Systems for Action

Systems and Services Research to Build a Culture of Health

PHSSR Research In Progress Webinar

Wednesday, March 16, 2016 *12:00-1:00pm ET*

Cost, Quality and Value of Public Health Services

Economic, Organizational, and Network Variation in Public Health Services Delivery

Funded by the Robert Wood Johnson Foundation

UK UNIVERSITY OF KENTUCKY
Center for Public Health Systems and Services Research

Agenda

Welcome: CB Mamaril, PhD, Senior Research Scientist, RWJF *Systems for Action* National Coordinating Center, U. of Kentucky

Economic, Organizational, and Network Variation in Public Health Services Delivery

Presenters:

CB Mamaril, PhD, MS, Research Assistant Professor *cbmamaril@uky.edu*, University of Kentucky College of Public Health

Commentary: Georgia Heise DrPH, Director, Three Rivers District Health Department, Kentucky *georgiaf.heise@ky.gov*

Glen Mays, PhD, MPH, Scutchfield Endowed Professor of Health Services & Systems Research *Glen.Mays@uky.edu*

Questions and Discussion

Presenter

Cesar B. Mamaril, PhD

Senior Research Scientist, *Systems for Action* National Coordinating Center

Research Assistant Professor, Health Management and Policy, College of Public Health

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Systems for Action

Systems and Services Research to Build a Culture of Health

Economic, Organizational, and Network Variation in Public Health Services Delivery:

Model Simulation Techniques to Estimate the Cost of Providing Foundational Public Health Services

C.B. Mamaril, PhD
Glen Mays, PhD
Keith Branham, MPH
Lava Timsina, MPH

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Acknowledgements

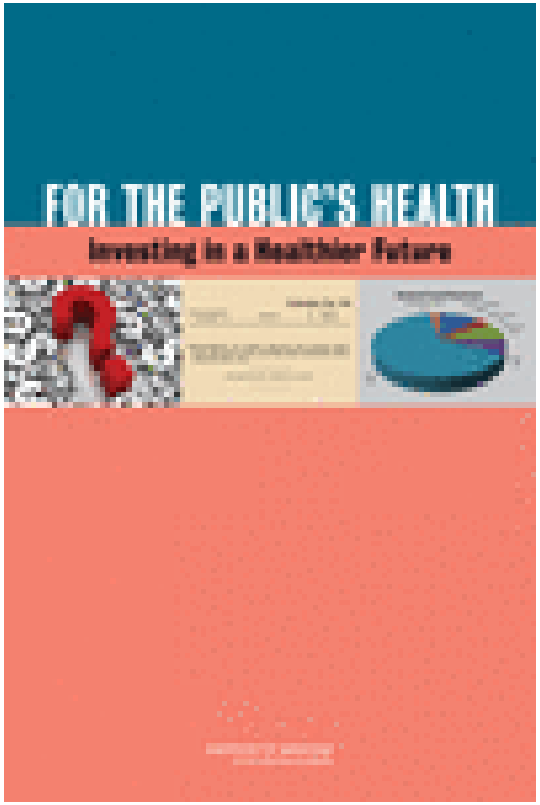
Systems for Action is a National Program Office of the Robert Wood Johnson Foundation and a collaborative effort of the Center for Public Health Systems and Services Research in the College of Public Health, & the Center for Poverty Research in the Gatton College of Business and Economics, administered by the University of Kentucky, Lexington, KY.

- Robert Wood Johnson Foundation
- Washington Practice-Based Research Network (PBRN) Delivery & Cost Study (DACS) Research Team (University of Washington) led by Justin Marlowe, PhD and Betty Bekemeier, PhD
- Public Health Leadership Forum (PHLF) – ASTHO, NACCHO, PHAB, CDC, RESOLVE…
- Graduate research assistance of Keith Branham, Lava Timsina, Andrew Jonelis, Ben Wallace, Nurlan Kussainov, Justin McDaniel, Marylou Wallace, Arveen Kaur
- Kentucky Health Departments Association (KHDA) and Georgia Heise, DrPH
- Association of Ohio Health Commissioners, Inc. (AOHC) and Terry Allan

Toward a deeper understanding of costs & returns in public health

2012 Institute of Medicine Recommendations

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



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

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**

National Workgroup on Foundational Public Health Capabilities – Public Health Leadership Forum (PHLF)

- The 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)

Definitions

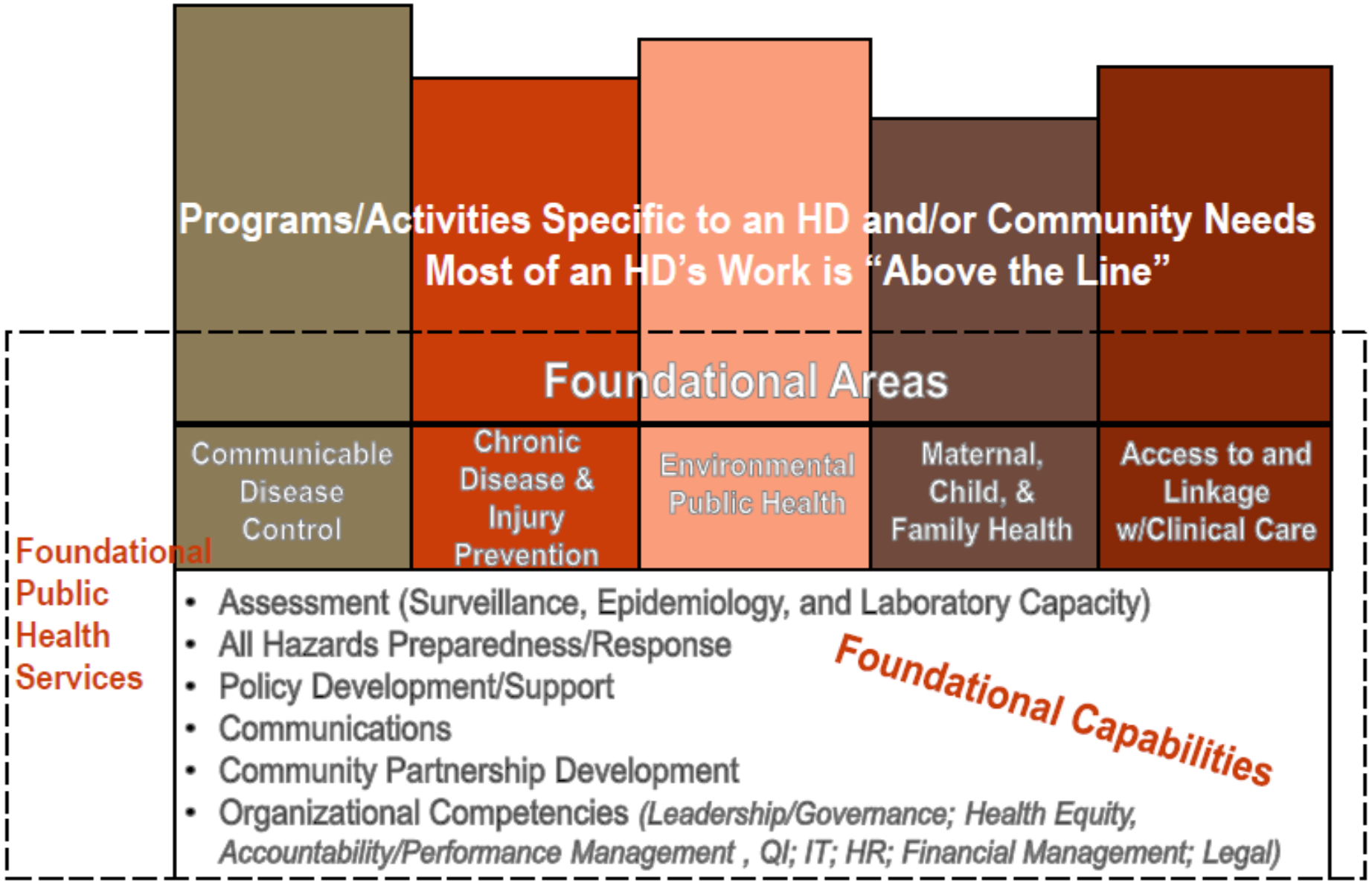
Foundational Capabilities (FC): Cross-cutting skills that need to be present in state & local health departments **everywhere** for the health system to work **anywhere**. Needed to support the foundational areas, & other programs & activities, key to protecting community health & achieving equitable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

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

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.

Defining what to cost

RESOLVE/Articulation of Definitions Workgroup (as of November 2014)



FPHS CE Workgroup & Research Team

- ***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/

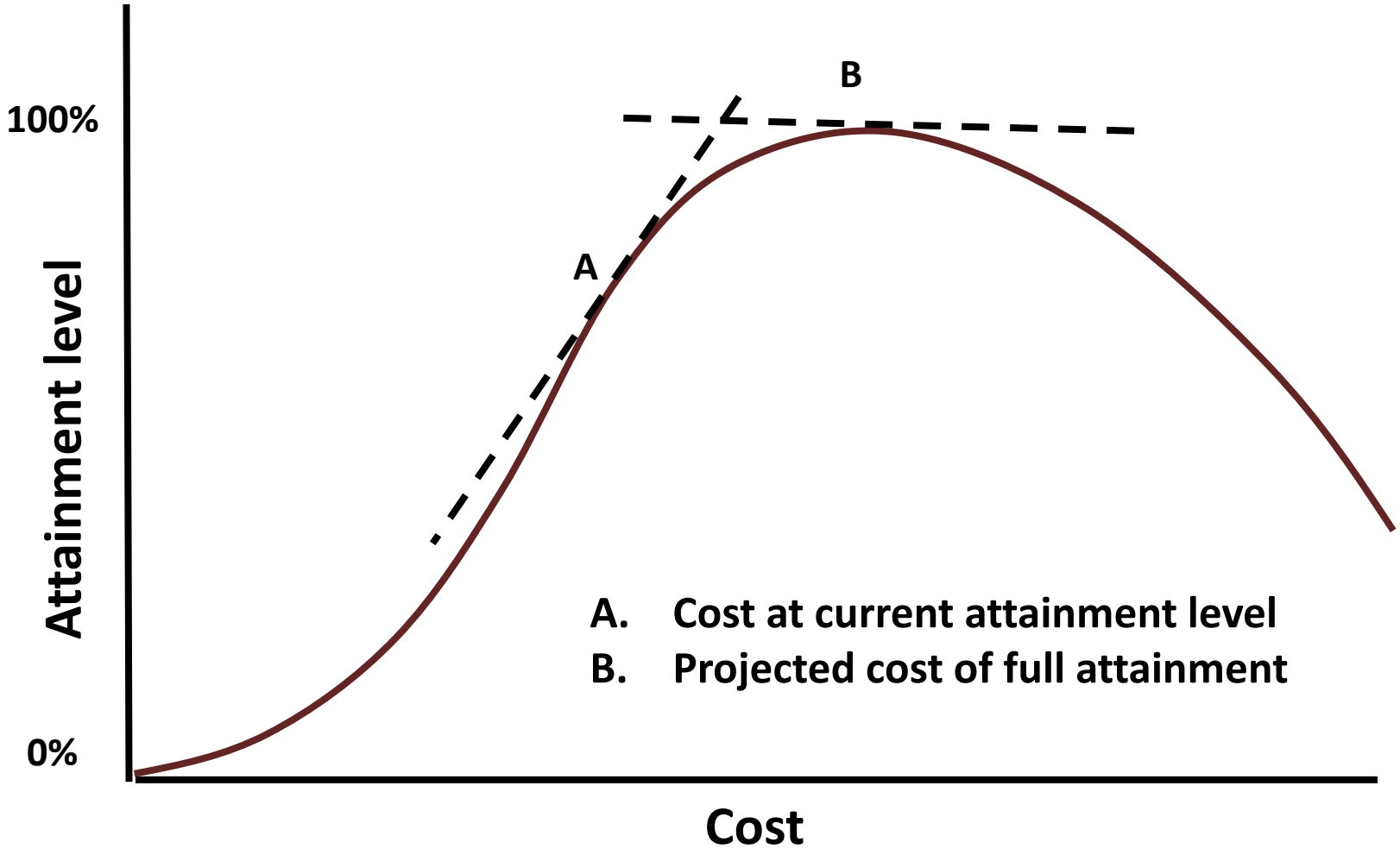
- Pilot-Tested Methodology with KHDA Finance Workgroup comprised of 6 Kentucky Health Departments (June-October 2014)
- Pre-Tested web-based survey questionnaire using FPHS V2 definitions with selected Ohio LHDs from AOHC (February 2015-May 2015).
- Ongoing national survey of LHDs in selected states (July 2015-present)

