



COLLEGE OF PUBLIC HEALTH
The University of Georgia



Introduction to Economic Evaluation Part I

April 20, 2011

Be Part of the Solution



Webinar Content

- Overview of economic evaluation (EE) methods
- Cost of Illness (COI) analysis or economic impact analysis
- Programmatic cost analysis (CA)



What is Economic Evaluation (EE)?

Applied analytic methods to:

*Identify,
Measure,
Value, and
Compare*

the costs and consequences of
treatment* and prevention**
strategies.

* *Done a lot*

** *Done “not so much”*



Why Care About EE?

Maximizing outcomes is important.

Minimizing costs is important too.

Resources are limited, so hard (resource allocation) decisions must be made.

Demonstrates the value provided from the resources expended (return on investment).



EE Methods

- Partial evaluation – costs only
 - Cost of illness (COI) analysis – Economic Impact Analyses
 - Cost analysis - programmatic cost analysis (CA)
- Full evaluation – costs and outcomes
 - Cost-benefit analysis (CBA); Benefit-cost analysis (BCA)
 - Cost-utility analysis (CUA)
 - Cost-effectiveness analysis (CEA)

Benefit-Cost Analysis (BCA)

- Standardizes both costs and outcomes in \$
- Includes health *and* nonhealth outcomes
- Provides an objective summary measure
 - Net Benefits ($B - C$), Net present value (NPV)
 - Benefit-cost ratio (B / C)

Cost-Utility Analysis - CUA

- A method used to compare costs and benefits of interventions where benefits are expressed as the number of life years saved ***adjusted*** to account for loss of quality.
- Combines
 - Length of life (survival), and
 - Quality of life
- Compares disparate outcomes in terms of *utility*
 - Quality-adjusted life years (QALYs)
 - Disability-adjusted life years (DALYs)
- Derives a ratio of cost per health outcome
 - \$/QALY or \$/DALY

