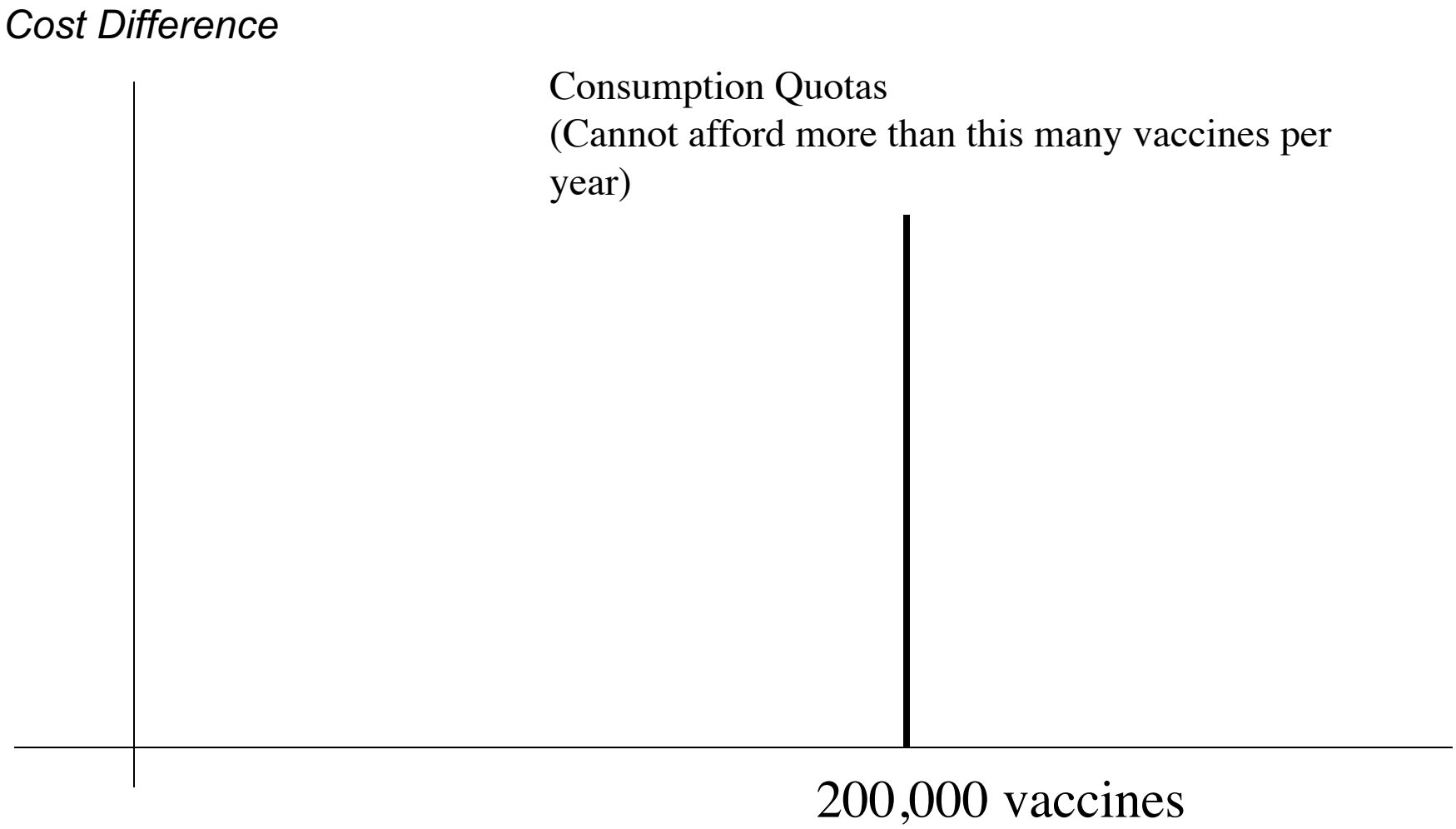
Lee, Kenneth KC, et al. "The health economic impact of universal infant vaccination with the 10-valent pneumococcal nontypeable Haemophilus influenzae protein D conjugate vaccine as compared with 13-valent pneumococcal conjugate vaccine in Hong Kong." Value in Health Regional Issues 2.1 (2013): 64-74.

WILLINGNESS-TO-PAY THRESHOLD

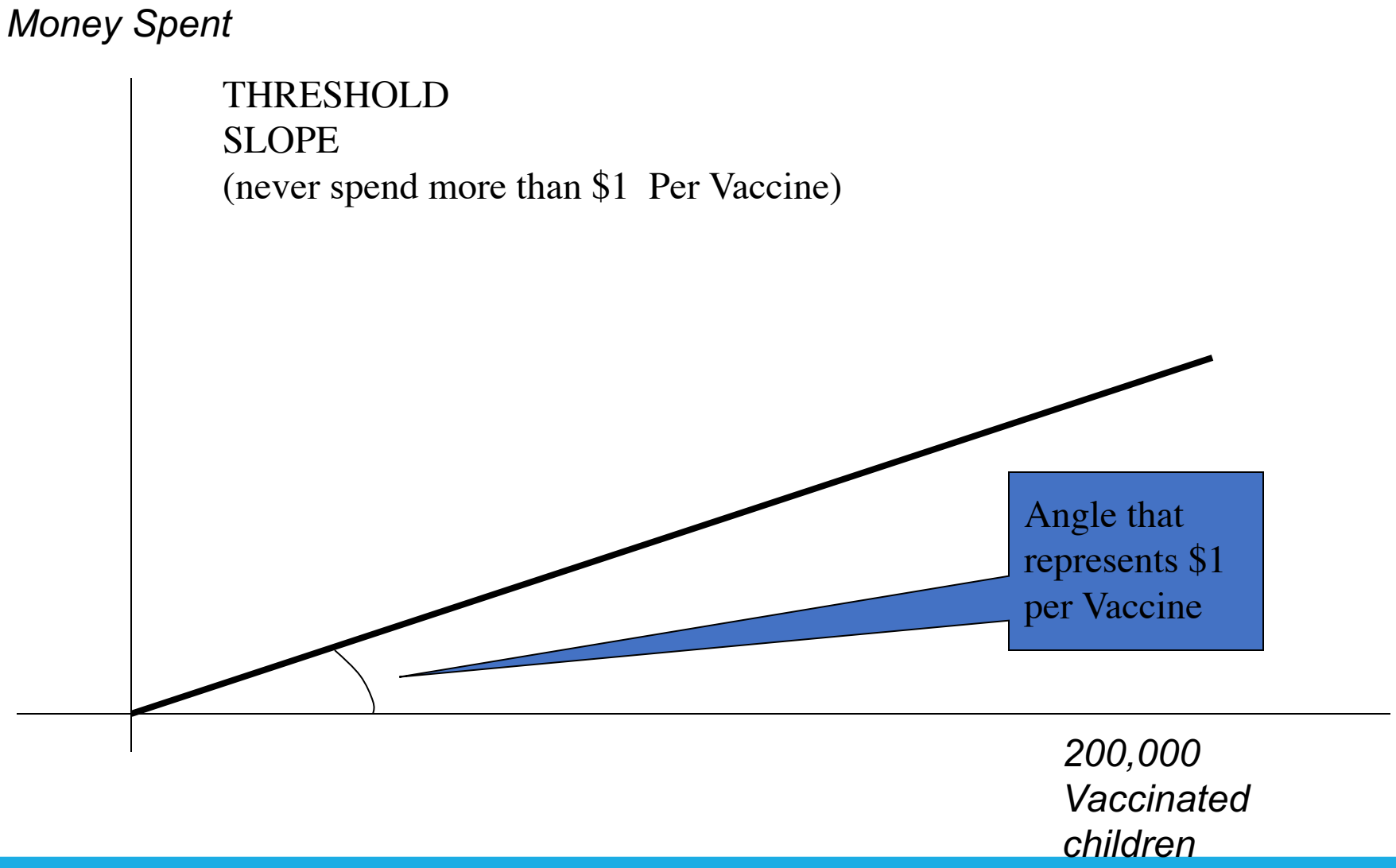
Spending On Vaccine: The Heartbreak Of Budget Caps



