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Methods of Evaluating Food & Nutrition Policies: How do we assess costs in relation to effect and benefit, and against alternative programs

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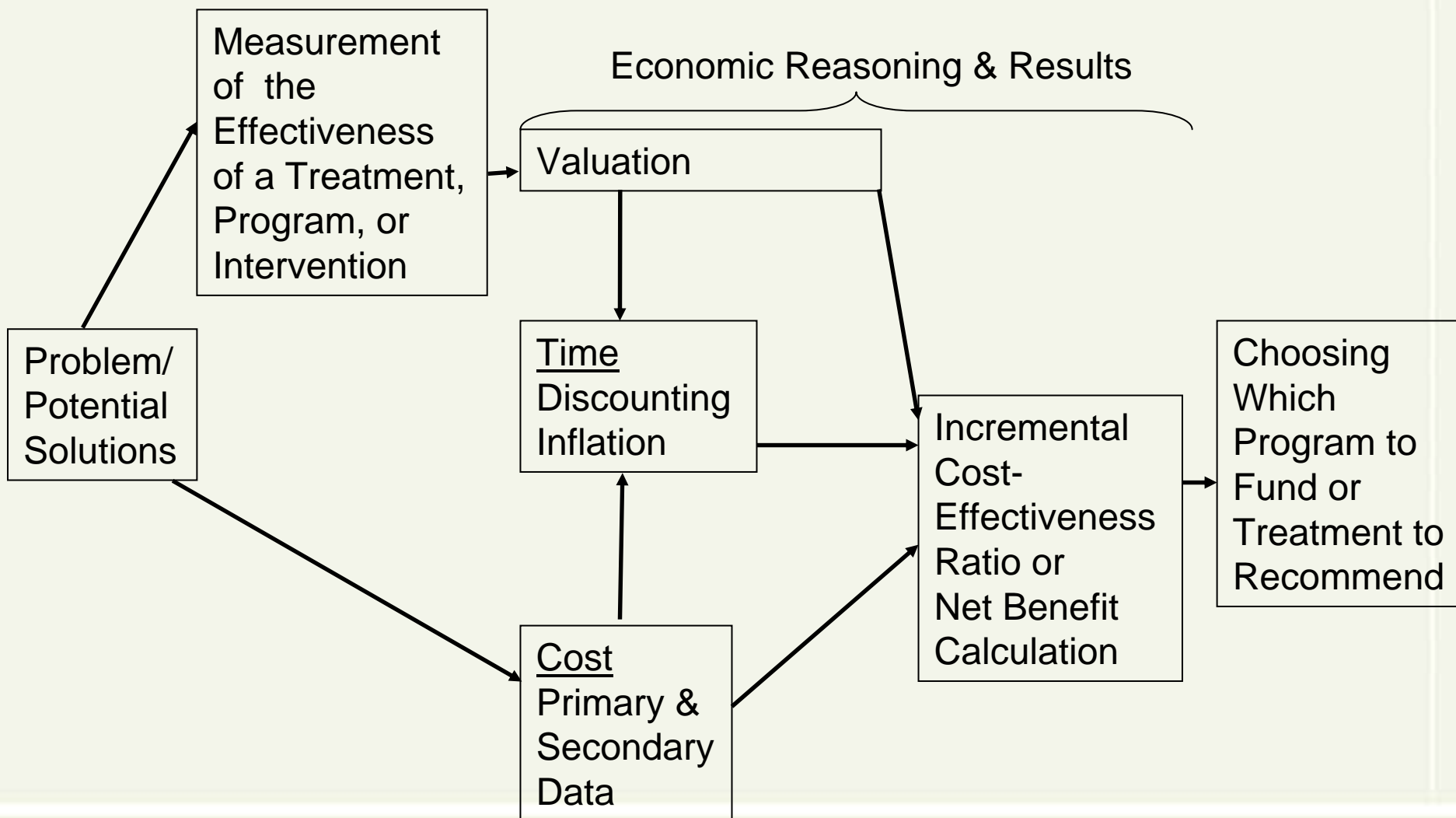
Outline

- What is economics?
 - Where does CEA fit into research?
 - Definitions
 - What are we comparing?
 - Perspective
 - Measuring Benefits
 - Modeling
 - Present Value
 - Sensitivity Analyses
- Examples