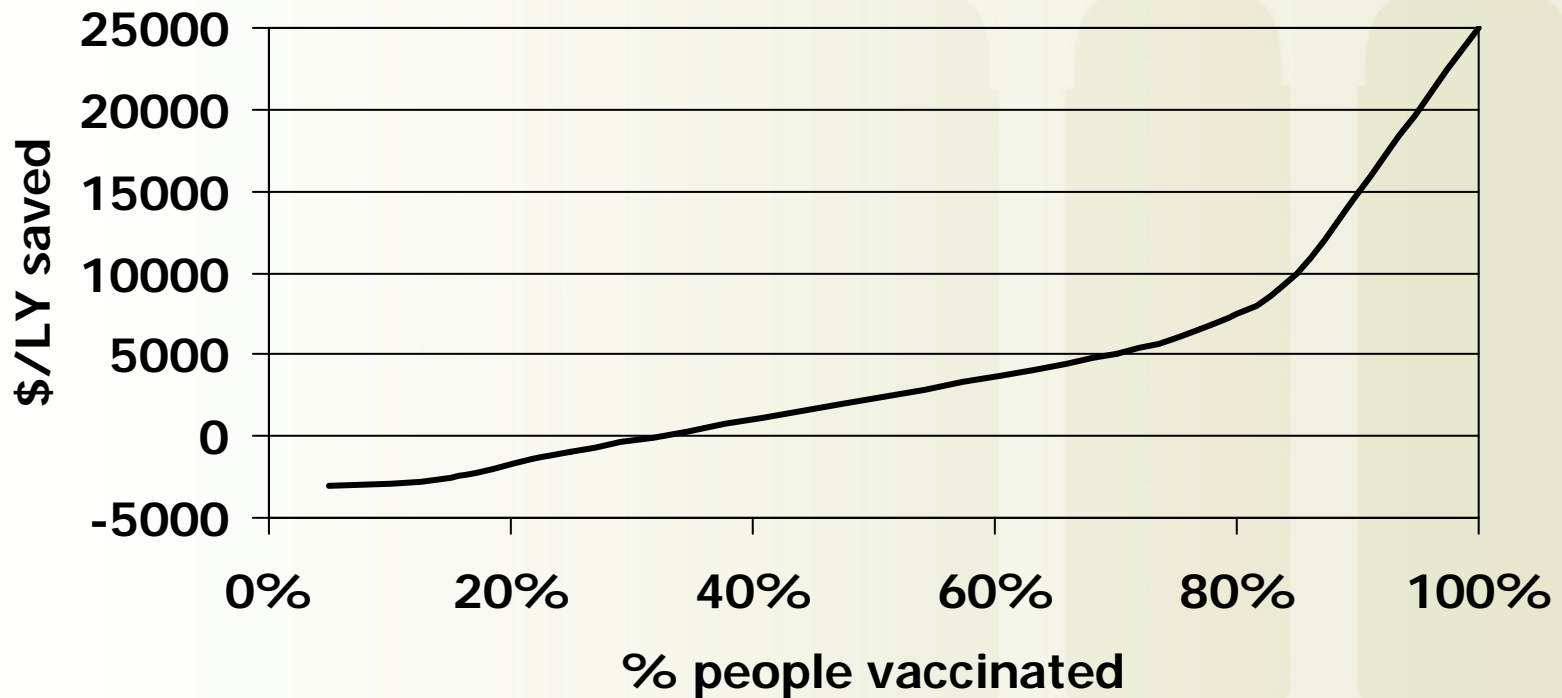


Cost-Effectiveness Analysis (CEA)

- Expresses outcomes in *natural* units.
 - (e.g., number of cases prevented or lives saved)
- Compares results with other interventions affecting the same outcome.
- Derives a *ratio* of cost per unit of outcome.
 - \$/case prevented
 - \$/life saved
 - \$/life year saved

