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From the Selected Works of Glen Mays

Summer August 10, 2015

Fundamentals of Economic Evaluation for Public Health

Glen P. Mays, *University of Kentucky*



Available at: https://works.bepress.com/glen_mays/212/

Fundamentals of Economic Evaluation for Public Health

Texas Department of State Health Services Workshop
Austin, Texas • August 10-11, 2015

Glen Mays, PhD, MPH
Cezar Mamaril, PhD, MS



Today's Agenda

- I. Fundamentals of economic evaluation
- II. Tools for economic evaluation in public health
- III. Examples of public health economic studies
- IV. Group exercise: applying economic evaluation principles to programs
- V. DSHS specific economic evaluations
- VI. Interpretation, applications, limitations & caveats

I. Fundamentals of economic evaluation

Why economics in public health?

- ◆ Do outcomes achieved by public health interventions justify their costs?
- ◆ Where should new investments be directed to achieve their greatest impact?

Related questions of value...

- How much **health** can we produce through public health investments?
- Can public health investments help “bend the curve” to contain **medical costs** or costs incurred by other stakeholders?

Uncertainty and Controversy

THE WALL STREET JOURNAL.

WSJ.com

JUNE 12, 2009

Prevention Efforts Provide No Panacea on Health Costs

By JANET ADAMY

Preventing Chronic Disease: An Important Investment, But Don't Count On Cost Savings

An overwhelming percentage of preventive interventions add more to medical costs than they save.

by Louise B. Russell

HEALTH AFFAIRS - Volume 28, Number 1

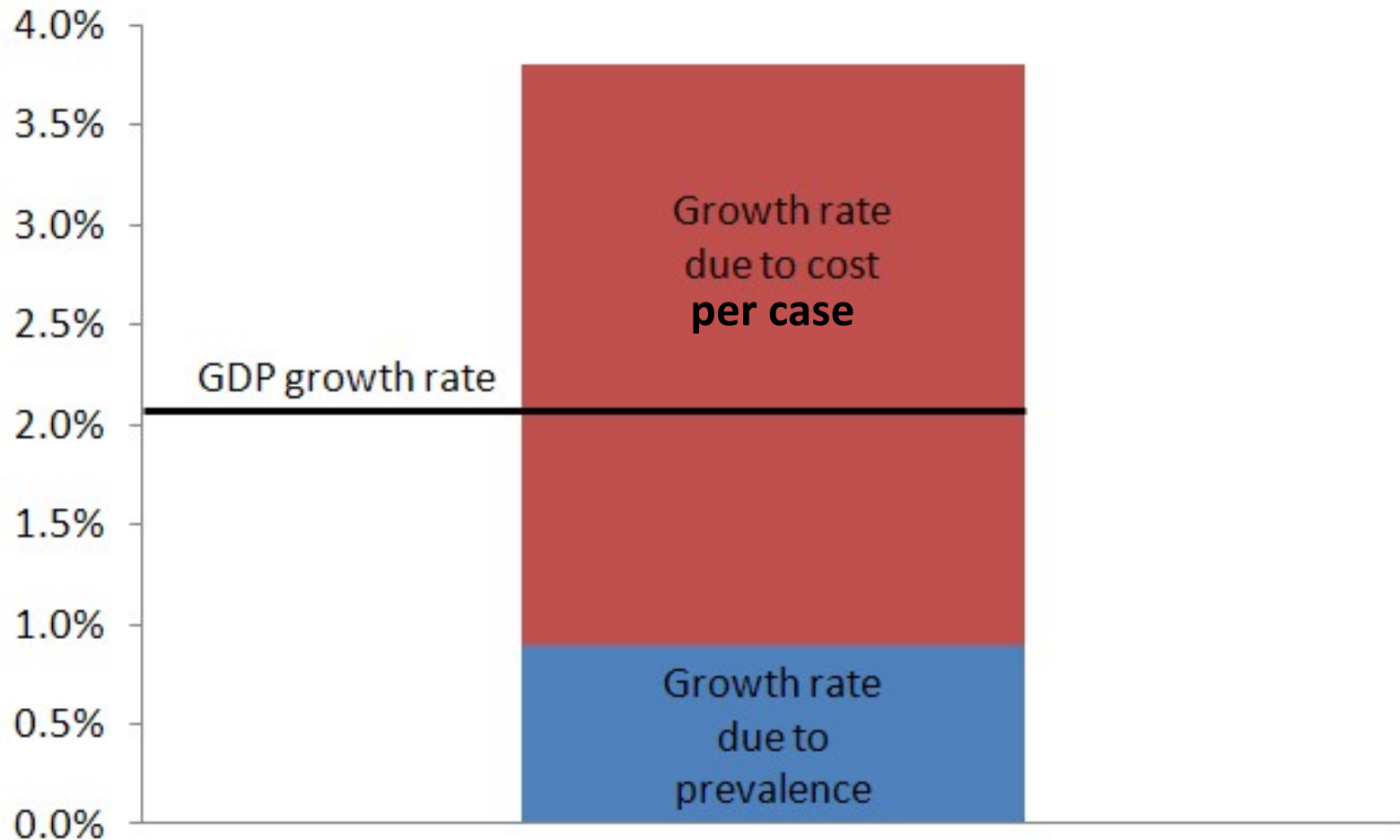
Prevention for a Healthier America:

INVESTMENTS IN DISEASE PREVENTION
YIELD SIGNIFICANT SAVINGS,
STRONGER COMMUNITIES



Public health spending and medical costs

Health spending growth rate 1996-2006



Challenges in demonstrating economic value in public health

- **Time lag** between costs and benefits
- **Distribution** of costs and benefits:
concentrated costs but *diffuse* benefits
- **Measurement** of costs and benefits requires good information systems
- **Attribution** of benefits: the counterfactual

Key ingredients

Investments

- Costs of implementing public health interventions
- Who pays: sources?
- Over what time frames?

Benefits/Returns

- Valuation of the outputs and outcomes attributable to public health interventions
- Who realizes returns?
- Over what time frames?
- Compared to what?

Setting and managing expectations

- **Cost savings** – a high bar
- **Cost effectiveness** – value for dollars spent
 - Compared to status quo
 - Compared to other possible investments
 - Compared to doing nothing

...Key concept: **opportunity costs**

Estimating value in public health:

Key considerations

Targets of study

- Primary, secondary or tertiary prevention programs
- Quality improvement projects
- Cross-cutting infrastructure

Perspective

- Federal, state, agency, health system, or societal?

Time Horizon

- How long can you wait to realize benefits?

Estimating value in public health:

Key considerations - Costs

Direct costs

- Cost of implementing intervention/infrastructure
- Cost savings attributable to the intervention

Indirect costs

- Economic value of productivity gains/losses or time savings/costs attributable to the intervention

Intangibles

- Quality of life, satisfaction, self-efficacy, social capital

Estimating value in public health:

Key considerations - Benefits

Efficiency gains (captured in cost measures)

- Reduced labor costs
- Reduced material costs

Productivity gains (captured in output measures)

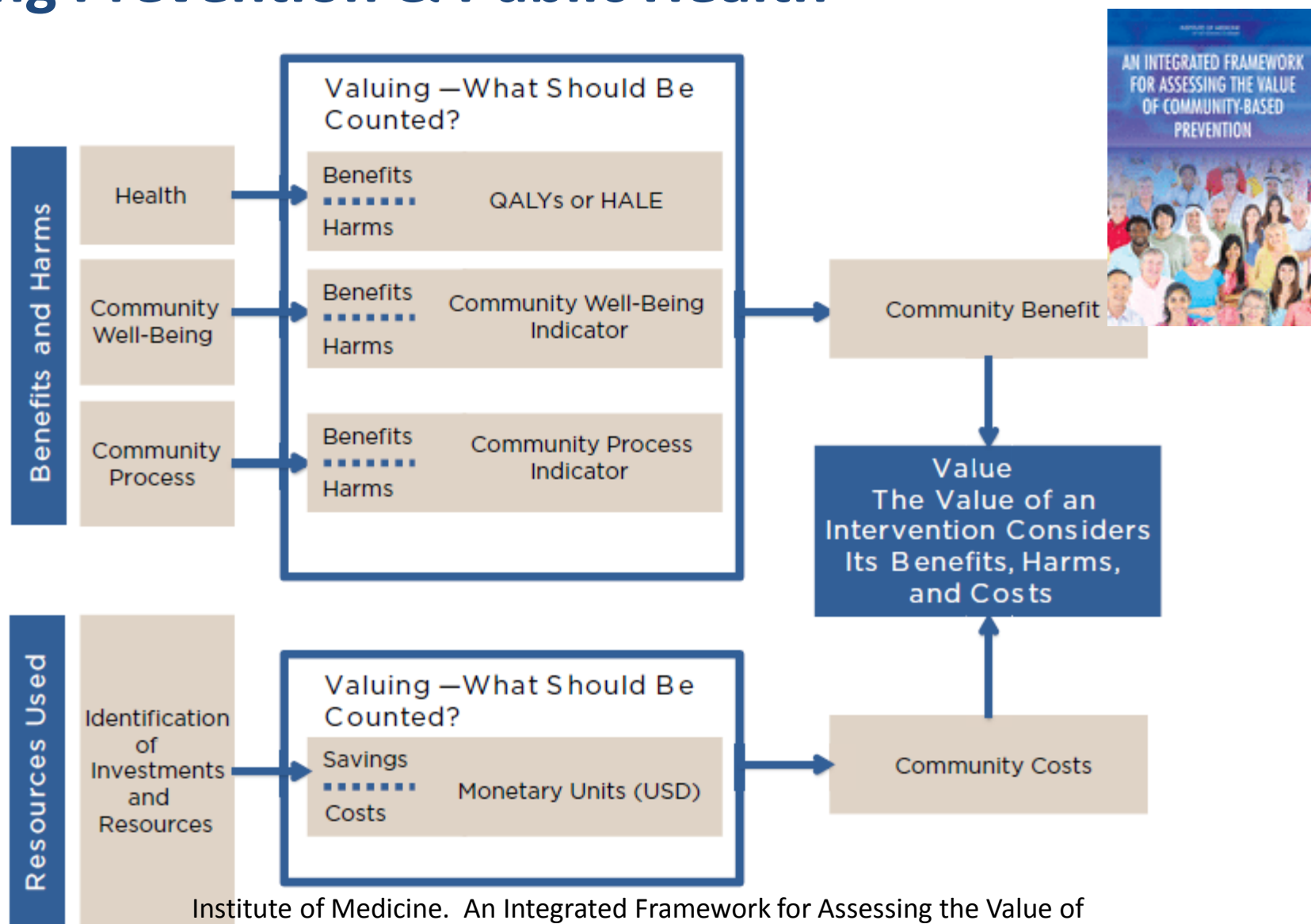
- Services delivered
- Cases detected

Revenue gains (captured in financial measures)

Health gains (captured in outcome measures)

- Deaths averted
- Cases prevented
- Quality-adjusted life years gained

Valuing Prevention & Public Health



Estimating value in public health:

Key considerations

Participation/Adherence

- ✦ What proportion of the population at risk engages in the program/intervention?

Break even

- ✦ How long does it take to recoup investment?

Maintenance/Persistence

- ✦ How long do the benefits last?
- ✦ Recurring costs?

Estimating value in public health:

Key considerations

- ◆ **Evidence** of program effectiveness
- ◆ Ability to **reach** populations at greatest risk
- ◆ Ability to **implement and maintain** active ingredients of programs/policies
- ◆ **Efficiency** in program delivery

Estimating value in public health:

Key considerations

- ✦ **Economies of scale:** many public health interventions can be delivered more efficiently across larger populations
- ✦ **Economies of scope:** efficiencies can be realized by using the same infrastructure to deliver an array of related programs and services

Estimating value in public health: common types of analyses

- ◆ **Cost analysis**
- ◆ **Cost comparison/cost minimization**
- ◆ **Budget impact analysis**
- ◆ **Return-on-investment analysis**
- ◆ **Cost-effectiveness analysis**
- ◆ **Cost-benefit analysis**
- ◆ **Health impact assessment**

Costs: why we need to know?

“Poor costing systems have disastrous consequences. It is a well-known management axiom that what is not measured cannot be **managed or improved**. Since providers misunderstand their costs, they are unable to **link cost to process improvements or outcomes**, preventing them from making good decisions....Poor cost measurement [leads] to huge **cross-subsidies across services**...Finally, poor measurement of costs and outcomes also means that effective and efficient providers **go unrewarded**.”