What is Economics

- “The study of how a society chooses to use its limited resources (land, labor, and capital goods) to produce, exchange, and consume goods and services”
 - Ruffin & Gregory 1988
- For economic evaluation of nutrition programs and policy, we could look at how individuals make decisions about nutrition in light of the incentives they are given or we could use economic reasoning to help us to evaluate the relative costs and effects of a program

Where Economic Evaluation (CEA Specifically) Fits Into Research & Policy Making



Definitions

Types of Cost Analyses

- Cost Minimization
- Cost Consequence
- Cost Effectiveness
- Cost Utility
- Cost Benefit

Cost Minimization Analysis

- Two methods of achieving the same objective
 - Determine which one costs less
- Examples
 - WIC
 - Guarantee that all breastfeeding mothers and children in the US have sufficient caloric intake
 - Healthy People-type
 - Increase breastfeeding initiation to 90% of mothers
 - Increase 6 months exclusive breastfeeding to 50% of all mother-child dyads
 - Ensure sufficient Vitamin A intake in a country

Cost Consequence Analysis

- Compare situation with and without intervention
 - Describe the costs
 - **Describe** the consequences
- Best when there is no primary outcome and it would be difficult to produce a summary measure of the outcomes
- Example
 - Cost of program to increase breastfeeding duration
 - Changes in health outcomes for children, health outcomes for mothers, and maternal-child bonding

Cost-Effectiveness

- Calculate ratio comparing **change** in costs with **change** in effectiveness
 - $\frac{\text{Cost(New)} - \text{Cost(Old)}}{\text{Effect(New)} - \text{Effect(Old)}}$
 - Interpret as extra money spent per extra unit of outcome
- Best if there is only one effect or if there is clearly a primary effect

Cost Utility Analysis

- Cost-effectiveness analysis with a particular type of outcome
 - Measures that can combine multiple types of morbidity and mortality
 - Multiple conditions and mortality risks associated with obesity can be combined in one measure
 - Quality adjusted life years (QALY)
 - Disability adjusted life years (DALY)
 - QALYs are more grounded in the theory of health utilities
- Hear about “dollar spent per QALY gained” or “dollar spent per DALY ***averted***”

Cost-Benefit Analysis

- All benefits converted into dollars
 - Some start as dollars but for others this is a complex process
- Simplest cost-benefit analysis would be an analysis of costs and cost-offsets
 - Spend additional money to provide Vitamin A supplements
 - Save money by not needing to treat complications of Vitamin A deficiency
 - Compare costs averted with additional spending
- CBA has the unique ability to say whether a new program is better than an old one (benefits are bigger than costs)

Simple CBA "Spreadsheet" Example

	New Vitamin A Program	Vitamin A Program
Program Costs	\$0	\$A
Costs of Treating Vitamin A Deficiency	\$B	\$C <i>If program is effective, $\\$C < \\B</i>
Total	\$B	$\$(A+C)$ <i>Empirical question whether $\\$(A+C) < \\B</i>



Definitions

Types of Costs

- Opportunity Cost
- Consumables
- Capital Goods

Opportunity Cost

- Economic concept of costs
- Technical definition is the value of the next best use of resources
- In most cases, the market price is the same as the opportunity cost
- However, there are some markets that do not operate in a competitive way (e.g. donated pharmaceuticals) and these often require measures of cost other than what was spent
 - Even the market for pharmaceuticals that are not donated is not a perfectly competitive market

Consumable

- Items that are used only once or last less than a one year
 - The criterion of lasting less than one year is relevant because costs are usually summed over an annual time period
- Examples
 - Vitamin A supplements
 - Containers of formula
 - Surplus food
- Mostly use actual price paid

