

An Introduction to Economic Evaluation

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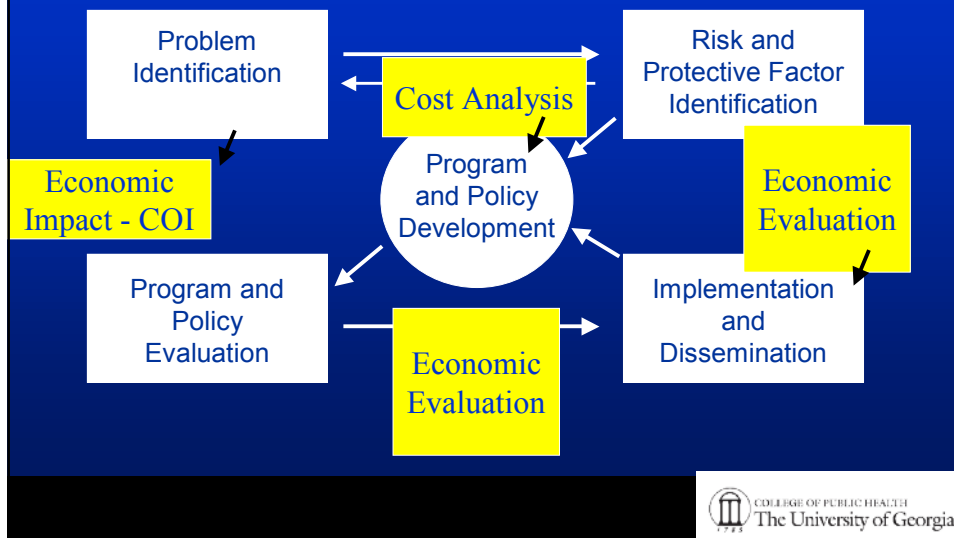


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Why Care About Economics within the Context of Evaluating Interventions?

- 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).

Public Health Model for Prevention

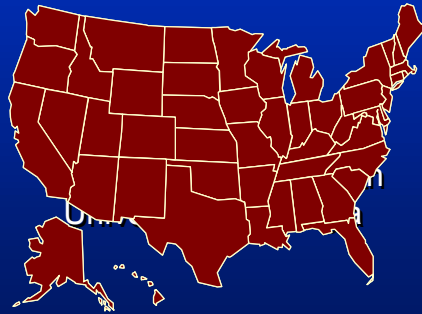


COI Analysis

- Estimates total costs incurred because of a disease or condition
 - (i.e., medical costs, non-medical costs, productivity losses)
- Generally reported as
 - annual total cost
 - average patient lifetime cost
- Used to show potential benefits of prevention efforts

Costs of Violence in the United States

Corso, Mercy, Simon, Finkelstein, Miller
American J Preventive Medicine, 2007



Methods: Incidence

- **Medically-treated** injuries caused by violence (e-codes) occurring in 2000
- Mutually exclusive categories of injuries, based on highest level of treatment setting - as a proxy for severity
 - Fatal
 - Hospitalized
 - Non-hospitalized
 - ◆ ED
 - ◆ Outpatient
- Incidence by age, sex, age and sex, mechanism, mechanism and age and sex, body region, nature, and severity

Methods: Costs

- Cost-of Illness (COI) analysis
- Includes medical costs:
 - coroner/medical examiner; medical transport; ED/outpatient; inpatient hospital; nursing home; pharmacy
- Includes productivity losses:
 - time lost from work, while being medically treated; value of wage work lost; value of household work lost
- **Lifetime costs** (Incidence-based) of injuries occurring in 2000
- CPI used to inflate costs to 2000 \$
- 3% discount rate used to develop NPV
- Several national data sets used to determine incidence and costs

Incidence: ~2.5 million Violence-related Injuries Requiring Medical Attention in 2000

	Fatal Assaults	Total Assaults	Fatal Self-Inflicted	Total Self-inflicted
Total	16,830	2.2M	29,416	324,053
Male	12,880	1.2M	23,677	145,375
Female	3,950 (23.5%)	1.0M (45.4%)	5,739 19.5%	178,678 (55.1%)