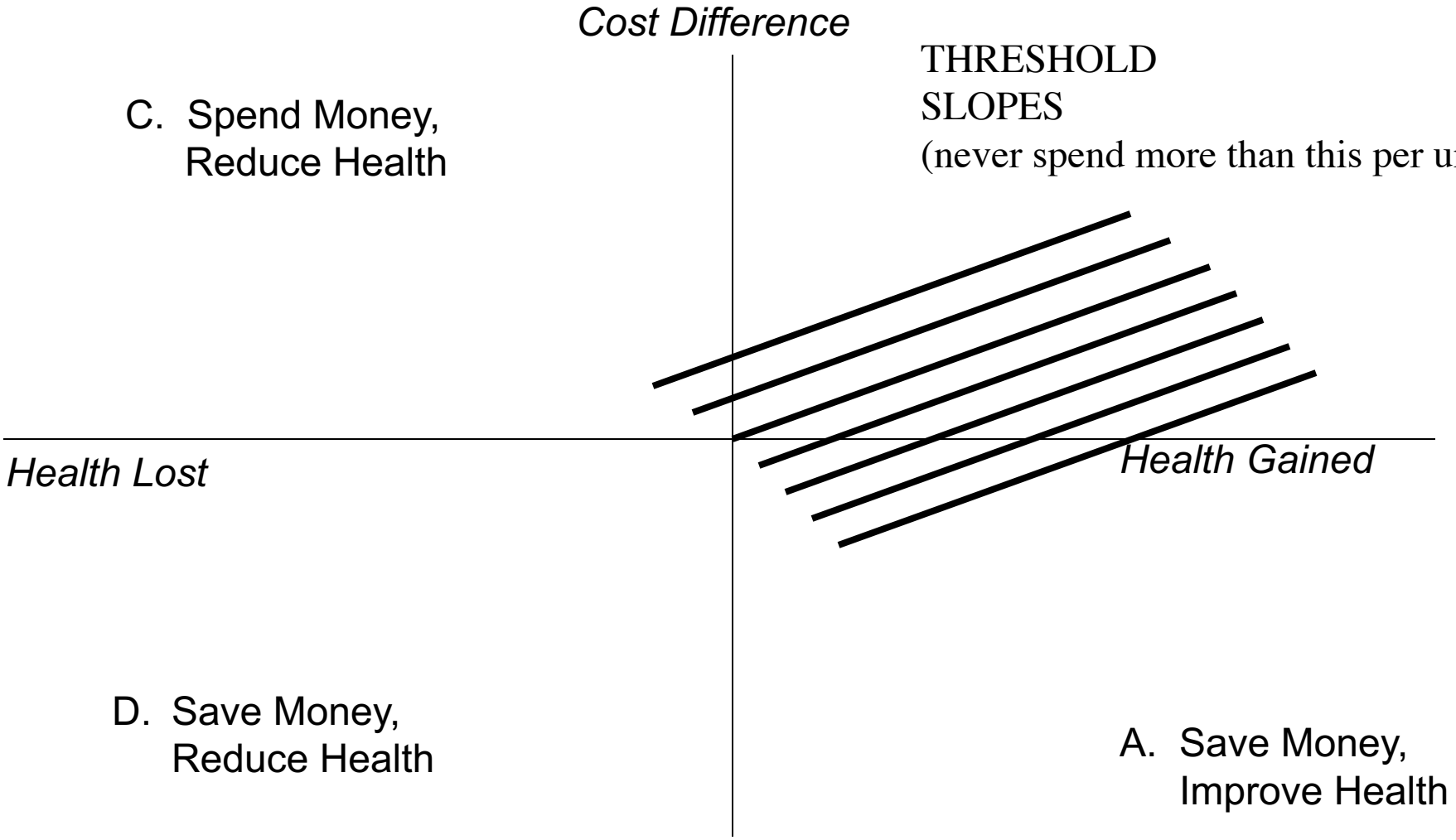
Spending On Vaccine: The Sorrow Of Consumption Quotas



Spending On Vaccines: The Sorrow Of Consumption Quotas

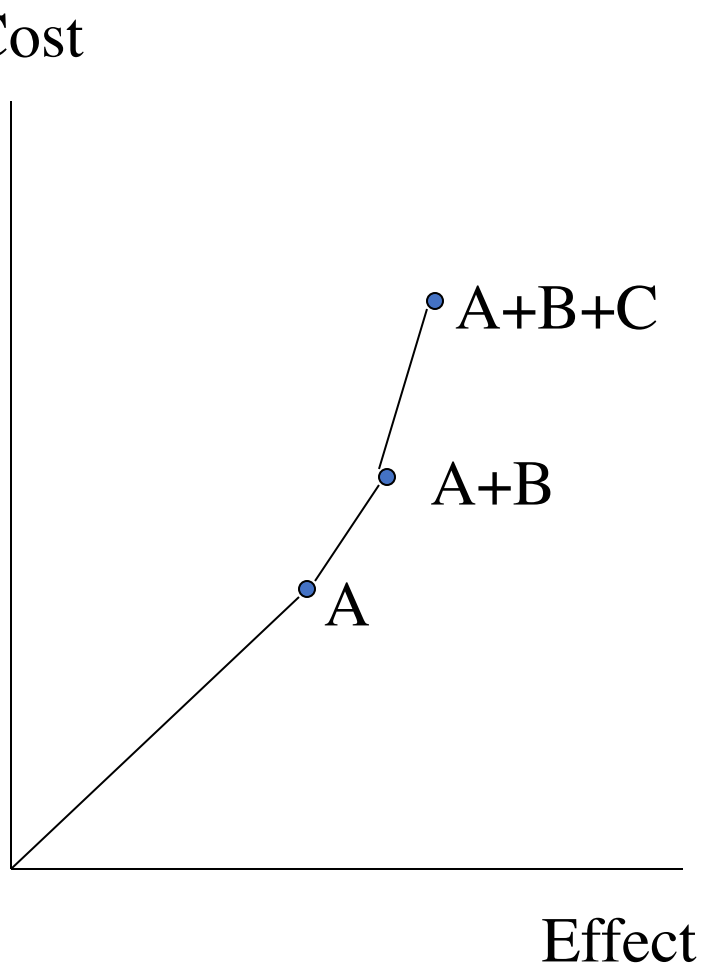


Price Thresholds are Efficient



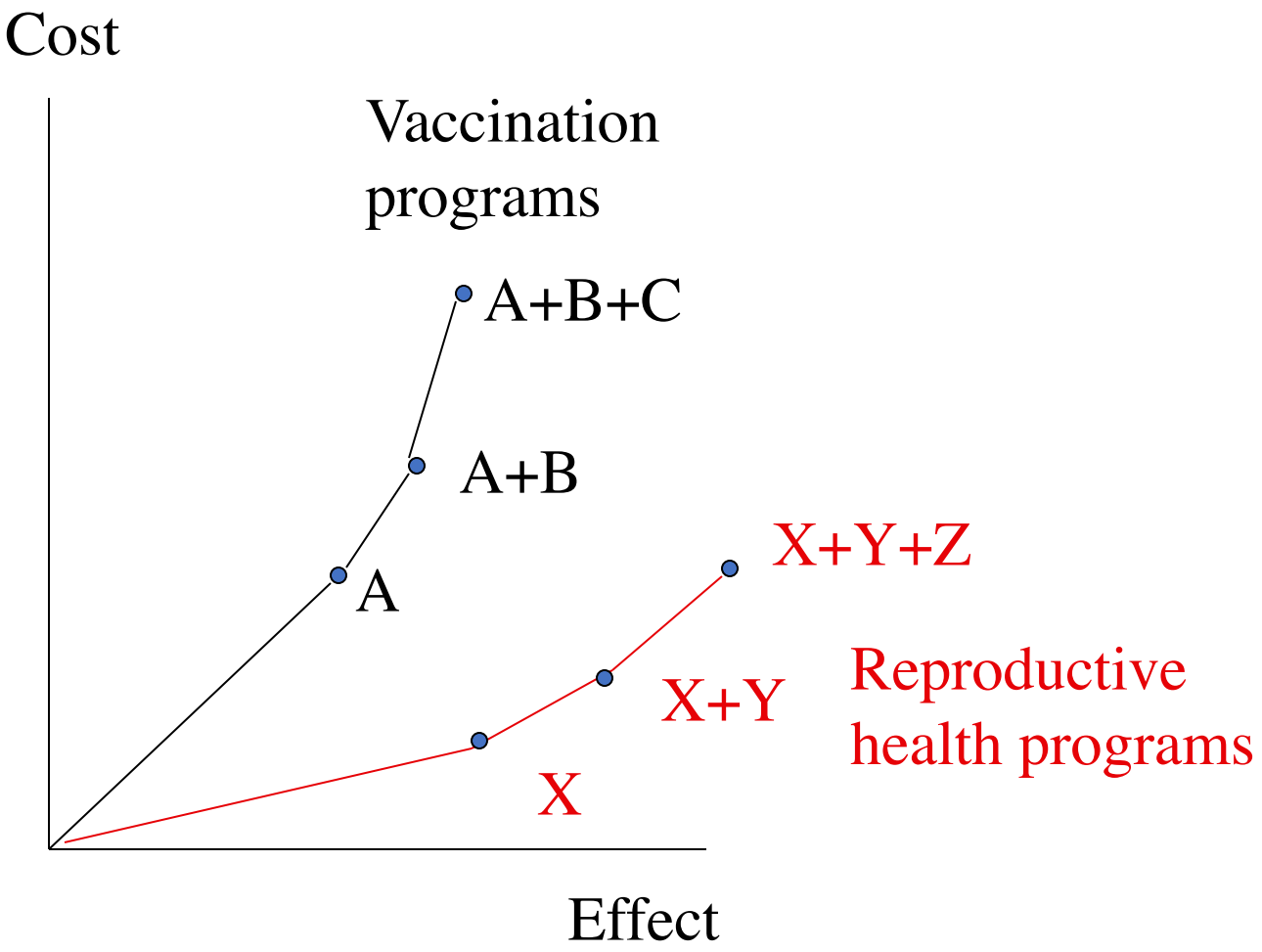
Health Programs in Region B

	Cost In $100	Effect	C/E	ΔC	ΔE	ΔC/ΔE (ICER)
Ø	$0	0	0	NA	NA	NA
A	$100	100	1	100	100	$1 per YLL saved
A+B	$150	140	1.1	50	40	$1.25 per YLL
A+B+C	$200	165	1.2	50	25	$2 per YLL