Capital Goods

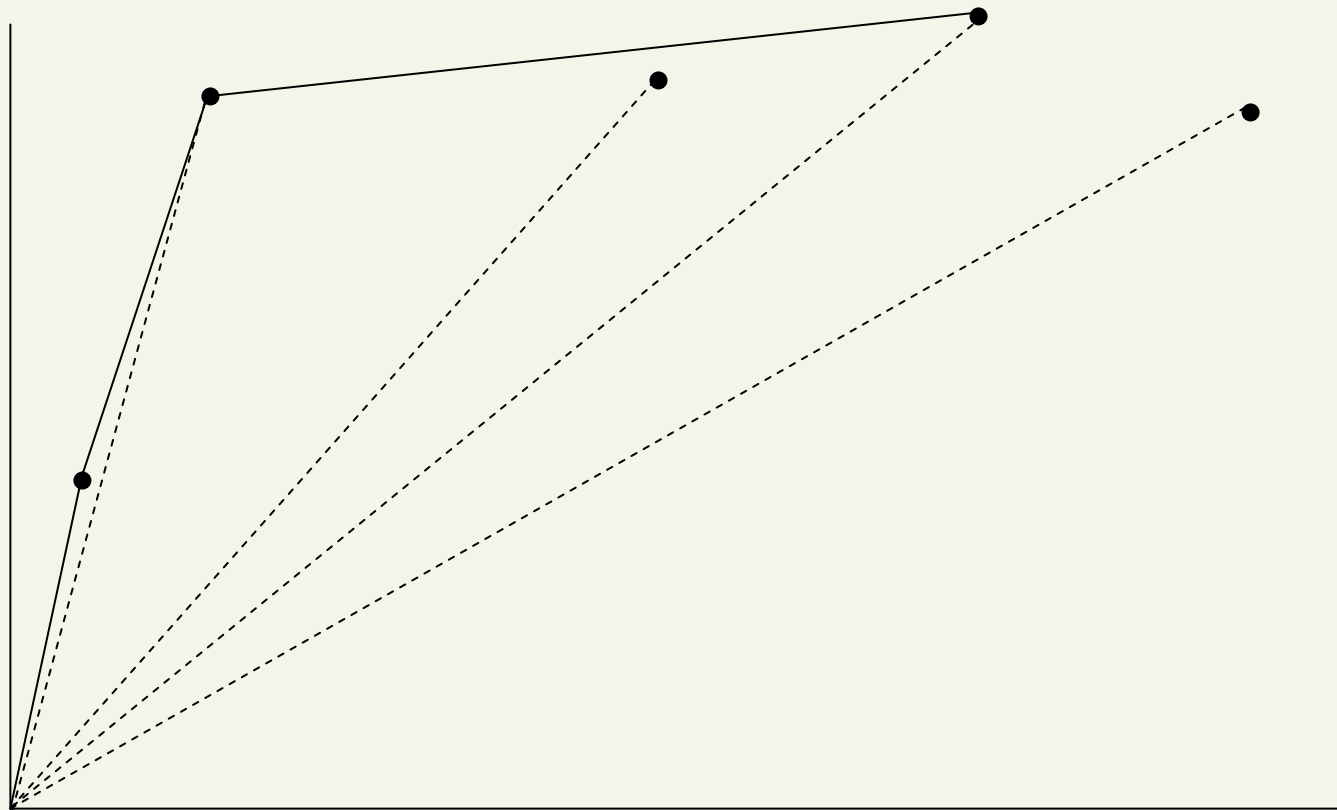
- Items that last for more than one year
- Lab equipment for blood testing
- Multiple ways to handle costs
 - Could count entire cost in one year
 - Sometimes paid for all at once
 - Suggests no value at end of the year
 - Not usually the choice in formal economic analysis
 - Add depreciation and interest not earned because of investment
 - Difficult if it is government spending
 - Depreciation in this sense is not necessarily the same as accounting depreciation
 - Consider re-sale or salvage value

What are we comparing?

- When have multiple programs, compare one with another rather than comparing all to doing nothing
- The question that is asked is:
 - If we want to spend more money than it costs for the least expensive program, what is the extra cost of achieving an extra unit of outcome?
 - Looking at the next least expensive program
 - In contrast, what would it cost to achieve other outcomes using the money for some alternative intervention?
 - If we have even more resources available, what is the extra cost per extra outcome gained to move to the next higher spending level? (This can be repeated)

Graph Showing What We Are Comparing

of Target
Individuals
With Proper
Nutrition



Cost of Differently Structured
Nutrition Supplementation Programs

What is a “good buy”?