Total Lifetime Costs= ~\$70 Billion for Violence-related Injuries Requiring Medical Attention in 2000

	Total Assaults	Total Costs	Total Self-inflicted	Total Costs
Total	2.2M	\$37.1 B	324,053	\$33.3 B
Male	1.2M	\$30 B	145,375	\$27.8 B
Female	1.0M (45.4%)	\$7.1 B (19.1%)	178,678 (55.1%)	\$5.5 B (16.5%)

Gender Differences in Mechanism

- Total costs were highest for males experiencing firearm assaults (52% of total costs)
- Total costs were highest for females reporting struck by/against injuries (34% of total costs)
- The rate of self-inflicted firearm injury was 6 times higher for males than females
- The rate of self-inflicted poisoning injury was 60% higher for females compared to males.

Limitations of the Study

- Older and non-representative data
- Combining multiple data sources
- Few longitudinal studies to determine longer term medical costs and productivity losses
- Human capital approach undervalues women, children, and the elderly

So What?

- Economic burden estimates
 - Provide the needed data to lobby for more prevention resources.
 - Illustrate the potential savings (or costs avoided) if effective interventions are implemented
 - Represent the potential **returns on investment** for prevention.

Cost Analysis of the *Family Connections* Replication Project

Office of Child Abuse and Neglect (Brodowski)

8 Replication Sites

James Bell Associates (Filene, Bell)

University of Georgia (Corso, Edelblute)



Step 1: Define Cost Categories

Type of Activity	*Activity Description
(D) Direct: Client-focused, face-to-face activity	<ul style="list-style-type: none"> a. Advocate b. Assess c. Counseling/support d. Court representation e. Assist/provide f. Plan g. Refer h. Schedule i. Teach j. Transport
(I) Indirect: Collateral activities on behalf of client systems	<ul style="list-style-type: none"> a. Advocate b. Clinical documentation c. Research d. Preparation for court e. Testify in court f. Consult/Collaborate g. Locate resources h. Team meeting i. Risk management meeting j. Clinical Interdisciplinary team mtng k. I&R referral
(AC) Administrative-Client: Related to client activities	<ul style="list-style-type: none"> a. Gives supervision b. Receives supervision c. etc
(AP) Administrative-Program: Related to programmatic/management activities	Etc.



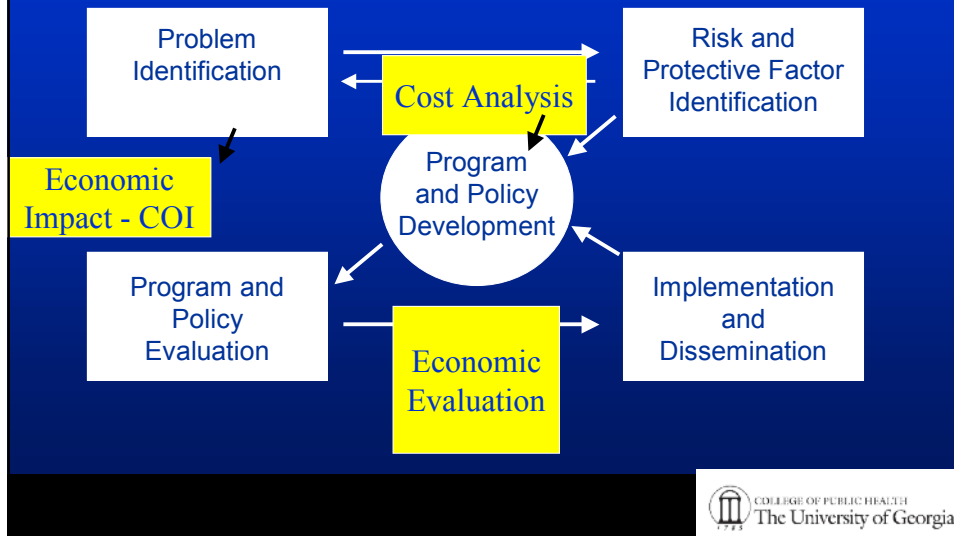
Summary of Results

- Aggregate pre-implementation costs
- A comparison of aggregate costs from year 1 to year 3
- Also collecting cost per case (or family)