- R.S. Kaplan and M.E. Porter, The big idea: how to solve the cost crisis in health care. *Harvard Business Review*; 2011.

Toward a deeper understanding of costs in public health

2012 Institute of Medicine Recommendations

- Identify the components and **costs of a minimum package** of public health services
 - Foundational capabilities
 - Basic programs
- Implement a **national chart of accounts** for tracking spending and flow of funds
- Expand **research on costs and effects** of public health delivery



Institute of Medicine. For the Public's Health: Investing in a Healthier Future. Washington, DC: National Academies Press; 2012.

Tools of the trade

- **Prospective “expected cost” methods (micro-costing)**
 - Vignettes
 - Surveys with staff and/or administrators
 - Delphi group processes
- **Concurrent “implementation cost” methods (micro-costing)**
 - Time studies with staff
 - Activity logs with staff
 - Direct observation
- **Retrospective “cost accounting” methods (micro-costing or gross-costing)**
 - Administrative records, financial reports, billing data
 - Decomposition, allocation or modeling
 - Surveys with staff and/or administrators

**Drug
Abuse
Treatment
Cost
Analysis
Program**

CostIt Software ©
(Costing Interventions templates)

Substance Abuse Services Cost Analysis Program

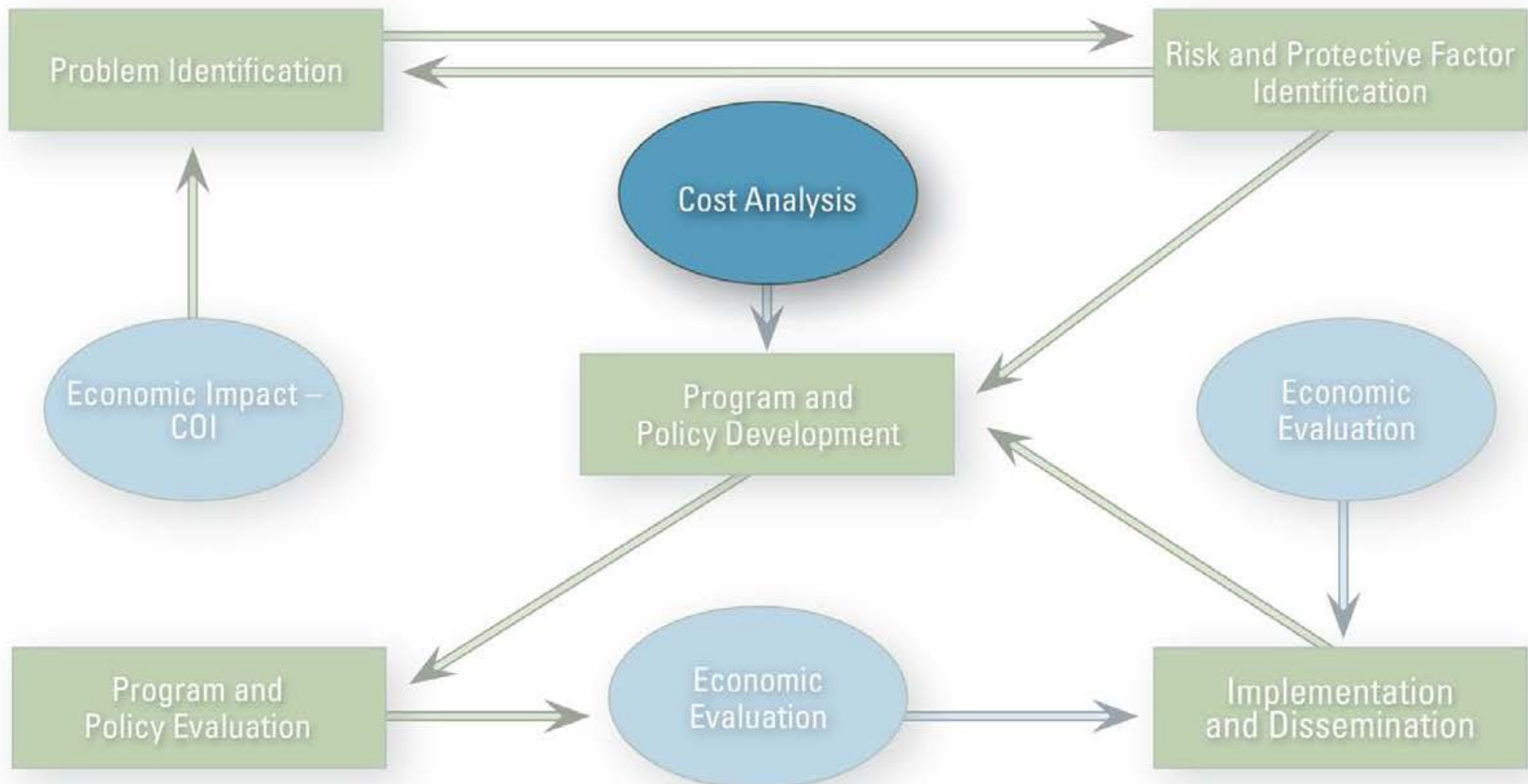
SASCAP™

Costing Methods

TABLE 1. Overview of Costing Methods Available to US Researchers

Method	Description of Method	Advantage	Disadvantage	Issues for Concern
Microcosting	Enumerate staff time, supplies, and items used to provide a specific service and estimate their cost.	Accurate, often needed to find a cost of a service intervention.	Method is labor intensive and not useful for finding overhead cost. It cannot be used to find total health care cost.	Need to include all costs: nonwage labor cost, person-level and institutional overhead, cost of development, set-up, screening, supplies, and space.
Activity-based cost allocation system.	Multistep cost allocation system. Assign cost of staff time, supplies, and equipment to production departments. Distribute overhead. Use relative values to find cost of specific products and assign cost to specific stays or encounters.	The best available estimate of economic costs of health services.	Used by relatively few hospitals, data may not be available to the researcher. Costing system unlikely to capture costs of a novel intervention tested in a research study.	Quality must be evaluated. Cost estimates may not be generalizable.
Cost-adjusted charges or total reimbursement.	Billed charges are adjusted by the ratio of cost-to-charges in a hospital cost report.	Charges routinely created for most of US health care. Hospital cost reports are available from Medicare.	Requires strong assumptions that charge is proportional to economic cost. Charges difficult to obtain for care received at other sites. Difficult to use to cost ambulatory care.	Use of unadjusted charge. Exclusion of cost of physician services to inpatients. Exclusion of patient copayments and deductibles from reimbursement amount.
Gross costing	Quantities of different services are determined, and cost estimated using service specific unit cost.	Relative ease of implementation.	Strong assumptions about homogeneity of services.	Data on characteristics of service may be inadequate. Use of appropriate unit costs.

CDC's Public Health Model for Prevention



First Principles

Estimating total economic costs of an activity

◆ **Costs** = value of resources used to produce activity

◆ **Resources** = people, facilities, equipment, supplies

...Key concept: **opportunity costs**

Financial Costs

- ✦ **Expenditures** for resources to implement the activity – based on market prices
- ✦ Often reflected in expenditure reports, invoices
- ✦ Convenient, sometimes incomplete, measures
- ✦ Examples:
 - Salaries for project personnel
 - Supply costs
 - Computer purchases
 - Cost of curriculum materials

Economic Costs

- ✦ **Value** of the lost benefit because the resource is not available for its next best use
- ✦ Examples:
 - Volunteer time
 - Donated space
- ✦ Shadow prices may be used when market price does not accurately reflect the value of the resource

Developing a cost classification system

- ✦ Perspective: who incurs cost
- ✦ Timeframe: over what period
- ✦ Type of resource
 - Labor, equipment, supplies, facilities, etc
- ✦ Activity domains/areas
 - Training, curriculum development, surveillance, recruitment, screening, **administration**
 - Pre-implementation vs. post-implementation
- ✦ “Direct” vs. “indirect” activities
- ✦ Capital vs. operating costs (& depreciation)

Developing a cost classification system

✦ Common resource categories

- Noncontract labor
- Contract services
- Materials/supplies
- Building/facilities
- Donated labor and resources
- Other resources not funded directly

Developing a cost classification system

Don't overlook...

- ✦ Resources that are hard to measure or value
- ✦ Resources used in small amounts
- ✦ Resources procured without money
 - Volunteer time
 - Parent/caregiver time
 - Intervention recipient time
 - In-kind contributions/donated materials
 - Existing resources

Developing a cost classification system

- ◆ Include measures of units of activity

- Unit costs

- ◆ Fixed vs. variable costs

- Variable costs vary with activity level

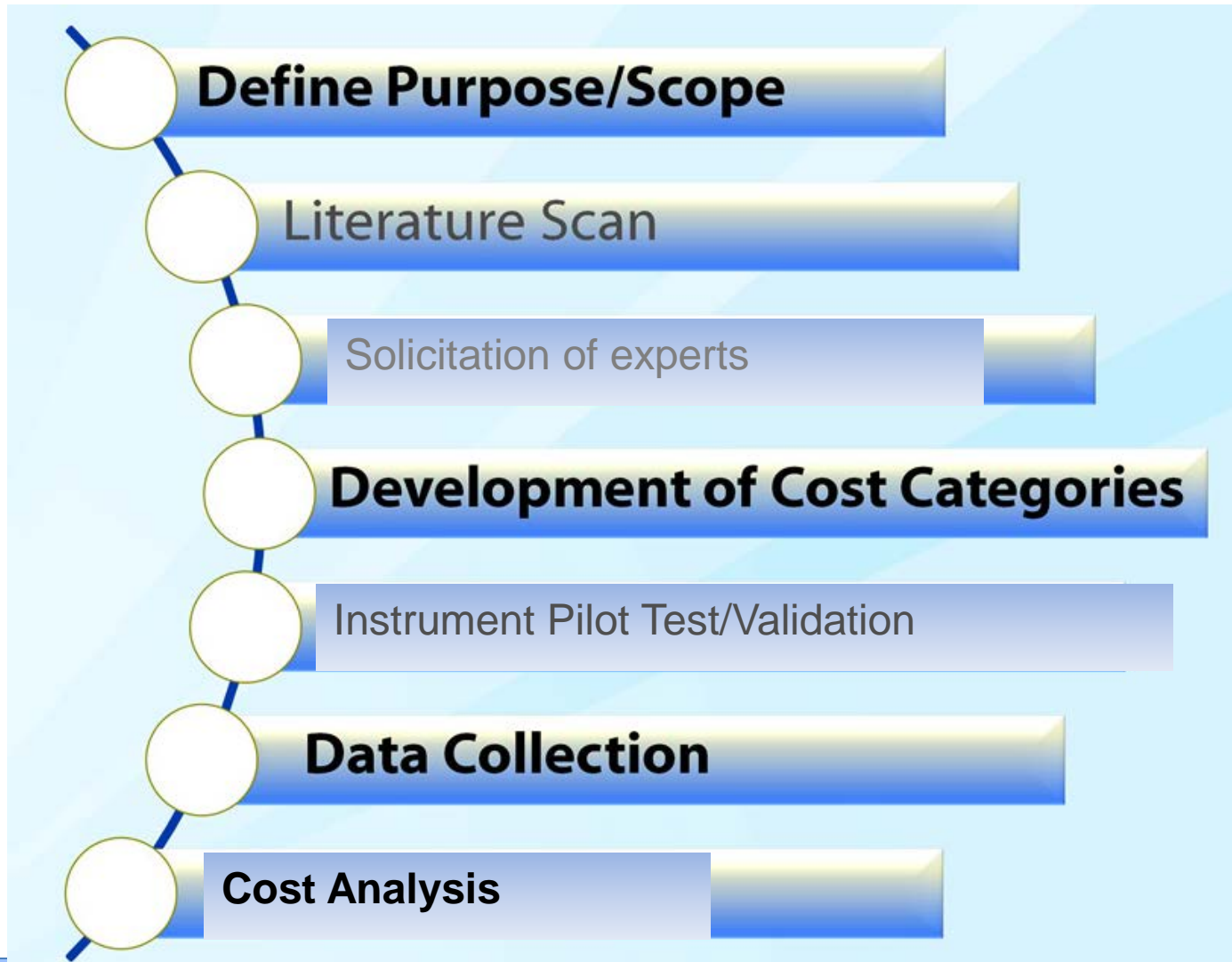
- Fixed costs are constant despite volume of activity

- Long term, all costs are variable

Developing a cost classification system

- ✦ Handling resources that are shared by multiple programs, activities, or organizations
- ✦ Cost allocation methods
 - Time
 - Intensity of use

Conducting a cost study



Conducting a cost study: focus

- ◆ Program/intervention
- ◆ Cross-cutting infrastructure (e.g. PHAB stds)
 - Assessment
 - Surveillance
 - Planning
 - Policy development
- ◆ Organization
- ◆ Industry/enterprise

Cost data collection methods

- **Direct observation methods**
- **Time studies and time-and-motion methods**
 - random moment time sampling
- **Activity logs**
- **Analysis of administrative records**
- **Surveys**
 - Program delivery staff
 - Program managers/directors
- **Group process methods with vignettes**

Examples: Survey methods

SPECIAL REPORT



The NEW ENGLAND
JOURNAL of MEDICINE

Results and Policy Implications of the Resource-Based Relative-Value Study

William C. Hsiao, Ph.D., Peter Braun, M.D., Daniel Dunn, Ph.D., Edmund R. Becker, Ph.D., Margaret DeNicola, M.P.H., and Thomas R. Ketcham, M.P.H.