- If outcome is not a life year, DALY, or QALY, the definition of a “good buy” is arbitrary
 - Is it worth \$1 per child to give an annual Vitamin A supplement?
 - How about \$10, \$100, or \$1000?
 - Can compare with the cost-effectiveness of established programs
 - However, it is not necessarily clear that these are good buys
- Rule of thumb says less than \$50,000/QALY gained in the US
- Rule of thumb says less than 3xGDP per capita per DALY **averted** in the world

Perspective

- Whose costs and whose benefits matter
- Government
 - Which level?
 - Which agency?
- Employer
- Societal
 - Recommended
 - Often difficult
 - Not always what decision makers are actually concerned about

Example of Differences in Perspective

- Breastfeeding promotion program
 - Community health nurse & peer counselor
 - Who pays and who benefits
 - Local public health agency might fund it
 - Managed care organization might fund it
 - Short-term benefits may accrue to child and mother
 - May lead to savings for Medicaid or a private insurer
 - Long-term benefits may accrue to child and mother
 - Not clear who will benefit monetarily other than family
 - Could also have affects on workplace, family, and others in society
 - Key is that costs and benefits do not accrue to the same parties in society

Another Example of Importance of Perspective

- Reported in: *J Urban Health*, 81(1): 106-118
- Study in which older adults were randomized to participate in a 15 hour per week volunteer activity or not and public elementary schools were randomized to receive volunteers or not
 - Who funds program
 - Includes stipend for older adults
 - Local school district
 - Federal AmeriCorps program
 - Who benefits
 - Medicare, Medicaid, school district, juvenile justice, students and families

Measuring Benefits

- Dollars saved or expenditures avoided
- Ask individuals how much they value health outcomes
- Use productivity measures for people who are able to continue work or to go back to work rather than being disabled
- Quality adjusted life years
 - Ask individual questions from a questionnaire over time and score the combination of quantity and quality of life
- Disability adjusted life years
 - Note condition over time and calculate disability adjusted life years combining time in condition and mortality from condition data
 - Try to **avert** rather than gain DALYs

Benefits Measures for Breastfeeding

- Dollar value of changes in sleep patterns
- Dollar value of changes in feeding time
- Dollar value of less need to buy formula
- Dollar value of different use of diapers
- Dollar value of reduced health care utilization
- Quality adjusted life years gained from avoiding breast cancer



Valuing Benefits of Vitamin A Supplementation

- Productivity associated with less xerophthalmia
 - DALY measure as well
 - Affects those who are deficient in vitamin A
- Productivity associated with less diarrhea
 - Affects those who are deficient and those who care for those who are deficient
- Decreased medical care costs associated with both conditions
- Others...

Valuing Benefits in the Older Adult Volunteer Program

- Decreased medical care costs for Medicare
- Decreased medical care costs for Medicaid
- Quality adjusted life year improvement
- Value of children being high school graduates rather than not
- Unable to value changes in time principal spent on discipline, changes in teacher retention, changes in community value of school

Modeling

- Think about where data come from
- Gold standard to show efficacy is the randomized trial
- However, many health interventions may not go beyond a “process” measure of effect
 - How many people got _____.....?
- How do we take the result further than “How many people got _____.....?”
 - Modeling
 - Easier to do in some fields than others
 - Consider health communication programs
 - Can we move beyond changes in behavior
- Accepted as a part of many cost-effectiveness studies
 - Often in combination with primary data collection

Why might we need modeling?

- Have only limited resources to collect outcome data
- In spite of thinking there are sufficient resources to collect outcome data, cannot do so
- Collected only intermediate outcome data
- Have other data available from clinical trials, other epidemiological studies, even white papers that provides probabilities of events or costs that would occur after your data collection ended
- Example
 - If we supply Vitamin A to 100,000 children, how will it change their outcomes for one year
 - Use a large number either because have a large population or because it helps to avoid discussion of “fractional” individuals when modeling rare events

Modeling in a breastfeeding study

- We only followed children for 6 months
- We didn't know exactly why they went to the doctor or hospital
- We didn't know exactly what type of formula was bought for them
- We didn't know the exact value of mothers' time
- We couldn't measure how it would affect children's obesity over a lifetime
- We couldn't measure how it would affect mother's risk of breast cancer over a lifetime

Modeling in the older adult volunteer study

- We collected data on self-reported health status
- We found other data that linked self-reported health status with health care expenditures and quality of life
- We assumed that findings from other data would apply to our population
- We asked if it would be cost-effective to spend the money for the program if the only benefit were for the older adults' health
- We then asked how many extra children would need to graduate from high school to offset all costs of the program

Study could be all modeling

- Suppose a program director was considering multiple micronutrient supplementation
- Previous studies showing uptake of individual supplements, cost of delivering individual supplements, and effects of supplements individually and in combination
- Want to consider multiple individual programs as compared with a multiple micronutrient delivery program
- Do we need a randomized trial?
- Do we need any type of study?
- How do we build a model?