Aggregating Costs Across Sites

	Total Per.	<i>Frng</i> Space and Rate Utilities	Travel	Consumables	Non Consumables	Total	
	\$ 94,043.91	31%	\$ 10,668.00	\$ -	\$ 2,599.00	\$ 8,694.00	\$ 116,005.22
	\$ 298,351.04	32%	\$ 16,531.02	\$ 10,176.98	\$ 16,037.05	\$ 15,600.00	\$ 356,696.41
	\$ 155,880.90	20%	\$ 3,885.10	\$ 4,659.17	\$ 4,119.99	\$ 15,813.43	\$ 184,358.79
	\$ 90,686.00	36%	\$ 40,000.00	\$ 4,676.00	\$ 5,456.00	\$ 4,145.00	\$ 144,963.36
	\$ 105,238.68	25%	\$ 31,206.18	\$ 9,059.93	\$ 1,236.11	\$ 20,849.43	\$ 167,590.58
	\$ 100,460.00	16%	\$ 1,823.66	\$ 2,570.00	\$ 16,366.00	\$ 8,604.00	\$ 129,823.82
	\$ 124,627.90	35%	\$ 1,535.28	\$ -	\$ 5,364.02	\$ 5,191.11	\$ 136,718.66
	\$ 146,277.00	25%	\$ 1,385.00	\$ 6,608.00	\$ 8,867.00	\$ 10,167.00	\$ 173,304.25
Low	\$ 90,686.00	16%	\$ 1,385.00	\$ -	\$ 1,236.11	\$ 4,145.00	\$ 116,005.22
High	\$ 298,351.04	36%	\$ 40,000.00	\$ 10,176.98	\$ 16,366.00	\$ 20,849.43	\$ 356,696.41
Mean	\$ 139,445.68	27%	\$ 13,379.28	\$ 4,718.76	\$ 7,505.65	\$ 11,133.00	\$ 176,182.64
Median	\$ 114,933.29	28%	\$ 7,276.55	\$ 4,667.59	\$ 5,410.01	\$ 9,430.50	\$ 156,276.97

Public Health Model for Prevention



Economic Evaluation Methods

- What is Economic Evaluation?
 - Applied analytic methods used to identify, measure, value and compare the costs and consequences of treatment and prevention programs, interventions, and policies.
- What are the Methods?
 - BCA – benefit-cost analysis
 - CEA – cost-effectiveness analysis
 - ◆ CUA – Cost-utility analysis

Benefit-cost Analysis – BCA or CBA

- A method used to compare costs and benefits of an intervention
 - where all the costs and benefits are standardized or valued in *monetary terms*.
- Provides a list of **all** costs and benefits over time:
 - Can have different time lines
 - Can have different amounts at different times
- Provides a single value:
 - Net Benefits: NB (Benefits – Costs)
 - Benefit/Cost ratio (Benefits / Costs)

When is BCA Used?

- To decide whether to implement specific programs
 - If $NB > 0$, implement
- When choosing among competing options
 - Implement program with highest NB
- For setting priorities on options given resource constraints

Quantify Benefits – BCA

Ex: Benefits of an intervention to reduce child maltreatment

- Monetary benefits:
 - Reduced health and mental health care costs
 - Reduced costs of child welfare services
 - Reduced costs of criminal justice system
 - Reduced costs of special education
- Non-monetary benefits:
 - Reduced personal and family stress
 - Better parenting skills
 - Fewer cognitive delays
 - Improved physical health, mental health, and fewer injuries
 - Lower mortality



Quantify Benefits - BCA

- Human Capital or Cost-of-Illness approach
- Willingness-to-Pay (WTP) or Contingent-valuation surveys
 - (e.g., how much is society *willing to pay to* reduce the annual morbidity and mortality risk associated with a disease or injury)



Example: COI Approach (from Corso et al, AJPM 2007)

- Homicide
 - \$1.3 million in lost productivity
 - \$4,906 in medical costs.
- Non-fatal assault resulting in hospitalization
 - \$57,209 in lost productivity
 - \$24,353 in medical costs.
- Suicide
 - \$1 million lost productivity
 - \$2,596 in medical costs.
- Non-fatal self inflicted injury
 - \$9,726 in lost productivity
 - \$7,234 in medical costs.