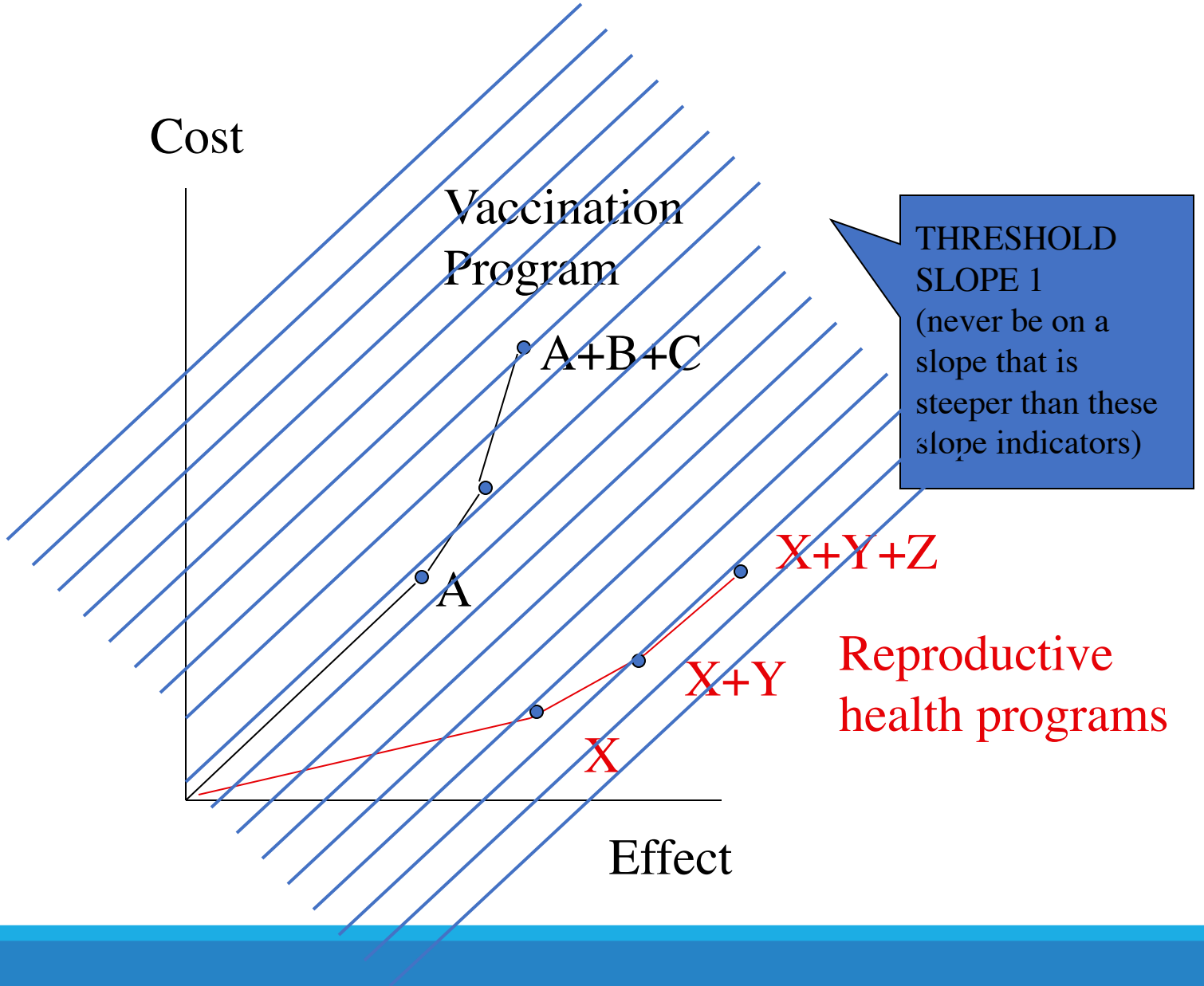


YLL is “year of life lost”

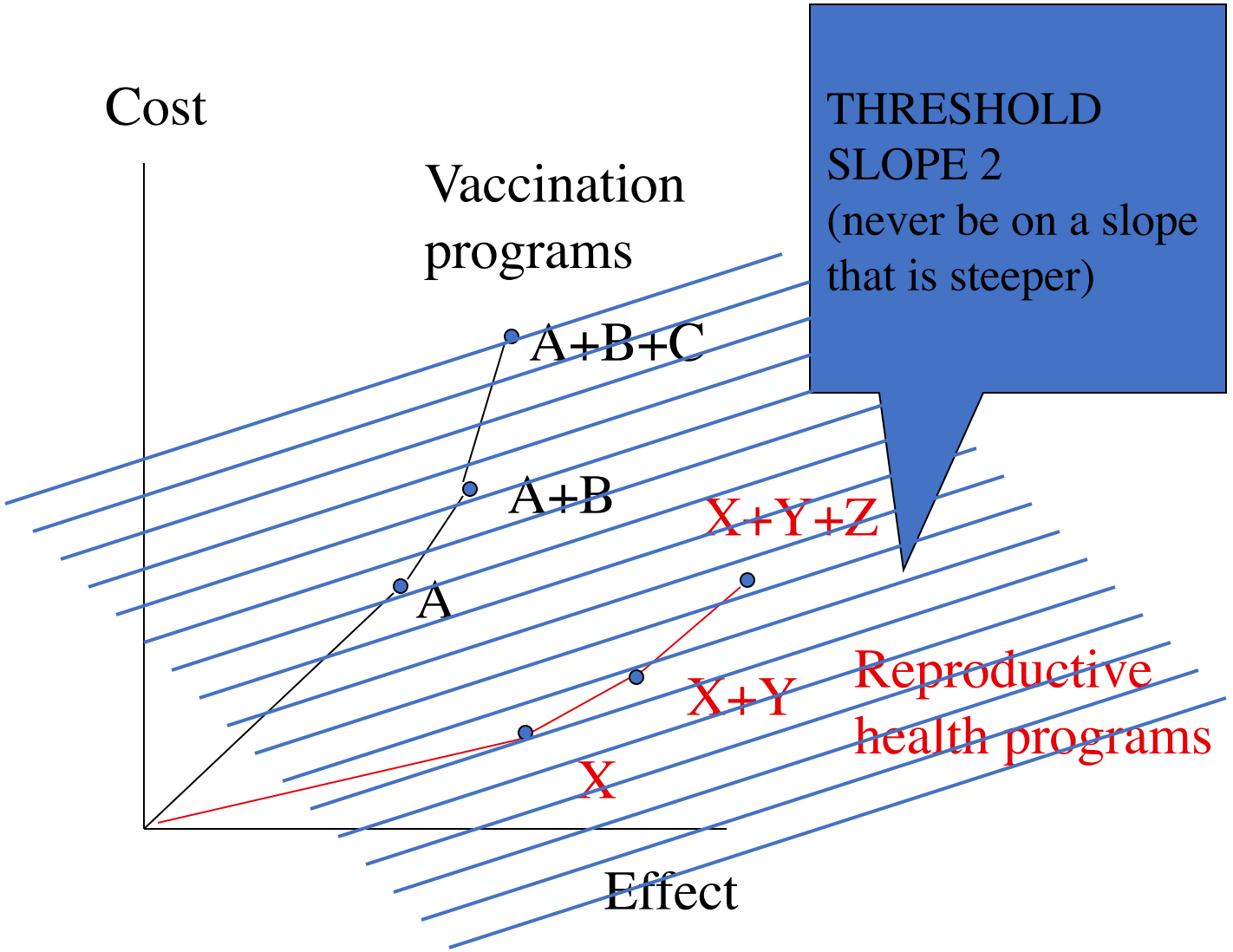
Choose your Strategy



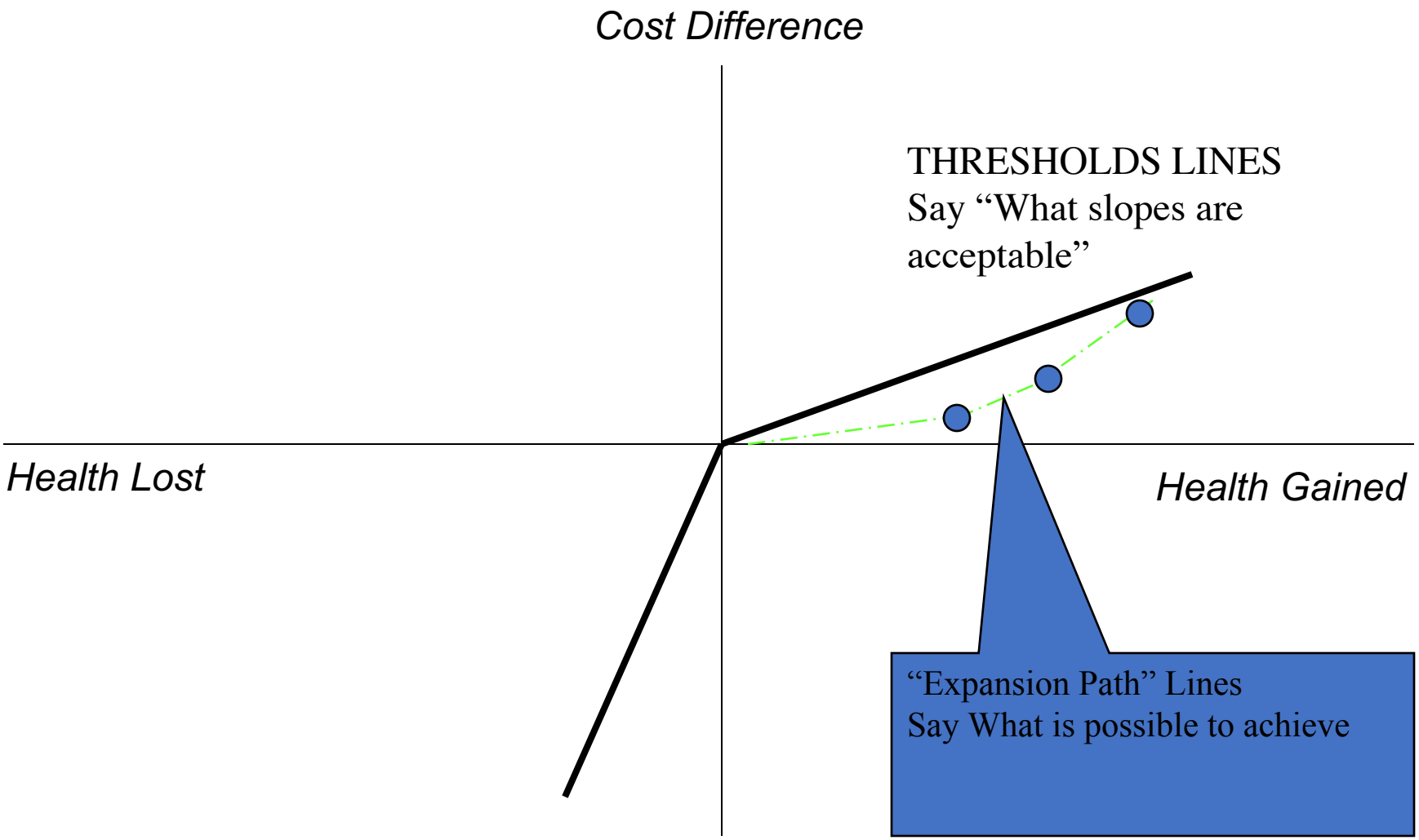
High Willingness To Pay



Low Willingness To Pay



Two Kinds of Lines



Willingness-to-Pay Thresholds

- 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.

