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From the Selected Works of Glen Mays

Fall September 14, 2018

Using Economic Analysis to Understand the Value of Population Health Improvement Strategies

Glen P. Mays, *University of Kentucky*



Available at: https://works.bepress.com/glen_mays/335/

Using Economic Evaluation to Understand the Value of Public Health Services

Mississippi Department of Health
September 14, 2018

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Today's Agenda

- I. Fundamentals of economic evaluation
- II. Examples of public health economic studies
- III. Tools for economic evaluation in public health
- IV. Interpretation, applications, limitations & caveats

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 reduce **medical costs** or costs incurred by other stakeholders?

Transforming policy & practice with cost estimation

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

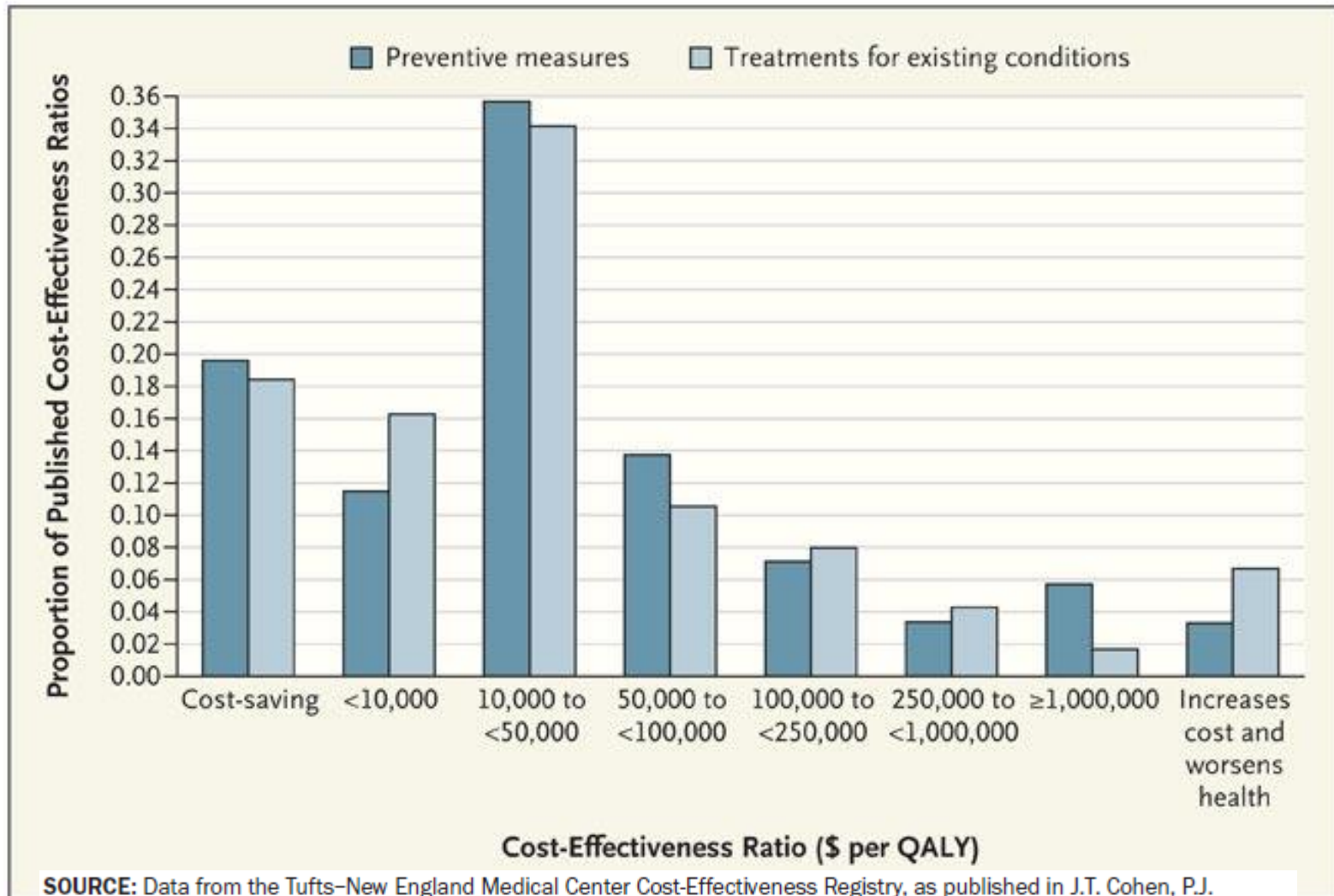


Setting and managing expectations

- **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**

Setting and managing expectations



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.

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

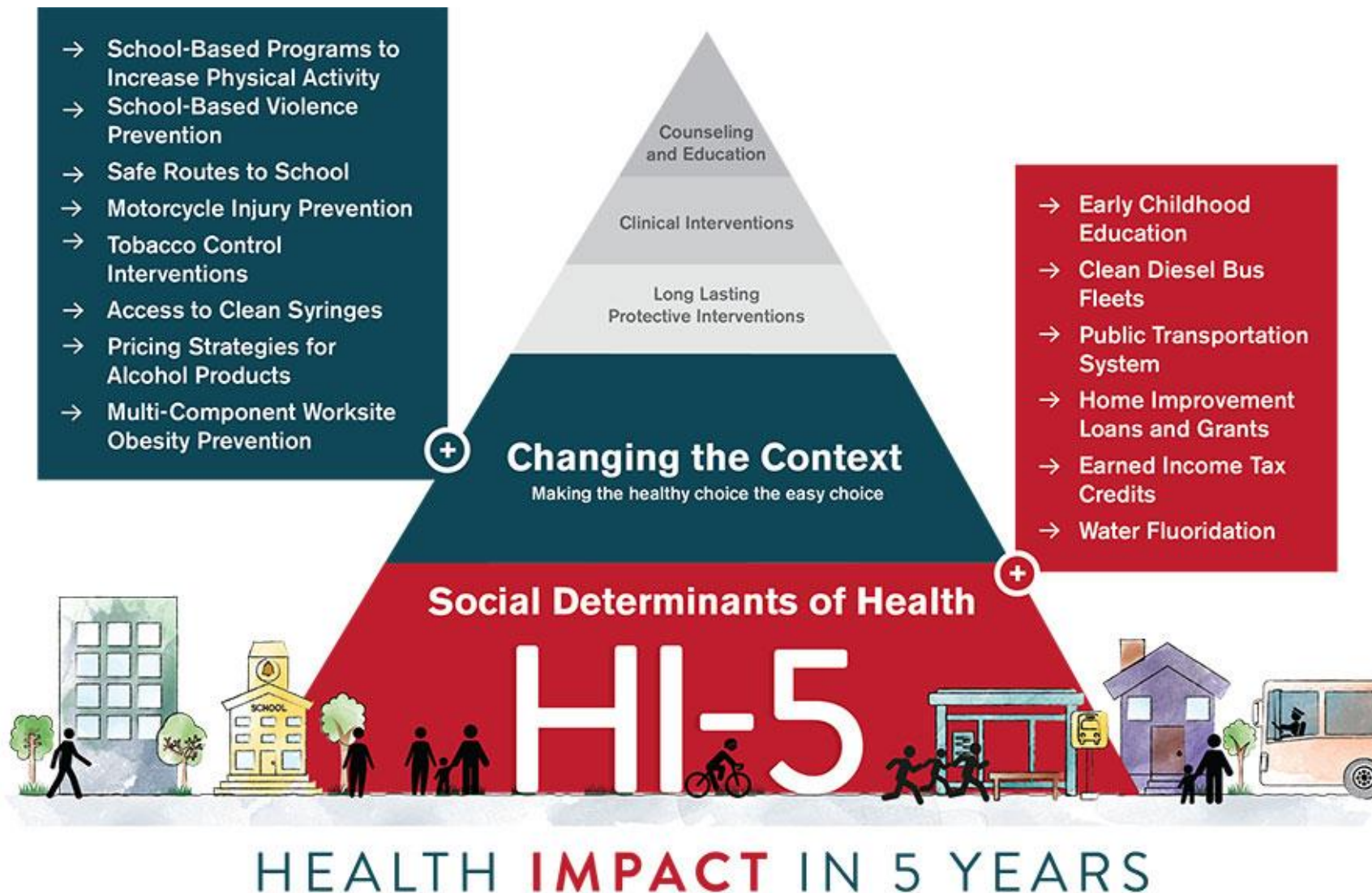
HEALTH AFFAIRS - Volume 28, Number 1

Prevention for a Healthier America:

INVESTMENTS IN DISEASE PREVENTION
YIELD SIGNIFICANT SAVINGS,
STRONGER COMMUNITIES



Some programs are more cost-effective than others

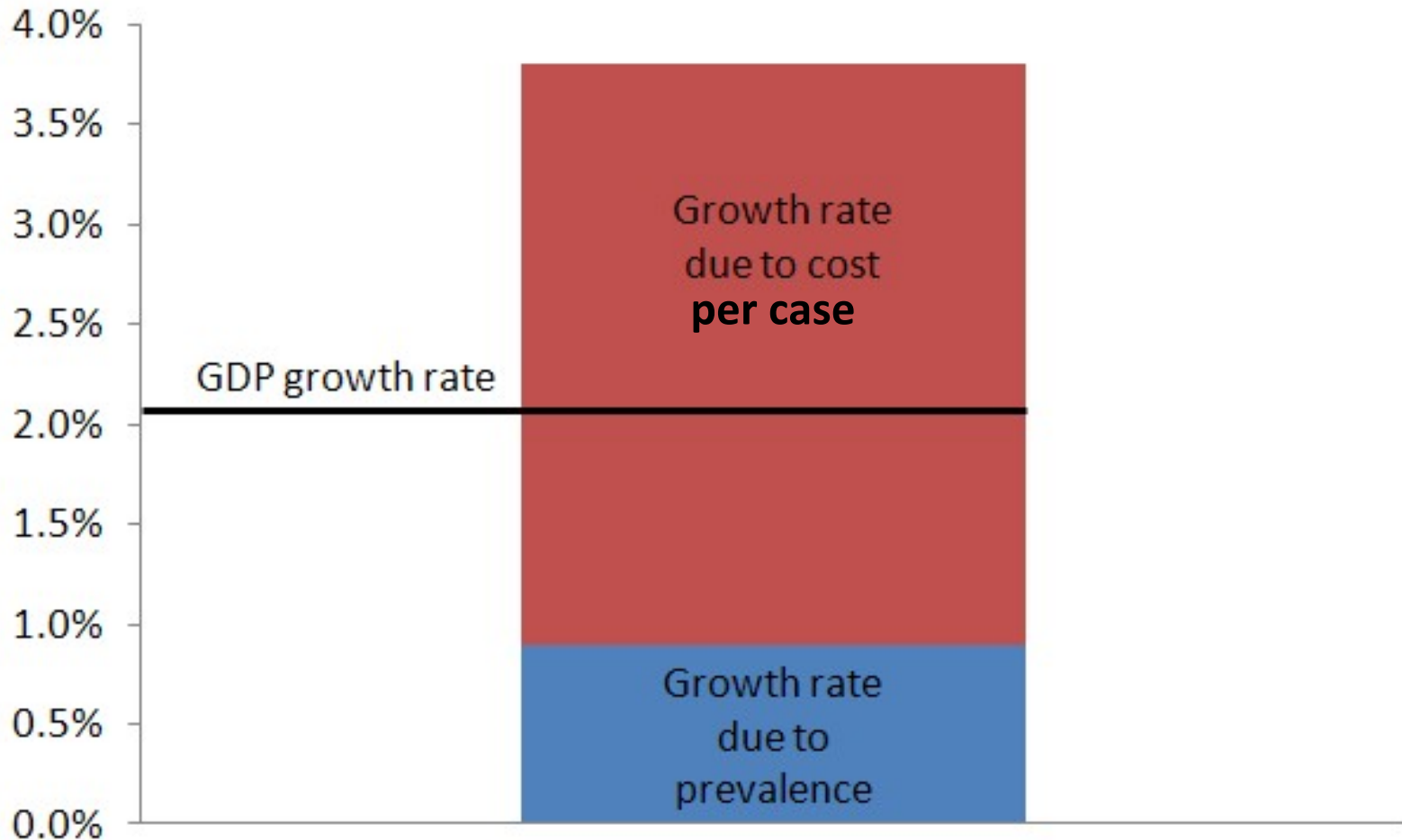


Challenges in demonstrating economic value in public health

- **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 to specific public health interventions
- **Estimating** the counterfactual

How public health activities relate to medical costs

Annual Growth Rate of Aggregate U.S. Medical Spending



Economic evaluation: key steps

1. Estimate resources used to implement intervention
2. Estimate effects attributable to the intervention
 - Health effects
 - Effects on resource use
3. Account for the timing of costs and benefits
4. Account for uncertainty in costs and benefits
5. Compare intervention costs to intervention benefits

Estimating value in public health:

Key considerations - Costs

Direct costs

- Cost of implementing the activity
- Costs avoided or incurred due to the activity's impact

Indirect costs

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

Intangibles

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

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 a return?

Estimating value in public health:

Key considerations - Benefits

Health gains (captured in outcome measures)

- Deaths averted
- Cases prevented
- Years of life gained (or QALYs)

Efficiency gains (captured in cost measures)

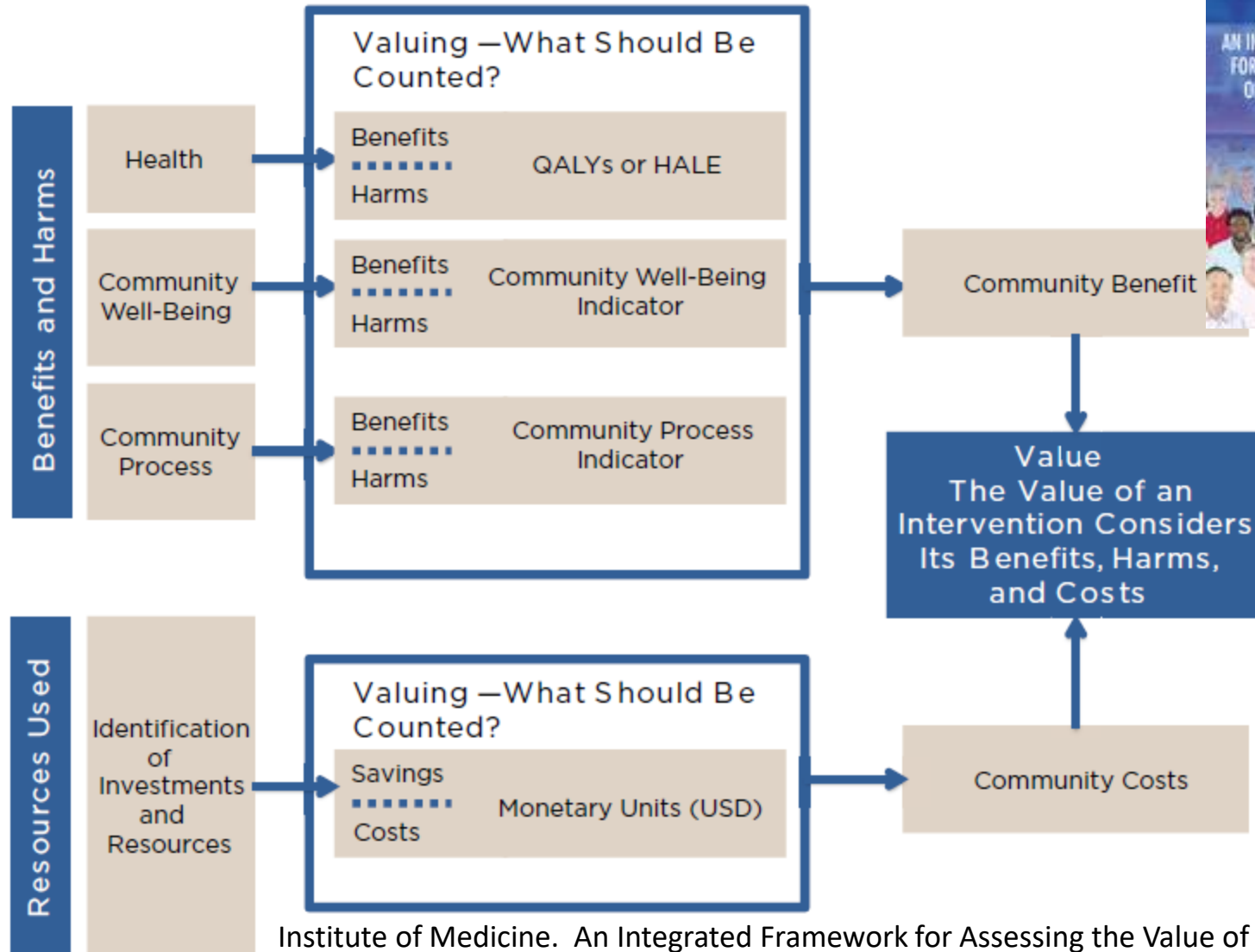
- Avoided medical care use (admissions, ED visits)
- Reduced labor costs
- Reduced material costs
- Reduced lost time from work, school, household production