Example: WTP Approach (Corso, Fang - Pilot Study, 2007-2008)

- Willingness to pay to prevent child maltreatment (in Georgia)
- Dichotomous choice
 - Also analyzed as single-bounded and adjusted
- Split Samples:
 - Fatal vs non-fatal
 - Taxes vs donations as payment vehicle
- Randomization of starting bid values



Corso Survey, Fall 2007

“Based on national data, 2 out of every 100,000 children annually, or an average of 4 children every day are killed as a result of child maltreatment by parents or caretakers.”

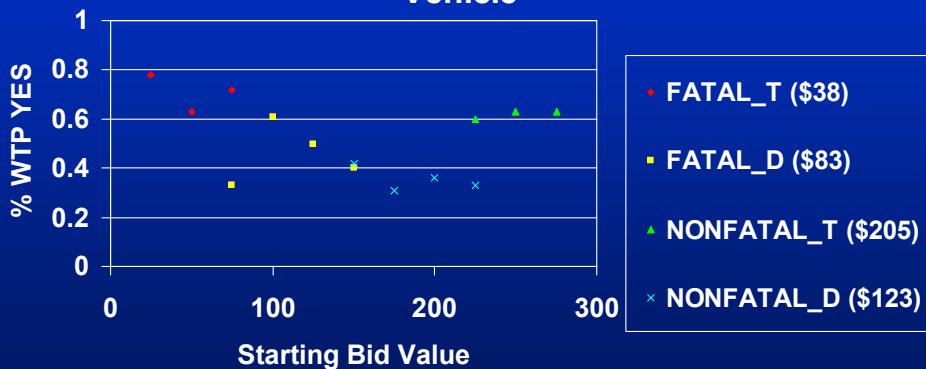
From this program were available to your state, would you be willing to pay \$150 in extra taxes per year to sponsor this program? This program was proven to reduce the risk of a child being killed due to child maltreatment by 50%. This means that the number of children killed on average every day in the U.S. by child maltreatment is reduced from 2 per day to 1 per day.

YES “Would you be willing to pay \$225?”

NO “Would you be willing to pay \$75?”

Preliminary Results

Percent YES WTP by Outcome and Payment Vehicle



Cost-effectiveness Analysis - CEA

- Estimates costs and outcomes of interventions
- Expresses outcomes in natural units
 - e.g., cases prevented, lives saved
- Compares results with other interventions affecting the same outcome

CEA – Summary Measures

- Average CE Ratio = $\text{Net Costs}_A / \text{Net Effects}_A$
 - *Net Costs = $\text{Program Costs}_A - \text{COI Averted}$
- Incremental CE Ratio =
 $(\text{Net Costs}_B - \text{Net Costs}_A) /$
 $(\text{Net Effects}_B - \text{Net Effects}_A)$

Quantify Outcomes – CEA of parenting interventions to prevent child maltreatment

- Intermediate outcomes
 - Increased child self-esteem and mental health status
 - Increased family cohesiveness/coping skills
 - Decreased depression in parents

- Final outcomes
 - Child maltreatment cases prevented
 - Lives or life years saved

CEA of Family Connections (DePanfilis et al., *Child Abuse & Neglect* 2008)

Table 2

Total and average monthly cost per family, by intervention group

	Total costs (column 1)	Cost per FC3 family (27 families) (column 2)	Cost per FC9 family (27 families) (column 3)
Staff salary and fringe	\$13,923	\$294	\$222
Intern salary and fringe	\$13,206	\$279	\$210
Rent and utilities	\$722	\$13	\$13
Supplies and copying	\$298	\$6	\$6
Transportation	\$163	\$3	\$3
Client family expenditures	\$643	\$12	\$12
Monthly total	\$28,955	\$607	\$466
Total cost		\$1,821	\$4,194

Table 3
Child Behavior Checklist—total raw scores by intervention group

	CBCL total raw scores (<i>SD</i>)		
	Baseline	Follow-up	Change
FC3 raw score mean, (<i>SD</i>)	43.5 (33.1)	38.1 (29.2)	5.4*
FC9 raw score mean (<i>SD</i>)	45.7 (28.6)	30.5 (24)	15.2**

p* < .05; *p* < .01.