Marseille, Elliot, et al. "Thresholds for the cost–effectiveness of interventions: alternative approaches." Bulletin of the World Health Organization 93.2 (2015): 118-124.

Willingness-to-Pay Threshold

- 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. Method

Cost per QALY	Accepted	Restricted	Rejected
< £20,000	14	3	1
£20,000 - £30,000	0	4	0
> £30,000	1	4	3

Source: Towse and Pritchard, 2002

ICER CALCULATION, INCREMENTAL RATIOS AND DOMINANCE

Incremental cost-effectiveness ratio (ICER)

Incremental Thinking

- Compare one alternative with another
  - Start by comparing the least expensive to the 2nd most expensive, to the 2nd most expensive, to the 3rd most expensive, etc.
- Focus on
  - Difference in costs: $Cost_O - Cost_N$
  - Difference in effects: $Effect_O - Effect_N$
  - where O is Old intervention and N is New intervention

	Effectiveness Decreases	Effectiveness Increases
Cost Increases	Never Do	Cost-effective
Cost Decreases	Cost-effective	Always Do

Incremental cost-effectiveness ratio (ICER)

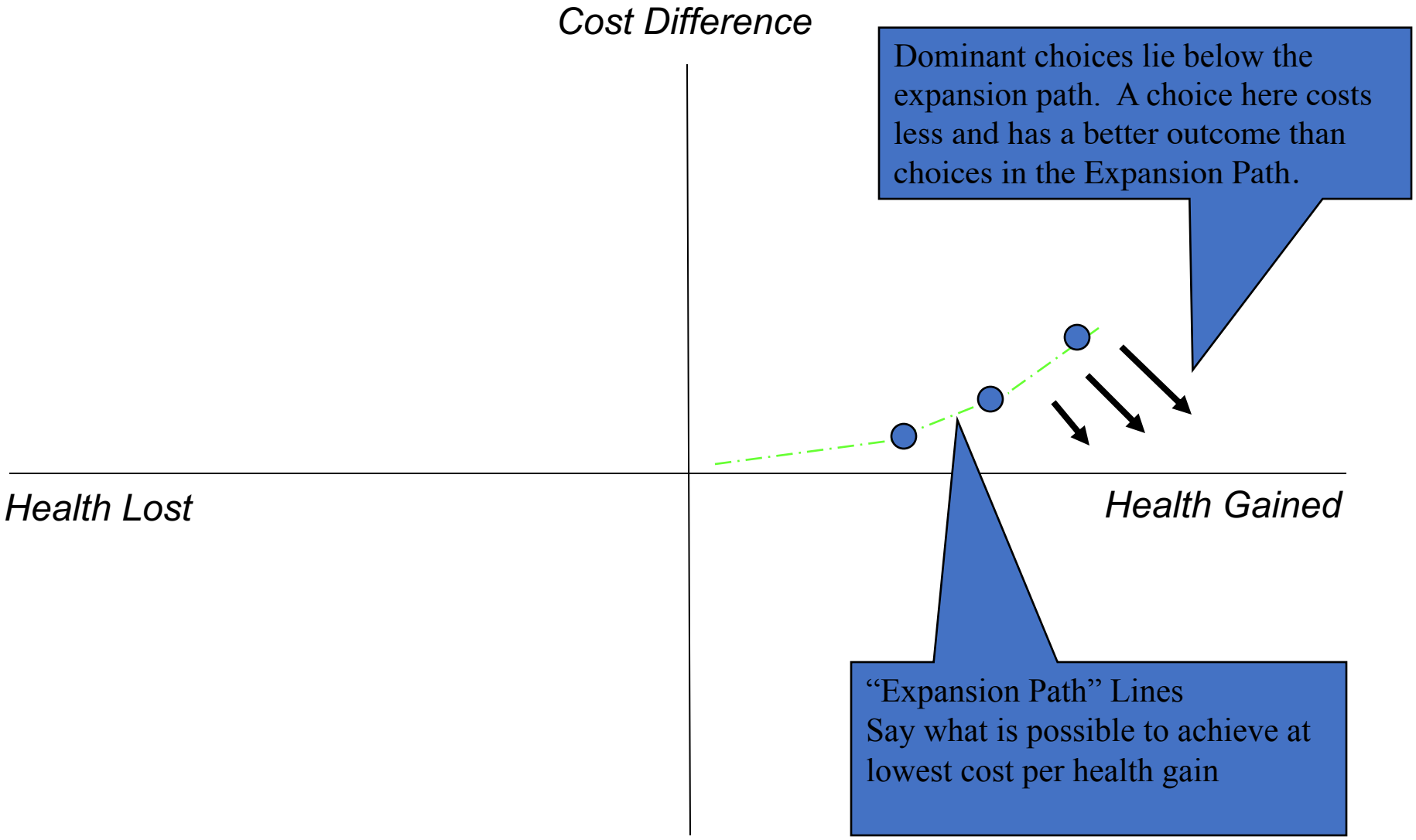
- Defined as the ratio between the incremental cost and the incremental effect between two interventions

$$\frac{Cost_O - Cost_N}{Effect_O - Effect_N} = \frac{\Delta\ Cost}{\Delta\ Effect} = ICER$$

Net Monetary Benefit

$$NMB = (WTP * \Delta Effect) - \Delta Cost$$

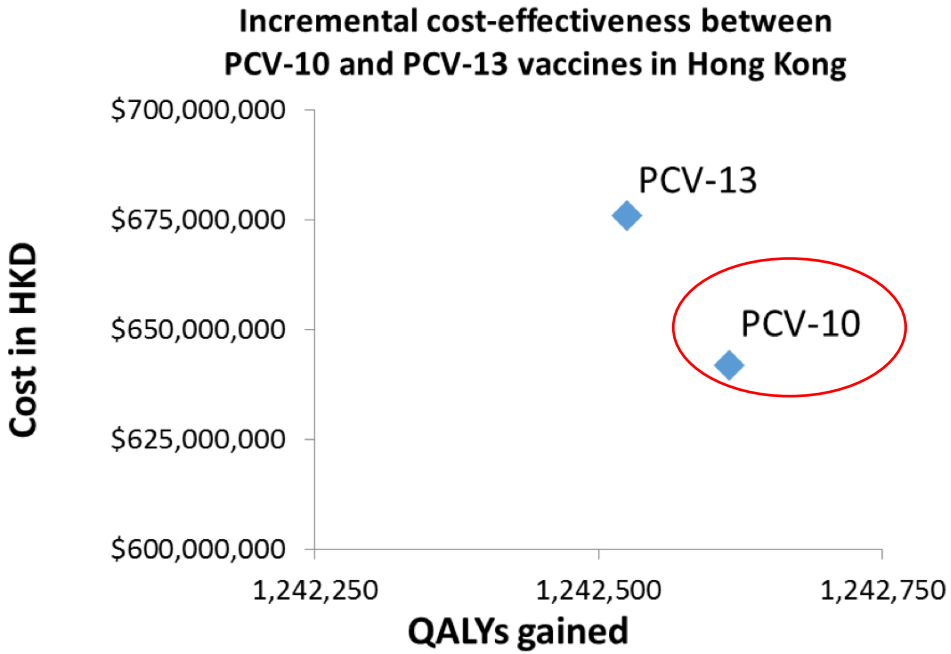
Strong Dominance



Strong Dominance Example

Cost-effectiveness of infant vaccination with the 10-valent pneumococcal (PCV-10) vaccine vs. the current 13-valent (PCV-13), in Hong Kong in 2011

- PCV-10 exhibits dominance because it has a lower cost and higher health gains (e.g. QALYs gained) compared to PCV-13



