Estimating Return on Investment in Public Health: Approaches and Methods

Glen P. Mays, University of Kentucky
Estimating Return on Investment: Approaches and Methods

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Why ROI?

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**?
Prevention Efforts Provide No Panacea on Health Costs

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

Prevention for a Healthier America:

INVESTMENTS IN DISEASE PREVENTION YIELD SIGNIFICANT SAVINGS, STRONGER COMMUNITIES
Why the Focus on Costs?

2012 Institute of Medicine Recommendations

• Identify the components and costs of a minimum package of public health services
  – Foundational capabilities
  – Basic programs
• Allow greater flexibility in how states and localities use federal public health funds
• Implement a national chart of accounts for tracking spending levels and flow of funds
• Expand research on costs and effects of public health delivery

Challenges in demonstrating ROI 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
ROI Key Ingredients

**Investments**
- Costs of implementing public health interventions
- Who’s investments?

**Returns**
- Valuation of the outputs and outcomes attributable to public health interventions
- Who realizes returns?
- Over what time frames?
- Compared to what?
Managing ROI 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 ROI in public health: Key Considerations

**Perspective**
- Federal, state, health system, or societal?

**Time Horizon**
- How long can you wait to realize returns?

**Types of Interventions**
- Primary, secondary or tertiary prevention
- Cross-cutting infrastructure
Estimating ROI 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
Estimating ROI 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 • Time in process
- Cases detected

**Revenue gains (captured in financial measures)**

**Health gains (captured in outcome measures)**
- Deaths averted
- Cases prevented
- Quality-adjusted life years gained
Estimating ROI in public health: Key Considerations

Break even
- How long does it take to recoup investment?

Maintenance/Persistence
- How long do the benefits last?
- Recurring costs?
Achieving ROI 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 ROI in public health: Types of Analyses

- Macro-level analysis
- Infrastructure-level analysis
- Program-level analysis
- Process-level analysis
Estimating ROI in public health: Macro-level Analysis

<table>
<thead>
<tr>
<th></th>
<th>1-2 Years</th>
<th>5 Years</th>
<th>10-20 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U.S. Total</strong></td>
<td>$2,848,000,000</td>
<td>$16,543,000,000</td>
<td>$18,451,000,000</td>
</tr>
<tr>
<td><strong>ROI</strong></td>
<td>0.96:1</td>
<td>5.6:1</td>
<td>6.2:1</td>
</tr>
</tbody>
</table>

Source: Trust for America’s Health, 2009
Estimating ROI in public health: Program-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

Source: Centers for Disease Control and Prevention 2008
Estimating ROI in public health: Program-level Analysis

- Washington State Comprehensive Tobacco Prevention and Control Program: $5 in health care savings per $1 investment

Source: Dilley et al., AJPH 2011
Mortality reductions attributable to local public health spending, 1993-2008

Mays et al. Health Affairs, 2011
Medical Care Offsets Attributable to Local Public Health Spending, 1993-2008

Medical Cost Offset = 0.088%

Mays et al. Health Services Research, 2009
Projected effects of new ACA 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

Mays et al. forthcoming 2012
Estimating ROI in public health: Existing Tools

AHRQ Asthma ROI calculator
http://statesnapshots.ahrq.gov/asthma/Required.jsp

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
Estimating ROI in public health: National Public Health Improvement Initiative

- **Goal**: Develop ROI 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
The Public Health ROI Calculator:

PUBLIC HEALTH RETURN ON INVESTMENT TEMPLATE

Demonstration Version

October 29, 2012

Prepared for:

The Association of State and Territorial Health Officials

Prepared by:

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Center for Public Health Services and Systems Research
University of Kentucky

Supported by the U.S. Centers for Disease Control and Prevention's National Public Health Improvement Initiative
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
The Public Health ROI Calculator: Demonstration Version

◆ Potential streams of returns addressed by the calculator:
  – Changes in operating costs
  – Changes in output
  – Changes in time required to produce output
  – Changes in program delivery (reach)
  – Changes in health-related outcomes
Key questions for cost analysis

- What level of resources are required to deliver a given bundle of public health activities for a given population?