CEA Results:

FC3 = \$337/unit change in CBCL raw score

FC9 = \$276/unit change in CBCL raw score

ICER = \$242/unit change in CBCL comparing FC9 to FC3



Cost-utility Analysis – CUA

A CEA that includes Quality of Life

- 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



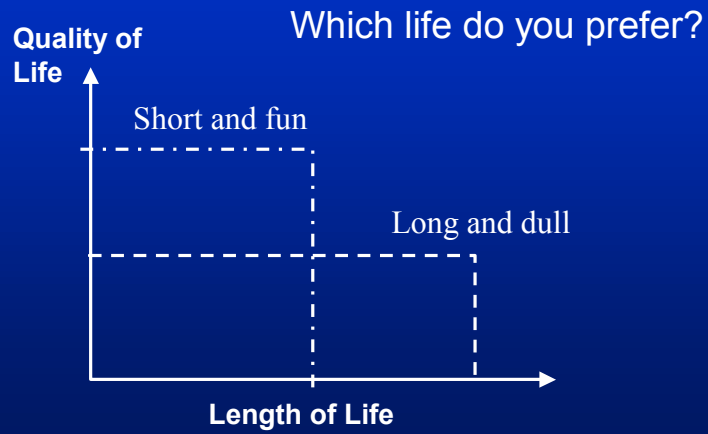
When is CUA Used?

- When quality of life is **the** important outcome.
- When the program affects both morbidity and mortality.
- When the programs being compared have a wide range of different outcomes.
- When the program is being compared with a program that has already been evaluated using CUA.

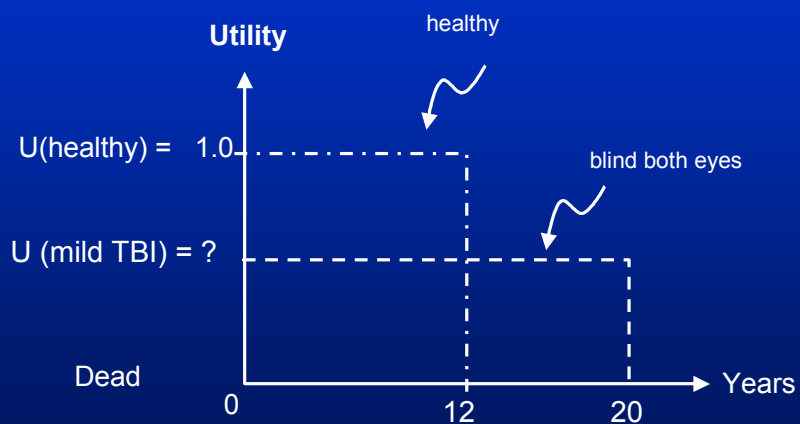
Quantify Benefits - CUA

- Utilities are:
 - A quantitative approach for describing preferences for quality of life
 - Typically based on a 0 to 1 scale
 - 0 “death”
 - 1 “perfect health”
 - Directly measured using:
 - A description of the the health state
 - Valuation tools such as visual analog scales, time trade-off, standard gamble

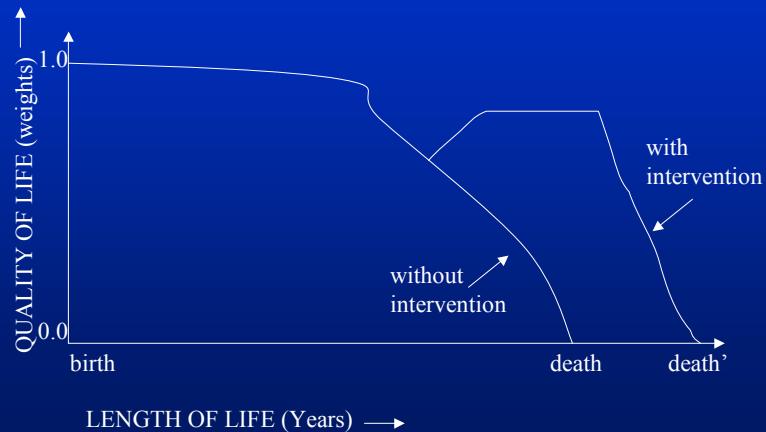
Example of Tool to Elicit Utilities: Time Trade-Off (TTO)