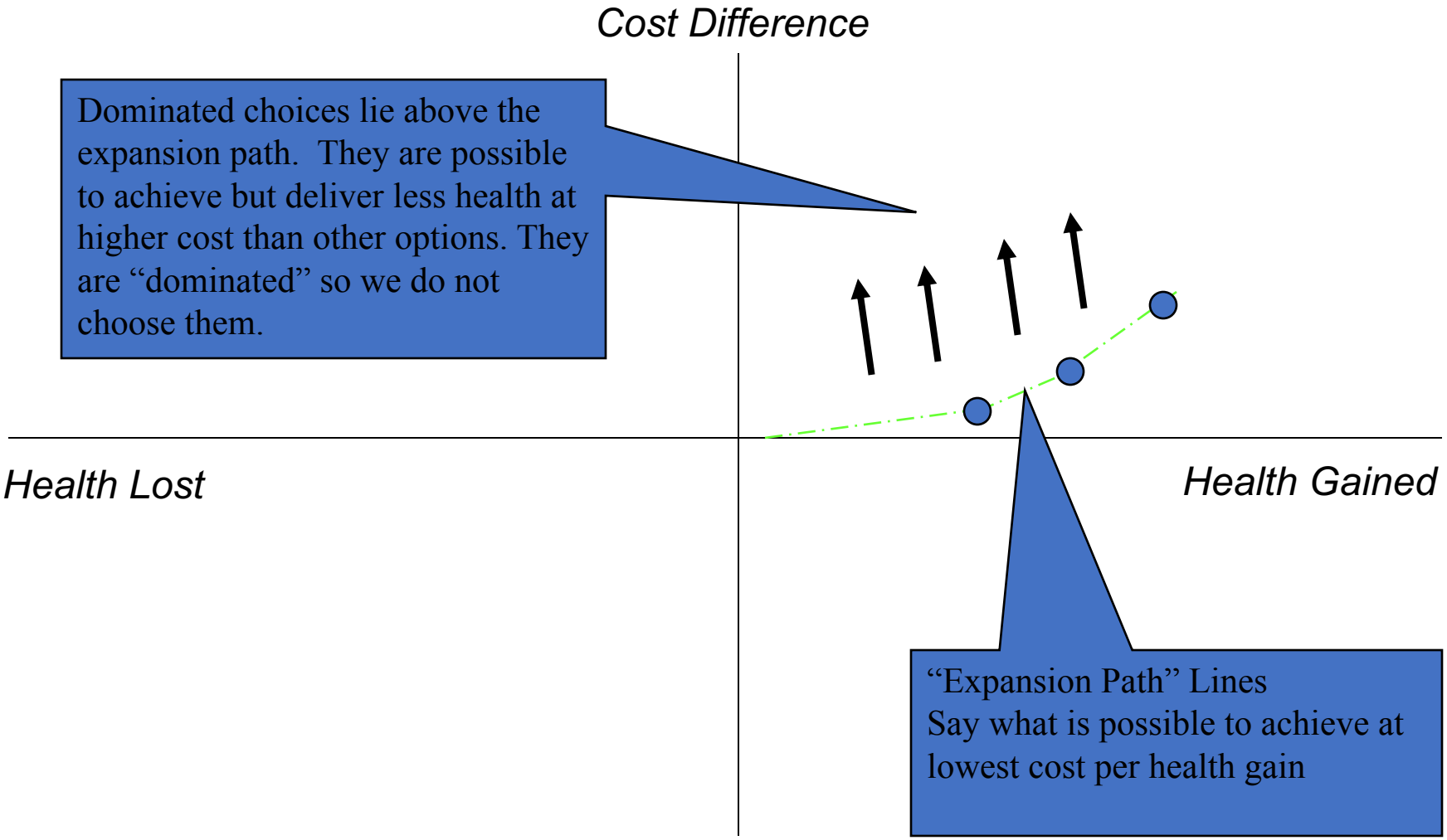
Lee, Kenneth KC, et al. "The health economic impact of universal infant vaccination with the 10-valent pneumococcal nontypeable Haemophilus influenzae protein D conjugate vaccine as compared with 13-valent pneumococcal conjugate vaccine in Hong Kong." Value in Health Regional Issues 2.1 (2013): 64-74.

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

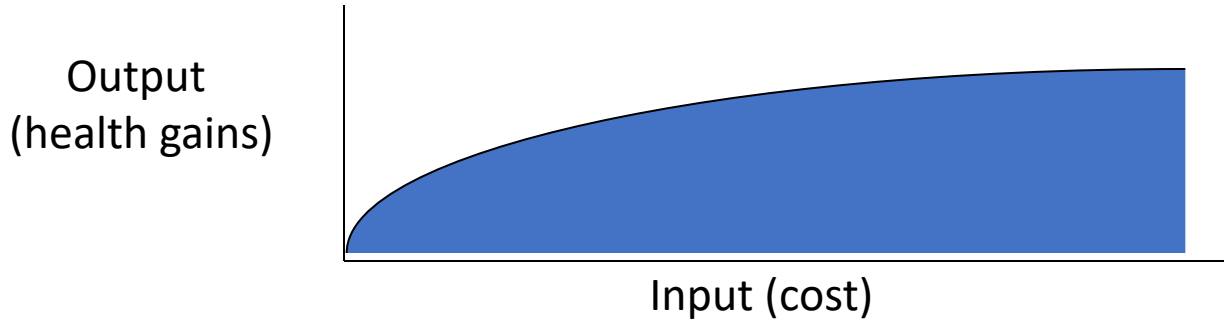
Alternative	Cost	QALYs
PCV-10	$641,860,544	1,242,615
PCV-13	$675,994,429	1,242,525

Dominated Choices



Eliminating Dominated Alternatives Graphically

- Non-dominated alternatives get increasingly flatter as we move from less expensive to more expensive undominated alternatives
- Graph should resemble a “production function”
  - First unit of input produces more output than next unit of input and this trend continues
  - Creates a graph looking like the one below



REPORTING ON QUALITY OF ANALYSIS

CHEERS Checklist

- **Aim:** Provide recommendations, in the form of a checklist, to optimise reporting of health economic evaluations
- **Primary Audience:** Researchers reporting economic evaluations, the editors and peer reviewers evaluating their publication potential
- Consists of a **24 item checklist** with recommendations on the minimum amount of information to be included
  - Check list can be found on the ISPOR Health Economic Evaluations Publication Guidelines Task Force website: (www.ispor.org/Task- Forces/EconomicPubGuidelines.asp)

Husereau, Don, et al. "Consolidated health economic evaluation reporting standards (CHEERS) statement." CE & Resource Allocation 11.1 (2013): 6.

CHEERS Checklist - full list of items discussed

Title and abstract

1. Title
2. Abstract

Introduction

3. Background & Objectives

Methods

4. Target Population & subgroups
5. Setting and location
6. Study perspective
7. Comparators
8. Time horizon
9. Discount rate
10. Choice of health outcomes
11. Measurement of effectiveness
12. Measurement and valuation of preference based outcomes
13. Estimating resources and costs
14. Currency, price date, and conversion
15. Choice of model
16. Assumptions
17. Analytical methods

Results

18. Study parameters
19. Incremental costs and outcomes
20. Characterizing uncertainty
21. Characterizing heterogeneity

Discussion

22. Study findings, limitations, generalizability, and current knowledge

Other

23. Source of funding
24. Conflicts of interest

Husereau, Don, et al. "Consolidated health economic evaluation reporting standards (CHEERS) statement." CE & Resource Allocation 11.1 (2013): 6.

QHES Assessment

- Instrument designed to evaluate all 3 types of health economic analyses
  - cost-minimization
  - cost-effectiveness
  - cost-utility
- **Consists of 16 criteria** (based on criteria included in 19 existing guidelines and checklists for cost-effectiveness evaluations)
- Each criterion has a weighted point value
  - generated using random-effects general least-squares regression
- The perfect quality score for a study is 100

Ofman, Joshua J., et al. "Examining the value and quality of health economic analyses: implications of utilizing the QHES." Journal of Managed Care Pharmacy 9.1 (2003): 53-61.

QHES Assessment

TABLE 1 The QHES Instrument

	Questions	Points	Yes	No
1.	Was the study objective presented in a clear, specific, and measurable manner?	7		
2.	Were the perspective of the analysis (societal, third-party payer, etc.) and reasons for its selection stated?	4		
3.	Were variable estimates used in the analysis from the best available source (i.e., randomized control trial - best, expert opinion - worst)?	8		
4.	If estimates came from a subgroup analysis, were the groups prespecified at the beginning of the study?	1		
5.	Was uncertainty handled by (1) statistical analysis to address random events, (2) sensitivity analysis to cover a range of assumptions?	9		
6.	Was incremental analysis performed between alternatives for resources and costs?	6		
7.	Was the methodology for data abstraction (including the value of health states and other benefits) stated?	5		
8.	Did the analytic horizon allow time for all relevant and important outcomes? Were benefits and costs that went beyond 1 year discounted (3% to 5%) and justification given for the discount rate?	7		
9.	Was the measurement of costs appropriate and the methodology for the estimation of quantities and unit costs clearly described?	8		
10.	Were the primary outcome measure(s) for the economic evaluation clearly stated and did they include the major short-term was justification given for the measures/scales used?	6		
11.	Were the health outcomes measures/scales valid and reliable? If previously tested valid and reliable measures were not available, was justification given for the measures/scales used?	7		
12.	Were the economic model (including structure), study methods and analysis, and the components of the numerator and denominator displayed in a clear, transparent manner?	8		
13.	Were the choice of economic model, main assumptions, and limitations of the study stated and justified?	7		
14.	Did the author(s) explicitly discuss direction and magnitude of potential biases?	6		
15.	Were the conclusions/recommendations of the study justified and based on the study results?	8		
16.	Was there a statement disclosing the source of funding for the study?	3		
	TOTAL POINTS	100		

Ofman, Joshua J., et al. "Examining the value and quality of health economic analyses: implications of utilizing the QHES." Journal of Managed Care Pharmacy 9.1 (2003): 53-61.

Case study review and application of the IMPACT/CHEERS checklist to score the quality of the study

Impact and Cost-Effectiveness of *Haemophilus influenzae* Type b Conjugate Vaccination in India

Andrew D. Clark, MA[1], Ulla K. Griffiths, PhD[1], Syed Shahid Abbas, MBBS, MPH[2], Krishna D. Rao, PhD[2], Lois Privor-Dumm, MIBS[3], Rana Hajjeh, MD[4], Hope Johnson, PhD[3], Colin Sanderson, MA, MSc, PhD[1], and Mathuram Santosham, MD, MPH[3]

Clark, Andrew D., et al. "Impact and cost-effectiveness of Haemophilus influenzae type b conjugate vaccination in India." The Journal of pediatrics 163.1 (2013): S60-S72.