Productivity gains (captured in output measures)

- Services delivered
- Cases detected

Revenue gains (captured in financial measures)

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

- **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

Examples of economic evaluation in public health

Examples: Program ROI

Arkansas Colorectal Cancer Program

- 3-year, state-funded demonstration program
- Identify at-risk uninsured residents and navigate them to screening and support
- Track program costs and screening outcomes



www.visionproject.org

Felix, Mays et al. 2011

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

Example: Costs

<u>Item</u>	<u>Pre-period</u>	<u>Implementation</u>	<u>Post-period</u>
Months	14	16	17
Program administration	\$165,443	\$249,435	\$86,970
Clinical services	\$0	\$284,569	
Supplies & other	\$780	\$14,716	\$15,636
total	\$166,237	\$548,736	\$102,623
annualized total	\$142,489	\$411,552	
Number screened		390	
Nominal cost per screen		\$1,407	
Amortization factor	0.05		
Total cost per screen		\$1,428	
Amortized total program cost		\$555,860	

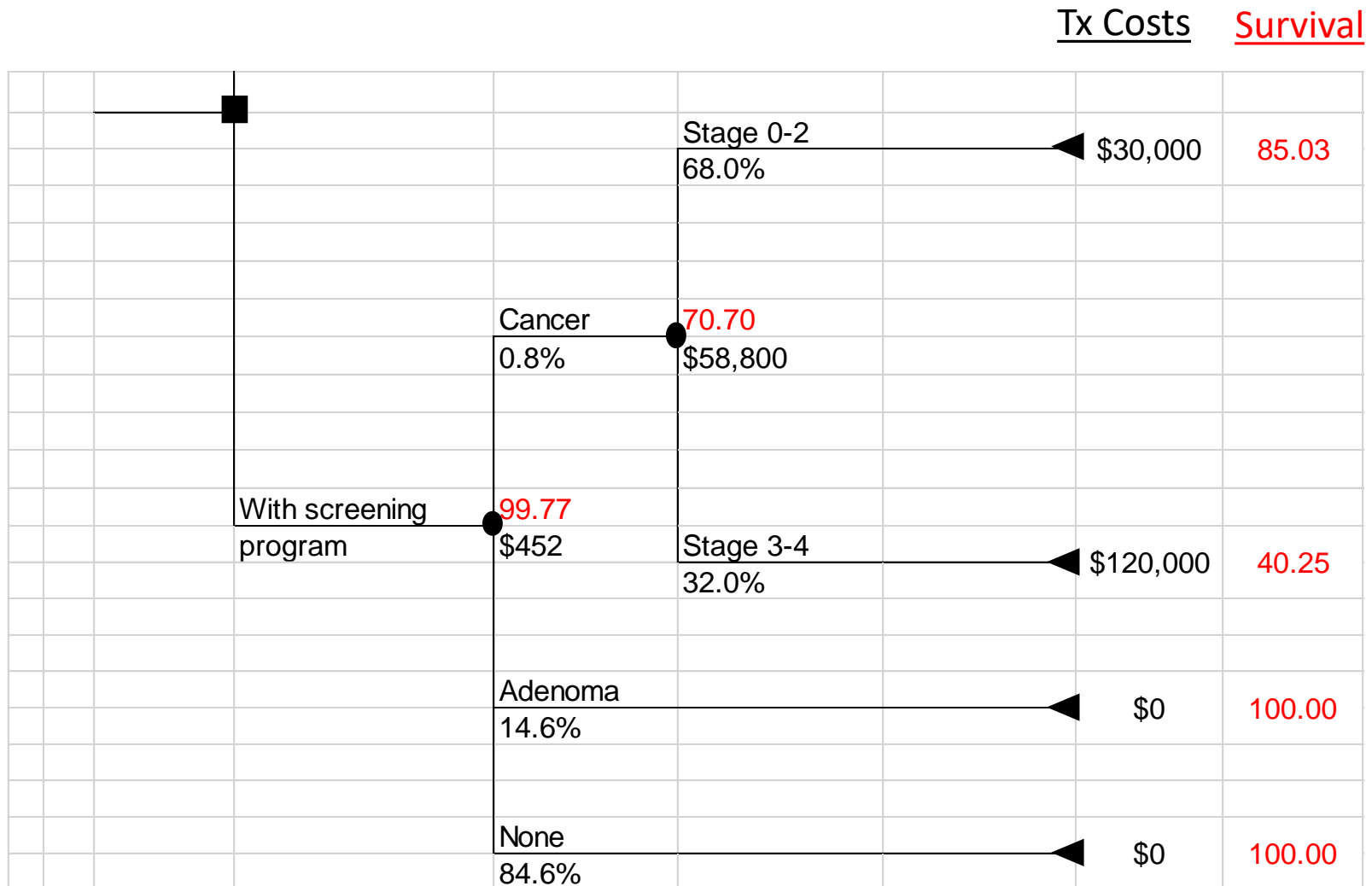
Example: Benefits

CRC Cancer by Stage of Diagnosis			
	Overall	Uninsured	Insured
Stage	Prob	Prob	Prob
1	0.25		
2	0.3		
3	0.26		
4	0.19		
3 or 4	0.45	0.63	0.32

Example: Costs & Benefits

<u>Parameter</u>	<u>Value</u>	<u>Source</u>
Treatment costs for late-stage CRC (III-IV, net present value)	\$120,000	AHRQ 2012
Treatment costs for early-stage CRC (0-II, net present value)	\$30,000	AHRQ 2012
Five-year survival for late-stage CRC (III-IV)	40.25%	IOM 2015
Five-year survival for early-stage CRC (0-II)	85.03%	IOM 2015
Proportion of uninsured CRC patients diagnosed at late stage	63.00%	Cancer registry; Halpern et al. 2008
Proportion of insured CRC patients diagnosed at late stage	32.00%	Cancer registry; Halpern et al. 2008
Proportion of screened adults diagnosed with CRC	0.77%	Demonstration
Proportion of screened adults with adenoma detected	14.62%	Demonstration
Proportion of adenomas that transition to cancer	2.50%	IOM 2015
Intervention costs		
Clinical costs	\$284,569	Demonstration
Administration, outreach, and navigation costs	\$249,435	Demonstration
Supplies and equipment	\$14,716	Demonstration
Start-up costs	\$166,237	Demonstration
Amortization rate for start-up costs	5.00%	Author approx.
Number screened	390	Demonstration