Example: TTO



Valuation of Benefits in a CEA: Combining Length of Life with Quality of Life



Utilities for CM Health States – the Bad News

- Non-existent for acute phase of maltreatment
 - Prosser and Corso, *Health and Quality of Life Outcomes*, 2007
- Why?
 - Eliciting preference-based HRQoL is expensive, time consuming, and cognitively challenging
 - Parents often used as proxies
 - No consistent definitions of CM health states
 - CM health states may vary by type and severity of abuse
 - CM health states may vary by acute versus chronic stage of injury

The Good News

- Methods have been developed that translate profile-based measures into **preference-based** measure of HRQoL, or utilities
- Maps SF-36 health states to *utilities* directly elicited from a general population sample, SF-6D
 - Brazier et al. 1998, 2002

Health-related quality of life in adults who experienced maltreatment during childhood

Corso, Edwards, Fang, Mercy
American J of Public Health, June 2008

College of Public Health
University of Georgia

Study Objective

- To estimate the long-term impact of CM on health-related quality of life (HRQoL)
- ... for use in developing lifetime estimates of reductions in quality-adjusted life years (QALYs) associated with CM
- ...for eventual application in assessing the cost-effectiveness of interventions designed to prevent CM

Unique properties of ACE dataset

- Adult HMO members (Kaiser, California) self-reporting different forms of maltreatment during childhood
- Age span of adults is expansive
- SF-36 data was collected in Wave 2
- Other variables that have been shown to be correlated with CM exist in the data set
 - Other ACEs – parental drugs, imprisonment, divorce
 - Other socio-economic variables

ACEs and SF-36 scores, Edwards et al., 2004

- Individuals with higher ACE scores had lower SF-36 scale scores, indicating poorer self-rated health, even after controlling for age
- However, we cannot use these results in a cost-effectiveness analysis because the SF36 provide a profile-based measure of health (value), not a preference-based measure of health (utility)
- Additionally, in order to tie back to cost-effectiveness of CM interventions, we need to look at outcomes SPECIFICALLY related to CM, NOT to all ACEs

Study Sample

- N = 8,667 in second survey wave
 - N = 7,641 agreed to complete SF-36
 - ◆ N = 6,815 completed all questions
- N = 6,168 in final sample
 - N = 25 dropped b/c missing info on CM
 - N = 622 dropped b/c missing info on one of the covariates needed to develop propensity score
- Demographics
 - Average age – 55.4 years (SD=14.9)
 - 53% female
 - 76% White

Study Design

- Utilities derived from the SF-36 score for each individual in the sample
- Propensity score methods were used to match cases (any CM) to controls (no CM)
- Eleven covariates included in logit model to estimate propensity score
 - Age, sex, race, education of mother, # of moves during childhood, parents owning home during childhood
 - Adverse exposures: witnessing parental violence, substance abuse, mental health, family member in prison, divorce

Results: Predicted Utilities, by Sample Population

Age Group	No CM	CM	Difference in Utilities
19-39	.7990	.7575	.042*
40-49	.7863	.7481	.038*
50-59	.7873	.7642	.023*
60-69	.7815	.7650	.016*
70+	.7534	.7295	.025*
ALL	.7813	.7534	.028*