DATA COLLECTION INSTRUMENT: Basic Process Flow

- Adapted & modified Washington PBRN Delivery and Cost Studies (DACS) FPHS CE data-collection instrument.
- FPHS CE respondent answers survey based on understanding of each FPHS capability and area as defined and articulated.
- Questionnaire is divided into six sections:

1) LHD **workforce composition** (# of employees per category)
2) LHD **labor resource use** (average hrs/wk per occupational category)
3) **Salary** and Indirects (wage rate scale: min-ave-max)
4) Total **Annual Non-Labor** Costs (per FPHS category)
5) **Needs assessment** (current attainment scale relative to full attainment of projected need)

Estimation of "projected/need" costs from current attainment rating



"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?*** "

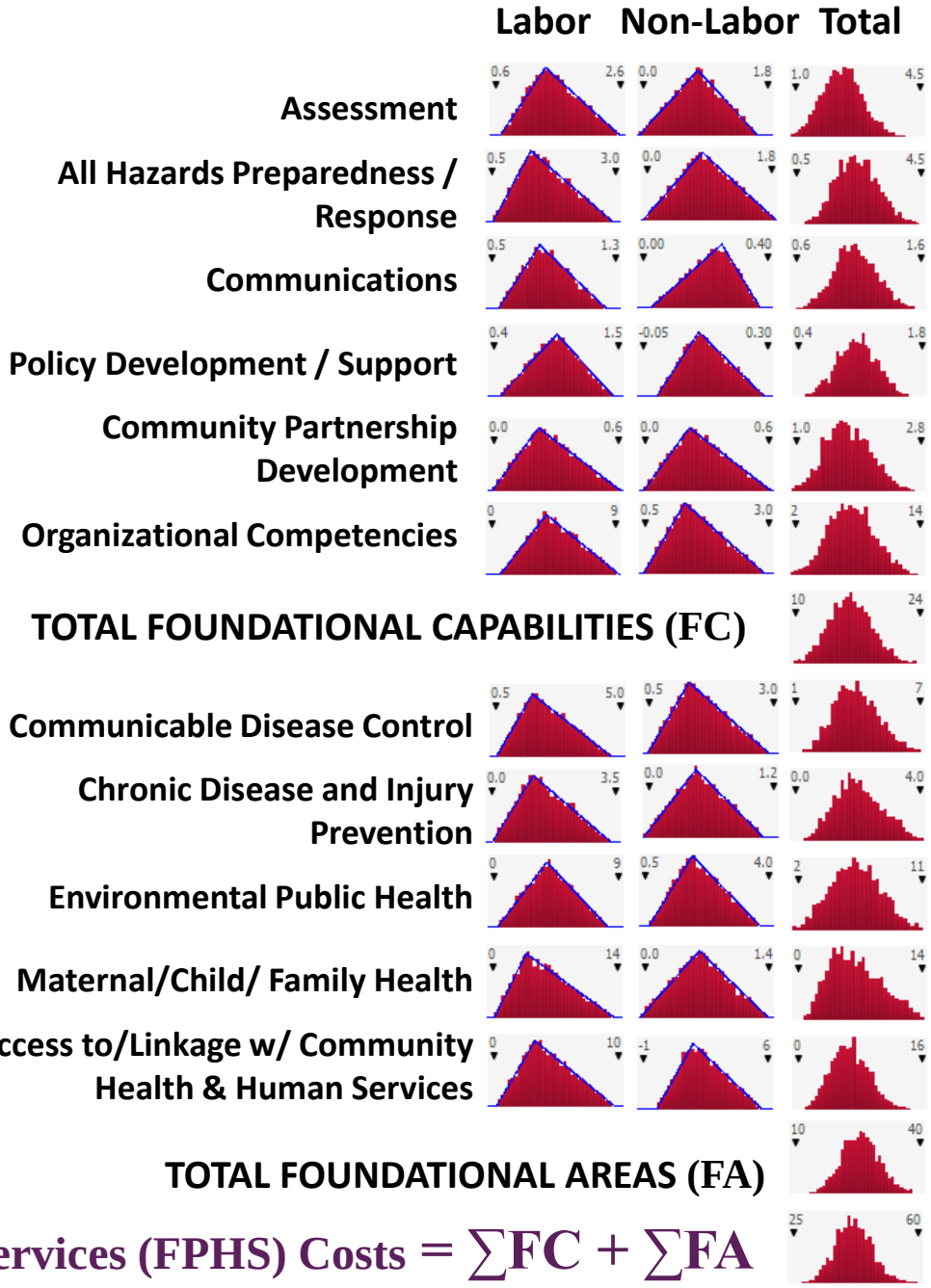
Development of FPHS CE Methodology

- Given inherent burden of complex survey, goal of efficiently self-administered to capture estimates that account for variation in costs due to the dynamic nature of public health.
- **Pragmatic Empirical approach**: Simulation modelling approach to estimate cost of implementing FPHS by modeling variation (i.e. uncertainty) associated with collected cost data
- Generate probability distributions of costs – the range of all possible cost values & the likelihood of their occurrence (versus point estimate).
  - Input costs distribution → Output value distribution
  - Distribution of output values calculated from all possible combinations ('scenarios'=iterations) of input costs.
  - Since probability distributions can be graphed, useful as a analytical, decision-making tool & planning aid.

Illustrating the Model Simulation Approach: Current Per Capita Costs

*In summary, the FPHS CE Methodology produces a **cost distribution** (as opposed to point estimates) or each Foundational Capability (FC) & Foundational Area (FA) specified in the National FPHS Definitions_V2 document …and for separate estimates of "current" & "projected/need" costs*

- ***Current**: cost of resources currently used to produce FCs & FAs*
- ***Projected/Need**: cost of resources estimated to be required to fully meet FC & FA definitions, based on current levels of attainment.*



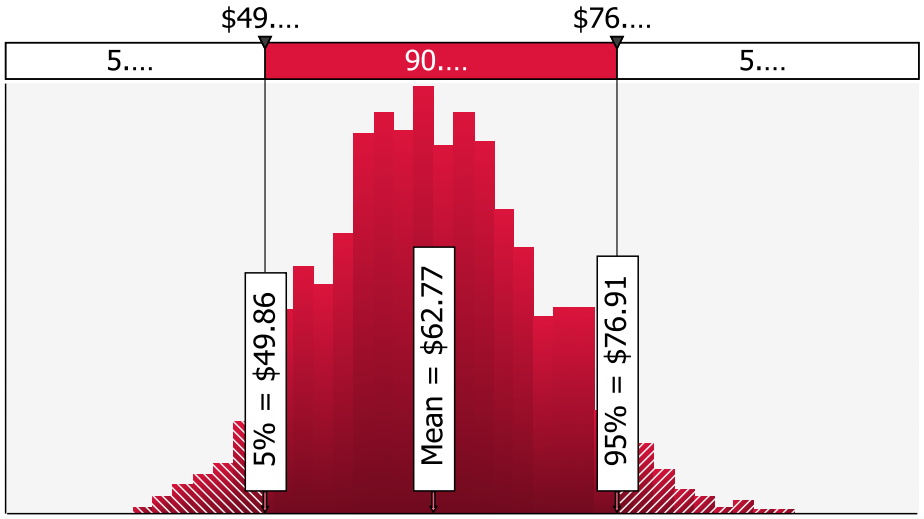
Total Foundational Public Health Services (FPHS) Costs = $\sum FC + \sum FA$

Model Simulation Results from FPHS CE Pilot Sample Survey Sites

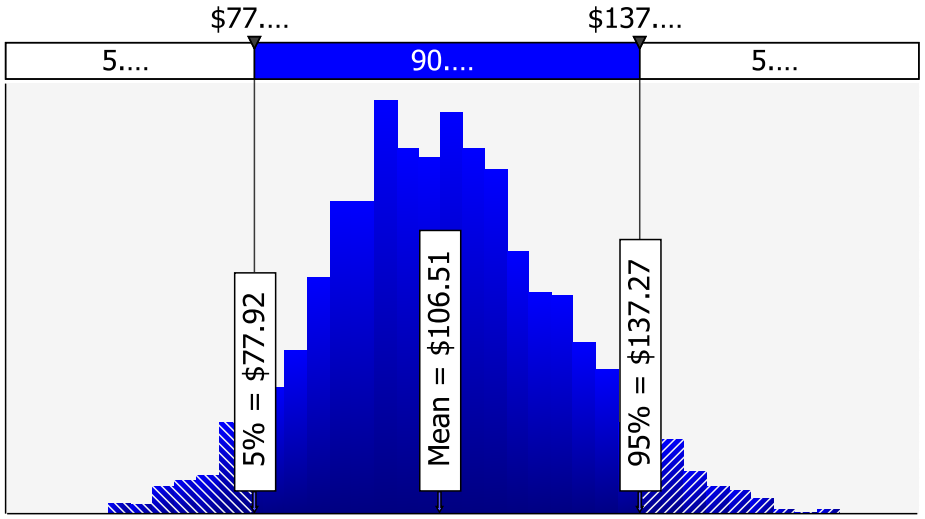
(Population weighted per capita cost estimates from pilot survey of 6 LHDs in Kentucky & 8 LHDs in Ohio and preliminary results incorporating data from Washington DACS)

Total Per Capita Costs of Foundational Public Health Services (FPHS)

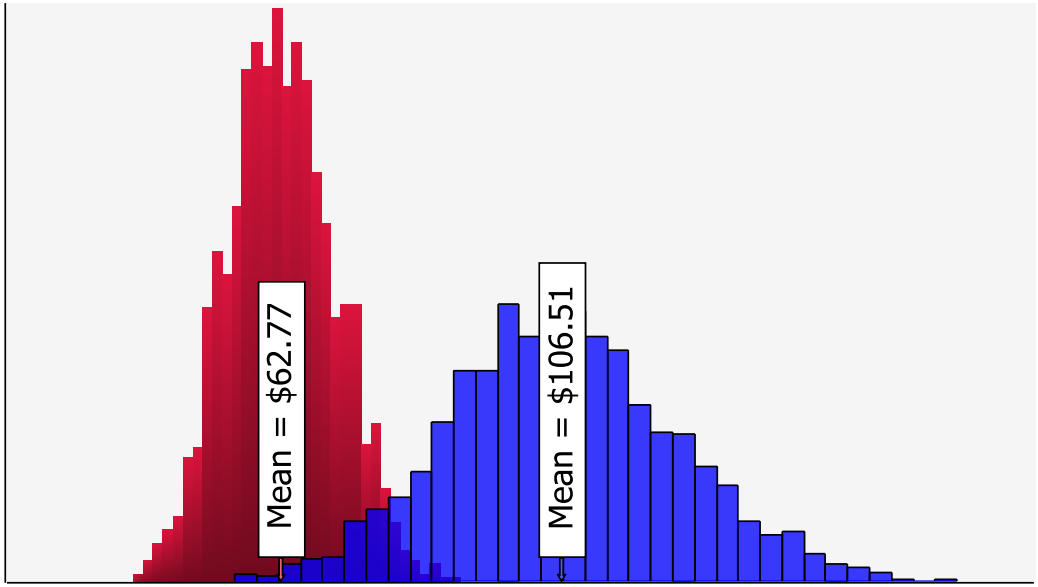
(**Full Combined Sample**: Current Per Capita Costs in Red – Projected/Need in Blue)