Example: Economic Analysis



Example: Economic Analysis

Tx Costs Survival

		Stage 0-2 37.0%	→ \$30,000	85.03	
	Cancer 0.8%	56.82 \$86,700			
		Stage 3-4 63.0%	→ \$120,000	40.25	
			Stage 0-2 37.0%	→ \$30,000	85.03
		Cancerous 2.5%	56.82 \$86,700		
	Adenoma 14.6%	98.92 \$2,168	Stage 3-4 63.0%	→ \$120,000	40.25
		Benign 97.5%	→ \$0	100.00	
Without screening program	99.51 \$984				
	None 84.6%		→ \$0	100.00	

Example: Economic Analysis

Number screened			390
Incremental treatment cost			-\$207,248
Net cost of the screening program			\$348,613
Incremental life years gained			20.64
Total cost per life-year gained			\$16,893

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

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>

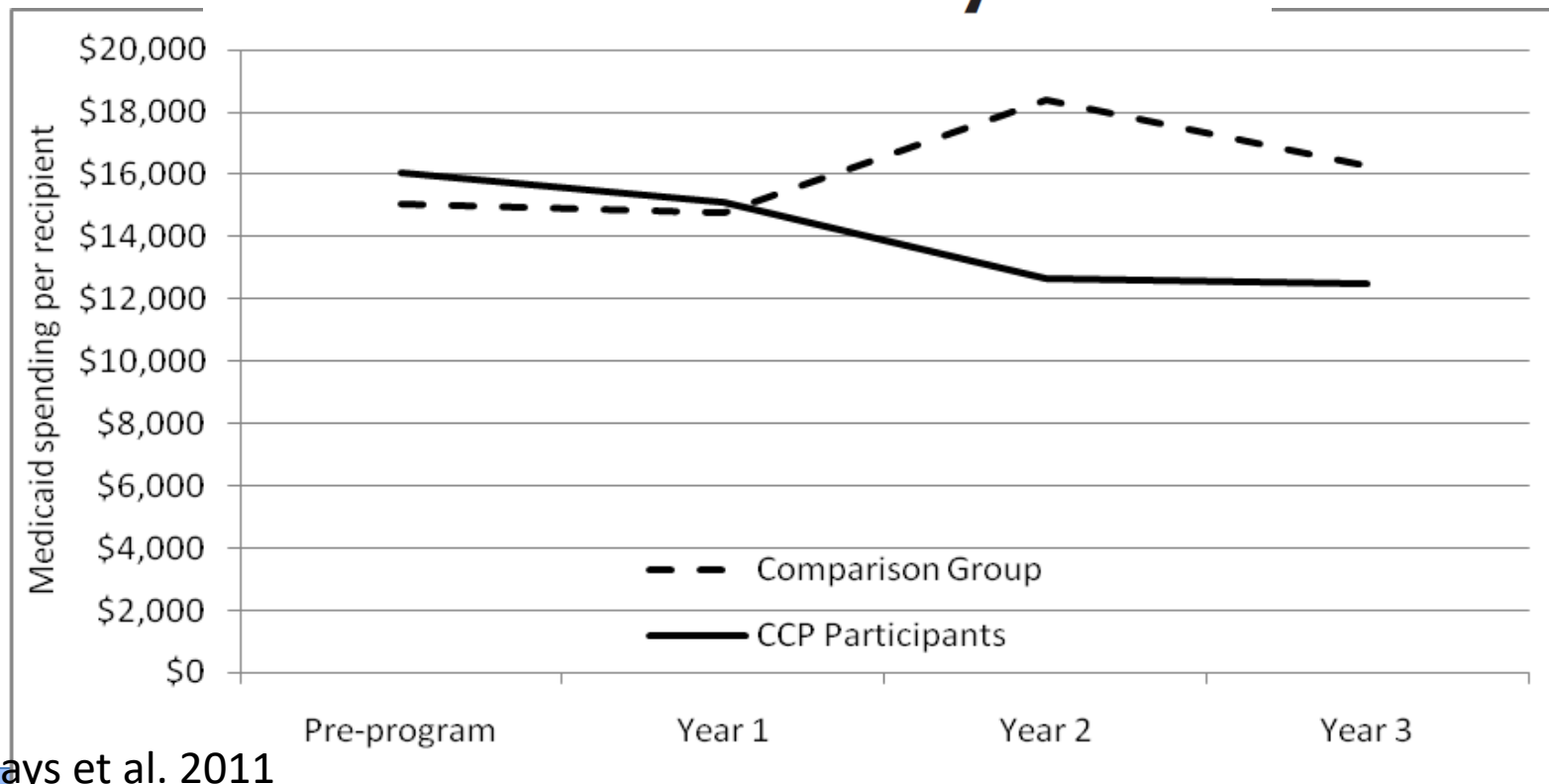
Examples: Program ROI

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 Specific Estimates

- 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



Examples: Environmental Health Interventions

- \$1 investment in lead paint hazard control saves \$12-155 per household (Gould 2009)
- \$1 spent on asthma control programs yields \$71 in medical cost savings (CDC 2013)
- \$1 spent on federal disaster mitigation yields \$6 in savings (National Institute of Building Sciences 2017)

Example: Cross-cutting Public Health Infrastructure

- How strong are the delivery systems that support public health improvement activities?
- How do these delivery systems change over time?
- How do these delivery systems influence health and economic outcomes?