N Engl J Med 1988; 319:881-888 | [September 29, 1988](#) | DOI: 10.1056/NEJM198809293191330

Three dimensions of work:

- Mental effort and judgment
- Technical skill and physical effort
- Stress

Examples: Survey methods



The
JO

Results and Relative-Val

William C. Hsiao, Ph.D.,

Thomas R. Ketcham, M.

N Engl J Med 1988; 319:

Table 4

**Summary of Estimated Cost of Data Collection
(in 1991 dollars)**

Collection Method	Total Cost ^a	No. of Completes	Cost per Complete ^b	Cost per Rated Service ^c
Telephone	\$105,000	1200	\$87.50	\$175.00
1-Round Mail	\$65,500	1200	\$54.58	\$109.17
2-Round Mail	\$80,000	1267 ^d	\$63.14	\$133.33
Panel	\$88,000	n/a	n/a	\$146.67

^aTotal cost of data collection includes all field activities (e.g., interviewing, survey distribution, data reduction), supervision, management, and instrument/materials development.

^bCost per complete is derived by dividing the total cost of data collection by the number of completed cases. (This calculation is not applicable to the panel-rating methodology.)

^cCost per service is derived by dividing the total cost of data collection by the 600 rated services.

^d667 completes for the first round and 600 completes for the second round.

Examples: Survey methods



- ✦ Surveys program managers
- ✦ Refers to expenditure records (not budgets)
- ✦ Explicit allocation of resources across multiple programs
- ✦ Available at:

<http://www.rti.org/page.cfm?objectid=7E6095C8-AE6E-4568-874839C81FAD414B>

Zarkin GA, Dunlap LJ, Homs G. The substance abuse services cost analysis program (SASCAP): a new method for estimating drug treatment services costs, **Evaluation and Program Planning** 2004; 27(1): 35-43,

Examples: Survey methods

SASCAP™

Substance Abuse Services Cost Analysis Program

SASCAP™ Labor Module

Time Allocation Table for Non-Medical Direct Care Staff

1 Job Type	2 # of People	3 Total Hours Worked Per Week by All the People Indicated in Column 2	Hours Spent in Average Week Providing Specified Patient Services											Hours Spent in Average Week Doing Administrative and Other Support Activities				
			4 Initial Patient Assessment and/or Orientation	5 Initial Medical Services	6 Ongoing Medical Services Other Than Pharmacological Dosing	7 Medication Dosing	8 Other Pharmacological Dosing	9 Individual, Couples, and Family Counseling	10 Group Counseling	11 Patient Educational Services Outside of Counseling	12 Case Management/Case Support	13 Patient-Specific Administrative	14 Any Other Patient Services	15 Quality Assurance	16 Program Evaluation	17 Staff Education	18 General Administrative	19 Any Other Activity
EXAMPLE: Social Worker (MSW/DSW)	2	60	20								20	20						
Non-Medical Direct Care Staff																		
Case Manager (certified)																		
Case Manager (non-certified)																		
Degreed Counselor (licensed or certified)																		
Degreed Counselor (non-licensed)																		

Zarkin GA, Dunlap LJ, Homs G. The substance abuse services cost analysis program (SASCAP): a new method for estimating drug treatment services costs, **Evaluation and Program Planning** 2004; 27(1): 35-43,

Analyzing costs

- ◆ Average vs. marginal costs?
- ◆ Compared to what?
 - Doing nothing
 - Status quo
 - Other settings, implementation strategies
 - Other activities/interventions
- ◆ Quantifying variation in costs
 - Scale and scope
 - Context

Analyzing costs: example

WISEWOMAN Cost Analysis

Steps:

1. Calculate total costs for 6-month period
2. Divide by # women screened in same period

WISEWOMAN Average Per Capita Costs	
Activity	Per capita costs
Outreach/follow-up	\$22
Screening	
WISEWOMAN screening	\$98
Annual prescriptions	\$26
Additional office visits	\$3
Total screening	\$127
Intervention	\$121
Total	\$270

Cost-Effectiveness of WISEWOMAN, a Program Aimed at Reducing Heart Disease Risk among Low-Income Women. Eric A. Finkelstein, PhD, Olga Khavjou, MA, and Julie C. Will, PhD

Analyzing costs

- ◆ Identifying determinants of costs
 - ◆ cost function estimation
- ◆ Examining cost heterogeneity and efficiency
 - ◆ Stochastic frontier analysis
 - ◆ Data envelopment analysis

Analyzing costs

Explaining the efficiency of local health departments in the U.S.: an exploratory analysis

Kankana Mukherjee • Rexford E. Santerre •
Ning Jackie Zhang

Health Care Manag Sci (2010) 13:378–387
DOI 10.1007/s10729-010-9136-5

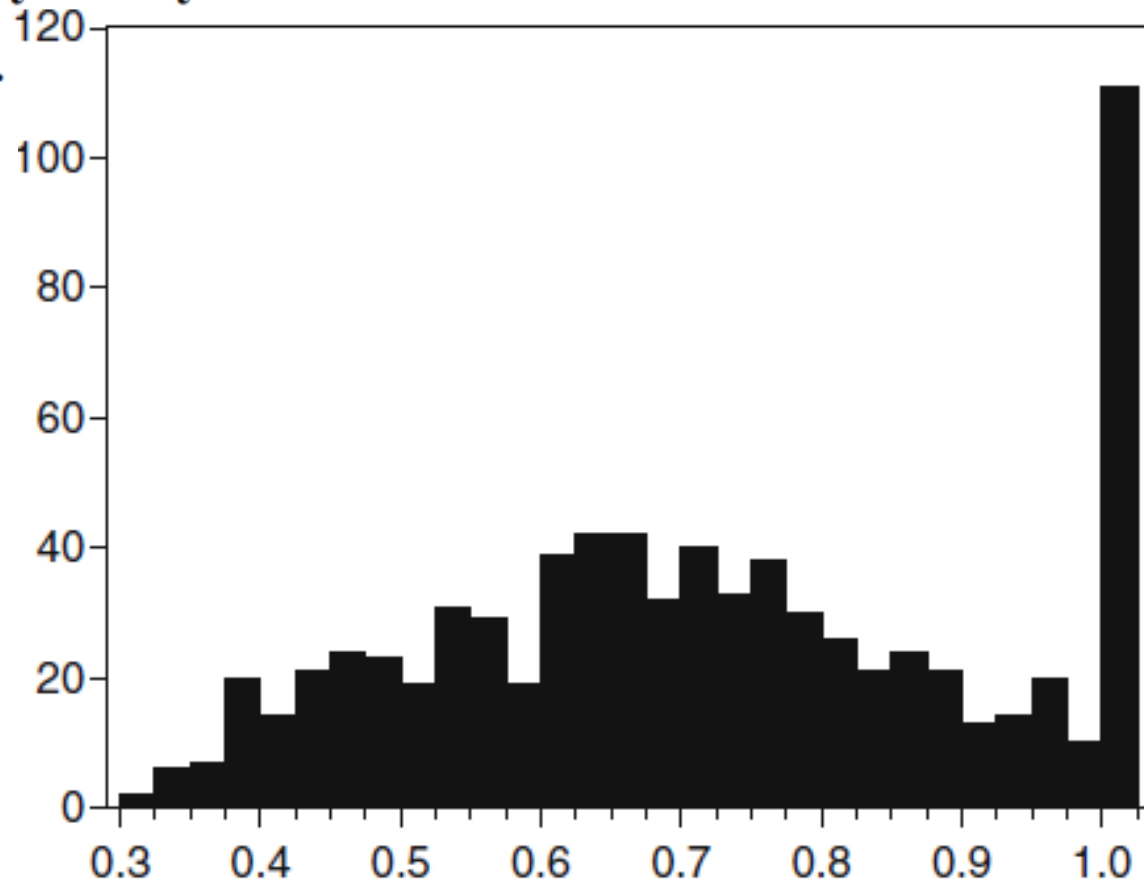
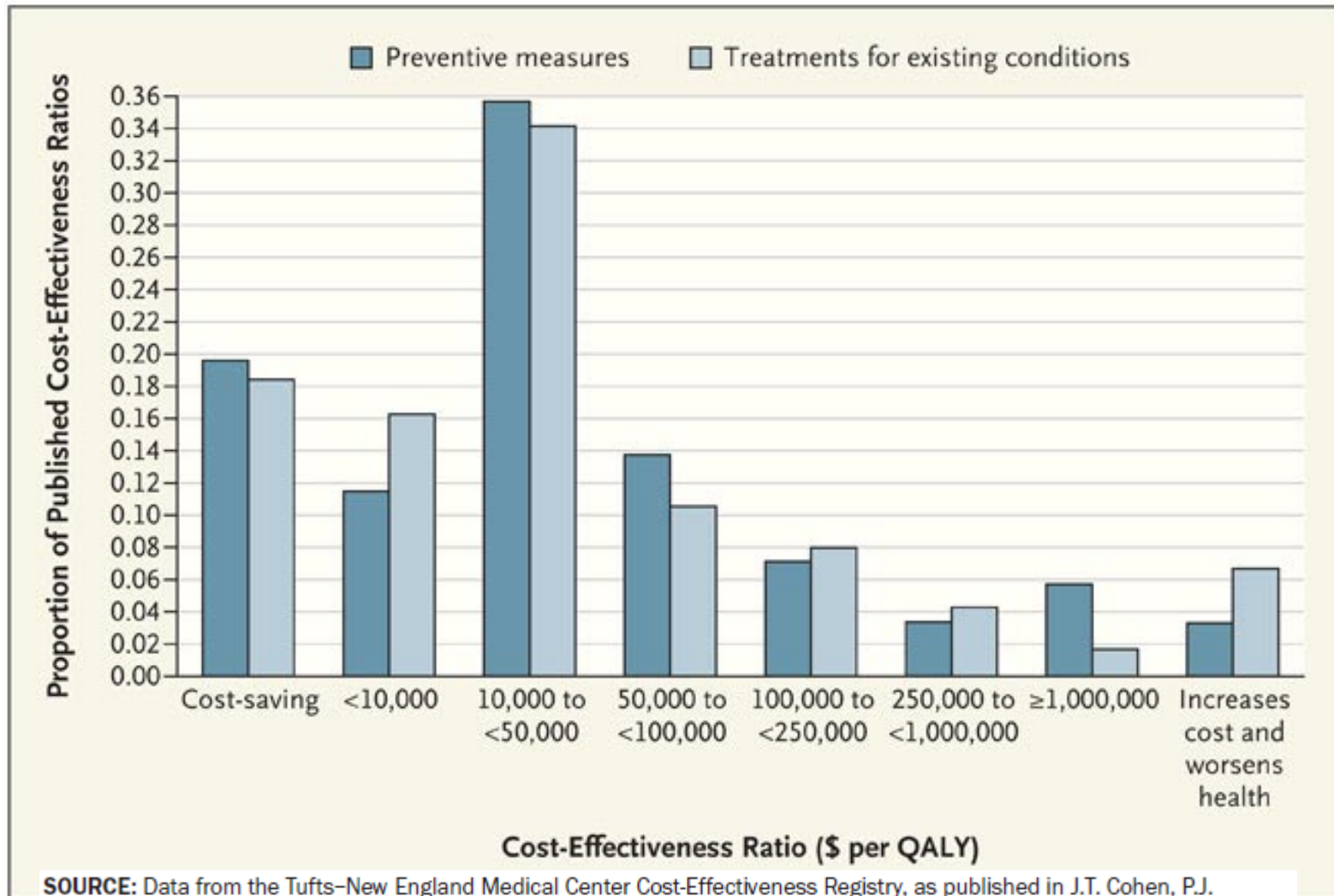