CHEERS 24 item Checklist

Title and abstract	
1. Title (describe economic evaluation & interventions)	- Compares the Hib vaccine and status-quo in CEA.
2. Abstract (structured summary of obj, perspective, setting, methods--design & inputs, results--base case & SA, conclusion)	-Impact & CEA of Hib vaccine -Government Perspective, -State level analysis from India -Decision model & 2nd effects and cost data. -US$192-1,033/DALY averted (gov.t perspective) OR US$155-939/DALY averted (gov.t perspective). SA of key parameters. -CE under WHO guidelines. Hib increased costs are offset by healthcare savings
Introduction	-National safe & effective Hib vaccine implemented in most countries but slow adoption in India. Mixed regional evidence. Lack of consensus on CE of national coverage in India. -Estimate state level and national level CE of Hib vaccine (compared to status-quo assumed) -Help decision-makers invest in the health interventions that provide greatest health returns per money invested
3. Background & Objectives (Explicit context for the study, study question, and policy relevance)	
Methods	
4. Target Population	All children in India under 5 years of age with Hib disease
5. Setting and location	State-level estimates
6. Study perspective	Societal: Including costs incurred by the Indian Government, the GAVI Alliance, and Indian households
7. Comparators	Hib vs. non-Hib conjugate vaccination

8. Time horizon	Aggregated costs & benefits of routine vaccination over 20 years, 2012-31 -Vaccine costs occur during the 1st year of each cohort. -Disease cases, deaths, and treatment costs estimated for 1st 5 yrs. of age -DALYs and squealed costs estimated over lifetime.
9. Discount rate	Costs and health benefits discounted by 3%/year
10. Choice of health outcome	-Primary health outcomes: Hib related lives saved and DALYs averted -Secondary health outcomes: No. of Hib cases: Hib Meningitis, Hib Pneumonia, Hib NPNM, and sequelae, outpatient visits, hospitalizations, -Population simulation model parameters: births, infant mortality, mortality of under-5 yrs. olds, LE, vaccine coverage and efficacy
11. Measurement of effectiveness	-Secondary literature for both primary and secondary health outcomes. -For DALYs: age distribution of Hib disease, disability weights, incidence of sequelae cases
12. Measurement and valuation of preference based outcomes	N/A, used DALYs
13. Estimating resources and costs	Health care: outpatient and hospital cost at public and private facilities (varied by level and type), traditional healers and drugs, -Household medical expenses for respiratory ailments in children <5 years old by type (medicines, user fees, lodging, transport, etc.) -Opportunity costs (time spent while looking after a sick child) -Government costs (from micro-simulation study) & NGO costs -Hib Conjugate Vaccine Cost
14. Currency, price date, and conversion	Secondary literature for price data. Costs were estimated in 2010 US$ using an exchange rate of 45.7 Indian rupees for one US$

15. Decision-analytical model used

Figure 1. Hib CEA decision model used in prior literature, Clark et al (2012)

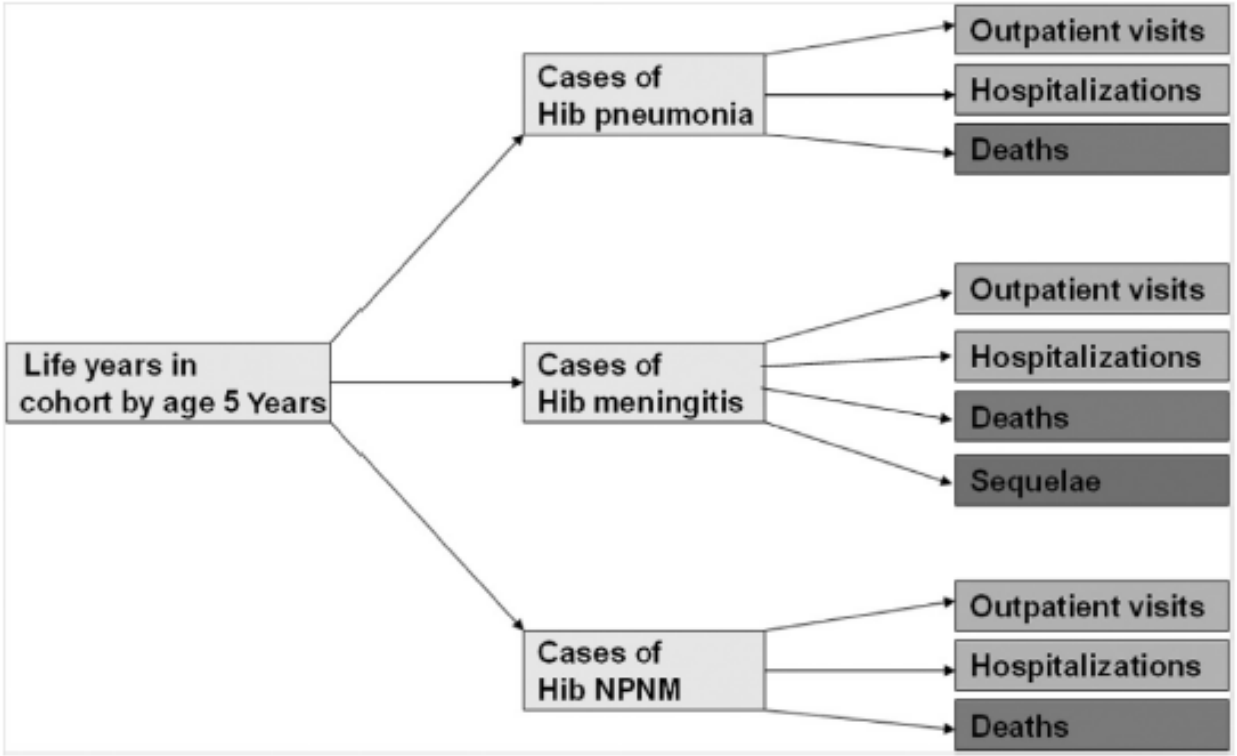


Figure 1. Simplified structure of the Hib disease burden model.

Clark, Andrew D., et al. "Impact and cost-effectiveness of Haemophilus influenzae type b conjugate vaccination in India." The Journal of pediatrics 163.1 (2013): S60-S72.

16. Assumptions (decision-analytical model)	**Cases incidence** -On the % of bacterial meningitis cases caused by Hib, assumed the % of unconfirmed cases attributable to Hib to be the same as the % of confirmed cases attributable to Hib (44%) -Final adjusted Hib meningitis incidence was 22/100K children same in all states -Clinical pneumonia incidence varied by site, assumed national range -23.6% CFR for all severe untreated pneumonia -23% of the cases had no access to formal medical care **Costs** -Children with access to medical care were admitted to hospitals
17. Analytical methods (approaches to validate or make model adjustments, etc.)	**Sensitivity Analysis** -Varied each parameter in turn by 10% (univariate 1-way sensitivity analysis) -Changed combinations of influential parameters (multivariate scenario analysis), ran 19 alternative scenarios, including worst case.

Results

18. Study parameters (report values, ranges, references, and table)

Tables 1-3, Figures 2 & 3

Table I. Burden-of-disease parameters by state

State	Region	Births per 1000	Mortality children <5 yrs per 1000	Life expectancy	Percent underweight*	Access to care	Incidence per 100 000, 1-59 mo: Hib pneumonia	Incidence per 100 000, 1-59 mo: Hib. meningitis	Incidence per 100 000, 1-59 mo: Hib NPNM	CFRs 1-59 mo: Hib pneumonia	CFRs 1-59 mo: Hib. meningitis	CFRs 1-59 mo: Hib NPNM
Delhi	North	351	25	74	26%	89%	1184	22	4	0.1%	21%	5%
Haryana	North	547	64	70	40%	88%	1530	22	4	0.1%	22%	5%
Himachal Pradesh	North	125	42	73	37%	69%	1450	22	4	0.3%	39%	6%
Jammu and Kashmir	North	267	76	68	26%	73%	1171	22	4	0.3%	35%	5%
Punjab	North	519	52	71	25%	87%	1153	22	4	0.1%	22%	5%
Rajasthan	North	1735	79	69	40%	66%	1537	22	4	0.3%	41%	6%
Chhattisgarh	Central	629	93	64	47%	67%	1722	22	4	1.3%	41%	6%
Madhya Pradesh	Central	1981	94	65	60%	53%	2052	22	4	1.7%	53%	6%
Uttar Pradesh	Central	6216	85	66	42%	76%	1601	22	4	1.1%	32%	5%
Bihar	East	2487	65	69	56%	72%	1947	22	4	1.2%	36%	6%
Jharkhand	East	780	72	67	57%	71%	1962	22	4	1.2%	37%	6%
Orissa	East	837	83	66	41%	76%	1558	22	4	1.1%	32%	5%
West Bengal	East	1675	46	71	39%	70%	1507	22	4	1.2%	38%	6%
North East†	North East	281	46	71	36%	44%	1430	22	4	0.5%	61%	7%
Gujaret	West	1203	58	71	25%	64%	1156	22	4	0.5%	43%	6%
Maharashtra	West	2258	39	70	37%	74%	1463	22	4	0.4%	34%	5%
Andhra Pradesh	South	1619	55	69	33%	60%	1348	22	4	0.6%	46%	6%
Karnataka	South	1165	53	70	38%	71%	1478	22	4	0.4%	37%	6%
Kerala	South	578	12	75	23%	89%	1102	22	4	0.2%	21%	5%
Tamil Nadu	South	1159	43	70	30%	77%	1279	22	4	0.3%	31%	5%

*Weight for age < −2SD from WHO reference population.
†The North East region includes Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, and Assam.