Widely recommended activities to support population health improvement

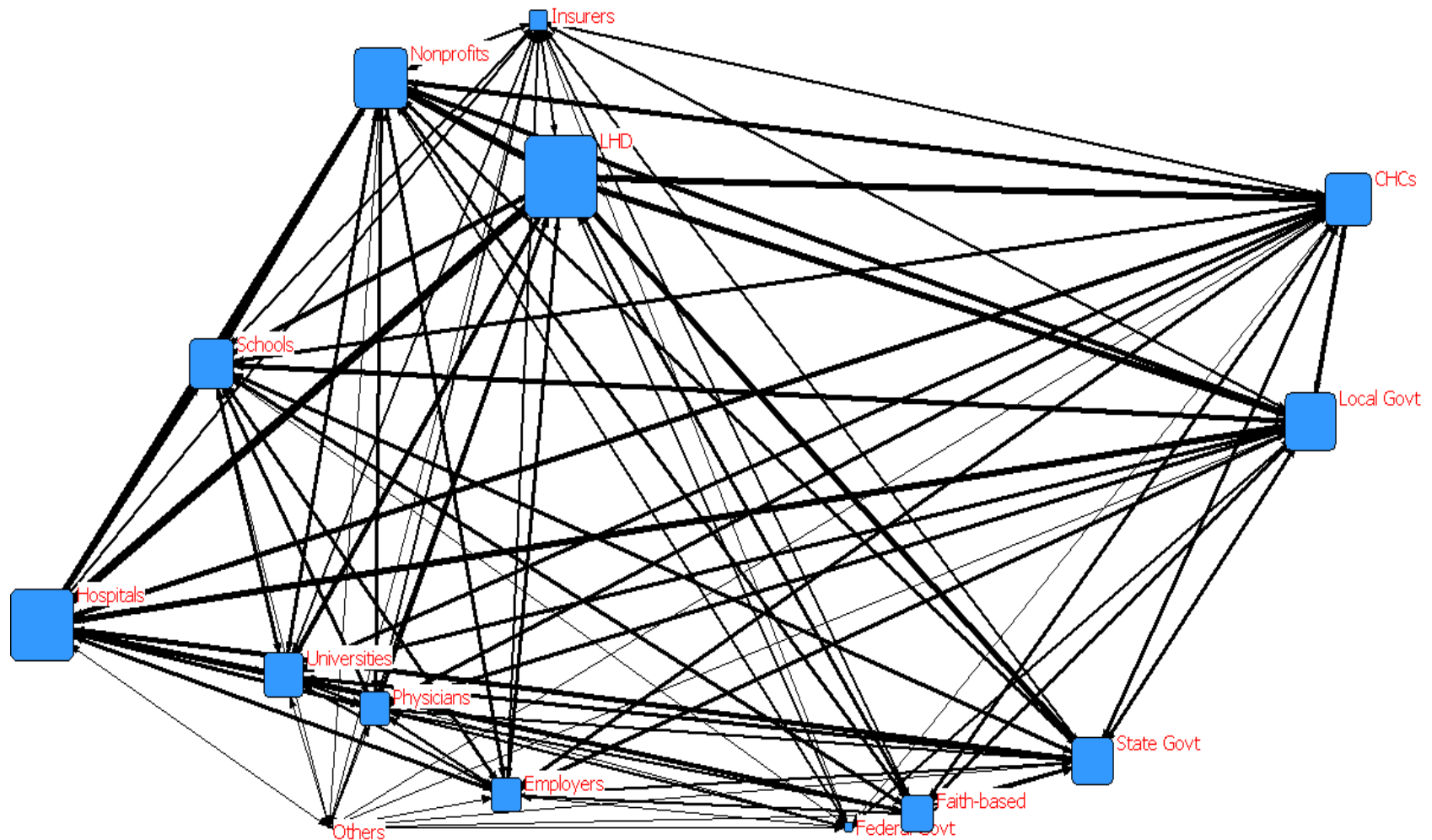


A useful lens for studying public health delivery systems

National Longitudinal Survey of Public Health Systems

- Nationally representative cohort of 600 U.S. communities
- Followed over time: 1998-2018
- Local public health officials report:
 - **Scope**: availability of 20 recommended population health activities
 - **Network density**: organizations contributing to each activity
 - **Network centrality**: strongest central actor
 - **Quality**: perceived effectiveness of each activity

Mapping delivery systems for public health



Node size = degree centrality

Line size = % activities jointly contributed (tie strength)

Mays GP et al. Understanding the organization of public health delivery systems: an empirical typology. *Milbank Q.* 2010;88(1):81–111.

Comprehensive Delivery Systems

One of RWJF's Culture of Health National Metrics

- **Broad scope** of public health activities
- **Dense network** of multi-sector relationships
- **Central actors** to coordinate actions

Access to public health

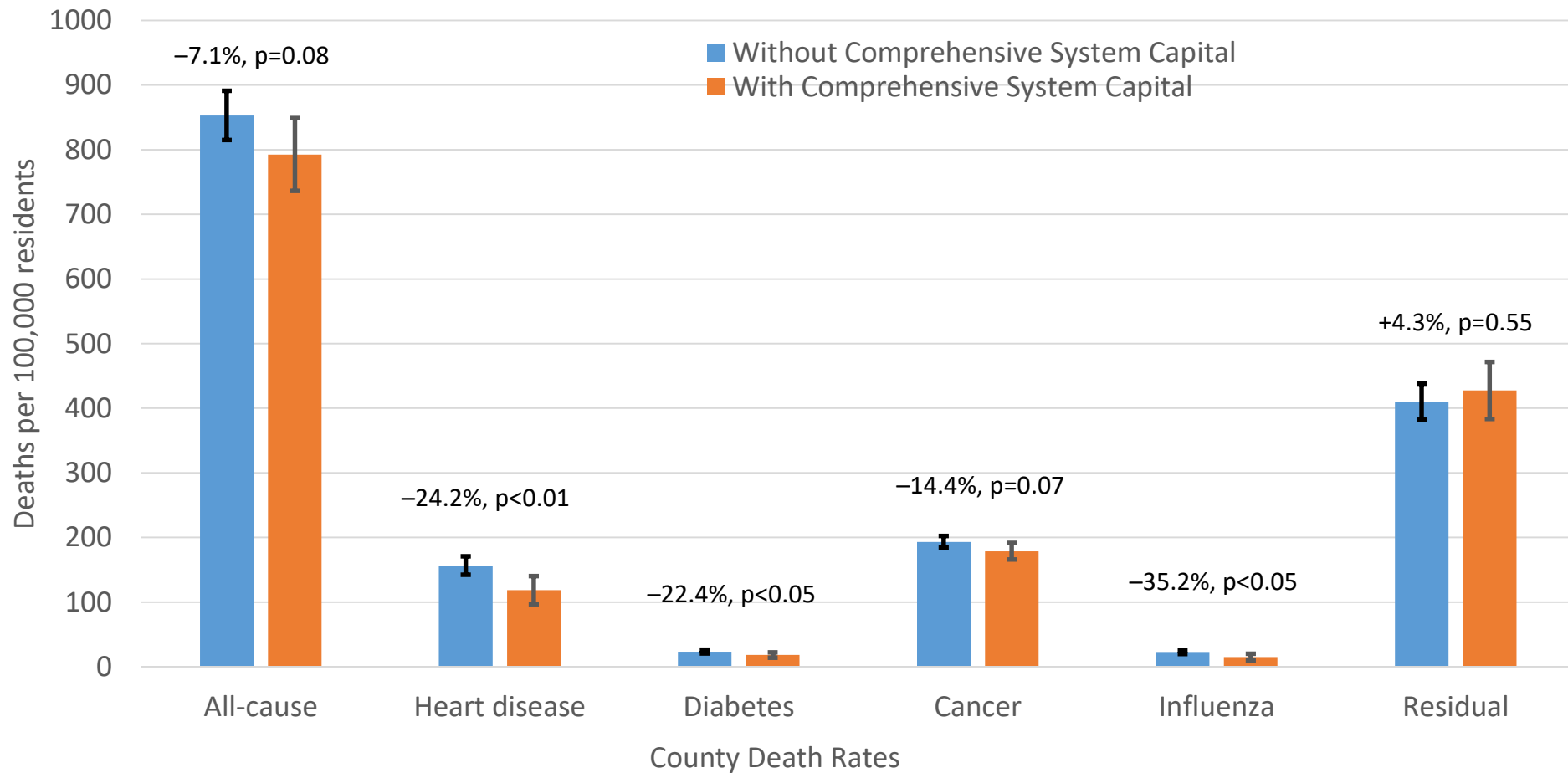
Overall, 47.2 percent of the population is covered by a comprehensive public health system. Individuals are more likely to have access if they are non-White (51.5 percent vs. 45.5 percent White) or live in a metropolitan area (48.7 percent vs. 34.1 percent in nonmetropolitan areas).