Current Per Capita Costs ($) – Full Sample



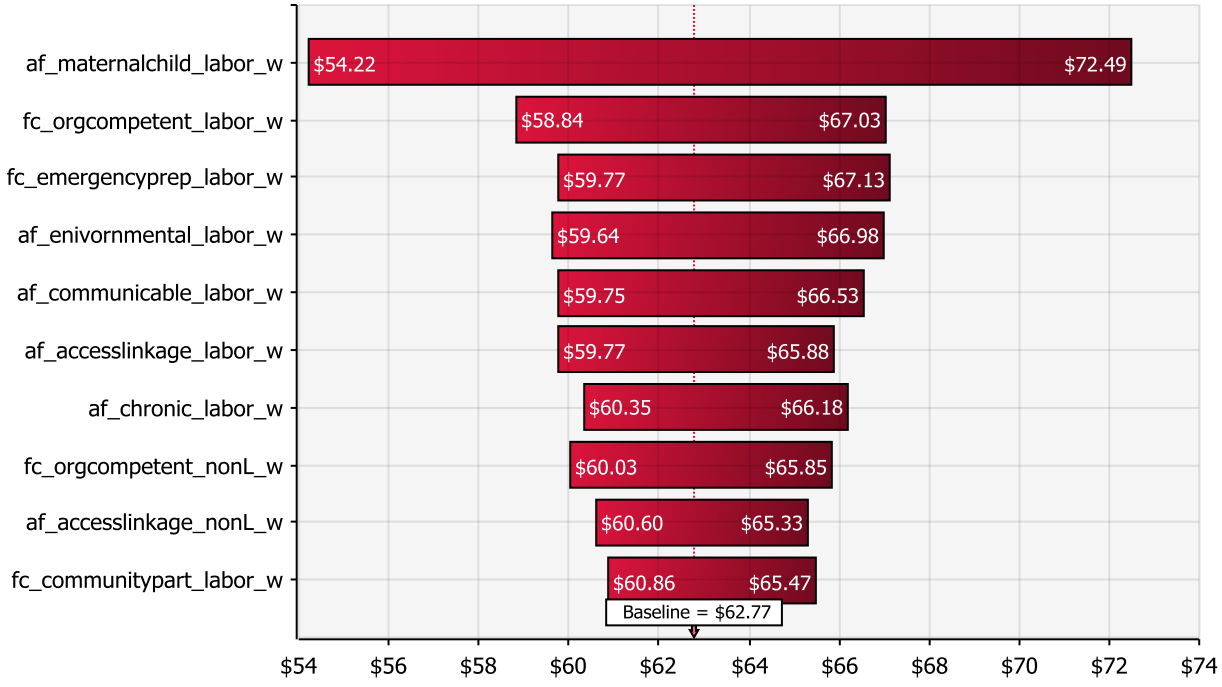
Per Capita Cost of Projected / Need ($) - Full Sample



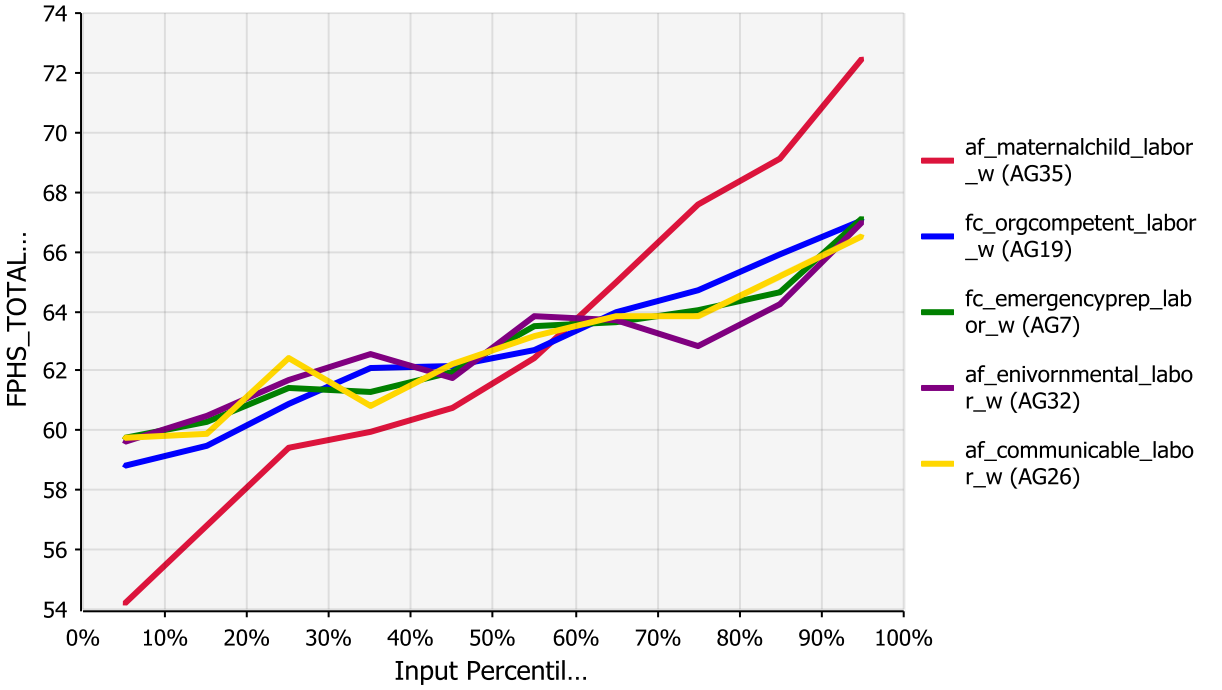
Graph Overlay of Current & Projected / Need – Full Sample

SENSITIVITY ANALYSES

"Tornado Chart" – inputs ranked by effect on output mean (i.e. total per capita FPHS costs)

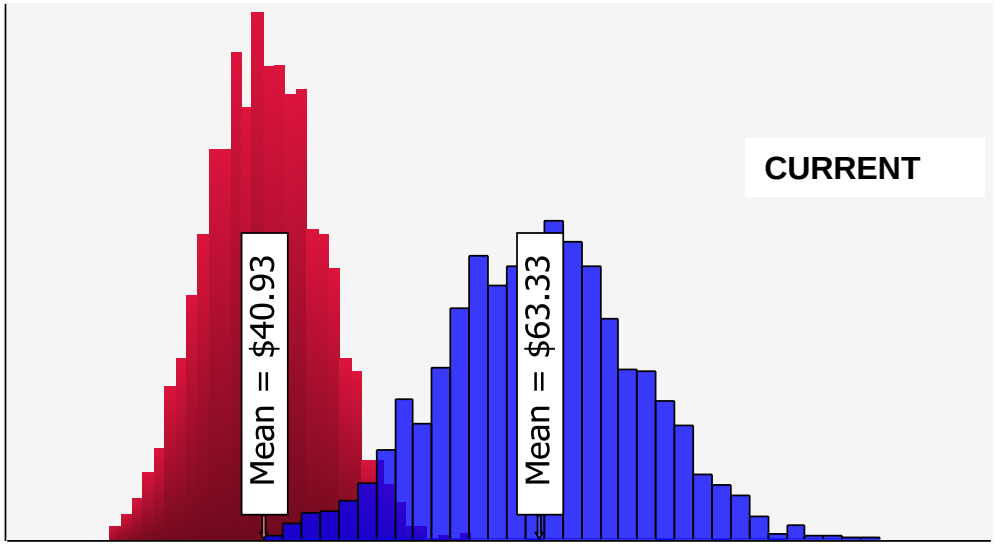


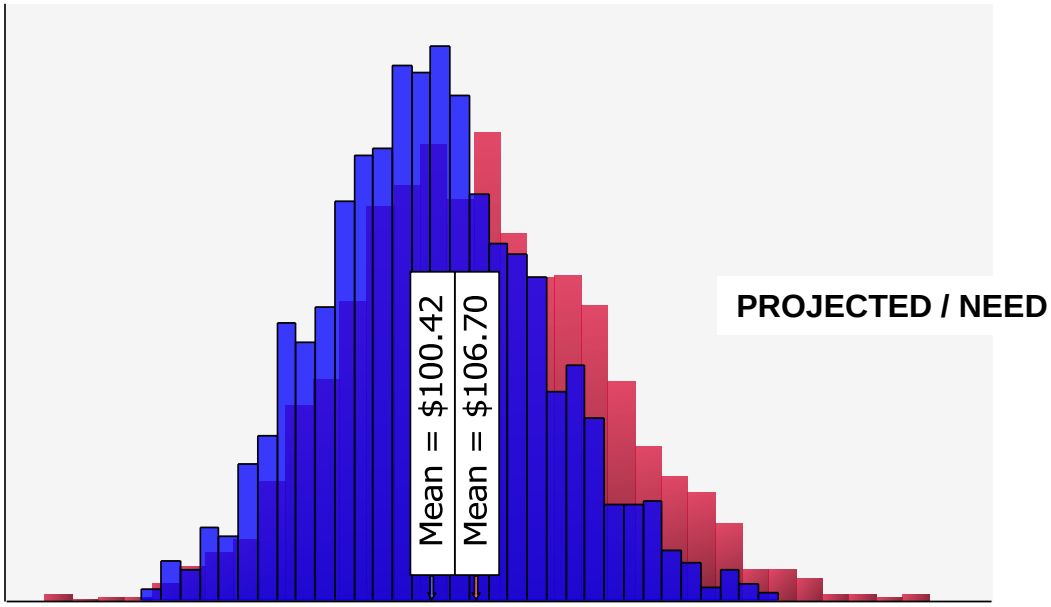
"Spider Graph" – change in output mean across range of input values (i.e. total per capita FPHS costs)



Total Per Capita Costs of Foundational Public Health Services (FPHS)

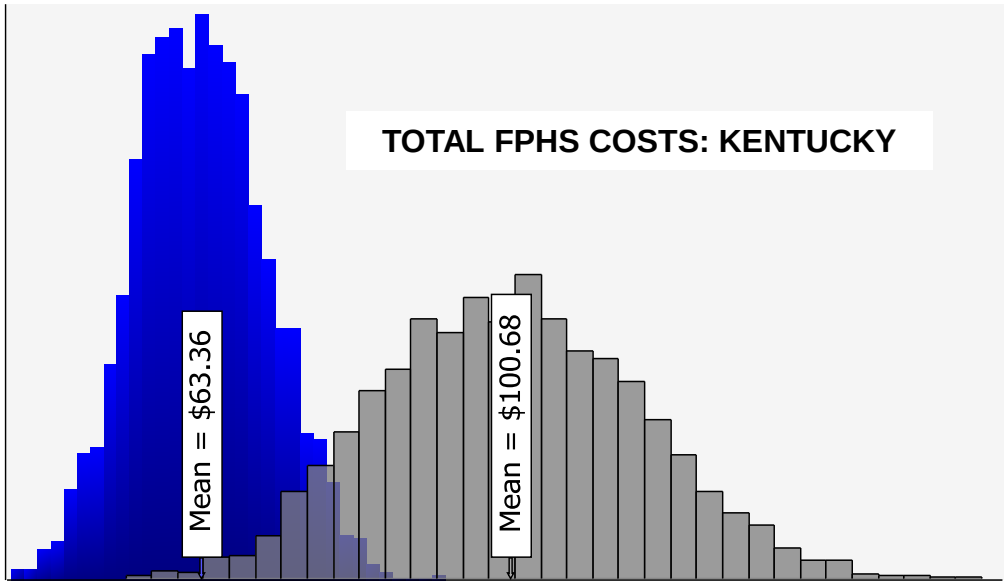
(**Between** States: Graph Overlay of **Kentucky in Blue** / **Ohio in Red**)

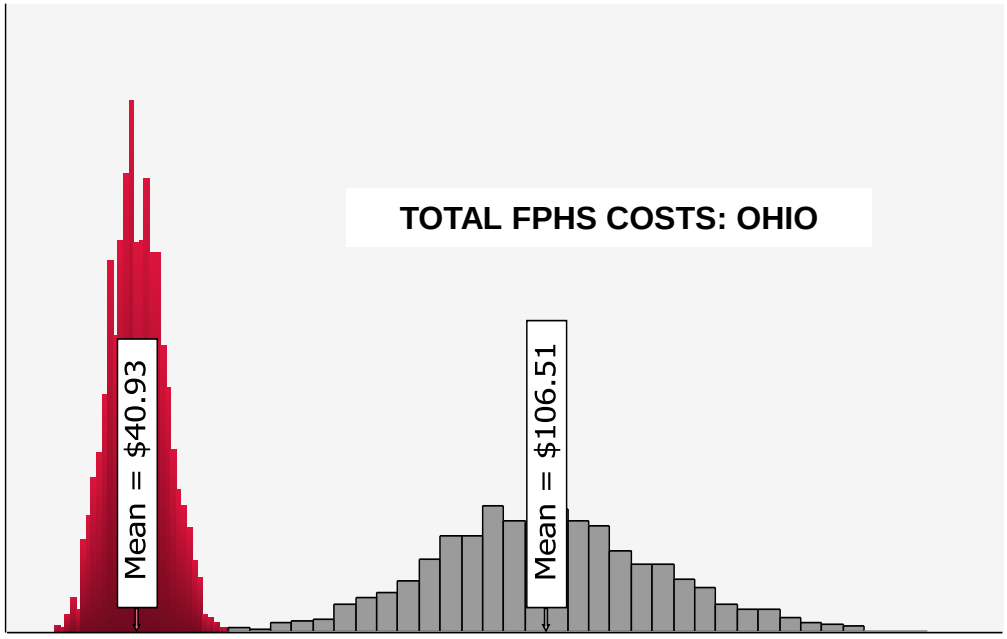




Total Per Capita Costs of Foundational Public Health Services (FPHS)