Table III. Average Hib disease treatment costs per inpatient admission and outpatient visit (2010 US$)

Type of Hib disease	Region	Cost per inpatient admission: Priv hosp All	Gov hosp 1ary	Gov hosp 2ary	Gov hosp 3ary	Cost per outpatient visit: Priv trad	Priv pharm	Priv clinic or hosp	Gov clinic or hosp
Meningitis	North	204	336 (51%)	343 (50%)	551 (31%)	6	1	11	15 (81%)
	Central	345	505 (67%)	513 (66%)	721 (47%)	1	1	9	6 (49%)
	East	229	217 (24%)	225 (23%)	433 (12%)	5	1	5	13 (77%)
	Northeast	468	206 (20%)	213 (19%)	422 (10%)	3	1	5	10 (70%)
	West	483	232 (29%)	240 (28%)	448 (15%)	0	1	6	4 (18%)
	South	193	201 (18%)	208 (17%)	417 (9%)	1	1	7	5 (37%)
Pneumonia/NPNM	North	126	202 (52%)	207 (51%)	329 (32%)	6	1	11	15 (81%)
	Central	213	307 (69%)	312 (68%)	434 (48%)	1	1	9	6 (49%)
	East	141	129 (25%)	134 (24%)	256 (13%)	5	1	5	13 (77%)
	Northeast	289	122 (21%)	127 (20%)	249 (10%)	3	1	5	10 (70%)
	West	298	139 (30%)	143 (29%)	266 (16%)	0	1	6	4 (18%)
	South	119	119 (19%)	124 (18%)	246 (9%)	1	1	7	5 (37%)

Parentheses show the percentage of total costs by households at government providers.

Clark, Andrew D., et al. "Impact and cost-effectiveness of Haemophilus influenzae type b conjugate vaccination in India." The Journal of pediatrics 163.1 (2013): S60-S72.

19. Incremental costs and outcomes (mean value & differences between comparators, ICERs)
Table 4

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	34 470	1033	939
Haryana	North	472	1038	42	1552	0.3%	$43	$0.3	$4.9	47 096	903	800
Himachal Pradesh	North	253	506	13	773	1.0%	$10	$0.3	$1.0	20 314	500	453
Jammu and Kashmir	North	262	662	19	943	0.3%	$20	$0.5	$1.2	25 620	777	728
Punjab	North	364	1048	41	1453	0.4%	$45	$0.4	$3.7	44 145	1017	934
Rajasthan	North	2942	5492	140	8575	0.4%	$118	$3.0	$9.9	220 070	524	479
Chhattisgarh	Central	6050	2315	59	8424	1.0%	$51	$2.8	$11.3	197 709	245	188
Madhya Pradesh	Central	21 415	7010	152	28 578	1.1%	$133	$5.6	$24.4	661 798	192	155
Uttar Pradesh	Central	30 054	12 112	364	42 531	0.5%	$432	$24.6	$82.6	1 040 354	392	312
Bihar	East	19 200	6431	179	25 810	1.0%	$169	$2.4	$24.4	617 964	269	229
Jharkhand	East	7482	2493	68	10 043	1.2%	$62	$2.5	$7.8	237 934	252	219
Orissa	East	4820	1995	60	6876	0.7%	$58	$4.7	$4.9	169 599	315	286
West Bengal	East	12 577	5468	147	18 191	1.5%	$130	$8.3	$8.9	439 363	276	256
North East*	North East	614	1170	23	1807	0.9%	$19	$0.3	$0.4	43 599	420	411
Gujaret	West	2419	3793	94	6305	0.6%	$83	$1.1	$7.0	161 467	506	463
Maharashtra	West	6073	7993	233	14 299	1.0%	$204	$4.6	$22.2	374 003	533	474
Andhra Pradesh	South	6019	7979	188	14 186	1.0%	$147	$2.2	$7.7	351 765	411	389
Karnataka	South	3645	4636	127	8408	0.9%	$104	$1.7	$7.1	216 132	474	441
Kerala	South	662	1403	58	2123	2.0%	$51	$1.3	$3.2	64 781	775	725
Tamil Nadu	South	2266	3490	107	5863	0.8%	$90	$3.1	$4.4	156 945	555	526
India		127 869	77 840	2150	207 859		$2006	$70	$240	5 125 128	378	331

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

Clark, Andrew D., et al. "Impact and cost-effectiveness of Haemophilus influenzae type b conjugate vaccination in India." The Journal of pediatrics 163.1 (2013): S60-S72.

20. Characterizing uncertainty

Figure 5

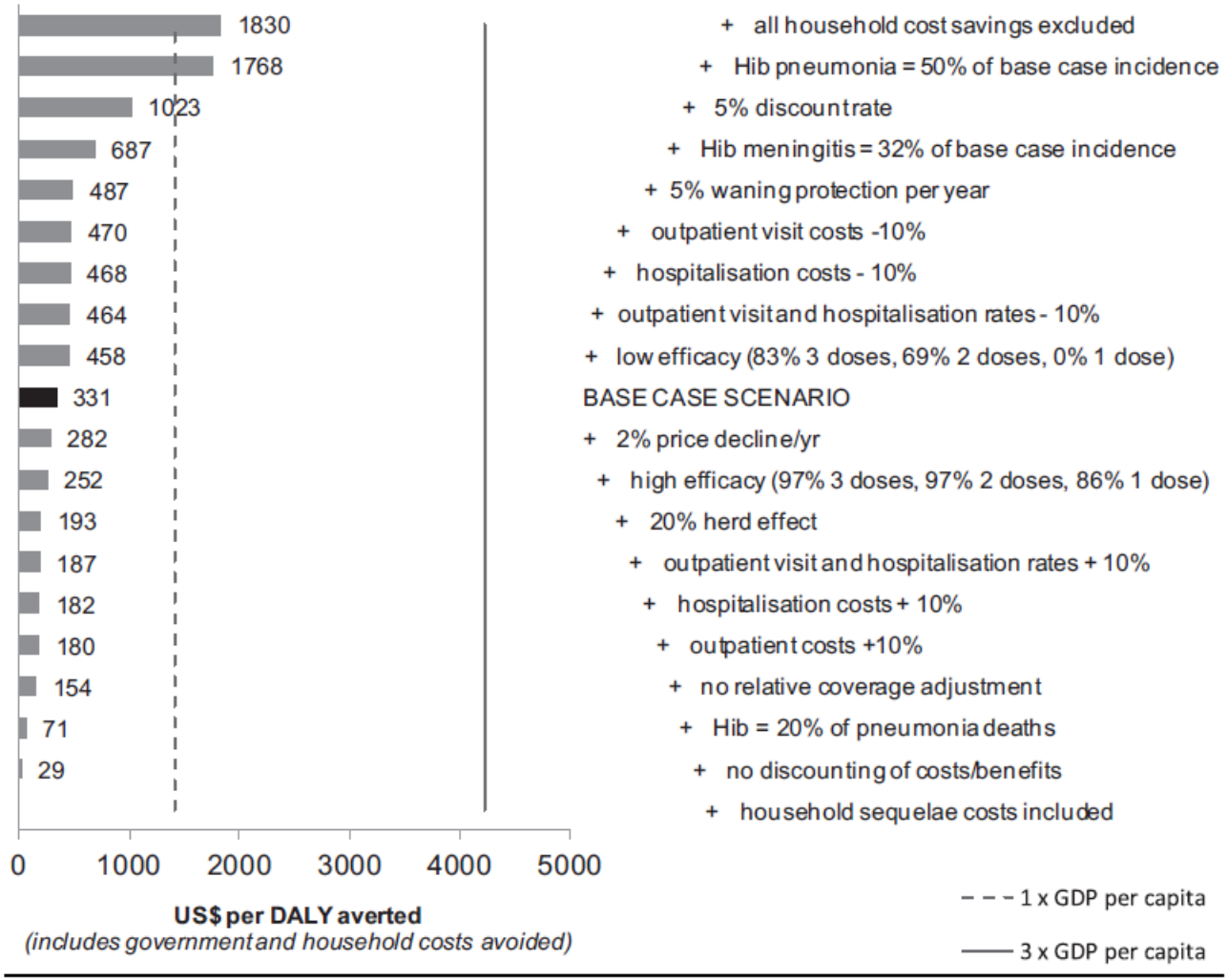


Figure 5. Scenario analysis showing the cost per DALY averted for the base case scenario and the cumulative effect of introducing favourable and unfavorable assumptions in sequence. The *plus symbol* (+) indicates the sequential and cumulative addition of assumptions to the base case. These are either favorable to the vaccine (*bottom* half of chart) or unfavorable to the vaccine (*top* half of chart).

Clark, Andrew D., et al. "Impact and cost-effectiveness of Haemophilus influenzae type b conjugate vaccination in India." The Journal of pediatrics 163.1 (2013): S60-S72.