47.2%

of population served by a
comprehensive public
health system

Health effects attributable to public health systems

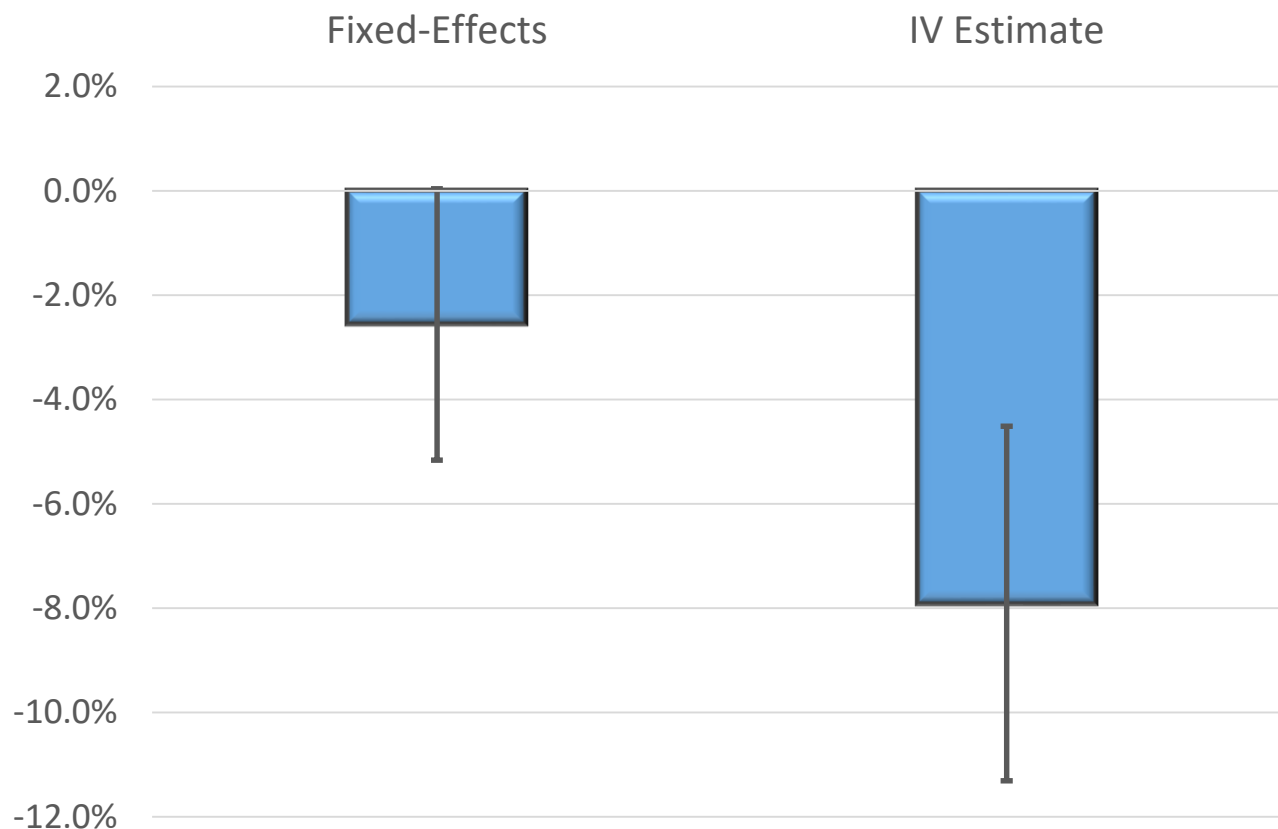
Impact of Comprehensive Systems on **Mortality**, 1998-2014



Fixed-effects instrumental variables estimates controlling for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects.

Economic effects attributable to public health systems

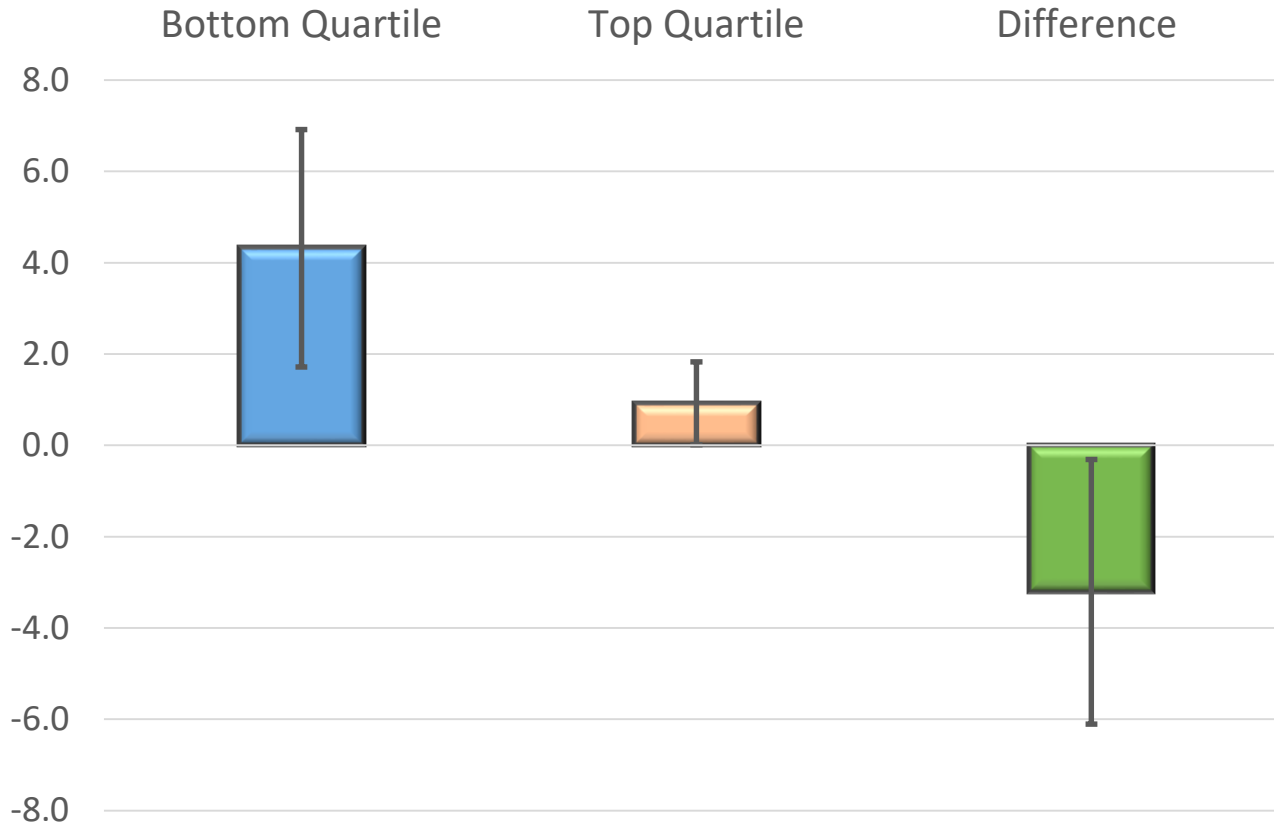
Impact of Comprehensive Systems on **Medical Spending** (Medicare) 1998-2014



Models also control for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects. Vertical lines are 95% confidence intervals

Economic effects attributable to public health systems

Impact of Comprehensive Systems on **Life Expectancy by Income** (Chetty), 2001-2014



Models also control for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects. Vertical lines are 95% confidence intervals

Aggregate economic benefit

- 1% 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

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.

Estimating the Cost of Foundational Public Health Services (FPHS)

Toward a deeper understanding of costs & returns in public health

2012 Institute of Medicine Report* identified two fundamental barriers to improving the nation's public health system

- (1) lack of agreement on a core set of public health capabilities that should be present in every U.S. community
- (2) lack of knowledge about the resources required to implement these capabilities.

The report concludes that sound policy for improving the nation's public health system can move forward only when there is sufficient understanding and agreement about what the public health system should be able to do and how much it will cost.

2012 Institute of Medicine Recommendations

- Called for an expert panel process to identify the components of a “minimum package” of public health services and cross-cutting capabilities that should be available in every U.S. community to protect and improve population health.
- Undertake and expand research to estimate the resources required to implement these services and capabilities universally across the U.S.
- Develop and implement a **national chart of accounts** for tracking spending & flow of funds



Defining What to Cost: The Public Health Package

- Washington State's Foundational Public Health Services
- Ohio's Public Health Futures Committee: Minimum Package of Services
- Colorado's Core Public Health Services



In response to IOM recommendations, RWJF commissioned a national expert panel in 2014 - Public Health Leadership Forum (PHLF)

- PHLF included representatives from federal, state, and local public health agencies, public health professional associations, universities, public health accrediting bodies, and health policy advisory commissions.
- Used available research, practical experience & expert opinion to distinguish two broad types of responsibilities or “actions” within the public health system: (1) categorical programs and policies; and (2) cross-cutting capabilities

FPHS Definitions

- The PHLF National Workgroup developed definitions of foundational public health capabilities, specified in the *Public Health Leadership Forum's **Articulation of Foundational Capabilities & Foundational Areas*** (funded by RWJF, facilitated by RESOLVE): <http://www.resolv.org/site-healthleadershipforum/>
- FPHS Categories articulated and defined ([V1](#))

Foundational Areas (FA): substantive areas of expertise or program-specific activities in all state & local health departments essential to protect the community's health.