Fig. 4 Relative efficiency of 771 LHDs with nonzero inputs and outputs

Resources

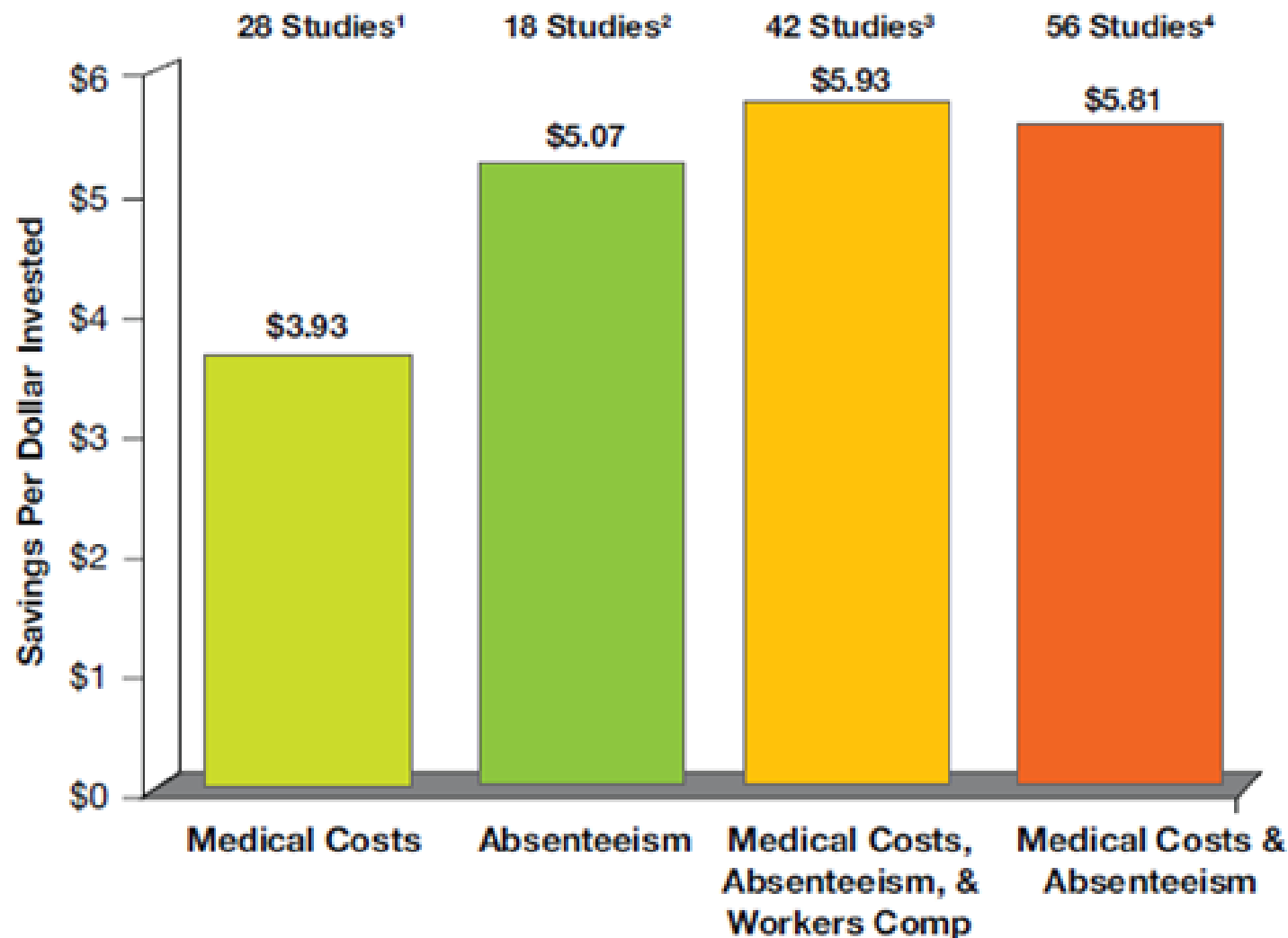
- USDHHS Assistant Secretary for Planning and Evaluation. **Guide to Analyzing the Cost-Effectiveness of Community Public Health Prevention Approaches.**
www.aspe.hhs.gov/health/reports/06/cphpa/report.pdf
- Haddix AC et al (CDC). **Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation.** Oxford University Press.
- RTI. **Substance Abuse Services Cost Analysis Program.**
<http://www.rti.org/page.cfm?objectid=7E6095C8-AE6E-4568-874839C81FAD414B>

Cost-effectiveness analyses: prevention vs treatment



SOURCE: Data from the Tufts–New England Medical Center Cost-Effectiveness Registry, as published in J.T. Cohen, P.J. Neumann, and M.C. Weinstein, “Does Preventive Care Save Money? Health Economics and the Presidential Candidates,” *New England Journal of Medicine* 358, no. 7 (2008): 661–663 © 2008 The Massachusetts Medical Society. All Rights Reserved.

ROI analyses: worksite health promotion



Estimating value in public health: levels of analyses

- ◆ **Macro-level analysis**
- ◆ **Infrastructure-level analysis**
- ◆ **Intervention-level analysis**
- ◆ **Process-level analysis**

Example:

Macro-level Analysis



NATIONAL RETURN ON INVESTMENT OF \$10 PER PERSON (Net Savings in 2004 dollars)

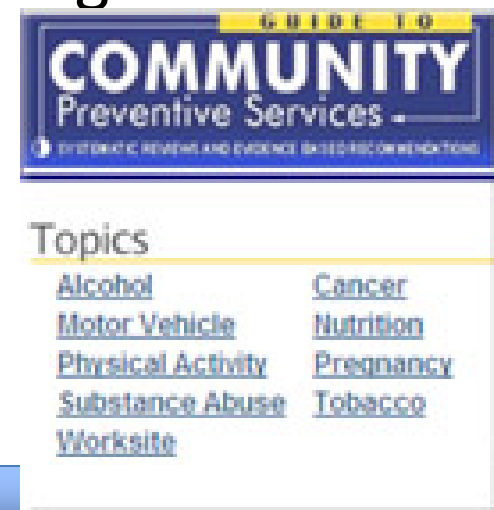
	1-2 Years	5 Years	10-20 Years
U.S. Total	\$2,848,000,000	\$16,543,000,000	\$18,451,000,000
ROI	0.96:1	5.6:1	6.2:1

Source: Trust for America's Health, 2009

Example:

Intervention-level analysis

- Smoking cessation interventions cost an estimated \$2,587 for each life-year gained
- \$1 spent on STD and pregnancy prevention produces \$2.65 in medical cost savings
- \$1 spent on preconception care for diabetic women produces \$5.19 in medical cost savings
- \$1 spent on childhood immunization produces \$6.30 in medical cost savings



II. Tools for economic evaluation in public health

Existing public use tools

AHRQ Asthma ROI calculator

<http://nhqrnet.ahrq.gov/asthma/>

CDC Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC)

<http://apps.nccd.cdc.gov/sammec/>

CDC LeanWorks Obesity Cost Calculator

<http://www.cdc.gov/leanworks/costcalculator/index.html>

RWJF Diabetes Self-Management ROI Calculator

<http://www.diabetesinitiative.org>

HIMSS Electronic Health Record ROI

http://www.himss.org/ASP/ROI_Calc.asp

Existing public use tools

County Health Calculator: impact of education and income

<http://countyhealthcalculator.org/>

OSHA Safety Pays Cost Calculator for Occupational Health

<https://www.osha.gov/dcsp/smallbusiness/safetypays/index.html>

Economic Impact Analysis Tool

<https://www.raconline.org/econtool/>

CommunityFlu 2.0

<http://www.cdc.gov/flu/pandemic-resources/tools/index.htm>

Integrated Disease Surveillance and Response Cost Calculator

<http://www.cdc.gov/globalhealth/healthprotection/ghsb/idsr/default.htm>

Community Health Advisor: physical activity and tobacco prevention

<http://www.communityhealthadvisor.org/>

Estimating value in public health:


National Public Health Improvement Initiative

- **Goal:** Develop approaches to assess value of improvements in public health capacity, infrastructure, administrative processes
- **Near-term:** capture effects on labor costs, time costs, productivity
- **Longer-term:** capture effects on program delivery (reach, effectiveness), population health



Public Health
Prevent. Promote. Protect.

The Public Health ROI Calculator:

A	B	C	D	E	F	G	H	I	J	K	L
<h2>PUBLIC HEALTH RETURN ON INVESTMENT TEMPLATE</h2> <p>Demonstration Version</p> <p>October 29, 2012</p> <p>Prepared for:</p> <p>The Association of State and Territorial Health Officials</p> <p>Prepared by:</p> <p>Glen P. Mays, Ph.D., M.P.H. Center for Public Health Services and Systems Research University of Kentucky</p> <div style="text-align: right;"><p>UK UNIVERSITY OF KENTUCKY Center for Public Health Systems and Services Research</p></div> <p>Available for download: http://works.bepress.com/glen_mays/64/</p> <p>Supported by the U.S. Centers for Disease Control and Prevention's National Public Health Improvement Initiative</p>											

The Public Health ROI Calculator: Demonstration Version

- Requires data on:
 - Operating costs before and after implementation of your public health strategy
 - Revenues (if any) before and after implementation of your public health strategy
 - Measures of outputs/services before and after
 - Measures of health and economic outcomes (if available) before and after



Available for download: http://works.bepress.com/glen_mays/64/



Public Health
Prevent. Promote. Protect.



■ Pathways to Realizing ROI for QI

- Reductions in standard operating costs
 - *Greater efficiencies realized*
- Revenue enhancements
 - *Increased cost reimbursement*
- Increased productivity of agency functions
 - *Increased service encounters*
- Decreased time to produce outputs
 - *Reduced cycle time process*

Planning and Development Costs

Cost Category	Pre-Implementation(Baseline)	Post-Implementation (Year 1)	Year 2 ...
Personnel Costs			
Non-Personal <ul style="list-style-type: none"> Contracted Services Office Operations Facilities/Maint/Rent Communications Equipment Construction/Renovation 			
Other Direct Costs			
Indirect Costs			

Routine Operating Costs

Cost Category	Pre-Implementation(Baseline)	Post-Implementation (Year 1)	Year 2 ...
Personnel Costs			
Non-Personal <ul style="list-style-type: none"> Contracted Services Office Operations Facilities/Maint/Rent Communications Equipment Construction/Renovation 			
Other Direct Costs			
Indirect Costs			

Outcomes/Outputs

Cost Category	Pre-Implementation	Post-Implementation (Year 1)	Year 2 ...
Service Units Delivered			
Required Production Time			
Target Population Reach			
Other Outcomes/Outputs			

How the Tool Calculates ROI

❑ **ROI = Benefits – Costs**
Costs

Improvements in Routine Operations – Investment Costs
Investment Costs

(Routine Operations + Other Outcomes) – Investment Costs
Investment Costs

Incorporates Standard Accounting Practices in ROI Calculation

❑ Amortization

- The cost of an investment should not be absorbed entirely in the first year
- Amortization rate spreads the agency's cost/investment over the useful life of the product



❑ Present value

- The relative worth of a single dollar changes over time
- Accurate comparisons are made by applying a discount rate (inflation) to
 - Costs
 - Returns

Tool Can Be Used throughout Project

- ❑ **Prospectively – Planning Phase**
- ❑ **Implementation Phase**
- ❑ **Retrospectively – Post Implementation**



Example Quality Improvement Initiative

Improving the Connecticut Department of Public Health Databases

- AIM: Make three DPH databases compliant with the CT DPH policy on collecting sociodemographic data (similar to federal OMB-15 directive in 1997)
- Increase the percentage of compliant databases from 4% to 10%
- Put a plan in place to modify the remaining databases
- Make sure that all newly-designed databases are aligned with the DPH data collection policy.
- The modification process for the targeted databases was implemented and this strategy was followed on a continuous quality improvement basis through 2014.