Present Value

- Need a way to compare costs and benefits today with costs and benefits that will occur 20 years from now
 - Some nutrition policy has rather immediate effects
 - Some nutrition policy will have affects for years
 - Limiting or changing the type of calories a population takes in will have effects that don't necessarily show up until the future
- Present value
 - Add up value of costs and benefits over time with different weights depending on when costs and benefits occur
 - Have option of applying same weight to all costs and all benefits—no discounting
 - Generally hear about a discount rate of 3% which means that costs and benefits 24 years from now are worth half of what they are worth today

Life Experience Uses of Present Value

- Mortgage
 - Present value is the amount handed over to the seller on the day you buy the house
 - However, because you are not paying it all at once the total cash flow is higher than the present value
 - There is a bigger gap between cash flow and the present value when the interest rate is higher
- Retirement account
 - If you retire with \$1M in your account (the present value), you will consume more if you leave some in the bank to earn interest each year

Present Value and Breastfeeding

- Healthier baby in first year
 - Do not need to adjust
- If breastfeeding affects development which has affects for years to come
 - Have to adjust future benefits (weight them lower than present costs and benefits) in analysis
- Maternal risk of thrush while breastfeeding for 6 months
 - Do not need to adjust
- Mother's decreased risk of breast cancer
 - Need to adjust expenses and QOL changes and mortality changes associated with possibility of breast cancer in the future to their present value

Present value and older adult volunteer program

- Short-term changes in older adult health
 - Do not adjust
- If we could demonstrate 5-10 year changes in nursing home admission
 - Adjust cost of nursing home stay to its present value
- Children's increased lifetime earnings that won't start for 15 years
 - Adjust to present value

Present Value and Time Horizons

- A discussion of valuing improvements in the future leads us to consider how far into the future decision makers look
 - No one correct answer
 - CEA and CBA are supposed to try to trace all relevant effects
- Decision makers may have a higher discount rate (or a shorter time horizon) than society as a whole
- Does discounting and present value considerations more generally disadvantage prevention?

Sensitivity Analyses

- Make assumptions in modeling
 - Is nutrition education being delivered by a registered dietician or a community health worker?
 - Affects price
 - May affect outcome
- Make assumptions even if gather primary data
 - For example, there might be multiple prices that could be paid
 - CHW could be paid or volunteer
 - Want to know if the CHW being paid rather than being a volunteer would make a difference in the qualitative conclusion you draw

Sensitivity Analysis and Breastfeeding

- Different values of time spent bottle feeding the child depending on whether mother or someone else in the family is doing the breastfeeding
- Price of formula may be retail or wholesale and the formula may be generic or name brand
- Amount paid for medical care may depend on insurer
- Vary these one at a time to see if each choice in the modeling process makes a difference in whether the program is recommended