Foundational Capabilities (FC): Cross-cutting skills that need to be present in state & local health departments [everywhere](#) for the health system to work [anywhere](#). Needed to support the foundational areas, & other programs & activities, key to protecting community health & achieving equitable health outcomes.

Foundational Public Health Services (FPHS): Suite of skills, programs, & activities that must be available in state & local health departments system-wide; includes foundational capabilities & areas.

The FPHS framework



FPHS CE Data-Collection & Research Effort

- **Workgroup on Foundational Public Health Services (FPHS) Cost Estimation (CE)** convened to develop a methodology for estimating the resources required by governmental public health agencies to implement foundational public health services. Released a report on recommended methodology:

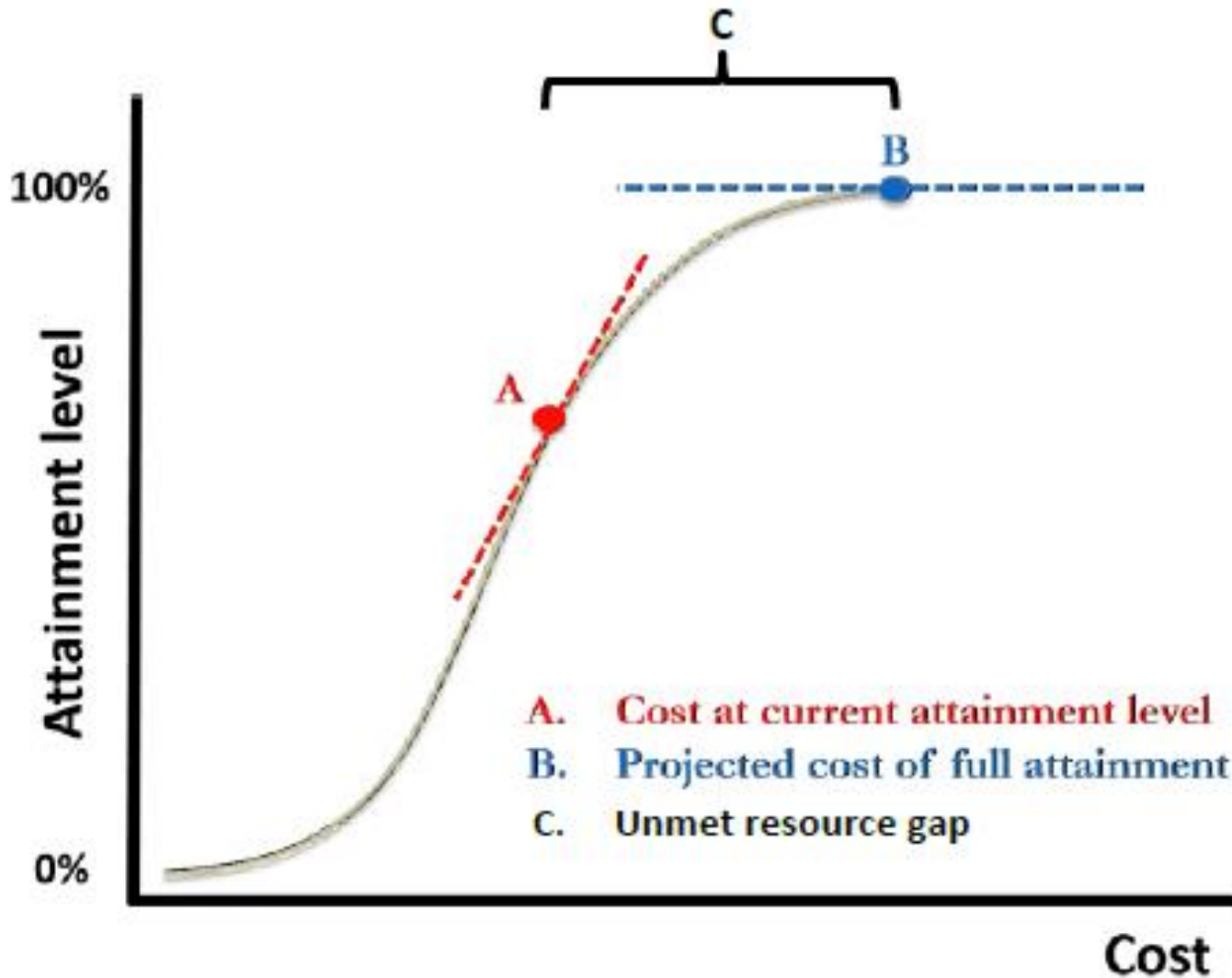
Estimating the Costs of Foundational Public Health Capabilities: A Recommended Methodology

Accessible at http://works.bepress.com/glen_mays/128/

- Pilot-Tested Methodology with KHDA Finance Workgroup comprised of 6 Kentucky Health Departments (June-October 2014)
- Pre-Tested web-based survey questionnaire using FPHS V2 definitions with selected Ohio LHDs from AOHC (February 2015-May 2015).
- Incorporated data from DACS study of Washington PHAST Study Team*

* Source: Bekemeier et. al. 2017. Perceived need versus current spending: Gaps in providing foundational public health services in communities. Journal of Public Health Management and Practice

Conceptual representation of how the expected costs of full FPHS attainment are derived from a current attainment scale