- How do delivery costs vary across communities and population groups?

- Where are the opportunities to realize efficiencies in delivery?
What’s the big deal?

“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.”

CDC’s Public Health Model for Prevention

- Problem Identification
- Risk and Protective Factor Identification
- Economic Impact – COI
- Economic Evaluation
- Program and Policy Development
- Economic Evaluation
- Implementation and Dissemination
- Cost Analysis
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

Define Purpose/Scope

Literature Scan

Solicitation of experts

Development of Cost Categories

Instrument Pilot Test/Validation

Data Collection

Cost Analysis
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

Three dimensions of work:
- Mental effort and judgment
- Technical skill and physical effort
- Stress
Table 4
Summary of Estimated Cost of Data Collection
(in 1991 dollars)

<table>
<thead>
<tr>
<th>Collection Method</th>
<th>Total Cost(^a)</th>
<th>No. of Completes</th>
<th>Cost per Complete(^b)</th>
<th>Cost per Rated Service(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone</td>
<td>$105,000</td>
<td>1200</td>
<td>$87.50</td>
<td>$175.00</td>
</tr>
<tr>
<td>1-Round Mail</td>
<td>$65,500</td>
<td>1200</td>
<td>$54.58</td>
<td>$109.17</td>
</tr>
<tr>
<td>2-Round Mail</td>
<td>$80,000</td>
<td>1267(^d)</td>
<td>$63.14</td>
<td>$133.33</td>
</tr>
<tr>
<td>Panel</td>
<td>$88,000</td>
<td>n/a</td>
<td>n/a</td>
<td>$146.67</td>
</tr>
</tbody>
</table>

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

\(^b\)Cost 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.)

\(^c\)Cost per service is derived by dividing the total cost of data collection by the 600 rated services.

\(^d\)667 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:


**Examples: Survey methods**

**SASCAP™**
Substance Abuse Services Cost Analysis Program

<table>
<thead>
<tr>
<th>Job Type</th>
<th># of People</th>
<th>Hours Spent in Average Week Providing Specified Patient Services</th>
<th>Hours Spent in Average Week Doing Administrative and Other Support Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>EXAMPLE: Social Worker (MSW/DSW)</td>
<td>60</td>
<td></td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>Non-Medical Direct Care Staff</td>
<td>20</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Case Manager (certified)</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Case Manager (non-certified)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degreed Counselor (licensed or certified)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demed Counselor (non-licensed)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Per capita costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outreach/follow-up</td>
<td>$22</td>
</tr>
<tr>
<td>Screening</td>
<td></td>
</tr>
<tr>
<td>WISEWOMAN screening</td>
<td>$98</td>
</tr>
<tr>
<td>Annual prescriptions</td>
<td>$26</td>
</tr>
<tr>
<td>Additional office visits</td>
<td>$3</td>
</tr>
<tr>
<td>Total screening</td>
<td>$127</td>
</tr>
<tr>
<td>Intervention</td>
<td>$121</td>
</tr>
<tr>
<td>Total</td>
<td>$270</td>
</tr>
</tbody>
</table>

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

DOI 10.1007/s10729-010-9136-5

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


Conclusions: Advancing ROI 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
Related Initiatives

- NACCHO Public Health Uniform Data System
- Public Health PBRN Delivery and Cost Studies
- RWJF/CDC National Chart of Accounts Workgroup
The Robert Wood Johnson Foundation’s Public Health PBRN Program

- First cohort (December 2008 start-up)
- Second cohort (January 2010 start-up)
- Affiliate/Emerging PBRNs

Map of the United States showing different regions colored to indicate which cohort they belong to.
Informing practice and policy decisions

- Align spending with preventable disease burden
- Identify and address inequities in resources
- Improve productivity and efficiency
- Demonstrate value: linking spending to outcomes
- Strengthen fiscal policy: financing mechanisms
For more information

Supported by The Robert Wood Johnson Foundation

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