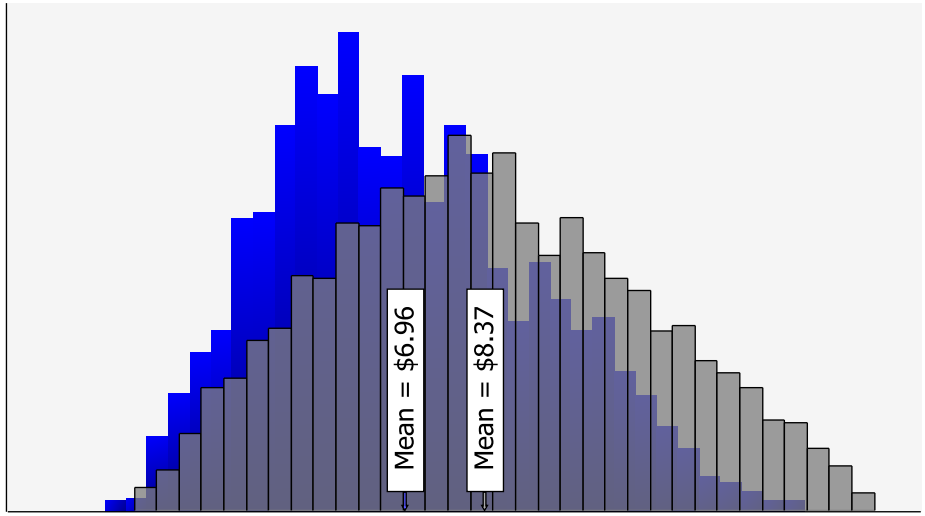
(**Within** State: Current vs **Projected/Need Graph** Overlay in **Kentucky** & **Ohio**)



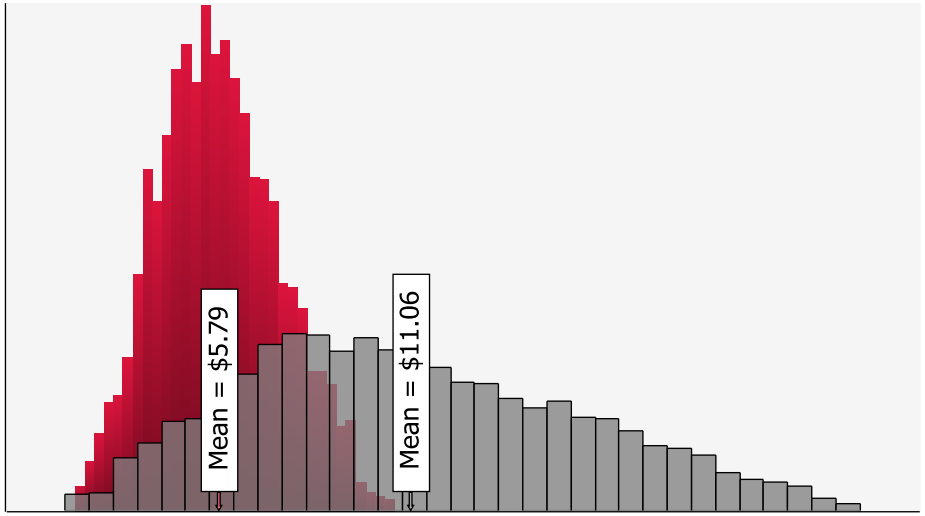


Per Capita Costs of FPHS Category By Sample Site

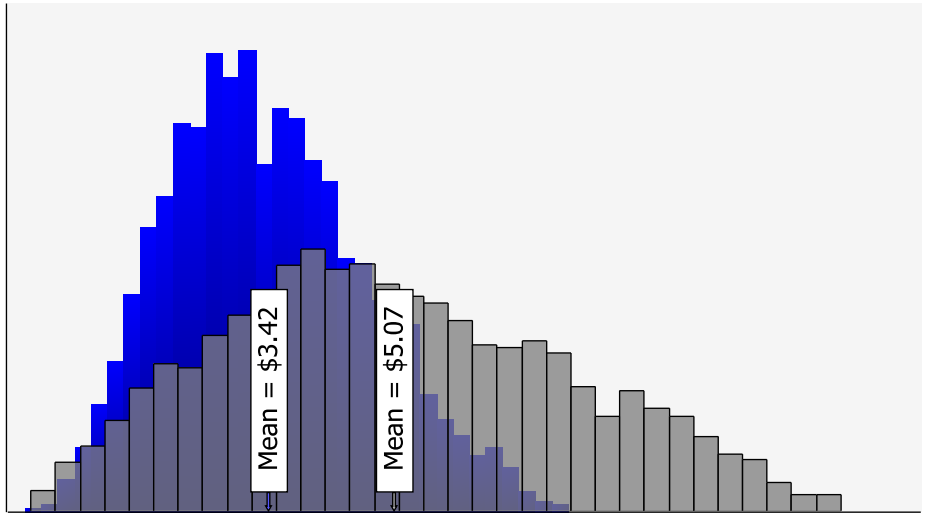
(**Within** State: Current vs Projected/Need Graph Overlay in **Kentucky** & **Ohio**)



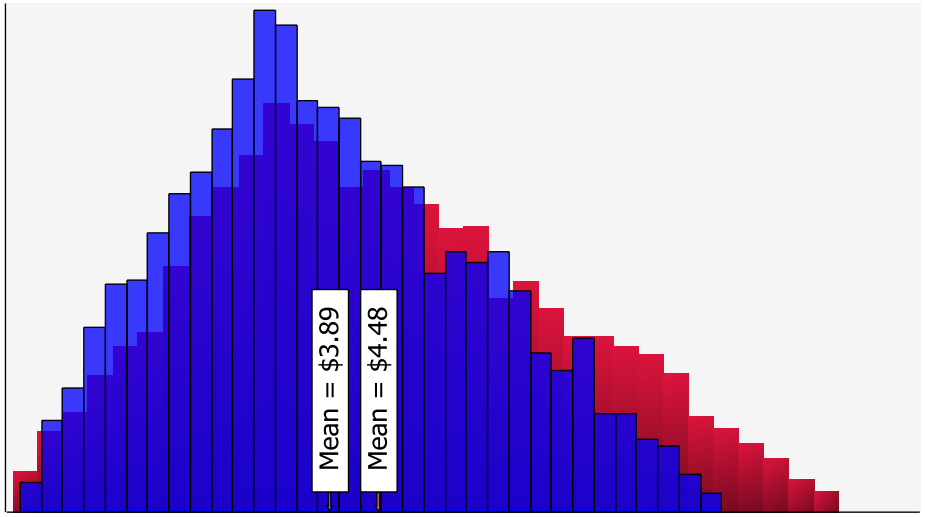
FA3-Environmental Public Health: KENTUCKY



FA3-Environmental Public Health: OHIO



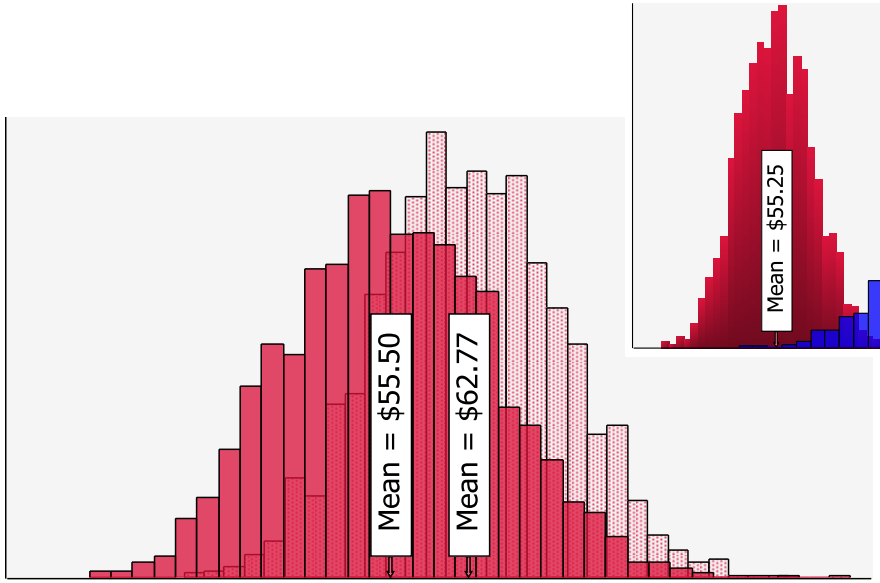
FC6-Organizational Competencies: KENTUCKY



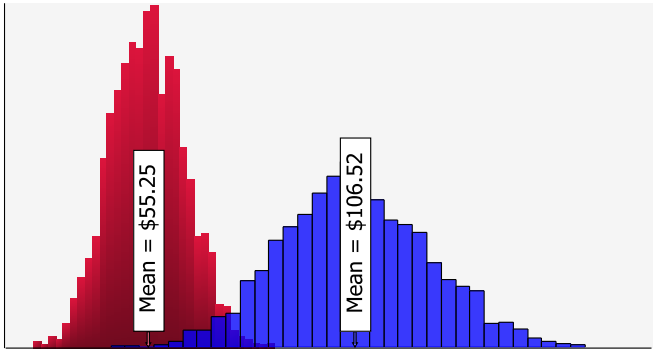
FC5-Community Partnership: OHIO

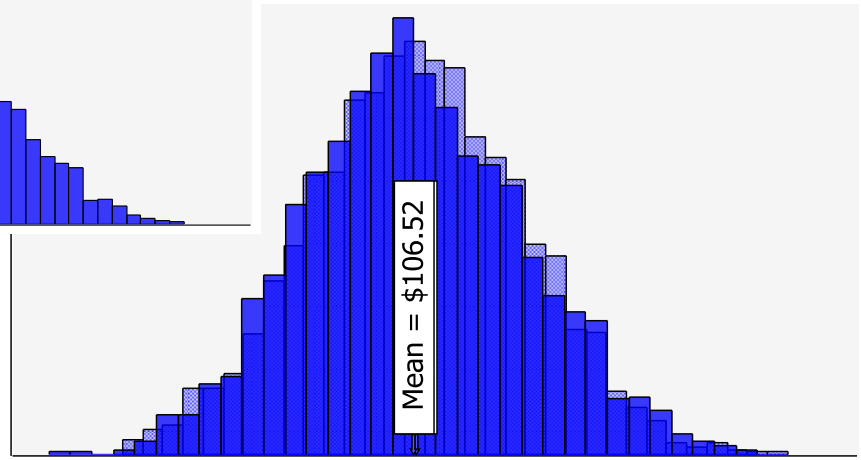
Weighted Estimates of Total FPHS Costs – Pilot KY+OH with WA DACS

(**Combined & separate**: **Current Per Capita Costs in Red – Projected/Need in Blue**)