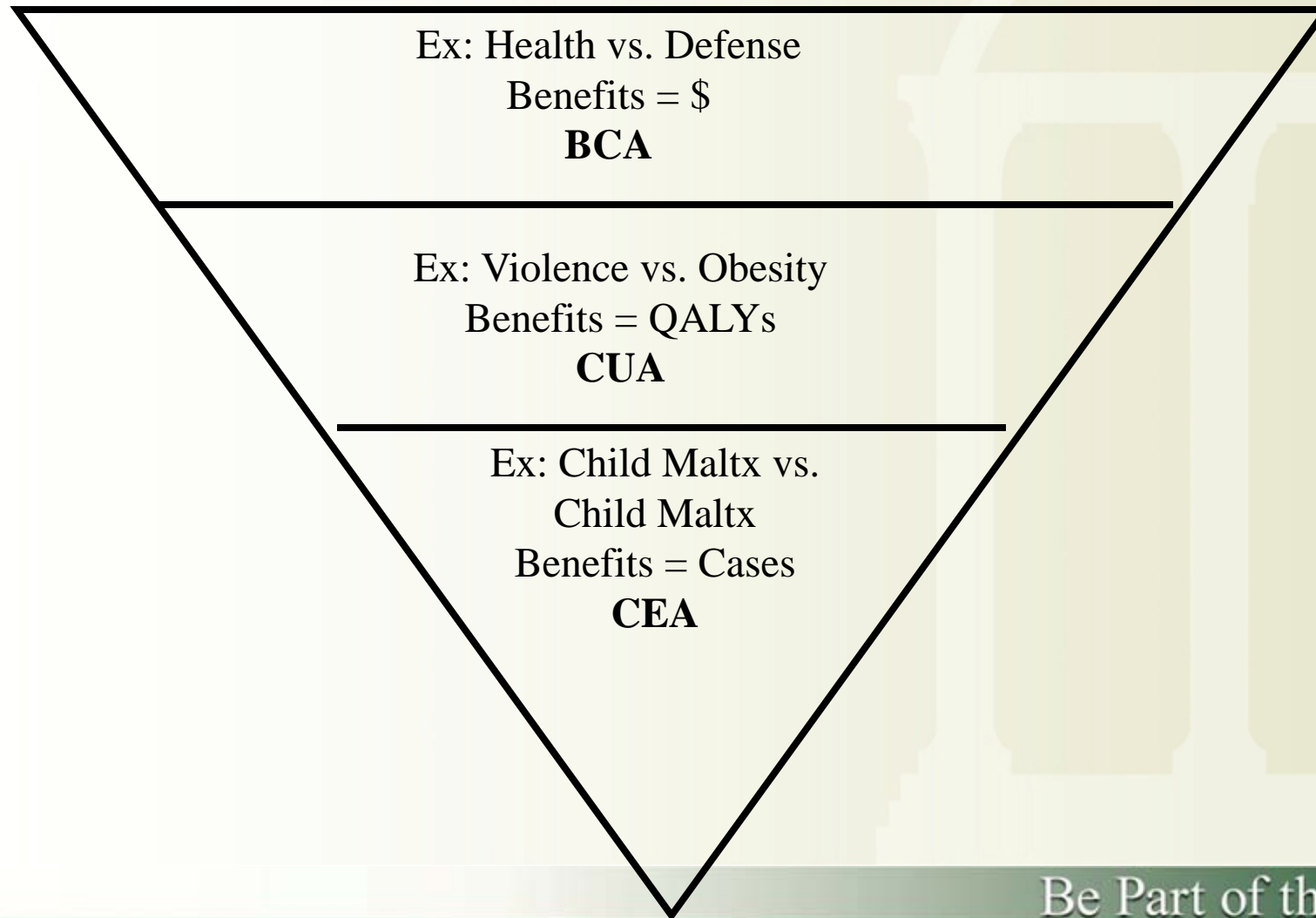


Cost-effective \neq Cost-saving





What EE Method to Use?



Economic Impact or Cost of Illness (COI) Analysis

- Estimates total costs incurred because of a disease or condition.
 - Costs of medical resources to treat disease/injury.
 - Costs of non-medical resources to treat disease/injury.
 - Losses in productivity due to disease.
- Uses:
 - To estimate economic burden of disease/injury
 - Benefits measure in BCA
 - In CUA, medical costs averted in numerator of CE ratio
 - In CEA, medical and productivity losses averted in numerator of CE ratio

Medical/Non-medical Costs

- Medical costs
 - Inpatient
 - Outpatient
 - MH
 - Rx
- Non-medical costs
 - Legal and justice system
 - Travel expenses to seek treatment
 - Childcare while seeking treatment



Productivity Losses – Human Capital Approach

- Assumes
 - Value of a worker's productivity=earnings, bc a profit-maximizing employer will not pay a worker more than the additional value he/she contributes
- Valuation is simplest when an intervention affects mortality
 - Categorizes work loss (gain) by age, sex, occupation
 - Calculates the discounted value of expected labor
 - Uses gross earnings (before taxes) and includes fringe benefits
 - Imputes value for non-market labor such as household productivity
 - Occasionally subtracts future consumption of goods and services

HC Approach - Valuation of Morbidity

- Is more complicated than valuation of death
- Valuation may not simply be the number of work days lost, bc
 - Ability to return to work may be occupationally related
 - Returning to work doesn't necessarily mean resuming the same level of productivity
 - The change in health status may necessitate job switching



COI Reporting

- Prevalence-based costs
 - Cross-sectional data
 - Includes all costs within a specific time period, regardless when event occurred
 - Useful for thinking about resources required for treatment within a given time period
- Incidence-based, or lifetime, costs
 - Longitudinal data
 - Includes lifetime costs for new events
 - Useful for thinking about potential savings from prevention

COI Methods

- **All medical costs for the victims**
- **Only diagnosis-specific costs for the victims**
 - Add attributable fraction
- **Incremental cost approach**
 - Match against control
 - Regression
 - Attributable fraction



Sum of All Medical Costs

- Prevalence-based, cross-sectional data
- Sum all annual medical costs comparing those reporting disease to those not reporting disease
- Pros: Good for relative comparisons and understanding of impact on the healthcare system
- Cons: Does not isolate the economic burden associated with the smoking, or understanding of co-morbidities

Sum only Diagnosis-Specific Costs

- Pros:
 - Represents lower-bound actual costs of disease
 - Good for incidence-based models
- Cons:
 - May underestimate costs, if co-morbid events are not included.