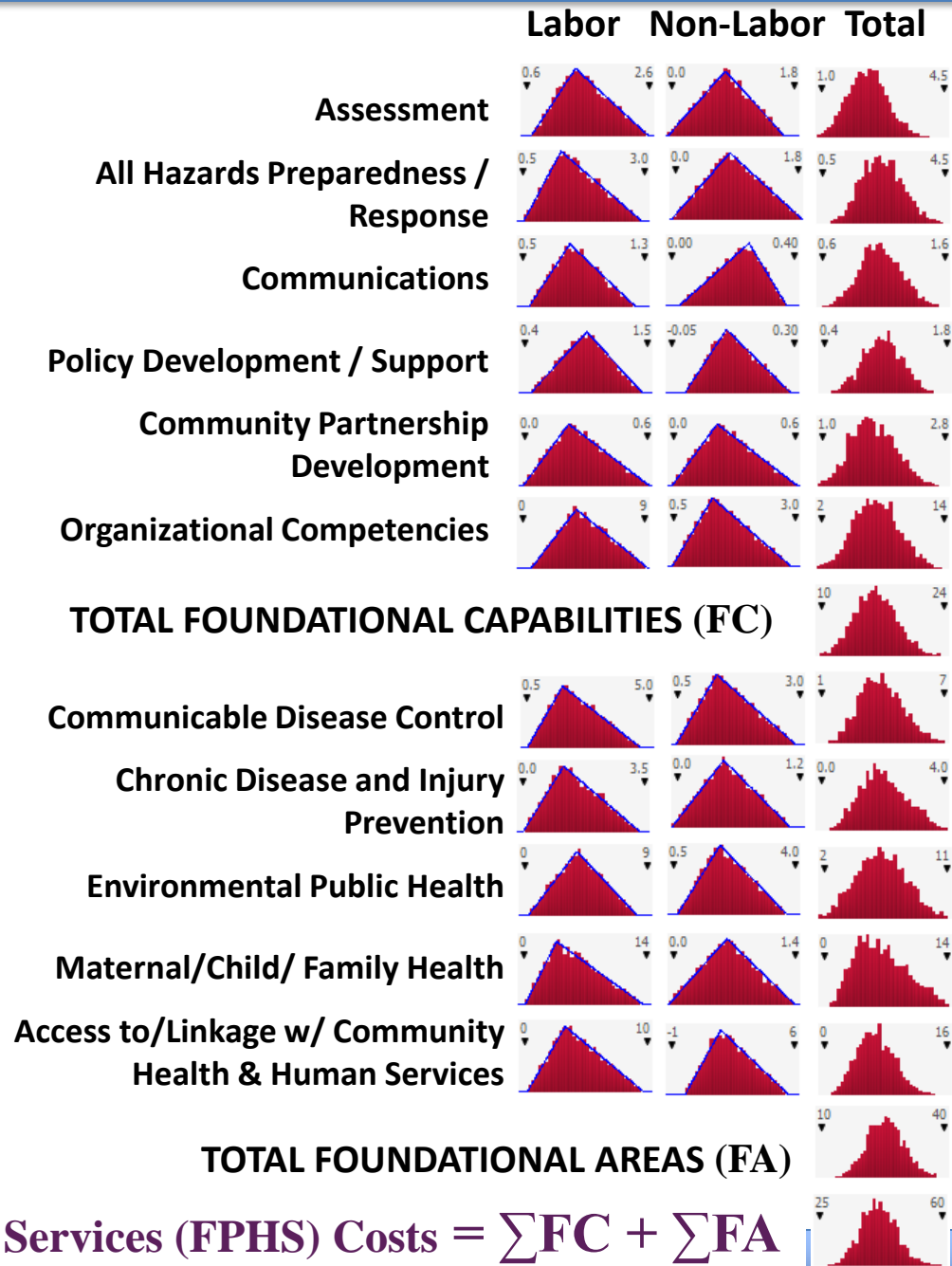


“Based on your understanding of how each public health foundational capability & foundational area is defined, please provide your **global or overall assessment** on the following question: *For each foundational category, what is the estimated percentage currently being met by your health department?* “

Illustrating the Model

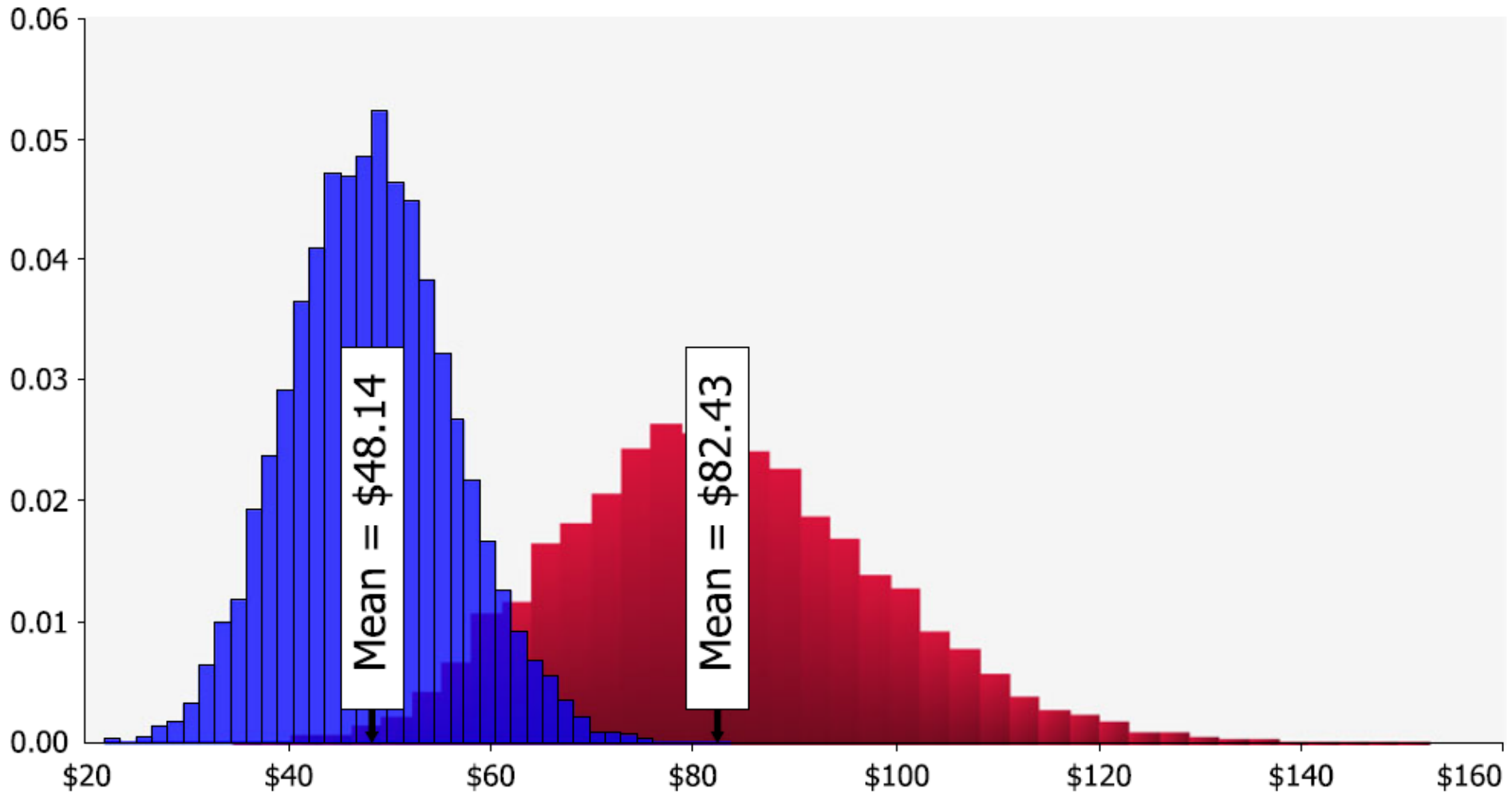
Simulation Approach: Current Per Capita Costs

In summary, the FPHS CE Methodology produces three sets of cost estimates: (1) costs currently incurred by an agency to implement each FPHS element (*current costs*); (2) *expected costs* that would be incurred by the agency to implement each FPHS at full attainment levels; and (3) *unmet resource gap* that is calculated as the difference between expected costs and current costs for each FPHS element.



$$\text{Total Foundational Public Health Services (FPHS) Costs} = \sum FC + \sum FA$$

Primary Results: Overlay of probability density graphs for current & expected FPHS per capita costs



FPHS CE Results in context...

- If we were to scale per capita resource gap estimates to a national level, results imply full attainment of FPHS recommendations would require an estimated \$34.29 per capita or around \$10.94 billion in additional resources per year (~318 mil. 2014 US Pop).
- Increase SLG PH activity spending by 16.1% over the levels estimated in the National Health Expenditure Accounts for 2014.
- Alternatively, resource gap could be filled by doubling federal govt spending on PH activities from the \$11.0 billion estimated in 2014.
- Consistent with these estimates, the 2012 IOM report recommended a doubling of the federal government's expenditures for public health activities in order to fund a minimum package of public health services.
 - Mamaril et al 2017. *Health Services Research*.
<https://onlinelibrary.wiley.com/doi/abs/10.1111/1475-6773.12816>
- Continued efforts towards collecting data to generate national estimates via alignment/crosswalk strategies with existing or established SLG accounting/reporting systems.
 - Uniform Chart of Accounts initiative (<http://phastdata.org/research/chart-of-accounts>)

Tools for economic evaluation in public health

Existing public use 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>

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>

Estimating value in public health:

ASTHO Public Health ROI Template

<http://www.astho.org/Evaluation/ASTHO-ROI-Tool-Instructional-Guide/>

- **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

- 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



Public Health
Prevent. Promote. Protect.

Interpretation, Limitations and Caveats

Conclusions and implications

- Sizable health and economic benefits are attributable to public health infrastructure and foundational capabilities
- Gains are not immediate – accrue over time
- Larger gains for low-income populations & communities
- Equity and opportunity: two-thirds of communities currently lack strong public health infrastructure
- Policy incentives and resources may help:
 - Hospital community benefit
 - Value-based health care payments
 - Insurer and employer incentives
 - Accountable Health Community models
- Sustainability and resiliency are not automatic

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

Systems for Action

National Coordinating Center
Systems and Services Research to Build a Culture of Health

Supported by The Robert Wood Johnson Foundation

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