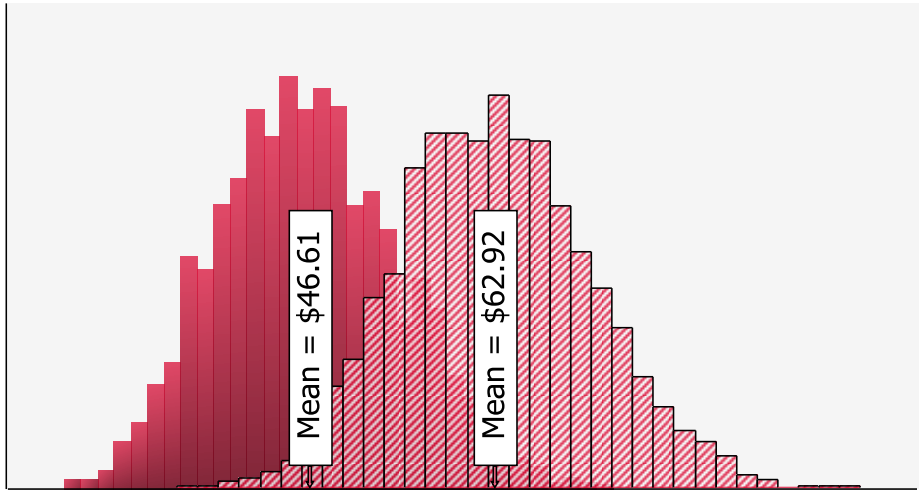


Current Per Capita Costs ($) – Full Sample

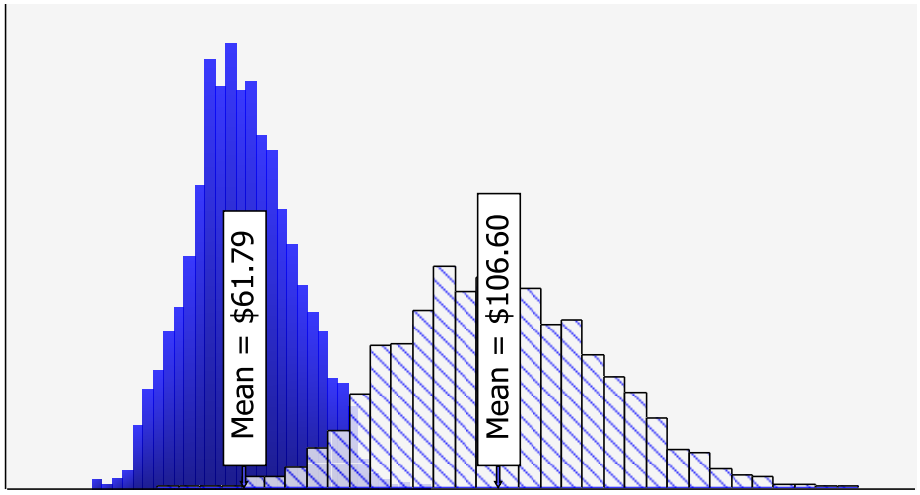




Per Capita Cost of Projected / Need ($) - Full Sample



Current Costs (WA DACS vs. KY-OH Pilot/)



Projected Need (WA DACS vs. KY-OH Pilot/)

Towards first-generation FPHS cost estimates…

- Part of the critical step outlined in 2012 IOM Report
- Model simulation results show both the variation across FPHS categories and the substantial gap between current costs of FPHS implementation and the projected costs to fully meet FPHS needs.
- Demonstrate feasibility and value of a hybrid cost-estimation methodology that combines survey-based cost allocation approaches with model simulation techniques to quantify the geographic variation of costs in implementing public health services
- Data-collection instrument and model simulation approach for analytical, decision-making, and policy related purposes.

Commentary

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Director, Three Rivers District Health Department
Co-director, Kentucky Population Health Institute
Immediate Past President, National Association of County and City Health Officials (NACCHO)
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Presenter

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Systems for Action

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Inter-organizational Network Effects on the Implementation of Public Health Services

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Acknowledgements & Disclosures

- Funded by the Robert Wood Johnson Foundation through the **Systems for Action National Program Office**
- Collaborators include Cezar Mamaril, Lava Timsina, Rachel Hogg, David Bardach

How do we support implementation of population health improvement strategies?

- Designed to achieve large-scale health improvement: neighborhood, city/county, region
- Target fundamental and often multiple determinants of health
- Mobilize the collective actions of multiple stakeholders in government & private sector

  - Usual and unusual suspects

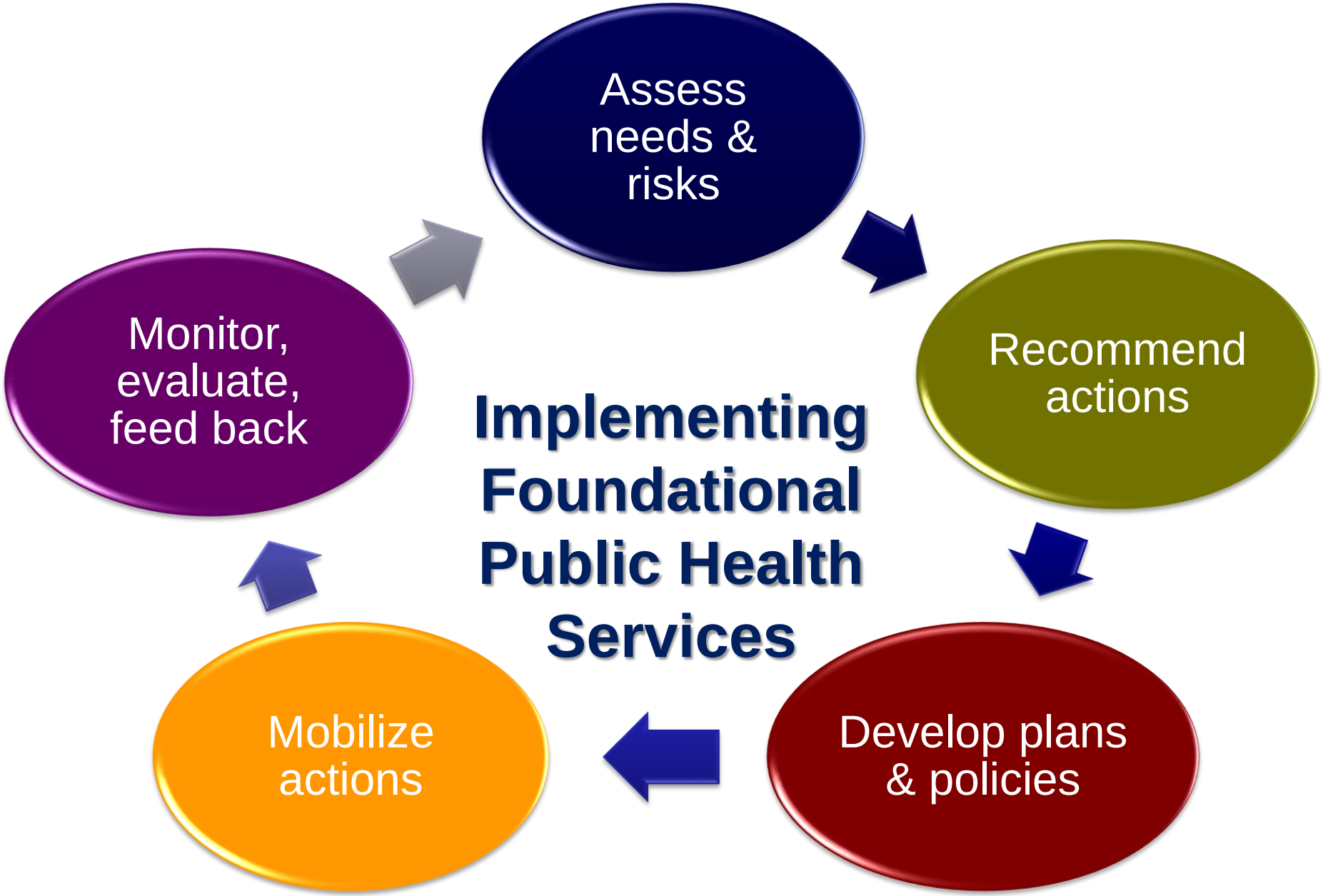
  - Infrastructure requirements

Mays GP. Governmental public health and the economics of adaptation to population health strategies. National Academy of Medicine Discussion Paper. 2014. http://nam.edu/wp-content/uploads/2015/06/EconomicsOfAdaptation.pdf

Fundamental challenge: overcoming collective action problems

- Incentive compatibility → public goods
- Concentrated costs & diffuse benefits
- Time lags: costs vs. improvements
- Uncertainties about what works
- Asymmetries in information
- Difficulties measuring progress
- Weak and variable institutions & infrastructure
- Imbalance: resources vs. needs
- Stability & sustainability of funding

Ostrom E. Collective action and the evolution of social norms. ***Journal of Economic Perspectives*** 14(3): 137-58.



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

Research questions of interest

- Which organizations contribute to the implementation of public health activities in local communities?
- How do these contributions change over time?

Recession | Recovery | Accreditation
ACA implementation

- How do changes in delivery system structures influence service delivery & population health?

Data: public health delivery systems

National Longitudinal Survey of Public Health Systems

- Cohort of 360 communities with at least 100,000 residents
- Followed over time: 1998, 2006, 2012, 2014**
- Local public health officials report:
  - ***Scope***: availability of 20 recommended public health activities
  - ***Network***: types of organizations contributing to each activity
  - ***Effort***: contributed by designated local public health agency
  - ***Quality***: perceived effectiveness of each activity

** Expanded sample of 500 communities<100,000 added in 2014 wave

Data: community & market characteristics

- **Area Health Resource File**: physician, hospital and CHC supply; population size and demographics, socioeconomic status, racial/ethnic composition, health insurance coverage
- **NACCHO Profile data**: public health agency institutional and financial characteristics
- **Medicare Cost Report**: hospital ownership, market share, uncompensated care
- **CDC Compressed Mortality File**: Cause-specific death rates by county

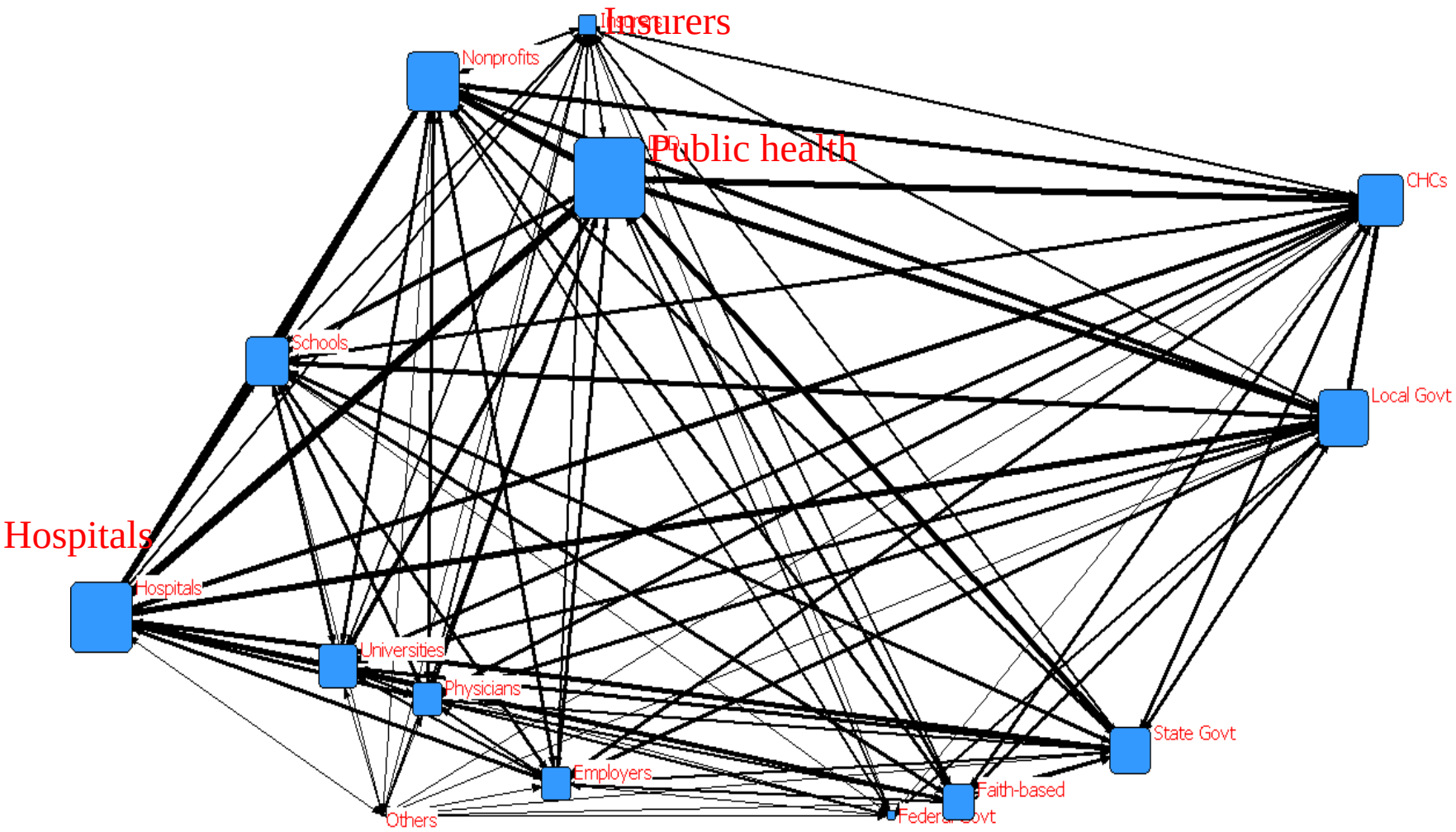
Cluster and network analysis to identify "system capital"