Attributable Fraction

- Also includes the indirect health expenditures associated with the behavior, through other diseases or conditions
- The attributable fraction is added to the total diagnosis-specific costs



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Ruff, Volmer, Nowak, & Meyer
European Respiratory Journal
2000; 16: 385-390

THE ECONOMIC IMPACT OF SMOKING IN GERMANY

Be Part of the Solution

Methods

- Sources of information
 - Official German statistics
 - MEDLINE
 - German Institute for Medical Documentation and Information
 - Internet
 - Health insurance companies databases
 - German Federal Institute of Statistics

Methods

- Direct Costs
 - Healthcare resources: ambulatory care, drug treatment, hospital care, rehabilitation, long-term care
 - Resource units multiplied by unit costs
- Indirect Costs
 - Costs incurred from productivity losses, premature retirement, and premature mortality
 - Human Capital Approach
 - Life years lost before age 65 multiplied by gross annual income
- Intangible Costs (not included)
 - Patient's quality of life (no reliable nationwide data)



Methods

Table 3. – Diseases included in the calculation

Disease category	ICD-9 code	Attributable risk %
Oral cavity and pharynx cancer	140–149	65
Larynx cancer	161	65
Lung cancer	162	89
CHD	410–414	35
Stroke, CVD	433–438	28
AOD	440	28
COPD	490–491	73

CHD: coronary heart disease; CVD: cerebrovascular disease;
AOD: atherosclerotic occlusive disease; COPD: chronic obstructive pulmonary disease.



Results

Table 4. – Smoking-attributable health care costs of smoking-related diseases

Disease category	ICD-9 code	Costs		Direct costs as % of total
		Direct	Total	
Oral cavity and pharynx cancer	140–149	124	771	16.0
Larynx cancer	161	47	226	20.7
Lung cancer	162	559	2593	21.6
CHD	410–414	2692	4963	54.2
Stroke CVD	433–438	1162	1774	65.5
AOD	440	625	762	82.0
COPD	490–491	3269	5471	59.7
Total		8478	16561	51.1

Data represents costs in million EURO. CHD: coronary heart disease; CVD: cerebrovascular disease; AOD: atherosclerotic occlusive disease; COPD: chronic obstructive pulmonary disease.