Source: Susan Logan, MS, MPH, Connecticut Department of Public Health

Salary Costs for QI Initiative Team

		Pre-Implementation - Baseline			Implementation Period 1		
		From		To	From		To
Cost Category		4/1/12		8/19/12	8/20/12		11/30/12
Personnel (see below)	Reporting Period: List by name or by category	FTE %	Salary and Fringe	Cost	FTE %	Salary and Fringe	Cost
Project Sponsor - Epidemiologist 4	Project team member	5.00%	87,931.00	\$ 1,721.98	3.00%	87,931.00	\$ 725.43
Project leader-Epidemiologist 2	Project team member	20.00%	53,143.00	\$ 4,162.87	20.00%	53,143.00	\$ 2,922.87
Epidemiologist 4	Project team member	4.00%	87,931.00	\$ 1,377.59	2.00%	87,931.00	\$ 483.62
Epidemiologist 3	Project team member	6.00%	76,884.00	\$ 1,806.77	5.00%	76,884.00	\$ 1,057.16
Section Chief: Practitioner Licensing	Project team member	5.00%	100,000.00	\$ 1,958.33	5.00%	100,000.00	\$ 1,375.00
Manager Vital Statistics	Project team member	5.00%	86,300.00	\$ 1,690.04	5.00%	86,300.00	\$ 1,186.63
Section Chief: IT	Project team member	4.00%	100,000.00	\$ 1,566.67	2.00%	100,000.00	\$ 550.00

Takes into account time prds (4.7 mos baseline)

Source: Susan Logan, MS, MPH, Connecticut Department of Public Health

Salary Costs for QI Initiative Team: Implementation Periods 2 and 3

Data quality committee reviewing
databases and overseeing fixes (Impl
Prds 2 - 3)

Cost Category	Implementation Period 2			Implementation Period 3		
	From		To	From		To
	12/1/12		12/31/13	1/1/14		12/31/14
Personnel (see below)	FTE %	Salary and Fringe	Cost	FTE %	Salary and Fringe	Cost
Project Sponsor - Epidemiologist 4	6.00%	87,931.00	\$ 5,715.52	6.00%	87,931.00	\$ 5,275.86
Project leader-Epidemiologist 2	8.00%	53,143.00	\$ 4,605.73	8.00%	53,143.00	\$ 4,251.44
Epidemiologist 4	4.00%	87,931.00	\$ 3,810.34	4.00%	87,931.00	\$ 3,517.24
Epidemiologist 3			\$ -			\$ -
Section Chief: Practitioner Licensing			\$ -			\$ -
Manager Vital Statistics	3.00%	86,300.00	\$ 2,804.75	3.00%	86,300.00	\$ 2,589.00
Section Chief: IT	3.00%	100,000.00	\$ 3,250.00	3.00%	100,000.00	\$ 3,000.00

Source: Susan Logan, MS, MPH, Connecticut Department of Public Health

Non-Personnel Investment Costs: Planning and Implementation Periods

Cost Category	Reporting Period:	Baseline - Pre-implementation		Implementation - Year 1	
		From	To	From	To
		4/1/12	8/19/12	8/20/12	11/30/12
Contracted services³					
Other contracted services	Modifications done - 5 hours at \$40.00/hr		-		200.00
Office operations⁴					
Printing	paper (\$5/ream) and toner(\$602/crtrdg)		303.50		303.50
Office supplies/postage	flip charts (2 cartons at \$41/crtn), pens (4 dzn at \$11.82/dzn), markers (4 at \$2 ea), post-its (\$15/18 pk)		76.26		76.26
Travel/conferencing	Dinners (\$26 per) and Taxis(\$25 per): Travel to Portland, OR in Apr. and Charlotte, NC in Dec.		1,050.00		1,050.00
Training			-		137.08
Other office operations	frames for certificates of recognition/appreciation (11 at \$11.70/ frame)				128.70
Communications	8 hours of writing article for DPH newsletter and creating story board		-		-
Equipment⁶					
Subtotal direct costs			\$ 17,815.61		\$ 17,466.42
Indirect cost percentage (if % of direct costs) ⁹					
Indirect costs ⁹			\$ -		\$ -
Total costs of investment in strategy			\$ 17,815.61		\$ 17,466.42
Years of expected utility from pre-implementation investments (for amortization) ¹⁰			1.00		
Amortized Pre-Implementation Investment Costs			\$17,815.61		

Source: Susan Logan, MS, MPH, Connecticut Department of Public Health

Determining Costs and Savings for Outcomes and Outputs: ROI Produced

Calculate Costs/Savings for Outcomes

ROI is Produced based on Prior Calculations

- Baseline and Post Periods
- Measures of Production Time
- Time to analyze data with standardized sociodemographic categories (expected reduction)
- Time to review databases (improves over time)
- Improve Health Outcomes: Based on finding new cases in sociodemographic groups
- Taking into account the Investment and Routine Operating Costs Only
 - Implementation Period 1
 - Benefit (savings) was 64 cents for every dollar spent
 - Implementation Period 2
 - Cost was \$2.21 for every dollar spent
- Adding in Outcomes
 - Implementation Period 1 and Overall
 - **Savings was \$17.05 (\$18.16 overall) for every dollar spent**

Outcome/Output Measures: Production Time Costs and Savings

Measures of Production Time

☒ Check here to use these measures in ROI

Description: output/event and time frame		Baseline			Post Period - Year I		
		Total events	Average time (days)	Total time (days)	Total events	Average time (days)	Total time (days)
Time to analyze data with standardized sociodemographic categories	May see reductions in Post Periods-Year 2 and 3 when employees are trained and databases were starting to be used for quarterly and final reports: 1/1/2013 to 12/31/2014	7.00	3.00	21.00	7.00	2.50	17.50
Number of databases reviewed by project sponsor and leader	Spent 1 hour per database review in baseline and QA checks	8.00	0.20	1.60	8.00	0.03	0.24
Number of databases reviewed by data quality committee	Will spend 1 hour per database review in baseline and QA checks			-			-
Total		5	4.52	22.60	5	3.548	17.74

Source: Susan Logan, MS, MPH, Connecticut Department of Public Health

Outcome/Output Measures: Reach Outcomes: Rates

Did not include data in ROI calculations (unchecked)

Measures of Reach/Intermediate Outcomes

☐ Check here to use these measures in ROI calculations

Baseline

Post Period - Year I

FALSE	Description: target population and outcome	Numerator	Denominator	Rate	Numerator	Denominator	Rate
Finding cancer cases based on self-identified gender	Using SEER cancer registry as source data	343	75,250	455.81	350	75,250	465.12
Finding cases of reportable disease based on sociodemographic characteristics (e.g. black race)	Focusing program services for African-Americans throughout the CT	5,000	660,000	757.58	5,500	660,000	833.33
Finding cases of adult lead poisoning based on sociodemographic characteristics (e.g. Hispanic)	Finding more cases of hispanic origin	22	874,500	2.52	30	874,500	3.43
Composite reach		5,365	1,609,750	333.28	5,880	1,609,750	365.27

Used these rows as a worksheet for the health outcomes on next slide

Source: Susan Logan, MS, MPH, Connecticut Department of Public Health

Outcome/Output Measures: Health Outcomes Savings

Include data in ROI calculations
(checked)

☒ Check here to use these measures in ROI calculations

Measures of Health-Related
Outcomes

		Baseline	Post Period - Year 1	Post Period - Year 2	Post Period - Year 3	
Description		Total	Total	Total	Total	Est. Cost per Unit Outcome**
Preventing cancer deaths (based on better follow-up) people who self-identify as other than male or female	Can prevent 5% of cancer deaths if invasive cancer found and reported	17	18	18	19	-\$50,000.00
Preventing readmissions for reportable diseases in blacks	Can reduce readmissions by 10%	500	550	600	660	-\$9,500.00
Preventing further cases of adult lead poisoning in Hispanics in neighborhoods/communities	For every one person exposed and poisoned, there are 2 others exposed and potentially poisoned	44	60	70	80	-\$1,000.00
Composite outcomes		561	628	688	759	
Total value		-\$5,644,000	-\$6,185,000	-\$6,670,000	-\$7,300,000	

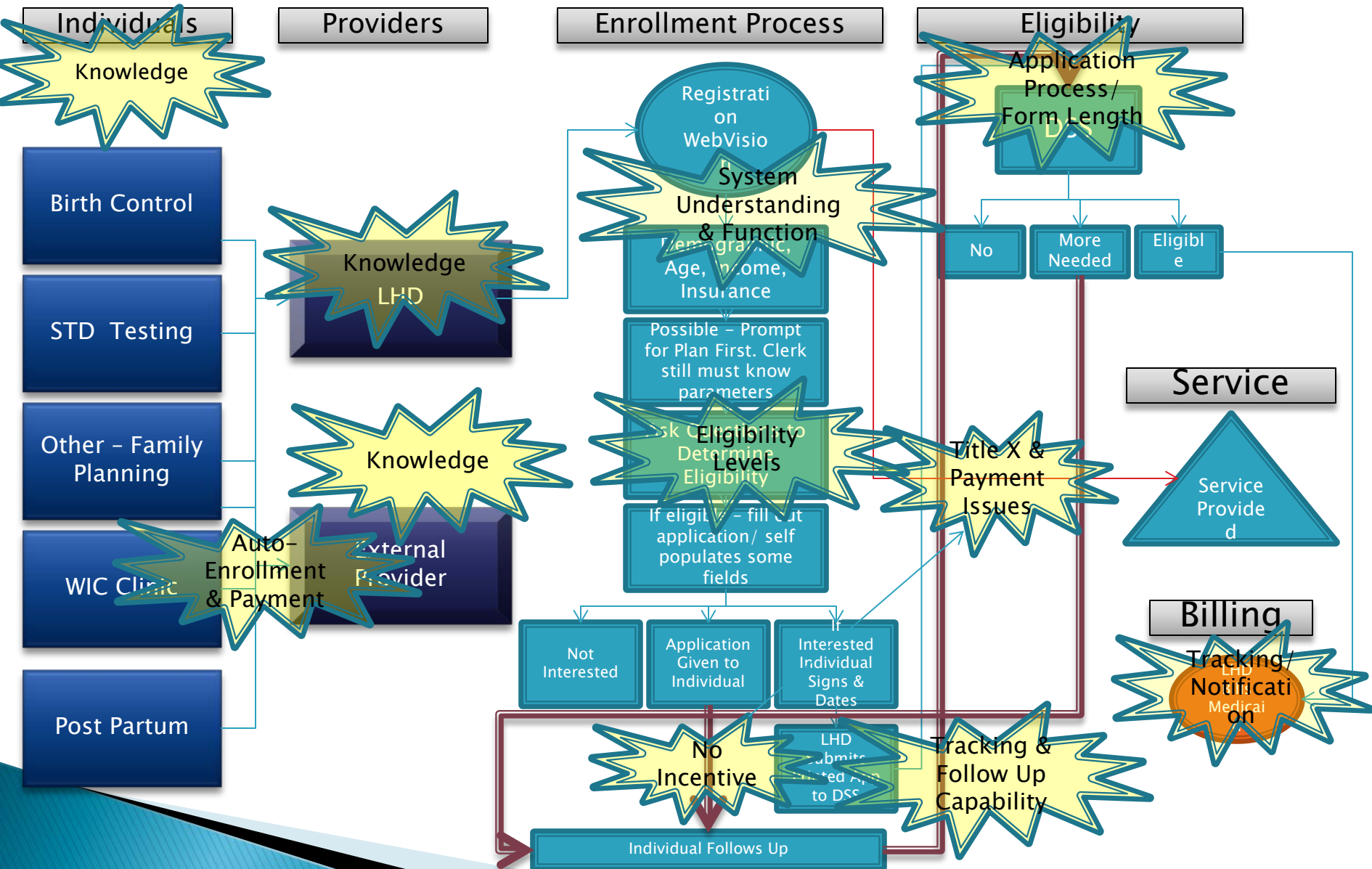
Source: Susan Logan, MS, MPH, Connecticut Department of Public Health