Cluster analysis is used to classify communities into one of 7 categories of ***public health system capital*** based on:

- ***Scope of activities*** contributed by each type of organization
- ***Density of connections*** among organizations jointly producing public health activities
- ***Degree centrality*** of the governmental public health agency

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

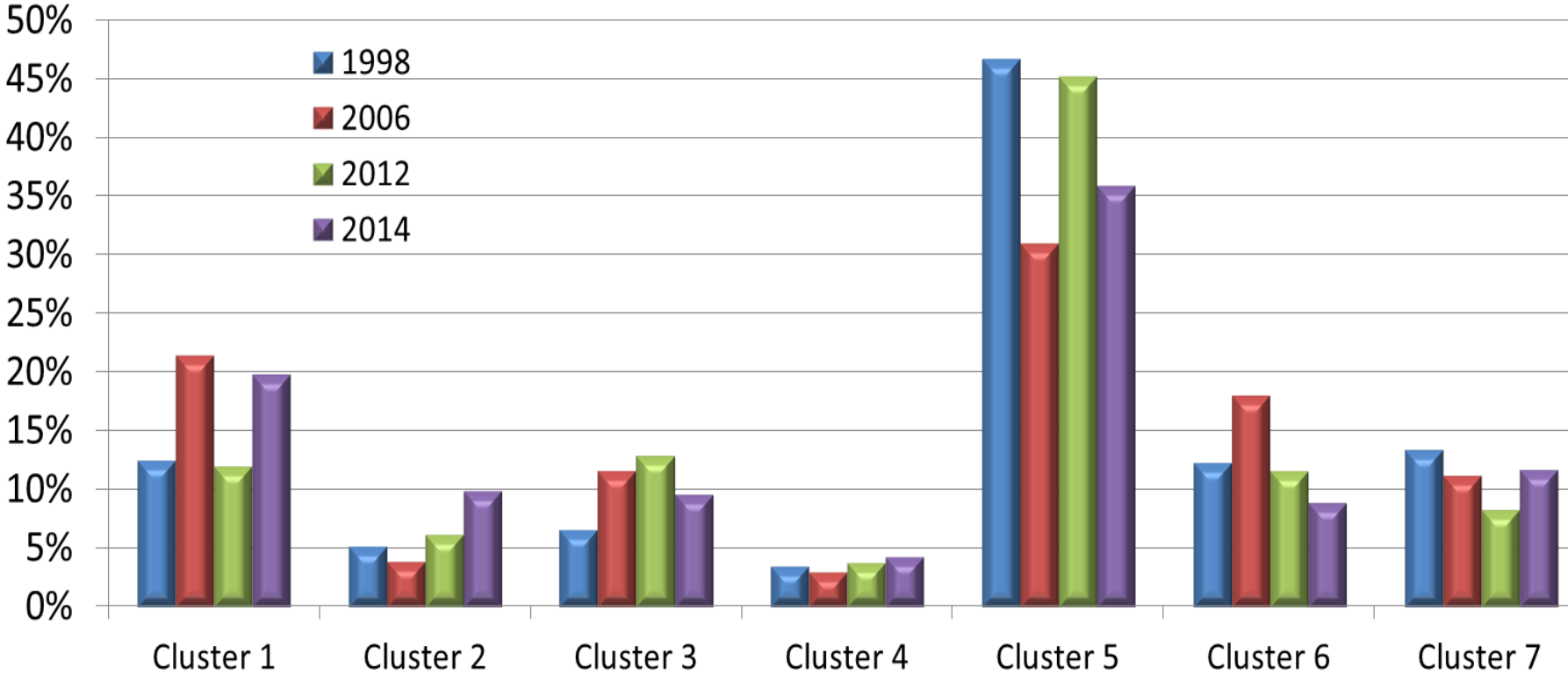
Average public health system structure in 2014



Node size = degree centrality

Line size = % activities jointly contributed (tie strength)

Prevalence of Public Health System Configurations 1998-2014



	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
Scope	High	High	High	Mod	Mod	Low	Low
Centrality	Mod	Low	High	High	Low	High	Low
Density	High	High	Mod	Mod	Mod	Low	Mod
	Comprehensive (High System Capital)			**Conventional**		**Limited**	

Changes in system prevalence and coverage

System Capital Measures	1998	2006	2012	2014	2014 (<100k)
Comprehensive systems					
% of communities	**24.2%**	**36.9%**	**31.1%**	**32.7%**	**25.7%**
% of population	**25.0%**	**50.8%**	**47.7%**	**47.2%**	**36.6%**
Conventional systems					
% of communities	50.1%	33.9%	49.0%	40.1%	57.6%
% of population	46.9%	25.8%	36.3%	32.5%	47.3%
Limited systems					
% of communities	25.6%	29.2%	19.9%	20.6%	16.7%
% of population	28.1%	23.4%	16.0%	19.6%	16.1%

Estimating network effects

Dependent variables:

- ***Health outcomes***: premature mortality(<75), infant mortality, death rates for heart disease, diabetes, cancer, influenza
- ***Resource use***: Local governmental expenditures for public health activities

Independent variables:

- ***Network characteristics***: network density, organizational degree centrality, betweenness centrality
- ***Delivery system structure***: comprehensive, conventional, or limited public health delivery systems

Estimating delivery system effects

Statistical Model

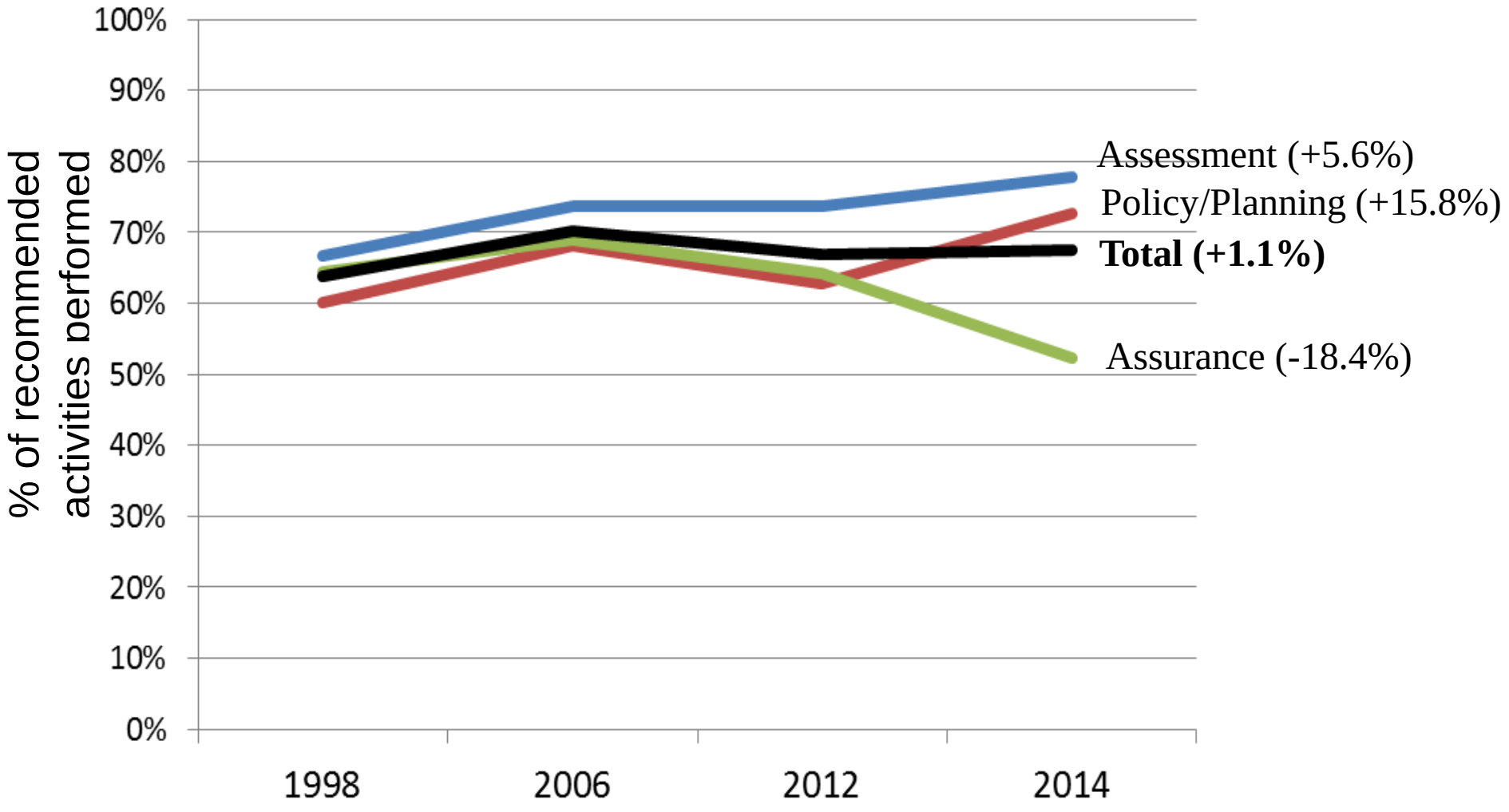
- Log-transformed Generalized Linear Latent and Mixed Models
- Account for repeated measures and clustering of public health jurisdictions within states
- Instrumental variables address endogeneity of system structures

$$\Pr(System_{z,ijt}=1) = \sum \alpha_z Governance_{ijt} + \beta_1 Agency_{ijt} + \beta_2 Community_{ijt} + \mu_j + \varphi_t + \varepsilon_{ijt}$$

$$Ln(Outcomes|Cost_{ijt}) = \sum \alpha_z (\widehat{System}_z)_{ijt} + \beta_1 Agency_{ijt} + \beta_2 Community_{ijt} + \mu_j + \varphi_t + \varepsilon_{ijt}$$

All models control for type of jurisdiction, population size and density, metropolitan area designation, income per capita, unemployment, racial composition, age distribution, educational attainment, and physician availability.