Results

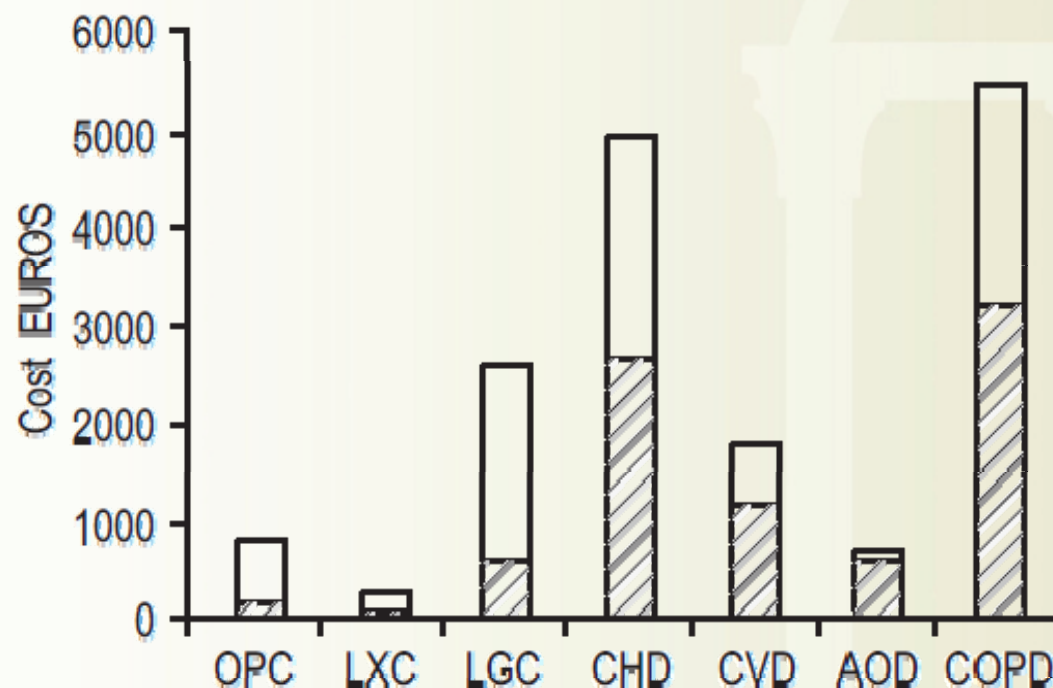


Fig. 1. – Total costs made up of direct costs (▨) and indirect costs (□) in million EURO by disease category. OPC: oral cavity and pharynx cancer; LXC: larynx cancer; LGC: lung cancer; CHD: coronary heart disease; CVD: cerebrovascular disease; AOD: atherosclerotic occlusive disease; COPD: chronic obstructive pulmonary disease.

Common Mistakes in COI Analyses

- Using cost estimates from different sources without converting into the same base year.
- Not adjusting market prices to reflect true costs.
- Combining reporting methods in same analysis
 - Annual vs lifetime costs
- Not using present value of future potential earnings.

So What?

- COI highlights the magnitude of the burden relative to other burdens.
- It provides data to argue for more resources to prevent the burden.
- Used with estimates of costs to prevent the burden, COI can provide policy-makers with return-on-investment information.



Programmatic Cost Analysis

- *Cost analysis* is an **economic evaluation** technique that involves the systematic collection, categorization and analysis of program **costs**.
- Costs are the **value of the resources** (people, buildings, equipment and supplies) used to produce a good or a service.

What are Resources?

Resources are the:

- People
- Places, and
- Things needed to carry out a task.

***Resources are what we spend our money on!
What they cost can be computed many
different ways.***



Cost Analysis

- Typically the first step in economic evaluation.
- Estimates total costs of running a program.
- Important for realizing costs from varying perspectives.
 - e.g., incurred by program, incurred by participant
- Important for budget justification, decision making, and forecasting.
- Type of cost analysis warrants which costs are included.
- **IMPORTANT:** not focusing on program outcomes. . . . yet.

Financial Costs

- Financial Costs
 - Monetary expenditures for resources required to implement the program – based on market prices
 - Typically found in the budget proposal
 - A convenient, but sometimes incomplete, way to measure costs
- Examples:
 - Salaries for project personnel
 - Supply costs
 - Computer purchases
 - Cost of curriculum materials

Economic Costs

- Economic Costs
 - (Or opportunity cost): The value of the forgone benefit because the resource is not available for its next best use.
 - Economists argue that a resource's cost is the sacrifice necessary to obtain goods or services.
- Examples:
 - Volunteer time
 - Donated space (e.g., from a University)
- **Shadow prices** used when market price does not accurately reflect the value of the good.

More Ways to Talk About “Costs”

- **Direct costs**
 - Those costs that are directly related to the project or intervention or the specific task at hand
- **Indirect costs**
 - Also called overhead costs – these are the “support” costs, including admin, accounting/finance management, office supplies, maybe utilities, etc....

Cost Analysis Terms

- Fixed Cost
 - Cost incurred only one time regardless of the number of times the intervention is conducted, i.e., the cost of staff training
- Variable Cost
 - Cost that varies with the the number of times the intervention is conducted or with the number of clients covered, i.e., the amount of condoms per clients.