Return on Investment Analysis

II. Analysis INCLUDING Output and Outcome Measures (Production Time, Reach, and Health-Related Outcome Factors)

	Baseline	Implementation Period			Total (All Periods)
		1	2	3	
Investment in Project					
Amortized Pre-Implementation Costs	\$17,815.61				
Ongoing Implementation Costs	\$0.00	\$14,766.42	\$22,158.71	\$20,256.01	
Total Annual Implementation Costs	\$17,815.61	\$14,766.42	\$22,158.71	\$20,256.01	
x Present Value Factors (see below)	\$1.00	\$0.97	\$0.94	\$0.92	
Total Discounted Annual Implementation Costs	\$17,815.61	\$14,336.33	\$20,886.71	\$18,537.11	\$71,575.76
Financial Gain/Loss Attributable to Project					
Estimated Changes in Operating Costs		\$ (21,330.43)	\$ 146,265.80	\$ 129,506.18	
Estimated Changes in Revenue		\$ -	\$ -	\$ -	
Total Net Financial Gain/Loss		\$ 21,330.43	\$ (146,265.80)	\$ (129,506.18)	
x Present Value Factors (see below)		\$ 0.97	\$ 0.94	\$ 0.92	
Total Discounted Annual Net Gain/Loss		\$ 20,709.15	\$ (137,869.54)	\$ (118,516.50)	\$ (235,676.89)
Non-Financial Gains/Losses Attributable to Project					
Estimated Production Time Gain/Loss		4.86	(28.85)	(20.40)	
Monetary Value of Time Gain/Loss		\$ 2,443.55	\$ (16,117.17)	\$ (11,396.54)	
x Present Value Factors (see below)		\$ 0.97	\$ 0.94	\$ 0.92	
Total Discounted Value of Time Gain/Loss		\$ 2,372.38	\$ (15,191.98)	\$ (10,429.45)	\$ (23,249.05)
Cumulative ROI including Time Cost		\$ 0.72	\$ (2.45)	\$ (3.62)	\$ (3.62)
Estimated Changes in Health-Related Outcomes		67.00	127.00	198.00	
Estimated Cost per 1 Unit Improvement in Outcomes		\$ (95.12)	\$ 1,250.05	\$ 692.19	
Monetary Value of Outcome Improvement/Loss		\$ 541,000.00	\$ 485,000.00	\$ 630,000.00	
x Present Value Factors (see below)		\$ 0.97	\$ 0.94	\$ 0.92	
Total Discounted Value of Outcome Improvement/Loss		\$ 525,242.72	\$ 457,159.02	\$ 576,539.25	\$ 1,558,940.98
Cumulative ROI including Value of Health-Related Outcomes		\$ 16.98	\$ 16.31	\$ 18.49	\$ 18.49
Cumulative ROI Including All Non-Financial Gains/Losses		\$ 17.05	\$ 16.07	\$ 18.16	\$ 18.16

Example: Increase Enrollment in Plan First – Virginia's Medicaid Family Planning Program



Source: Josh Czarda, Virginia Department of Health

Step 1: Calculating All Costs Pre-Implementation – Implementation Phases

Source: Josh Czarda, Virginia Department of Health

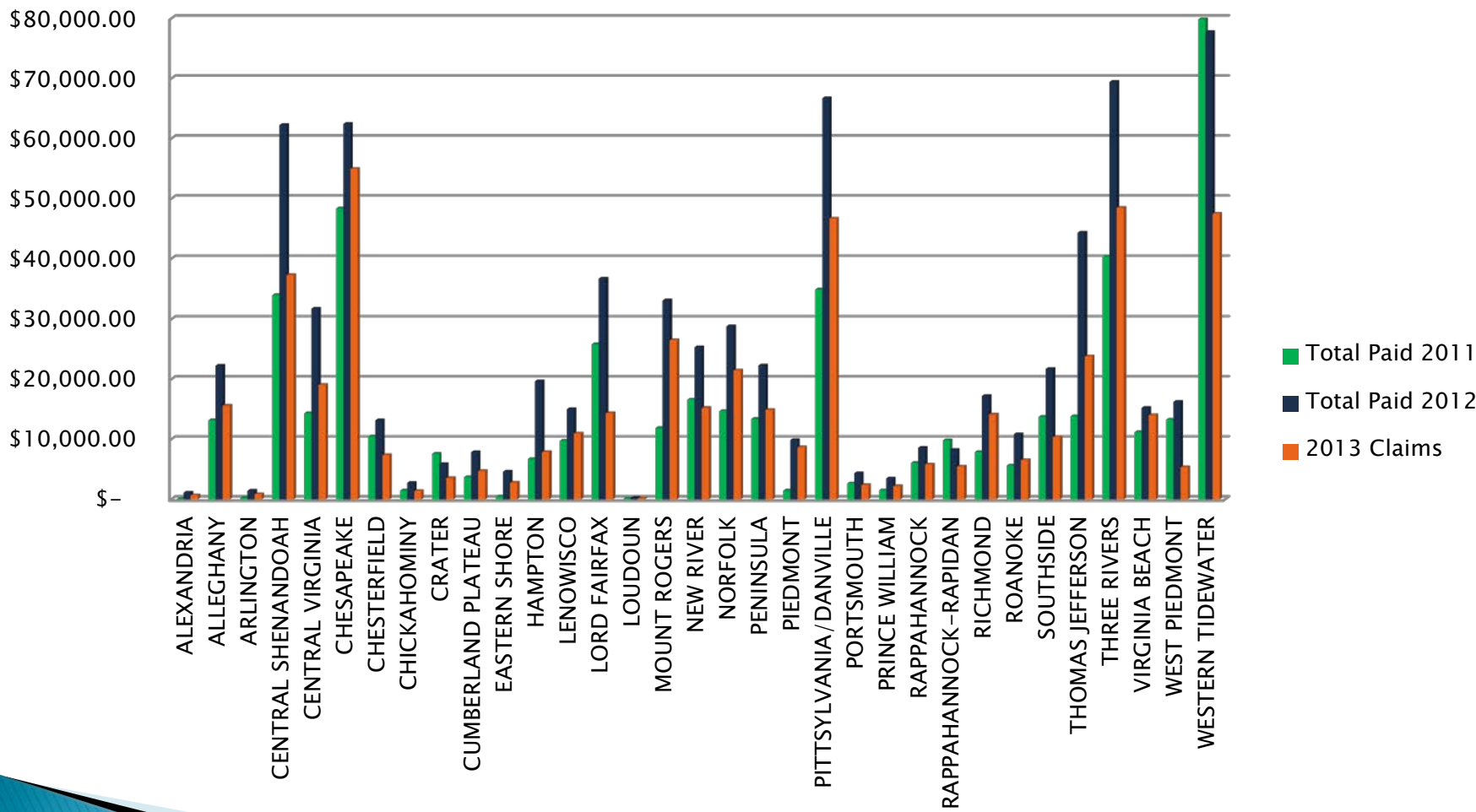
IMPLEMENT THE PUBLIC

Use this sheet to enter the personnel and non-personnel costs incurred specifically to design, develop, and implement the public health strategy that is the object of this ROI analysis. These costs represent the resources that have been invested in the public health strategy each year. (specific instructions below)

[illegible]

Step 2: Measuring Immediate Impact

Measuring Increased Revenue from Medicaid Billing Through May 2013



Initial View of Short Term ROI Calculations Using the Tool

ROI for Public Health Strategies					
Return on Investment Analysis					
virginia					
Joshua Czarda					
I. Analysis EXCLUDING Output, Production Time and Outcome Factors					
				Discount Rate	3%
	Pre-Implementation	Implementation Period			Total
	Baseline	1	2	3	(All Periods)
Investment in PH Strategy					
Initial Investment Costs	\$475.00	\$475.00	\$475.00	\$475.00	
Routine Operating Costs		162,547.25	212,730.00	\$ 72,304.17	
Total Annual Costs	475.00	163,022.25	213,205.00	72,779.17	
x Present Value Factors (see below)	1.00	0.97	0.94	0.92	
Total Discounted Annual Investment Costs	\$ 475.00	\$ 158,274.03	\$ 200,966.16	\$ 66,603.25	\$ 426,318.44
Financial Gain/Loss Attributable to PH Strategy					
Estimated Changes in Operating Costs		\$ 42,200.00	\$ 12,260.00	\$ 21,200.00	
Estimated Changes in Revenue		\$ 476,888.00	\$ 770,857.00	\$ 296,034.00	
Total Net Financial Gain/Loss		\$434,688.00	\$758,597.00	\$274,834.00	
x Present Value Factors (see below)		0.97	0.94	0.92	
Total Discounted Annual Net Gain/Loss		\$ 422,027.18	\$ 715,050.43	\$ 251,512.04	\$ 1,388,589.66
Return on Investment Summary					
Undiscounted Annual Net Cash Flows	\$ (475)	\$ 271,666	\$ 545,392	\$ 202,055	\$ 1,018,638
Cumulative ROI		2.66	3.16	3.26	3.26
Net Present Value					962,271.22
Internal Rate of Return					57293%

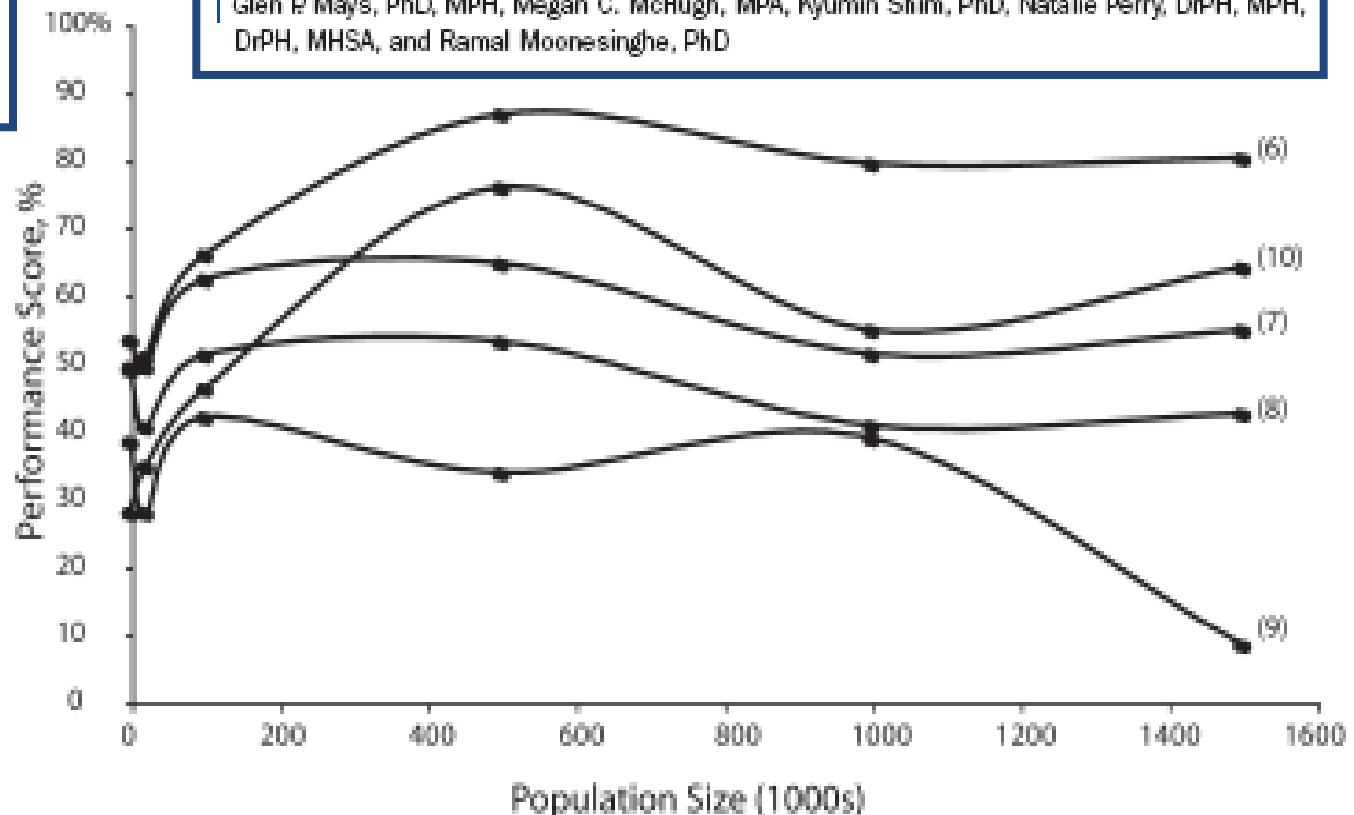
III. Examples of economic evaluation in public health