* Significant at $p < 0.05$

Predicted Utility Losses by Age Group and Type of CM

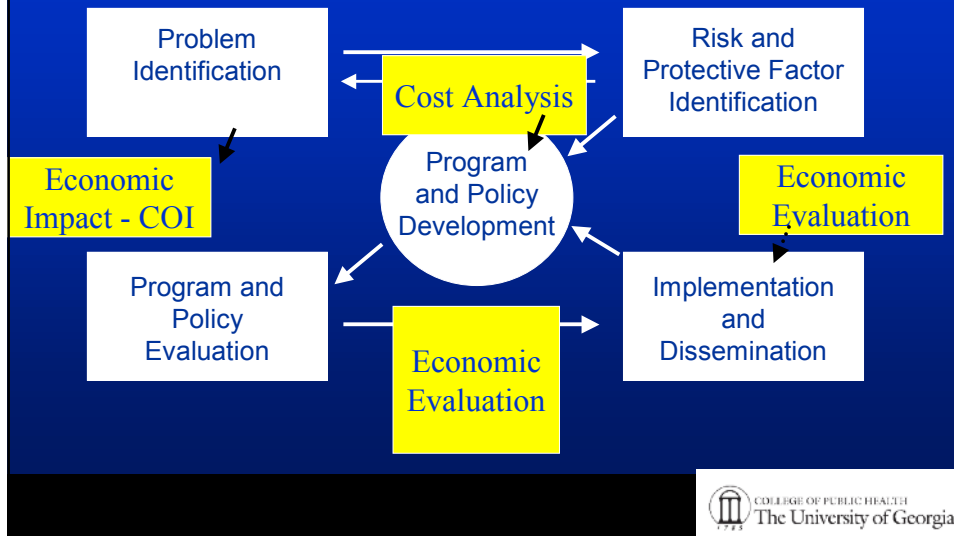
Age group	ALL	PA	SA	EA	PN	EN
19-39	.042*	.023*	.029*	.003	.018	.039*
40-49	.038*	.021*	.019*	.003	.011	.033*
50-59	.023*	.017*	.005	.007	.014	.015
60-69	.016*	.005	.018*	.004	.011	.028*
70+	.025*	.011	.013	.051*	.027	.017
ALL	.028*	.015*	.016*	.010	.013	.026*

* Significant at $p < 0.05$

Next Steps in this Research

- Differential mortality losses:
 - Assessment of LE and utility losses in conjunction with probability of comorbidities for a CM versus no CM population
 - Short-term losses in HRQoL:
 - Assessment of utility losses during acute phase of child maltreatment
- Assessment of QALYs lost due to CM for application to future CEAs of CM interventions

Public Health Model for Prevention



National Replication of Project Safecare

Research Type	Population	Strategies	Intermed Outcomes	Final Outcomes
Evaluation Research	Participants	SafeCare	Participation Attrition	Decreased CM
Implementation Research	Providers	Implementation Plan		Increased Fidelity

In Summary: Use of EE to Inform Prevention Policy

US Congress

Allocation decision between health, defense, and education.
Outcome comparator: \$

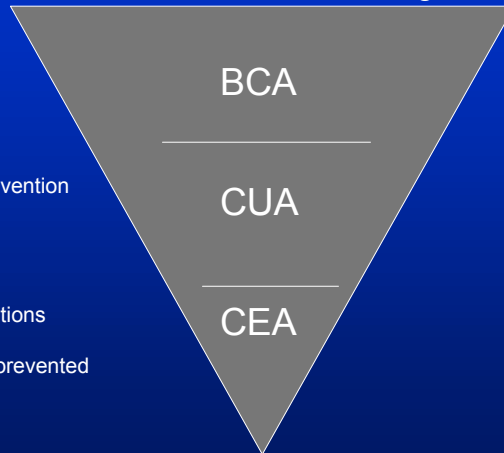
Director of HHS

Allocation decision between violence prevention and cancer screening.
Outcome comparator: QALYs

Local HD

Allocation decision between two interventions designed to reduce child neglect.
Outcome comparator: Cases of neglect prevented

Tier of Decision Making



Final Comments

- Economic evaluation (EE) methods are valuable to decision making and for setting health policy.
- For practitioners and evaluators, these skills are necessary because the DEMAND for these analyses is growing.

Resources

- Applying cost analysis to PH interventions (for sale at www.phf.org)
- Haddix, Teutsch, Corso – Prevention Effectiveness: A Guide to Economic Evaluation (Oxford University Press, 2003)



Thank You!!

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