Total Costs (TC)

$$TC = (P_1 * Q_1) + (P_2 * Q_2) + \dots + (P_n * Q_n) = \sum_{i=1}^n (P_i * Q_i)$$

where P_1 = Value of resource 1
 Q_1 = Quantity of resource 1 used
 P_2 = Value of resource 2
 Q_2 = Quantity of resource 2 used
...
 P_n = Value of resource n
 Q_n = Quantity of resource n used

Average Costs (AC)

- Total resource costs divided by total units of output.

$$AC = TC / Q$$

Where

TC = Total costs

Q = Total units of output

Marginal Cost (MC)

- The marginal cost is the resource costs associated with producing *one additional (or one less) unit* of the same intervention.

$$MC = (TC' - TC) / (Q' - Q)$$

Where

TC = total costs at the current activity level

TC' = total costs at the higher activity level

Q = current output level

Q' = higher output level



Average vs. Marginal Cost

- The marginal cost can be lower or higher than the average cost, depending on whether or not the program is operating at full capacity.
- When $MC < AC$, “economies of scale” are being realized.
 - This is the **fixed versus variable costs** issue

Additional Factors and Issues

- **Scaling**
 - How many times you do the intervention, or how many clients you serve, will affect your average cost – be careful!
- **Comparability**
 - Must count costs the same way for a valid comparison
- **Transferability**
 - Prices differ from market to market, and across time



Ritzwoller, Sukhanova, Gaglio & Glasgow
Annals of Behavioral Medicine
2009; 37(2): 218-227

COSTING BEHAVIORAL INTERVENTIONS: A PRACTICAL GUIDE TO ENHANCE TRANSLATION



Smoking Less, Living More Program

- Targeted adult smokers scheduled for surgery or diagnostic procedure
- Randomized to treatment or control arm of study
- 6-month intervention with telephone counseling, newsletters, and health education
- Completed a cost analysis of the intervention



Five-Step Process

1. Perspective of the Analysis
2. Identify Intervention Components
3. Capture Intervention Costs
4. Data Analysis
5. Sensitivity Analysis

Perspective of the Analysis

- Must consider decision maker
 - Medicare/Medicaid
 - Health plan
 - Community
 - Public health entity
- For future dissemination purposes include
 - Capital equipment
 - Prescription drugs
 - Technology used to deliver intervention



Identify Intervention Components

- Research
 - Removed from cost analysis
 - Examples
 - Grant administration, IRB approval, assessments and testing (not part of intervention), manuscript preparation
- Development
 - Necessary to differentiate those that would need to be replicated in the future and those that would not
 - Examples
 - Development of protocols and assessment, website design, telephone script production
- Implementation/Intervention
 - Recruitment
 - Include costs present in replication but exclude research specific such as informed consent
 - All Others
 - Labor, counseling, monitoring, supply, printing, and mailing costs

Capture Intervention Costs

- Prospective collection
- EXCEL-based templates collected on a monthly basis
- Personnel
 - Staff filled in time logs chronicling by hours or FTE
- Staff estimated to have spent 5-10 minutes per month recording resource use



Project manager related activities	Sep 05	Oct 05	Nov 05	Dec 05
	h/month			
Meetings				
Entire team				
Recruitment				
Protocol related	5			
Conference calls	3			
Meeting preparation		6	8	9
Personnel				
Human resources—hiring staff	12			
Orientation and training for staff		12	8	12
Grant Administration:				
Budget	12	15	15	15
IRB preparation	40			
Project related				
Recruitment scripts and materials				
Baseline assessments		6		
Travel to patient sample collections		4	3	5
Mailing and/or administering follow-up assessments		2	15	14
Development of procedures for study tasks		21	10	12
Monitoring				
Sample collection (prep and administration)		2		
Miscellaneous				
E-mail correspondence				
Data management				
Data collection		5	3	5
Database development	4			
Data entry				
Data pulls				
Other				
Travel				
Off-site commute		9	12	7
Scientific conferences				
Mailing: stuffing envelopes				
Total	64	82	74	79