Implementation of recommended public health activities 1998-2014

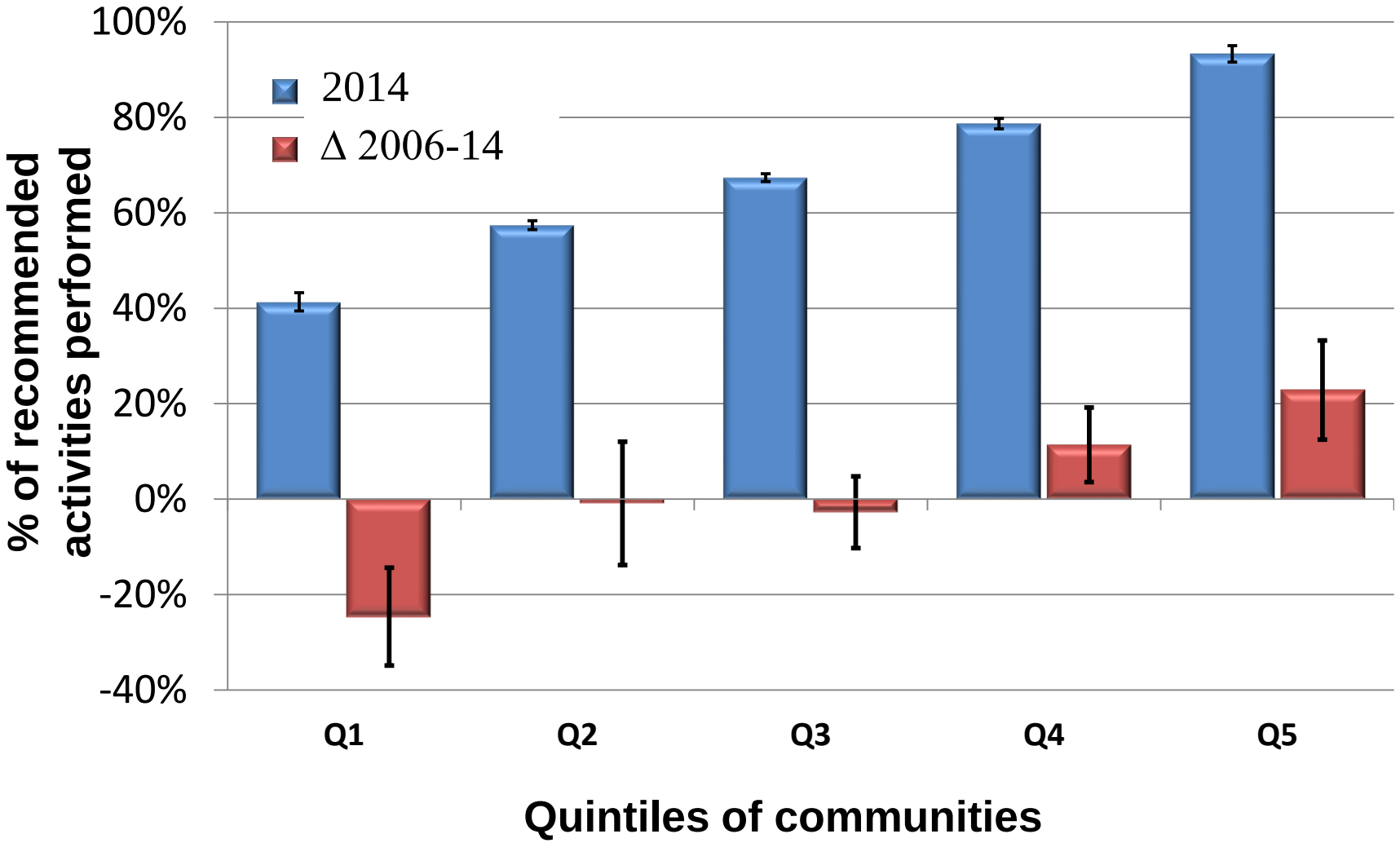


Implementation of recommended activities 1998-2014

	Public Health Activity	1998	2014	% Change
1	Community health needs assessment	71.5%	86.0%	20.2%**
2	Behavioral risk factor surveillance	45.8%	70.2%	53.2%**
3	Adverse health events investigation	98.6%	100.0%	1.4%
4	Public health laboratory testing services	96.3%	96.5%	0.2%
5	Analysis of health status and health determinants	61.3%	72.8%	18.7%**
6	Analysis of preventive services utilization	28.4%	39.4%	38.8%**
7	Health information provision to elected officials	80.9%	84.8%	4.8%
8	Health information provision to the public	75.4%	83.8%	11.1%*
9	Health information provision to the media	75.2%	87.5%	16.3%**
10	Prioritization of community health needs	66.1%	82.3%	24.6%**
11	Community participation in health improvement planning	41.5%	67.7%	63.0%**
12	Development of community health improvement plan	81.9%	86.2%	5.2%
13	Resource allocation to implement community health plan	26.2%	43.2%	64.9%**
14	Policy development to implement community health plan	48.6%	57.5%	18.4%*
15	Communication network of health-related organizations	78.8%	84.8%	7.6%
16	Strategies to enhance access to needed health services	75.6%	50.2%	-33.6%**
17	Implementation of legally mandated public health activities	91.4%	92.4%	1.0%
18	Evaluation of public health programs and services	34.7%	38.4%	10.8%**
19	Evaluation of local public health agency capacity/performance	56.3%	55.0%	-2.4%
20	Implementation of quality improvement processes	47.3%	49.6%	5.0%
	Composite availability of assessment activities (1-6)	66.7%	77.6%	16.4%**
	Composite availability of policy development activities (7-15)	60.2%	72.5%	20.4%
	Composite availability of assurance activities (16-20)	64.4%	52.8%	-18.0%*
	Composite availability of all activities (1-20)	63.8%	67.6%	6.0%*

Inequities in Implementation

Delivery of recommended public health activities, 2006-14

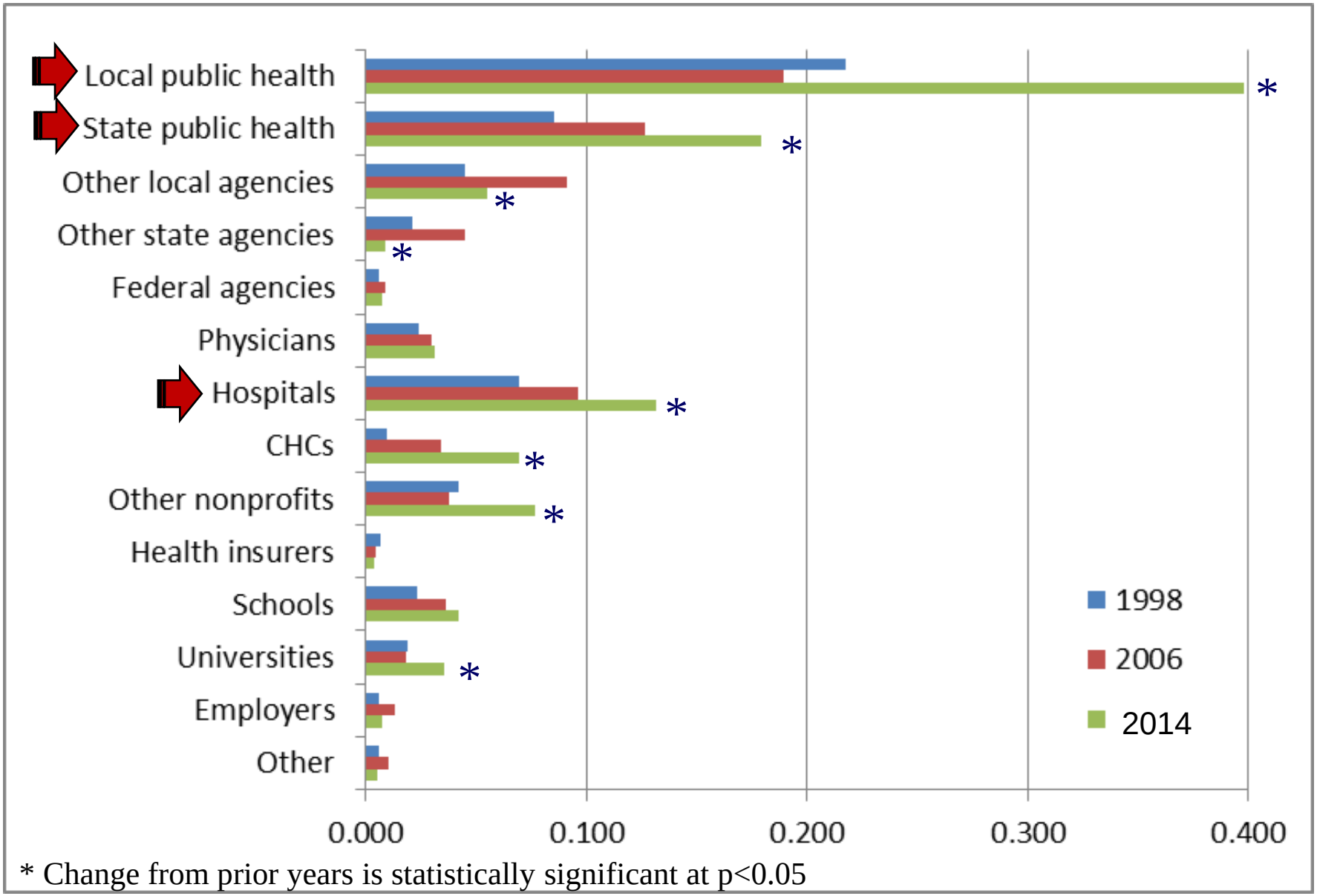


Organizational contributions to recommended public health activities, 1998-2014

% of recommended activities performed

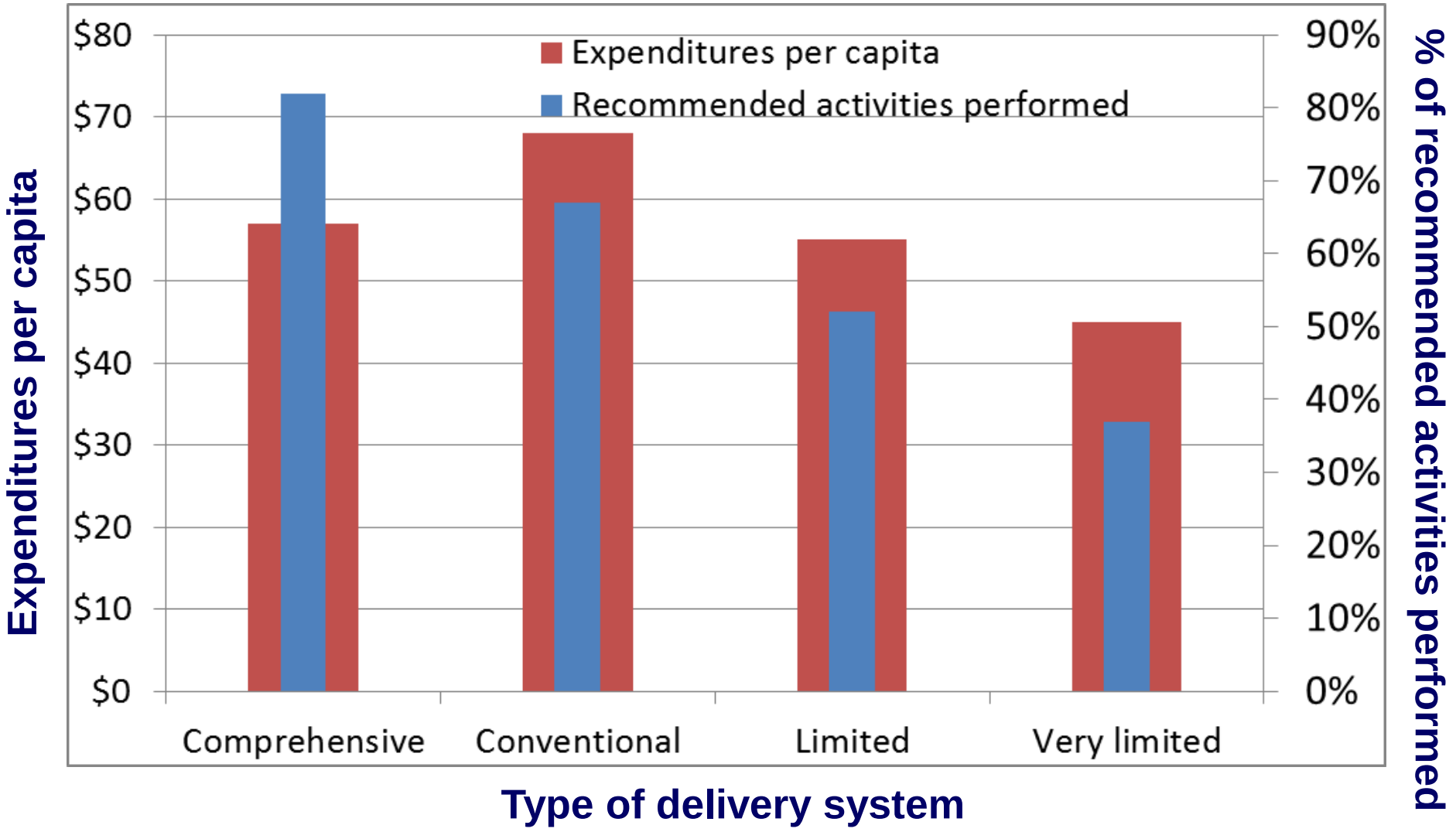
Type of Organization	1998	2006	2012	2014
Local public health agency	60.7%	66.5%	62.0%	67.4%
Other local govt agencies	31.8%	50.8%	26.3%	32.7%
State public health agency	46.0%	45.3%	36.4%	34.0%
Other state govt agencies	17.2%	16.4%	13.0%	12.7%
Federal agencies	7.0%	12.0%	8.7%	7.1%
Hospitals	37.3%	41.1%	39.3%	47.2%
Physician practices	20.2%	24.1%	19.5%	18.0%
Community health centers	12.4%	28.6%	26.9%	28.3%
Health insurers	8.6%	10.0%	9.8%	11.1%
Employers/business	25.5%	16.9%	13.4%	15.0%
Schools	30.7%	27.6%	24.9%	24.7%
Universities/colleges	15.6%	21.6%	21.2%	22.2%
Faith-based organizations	24.0%	19.2%	15.7%	16.8%
Other nonprofits	31.9%	34.2%	31.6%	33.6%
Other organizations	8.5%	8.8%	5.4%	5.4%