21. Characterizing heterogeneity

Figure 4

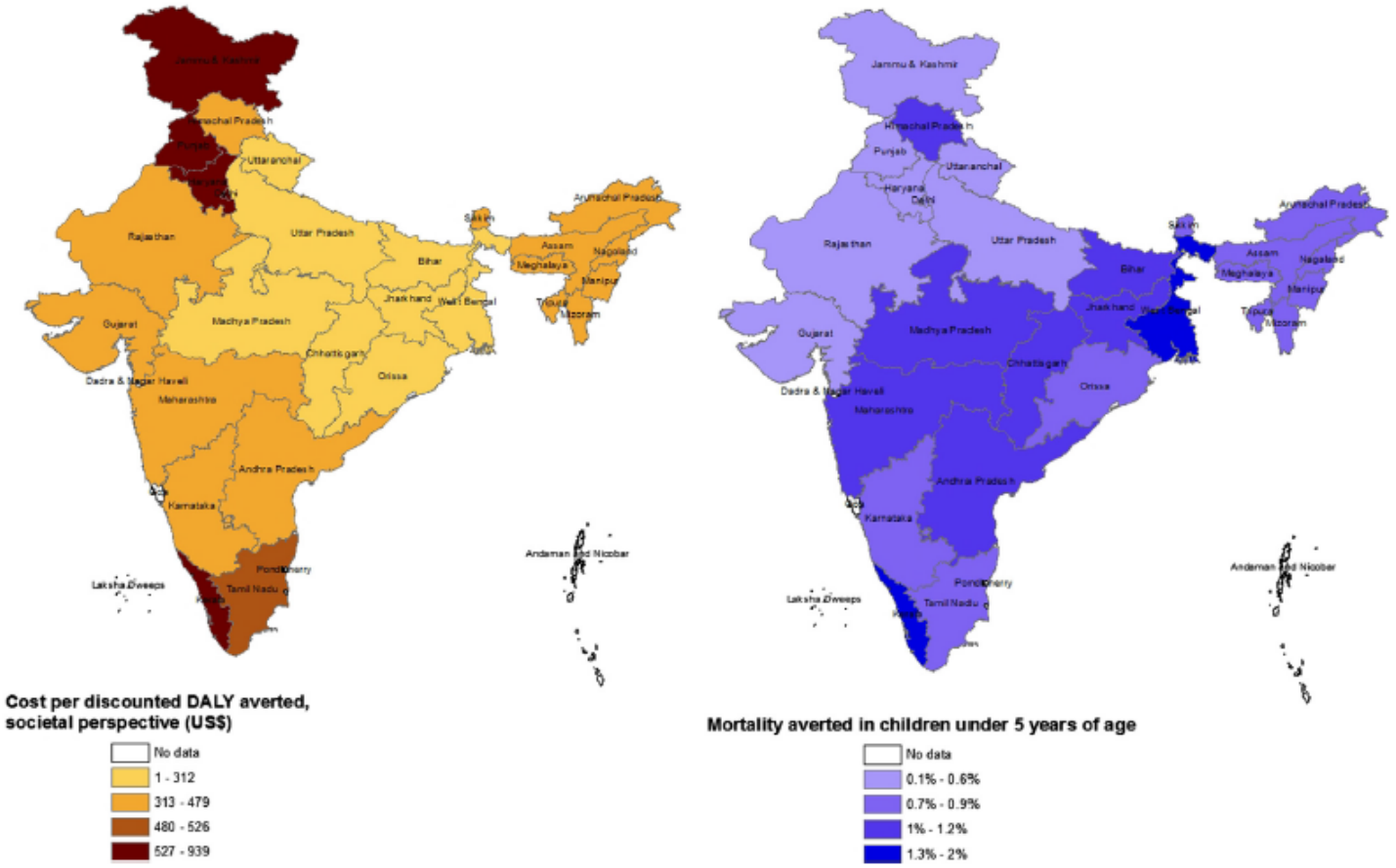


Figure 4. Impact and cost-effectiveness of Hib vaccination by State of India.

Discussion **22**. Study findings, limitations, generalizability, and current knowledge	-Authors report a cost of US$819/DALY from the gov. perspective, and report similarity with prior estimates from similar Haryana State study (US$903) -Hib vacc. would increase costs by US$130M. But $ is much less than other countries, & is offset by healthcare savings (77% of which is from OOP). -Limitations: Lacking or uncertain info. on risk factors for “Hib pneumonia” were assumed same as “all-cause pneumonia”. Also, assumptions on state-level variation. Ex: tested a 50% of the base case incidence for Hib pneumonia. Uncertain parameters varied in SA. Results consistent.
Other	
23. Source of funding	Author M.S. received research funding from GlaxoSmithKline, Merck, and Pfizer (previously Wyeth Lederle Vaccines), served on their scientific advisory boards and received honoraria for these activities.
24. Conflicts of interest	Other authors declare no conflicts of interest, real or perceived.

Impact Inventory Template (1)

Sector	Type of Impact (list category within each sector with unit of measure if relevant)[a]	Included in This Reference Case Analysis From...Perspective?		Notes on Sources of Evidence
		Health Care Sector	Societal	
Formal Health Care Sector				
Health	Health outcomes (effects)			
	Longevity effects	☐	☐	
	Health-related quality-of-life effects	☑ DALYs	☐	
	Other health effects (eg, adverse events and secondary transmissions of infections)	☑	☐	1st 5 yrs. of age
	Medical costs			
	Paid for by third-party payers	☑	☐	NGO
	Paid for by patients out-of-pocket	☑	☐	1st 5 yrs. of age
	Future related medical costs (payers and patients)	☑	☐	
	Future unrelated medical costs (payers and patients)	☑	☐	squealed costs
Informal Health Care Sector				
Health	Patient-time costs	NA	☐	
	Unpaid caregiver-time costs	NA	☑	
	Transportation costs	NA	☑	

a. Categories listed are intended as examples for analysts.

Sanders, Gillian D., et al. "Recommendations for conduct, methodological practices, and reporting of cost-effectiveness analyses: second panel on cost-effectiveness in health and medicine." Jama 316.10 (2016): 1093-1103.

Impact Inventory Template (2)

Sector	Type of Impact (list category within each sector with unit of measure if relevant)[a]	Included in This Reference Case Analysis From...Perspective?		Notes on Sources of Evidence
		Health Care Sector	Societal	
Non–Health Care Sectors (with examples of possible items)				
Productivity	Labor market earnings lost	NA	☐	
	Cost of unpaid lost productivity due to illness	NA	☐	
	Cost of uncompensated household production[b]	NA	☐	
Consumption	Future consumption unrelated to health	NA	☐	
Social Services	Cost of social services as part of intervention	NA	☐	
Legal or Criminal Justice	Number of crimes related to intervention	NA	☐	
	Cost of crimes related to intervention	NA	☐	
Education	Impact of intervention on educational achievement of population	NA	☐	
Housing	Cost of intervention on home improvements (eg, removing lead paint)	NA	☐	
Environment	Production of toxic waste pollution by intervention	NA	☐	
Other (specify)	Other impacts	NA	☐	

b. Examples include activities such as food preparation, cooking, and clean up in the household; household management; shopping; obtaining services; and travel related to household activity

Exercise: Reporting and Interpreting Vaccine CEA Results

- Review questions in groups
- Discuss potential responses
- Respond to questions online

Discussion Questions (Quiz)

1. Looking at the CEA Plane, interventions that fall under which of the four quadrants should never be implemented or should be stopped.
   a. Quadrant I. Interventions that increase costs and increase effectiveness
   b. Quadrant II. Interventions that increase costs and decrease effectiveness
   c. Quadrant III. Interventions that safe money and decrease effectiveness
   d. Quadrant v. Interventions that safe money and increase effectiveness

2. What is an efficient Willingness-to-Pay threshold?
   a. Budget caps (e.g. spend up to $200 in 1 year)
   b. Consumption quotas (e.g. get up to 5 hospital beds in 1 year)
   c. Prices caps (e.g. spend up to the average price)
   d. Both a and c

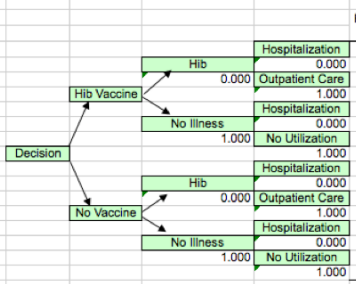
3. Which of the following statements is TRUE about the incremental-cost-effectiveness ratio (ICER)?
   a. The ICER informs about the extra amount of money that will be spent
   b. Decision maker is left to decide if spending the amount implied by the ICER to reach the next most expensive alternative is worthwhile
   c. Decision maker uses his or her own judgment to decide how much is worthwhile to spend
   d. If there are multiple undominated programs, first ask if it is worthwhile to spend the additional amount on the next to the least expensive undominated alternative. If it is worthwhile, then ask about moving up to
   e. All of the above

4. Which of the following statements about dominant and dominated alternatives is/are true?
   a. A dominated alternative is worse than some combination of two alternatives
   b. A dominant alternative is always more effective and more expensive
   c. A dominant alternative is both more effective and less expensive
   d. Both a and c

5. Which of the following is/are not one of the items part of the minimum information to be included when reporting economic evaluations
   a. Conflict of interest
   b. Currency, price date, and conversion
   c. Setting and location
   d. Incremental costs and outcomes
   e. Author's affiliation

Decision Tree Model in Excel

	A	B	C	D
1	**Parameter**	**Value**	**Source**	**Explanation**
2	*Probabilities*			
3	Efficacy of Hib Vaccine			
4	Probability of Hib Meningitis/Pneumonia with No Vaccine			
5	Probability of Hospitalization following Hib			
6	Probability of All-cause Hospitalization			
7				
8	*Costs ($)*			
9	Cost of Hib Vaccine			
10	Cost of No Vaccine			
11	Cost to Payer for Hib Vaccine			
12	Cost to Patient for Hib Vaccine			
13	Cost to Government/Payer for Hospitalization			
14	Cost to Patient for Hospitalization			
15	Cost to Government/Payer for Outpatient Care			
16	Cost to Patient for Outpatient Care			
17				
18	*Utility (DALYs)*			
19	Utility for Hospitalization			
20	Utility for Outpatient Care			
21	Utility for No Utilization			
22	Life Expectancy for those hospitalized			
23	Life Expectancy for those not hospitalized			



	I	J	K	L	M	N	O	P	Q	R	S	T
13	Probability of Outcome	Societal Cost	Cost to Government/Payer	Cost to Patient	Weighted Societal Cost	Weighted Payer Cost	Weighted Patient Cost	Health Utility	Expectancy	Weighted Life Expectancy	DALY	Weighted DALY
14	0	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.0000	0	0.0000
16	0	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.0000	0	0.0000
18	0	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.0000	0	0.0000
20	1	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.0000	0	0.0000
22	0	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.0000	0	0.0000
24	0	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.0000	0	0.0000
26	0	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.0000	0	0.0000
28	1	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.0000	0	0.0000
30			*Sums*									
31				***No Vaccine***	$ -	$ -	$ -			*0.000*		*0.0000*
32				***Hib Vaccine***	$ -	$ -	$ -			*0.000*		*0.0000*