Data Analysis

- Staff not asked to categorize resource use as research/development/implementation
 - Rather, researchers divvied the aggregated costs based on description of activity and knowledge of the intervention program
- Personnel time valued using salaries and benefit data of actual personnel
- Summarized as total intervention costs and cost per intervention participant



Table 2 Intervention and recruitment cost components

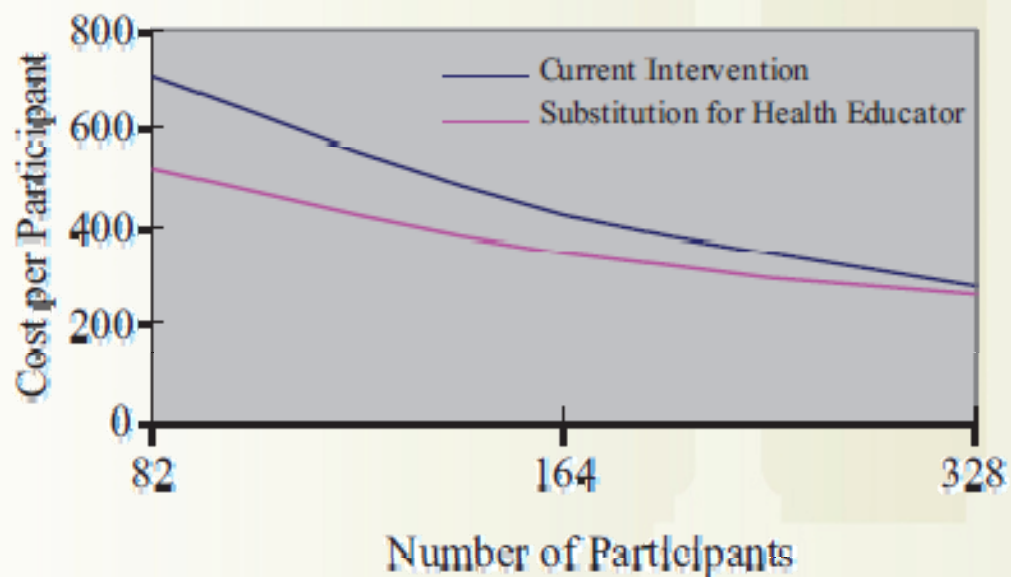
Cost Element	Variable (\$)	Fixed (\$)	Total (\$)
Recruitment			
Project staff			
Mailings	1,908		1,908
E-mail	3,990		3,990
Overhead ^a		24,912	24,912
Subject identification		1,470	1,470
Telephone interviewers			
Training		3,046	3,046
Enrollment/eligibility calls	8,104		8,104
Supplies	776		776
Total recruitment	14,778	29,428	44,206
Intervention components			
Tailored news letters	10,102		10,102
Interviewers training and supervision		23,865	23,865
Phone counseling/data management		11,872	11,872
Project meetings and email		5,667	5,667
Equipment and materials		2,890	2,890
Personnel management		9,643	9,643
Overhead ^a		4,603	4,603
3-Month intervention	21,974	46,668	68,642
Total recruitment plus 3-month intervention			112,848

^aOverhead includes office tasks as printing, copy making, unscheduled staff meetings, phone conversations, intervention preparation time, commute to the intervention site where calls are made and newsletters are produced, etc.



Scale Analysis

- Used fixed and variable costs to estimate how the total cost would vary depending upon the number of enrolled participants





Conclusion

- Cost analysis is an important first step in economic evaluation.
- Despite variation in data collected across sites, cost data provides important preliminary information on how much it may cost to replicate the program at hand.
- and more information about the relationship between outcomes and costs for future EEs.



Content of Part II Webinar

- Overview of BCA and CEA
- Measuring outcomes, QALYs, for use in CUAs



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Thank You!

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