Economies of scope and scale



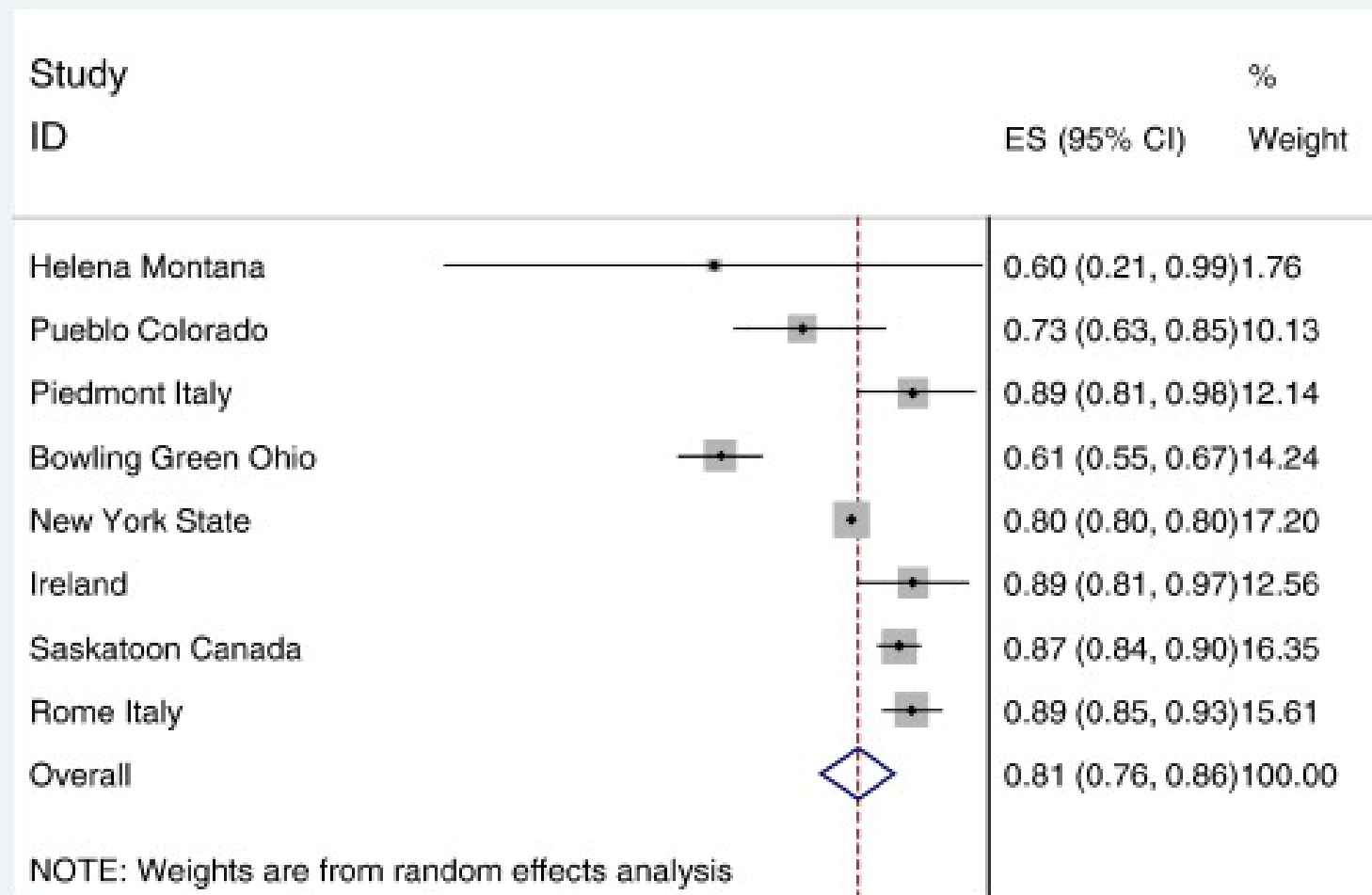
Institutional and Economic Determinants of Public Health System Performance

Glen P Mays, PhD, MPH, Megan C. McHugh, MPA, Kyumin Shim, PhD, Natalie Perry, DrPH, MPH, DrPH, MHSA, and Ramal Moonesinghe, PhD

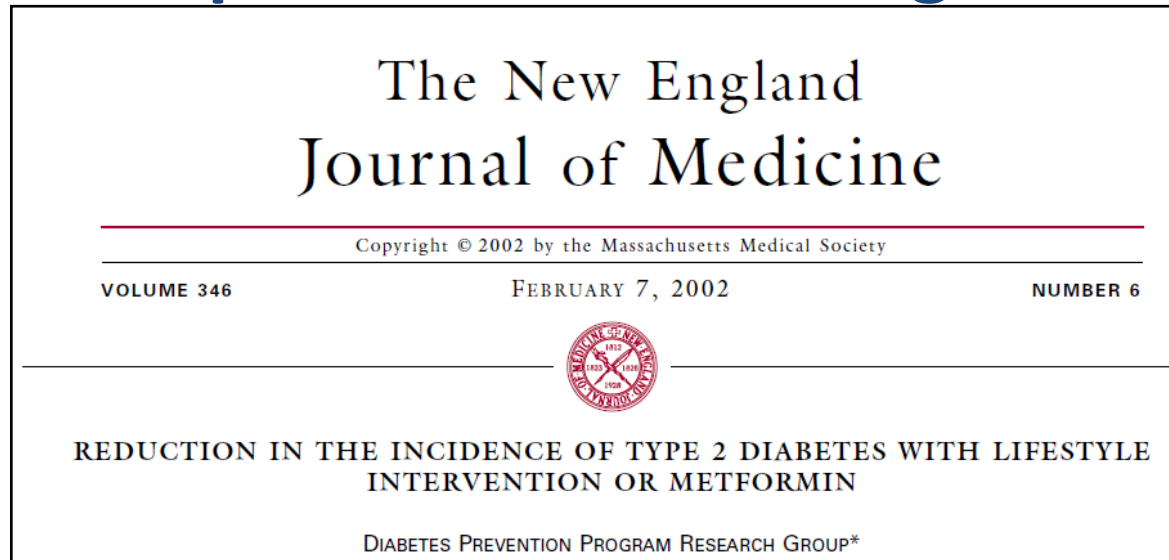


Variations in policy design, implementation, enforcement

Estimated Effects of Smoke-free Policies on AMI admissions



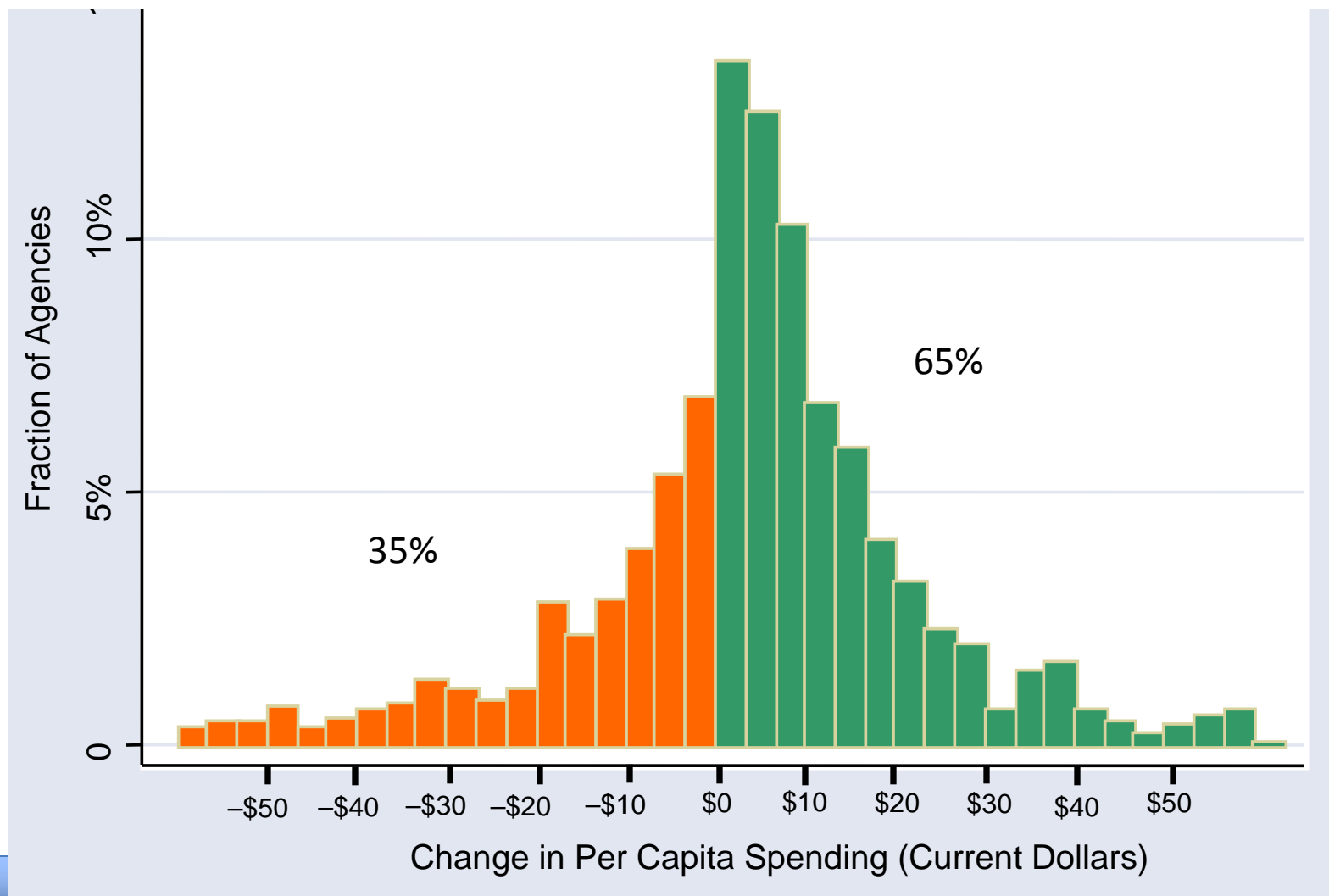
Example: comparison of alternative implementation strategies



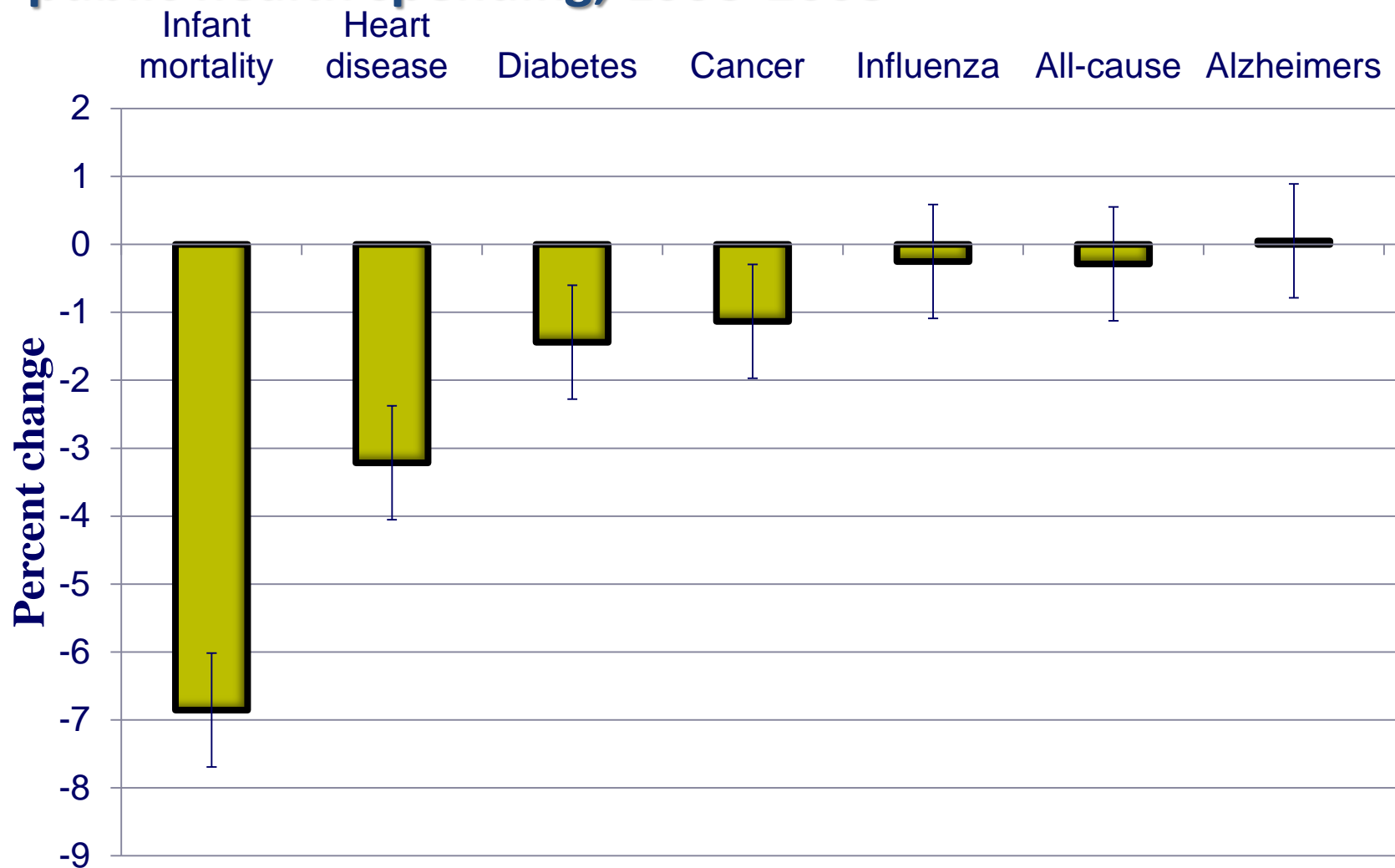
- Limited adoption of DPP: cost, staffing
- Non-inferiority trial comparing standard intervention to CHW-delivered intervention
- Clinical and cost-effectiveness estimates