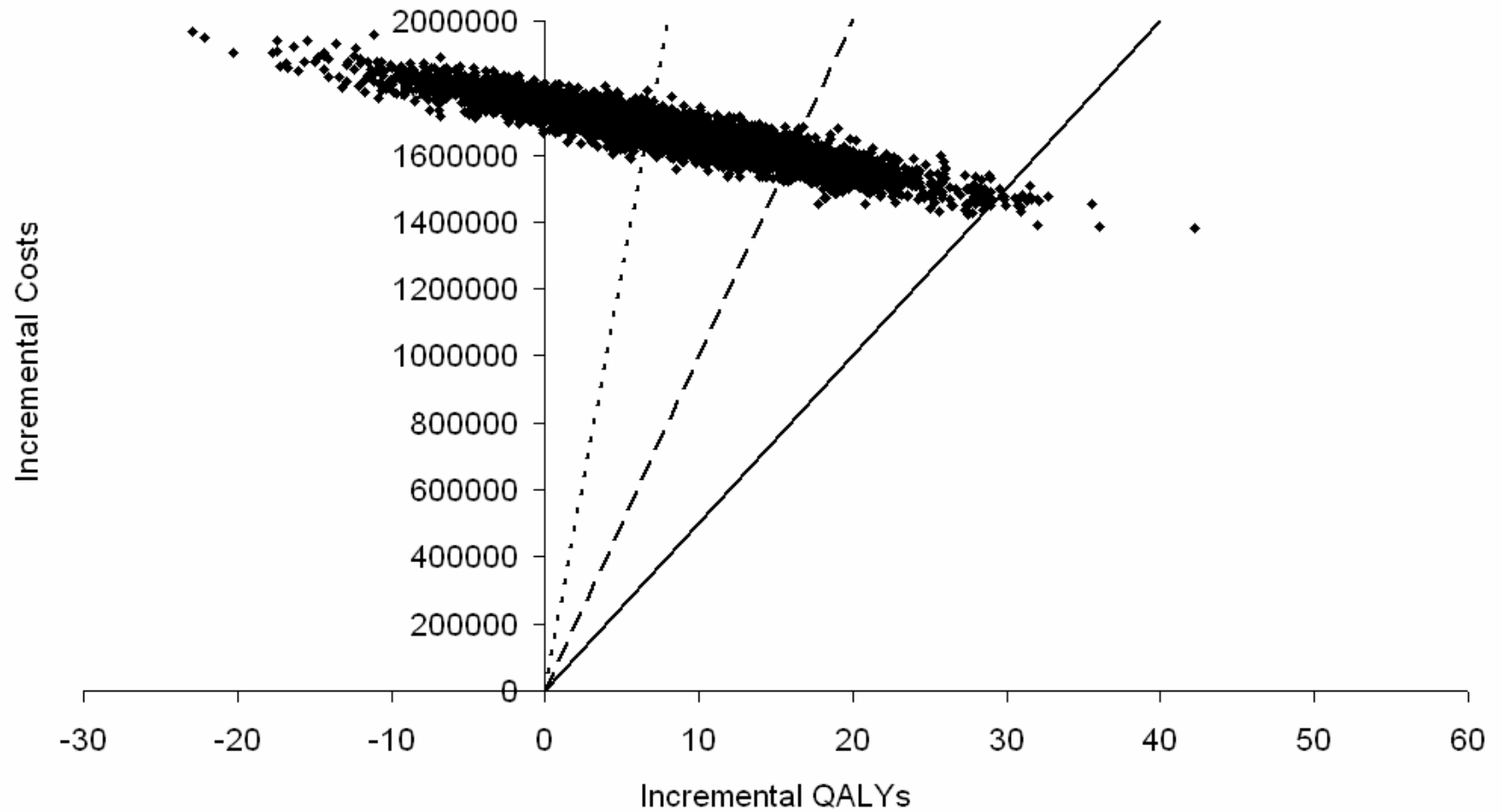
Multiple sensitivity analyses

- Can combine changes in multiple assumptions
- Example from some recent work on post partum hemorrhage
 - All combinations of assumptions led to same conclusion
 - Multiple simultaneous assumption changes useful in this case
 - If the conclusion varied in no interpretable systematic way, then the idea of multiple changes at once would not be so useful
 - If the conclusion changes in interpretable ways, this tells you what where more information is needed to make a more informed policy decision

Sensitivity Analysis and Simulation

- In addition to changing specific assumptions that assign one value, an analyst can work with ranges of values and probabilities of different parts of the range occurring
- Draw a number at random over and over again and see what happens
 - Do you always reach the same qualitative conclusion?
 - How often do you reach the same conclusion?
 - Is there too much uncertainty to make policy?

Simulation Results



Using CEA

- Economics adds information but does not make the decision
- Economics provides an explicit and transparent way to place a value on effects that may vary
- Economics emphasizes that we are comparing programs to each other (in terms of cost and effect) and not always to no program
 - While it may seem like we are spending few dollars per outcome achieved for a more expensive intervention, if you can get most of the benefits by spending a fraction of the money, it may be better for society to spend less money on the program in question and the remainder of the money on some other health improvement program

Summary with Breastfeeding CEA as an Exemplar

- Can gather primary data or model or both
 - Study breastfeeding intervention in a community but add data as necessary from outside sources to develop a model that is creative but credible
- Need a method for valuing benefits
- Consider relative value of short term and long-term benefits
- Need to comment on who is spending and who is saving
 - There is a fuss about the breastfeeding promotion program because someone feels they are losing
- Use results to inform policy making process
 - Economics doesn't consider ethics or distributional issues