Estimating the aggregate value of public health spending

Change in Local Public Health Spending, 1993-2005



Example: Mortality reductions attributable to local public health spending, 1993-2008



Aggregate value of spending

Source

Cost per Life- Year Gained

Medical care spending, 1990-2000
(Cutler et al. NEJM, 2006)

\$36,300

Public health spending, 1993-2005

\$12,200-\$25,600

THE NEW ENGLAND JOURNAL of MEDICINE

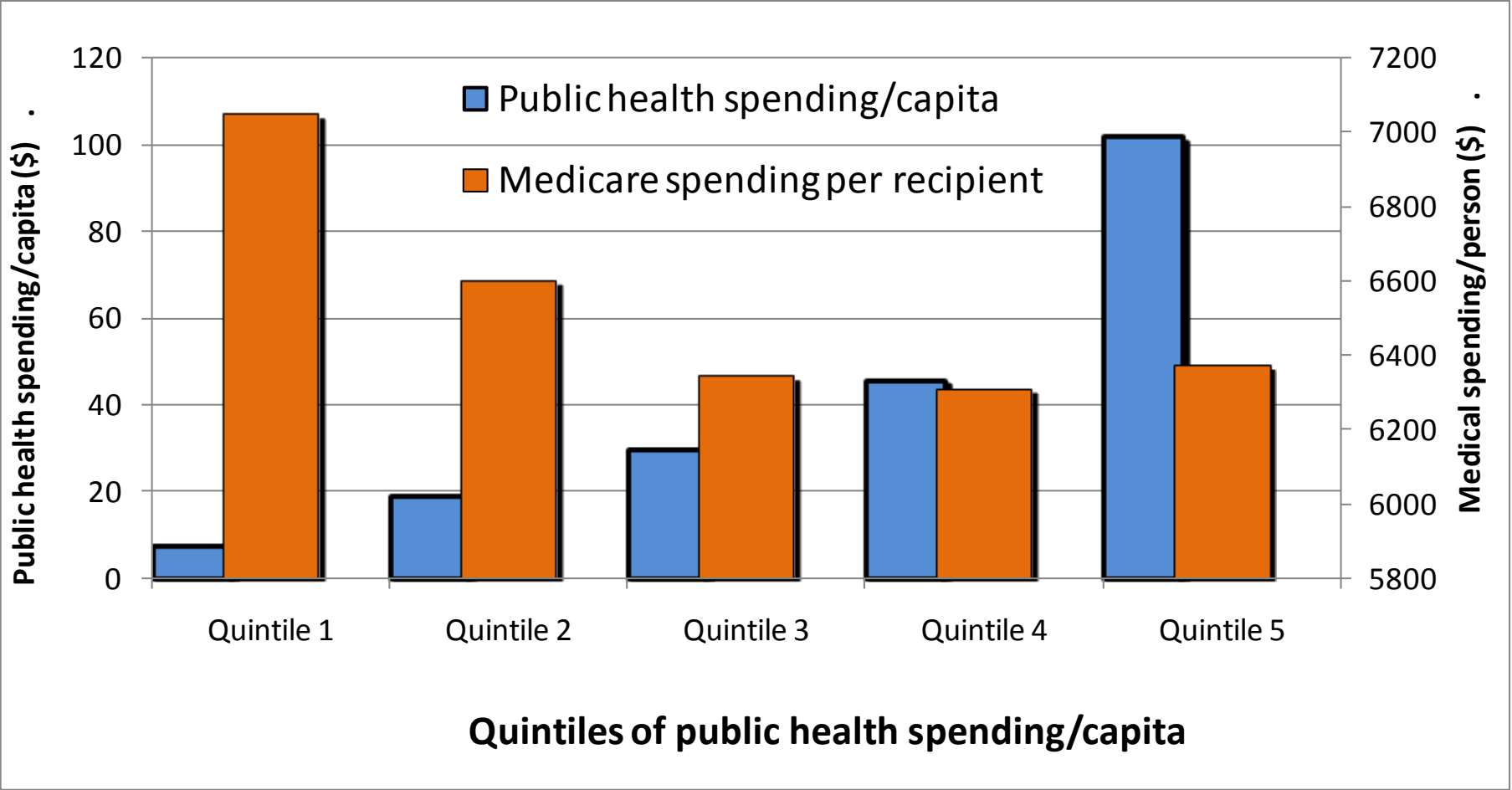
SPECIAL ARTICLE

The Value of Medical Spending in the United States, 1960–2000

David M. Cutler, Ph.D., Allison B. Rosen, M.D., M.P.H., Sc.D.,
and Sandeep Vijan, M.D.

Example: Medical Care Offsets Attributable to Local Public Health Spending, 1993-2008

Medical Cost Offset = 0.088%



Example: Projecting effects of new public health spending

- 1.2% increase in public health spending in average community over 10 years:

Public health cost	\$7.2M
Medical cost offset	-\$6.3M (Medicare only)
Deaths averted	175.8
Life years gained	1758
Net cost/LY	\$546

Examples: Program ROI

Arkansas Community Connector Program

- Use community health workers & public health infrastructure to identify people with unmet social support needs
- Connect people to home and community-based services & supports
- Link to hospitals and nursing homes for transition planning
- Use Medicaid and SIM financing, savings reinvestment
- Costing with electronic time logs



Felix, Mays et al. 2011

<http://content.healthaffairs.org/content/30/7/1366.abstract>

Example: Program ROI

- Quasi-experimental research design
- Three year demonstration period + 1 year extension
- Measured expenditures for CCP participants one year before participation and up to 3 years after participation
- Constructed a statistically-matched comparison group of Medicaid recipients not served by CCP
- Use difference-in-difference models to estimate impact, controlling for time-varying covariates

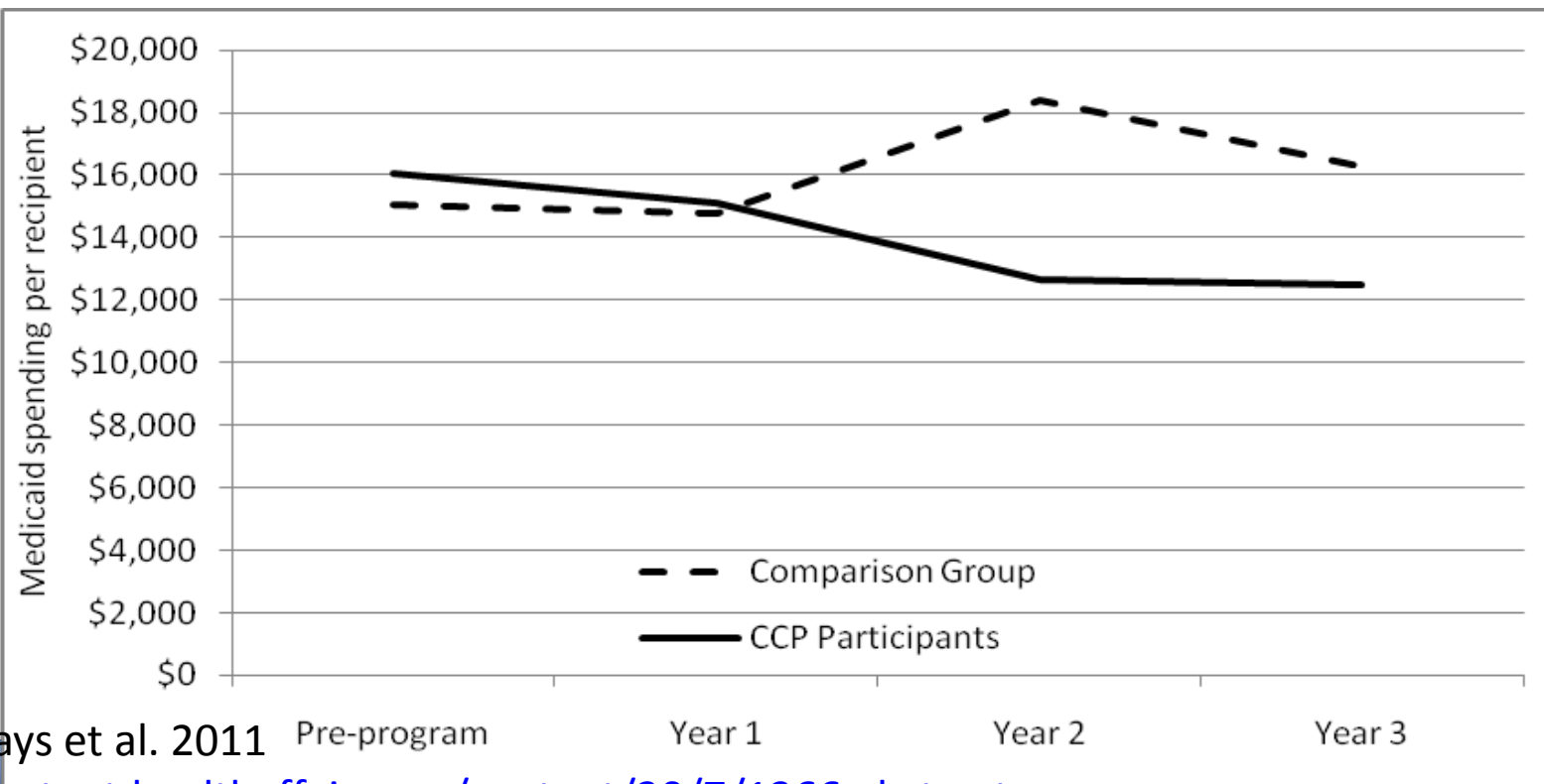
Examples: Program ROI

By Holly C. Felix, Glen P. Mays, M. Kathryn Stewart, Naomi Cottoms, and Mary Olson

THE CARE SPAN

Medicaid Savings Resulted When Community Health Workers Matched Those With Needs To Home And Community Care

HealthAffairs



Felix, Mays et al. 2011

<http://content.healthaffairs.org/content/30/7/1366.abstract>

Examples: Program ROI

Three Year Aggregate Estimates

➤ Combined Medicaid spending reductions:	\$3.515 M
➤ Program implementation costs:	\$0.896 M
➤ Net savings:	\$2.629 M
➤ ROI:	\$2.92

Felix, Mays et al. 2011

<http://content.healthaffairs.org/content/30/7/1366.abstract>

IV. Small Group Exercise

V. DSHS Examples

VI. Interpretation, Limitations and Caveats

Interpreting & using results:

Key considerations

- Uncertainty and sensitivity analysis
- Measurement error
- Attribution and threats to validity
- Scenario analysis
- Upper-bound and lower-bound estimates

Advancing Economic Analysis in Public Health

- Enhanced tracking of public health expenditures
- Enhanced monitoring of program performance
 - Reach/targeting
 - Effectiveness
 - Efficiency
 - Equity
- Analysis of cross-cutting infrastructure needed to implement/maintain programs

For More Information



Supported by The Robert Wood Johnson Foundation

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