Bridging capital in public health delivery systems
Trends in betweenness centrality



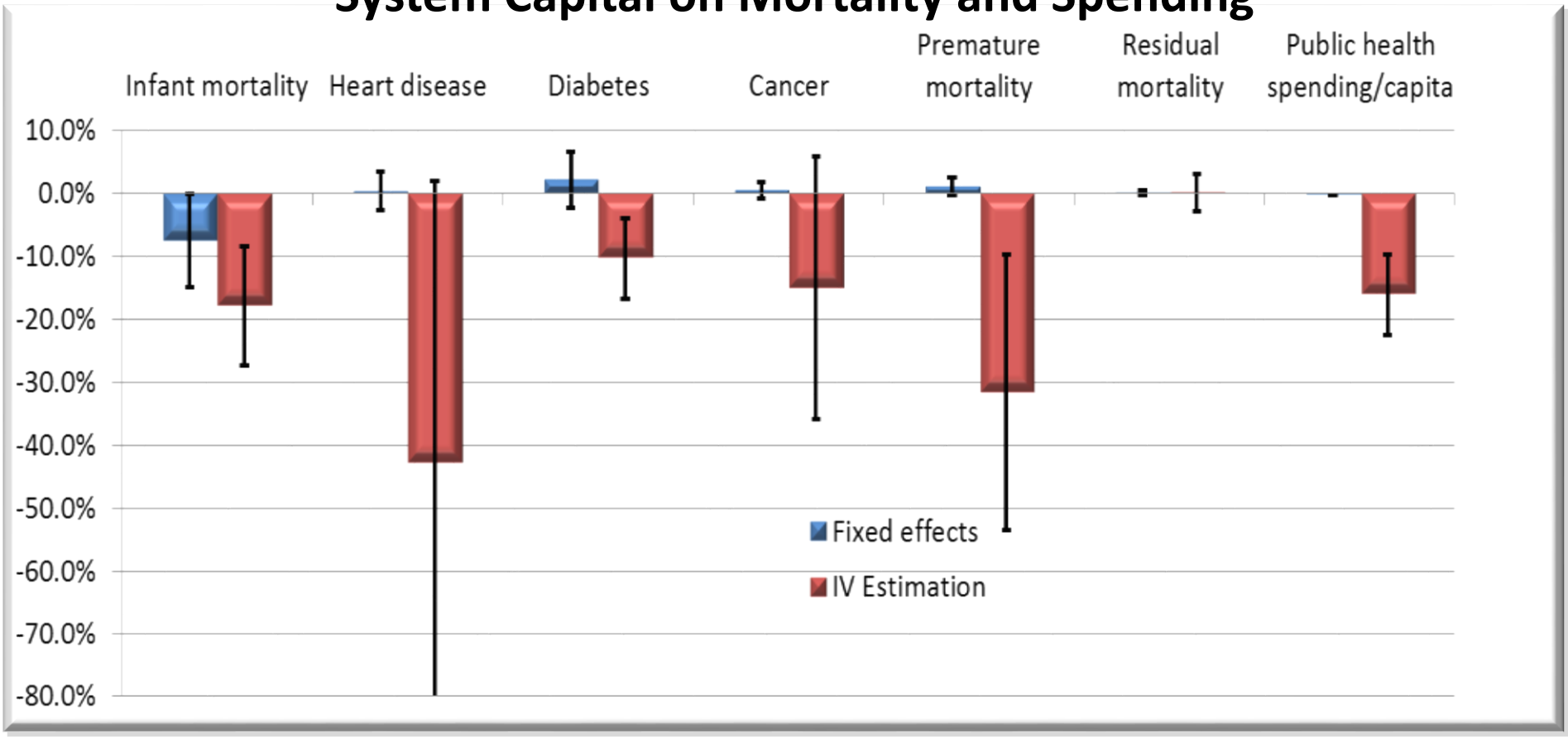
* Change from prior years is statistically significant at p<0.05

Comprehensive systems do more with less



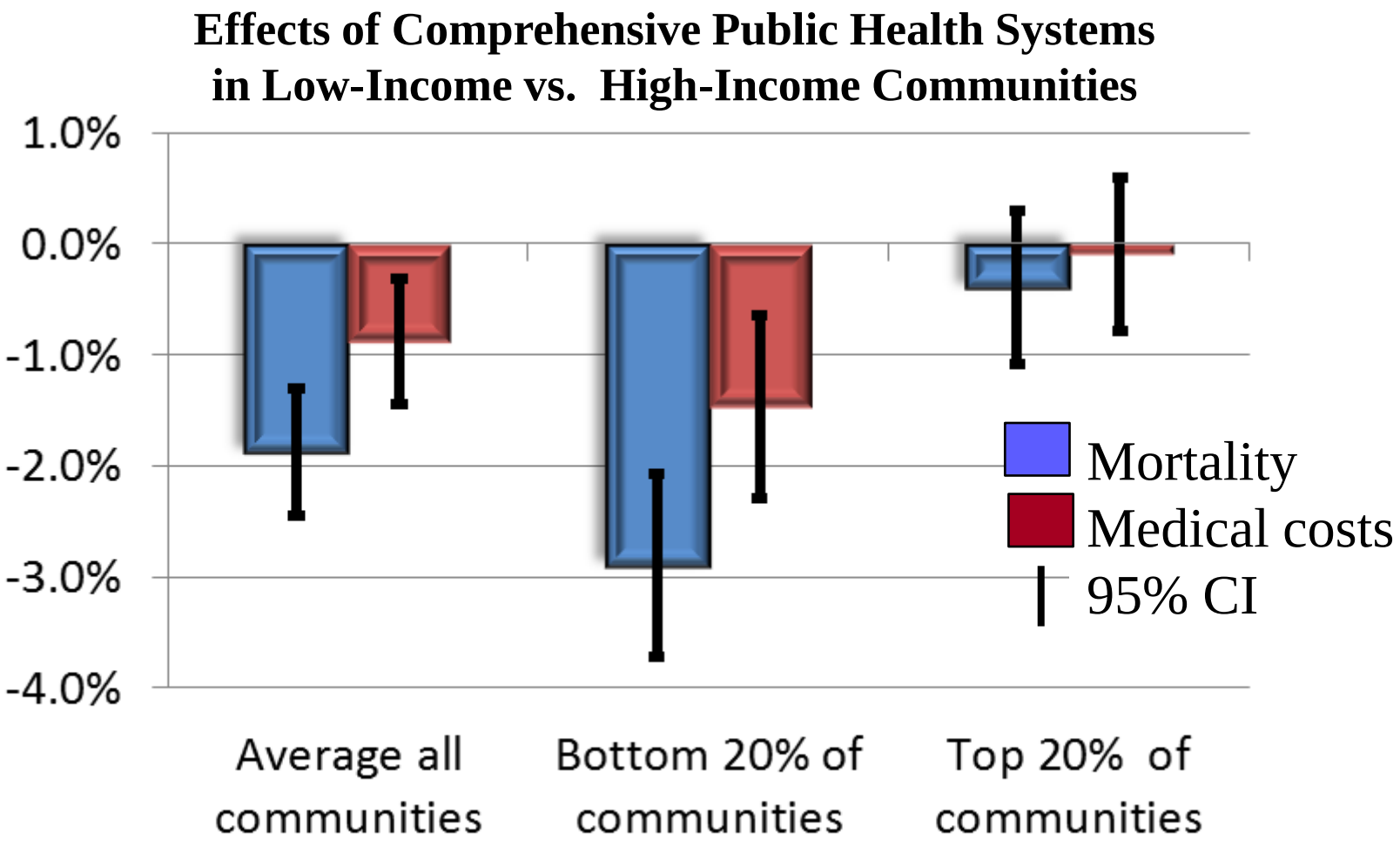
Health and economic impact of comprehensive systems

Fixed Effects and IV Estimates: Effects of Comprehensive System Capital on Mortality and Spending



Models also control for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects.
N=779 community-years **p<0.05 *p<0.10

Impact on equity: larger gains in low-resource communities



Log IV regression estimates controlling for community-level and state-level characteristics

Conclusions

- Comprehensive and highly-integrated public health systems appear to offer considerable health and economic benefits over time.
  - 30-45% more PH services implemented
  - 10-40% larger reductions in preventable mortality rates
  - 15% lower public health resource use
- Low-income communities are less likely to achieve comprehensive public health system capital, but they benefit disproportionately
- Failure to account for endogenous network structure can lead to biased estimates of impact

Policy and Practice Implications

Opportunities for building public health system capital and interorganizational networks:

- Hospital community benefit requirements
- CMMI State Innovation Models (SIMs)
- Accountable Communities initiatives
- Insurer and employer incentives
- Community development projects

Project Information & Updates

National Longitudinal Survey of Public Health Services:

http://www.publichealthsystems.org/national-longitudinal-survey-public-health-systems

Costs of Foundational Public Health Services

http://www.publichealthsystems.org/research/costs-foundational-public-health-services

Questions and Discussion

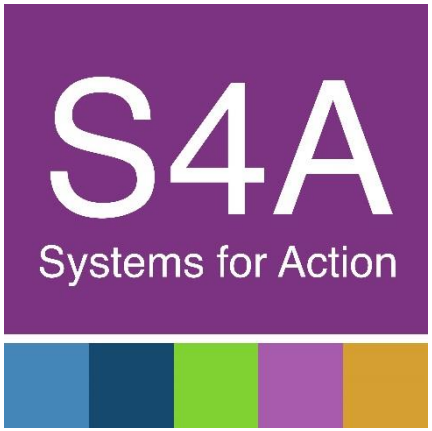
Webinar Archives & Upcoming Events

go to: *http://www.publichealthsystems.org/phssr-research-progress-webinars*

Upcoming Webinars

Thurs, Mar 24 (1-2p ET) **QUALITY IMPROVEMENT FOR COST EFFECTIVE SEXUALLY TRANSMITTED INFECTION PREVENTION SERVICES** William Livingood, PhD, and Lori Bilello, PhD, University of Florida
Wed, April 6 (12-1p ET/ 9-10a PT) **ACCOUNTABLE COMMUNITY OF HEALTH STRUCTURES AND CROSS-SECTOR COORDINATION** Nadine Chan and Eli Kern, Public Health-Seattle and King County
Wed, April 13 (12-1p ET) **INTERORGANIZATIONAL RELATIONSHIP AND INFRASTRUCTURE VARIATION AND PUBLIC HEALTH SYSTEM EFFORTS TO ADDRESS PRESCRIPTION DRUG ABUSE** Lainie Rutkow, JD, PhD, MPH, and Katherine C. Smith, PhD, Johns Hopkins University Bloomberg School of Public Health

Thank you for participating in today's webinar!



For more information about the webinars, contact:

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Speaker Bios

Glen Mays, PhD, MPH, director of the RWJF Systems for Action National Coordinating Center, is the Scutchfield Endowed Professor of Health Services & Systems Research at the University of Kentucky College of Public Health. He also serves as director of the Center for Public Health Systems and Services Research within the College of Public Health, and associate director of the Center for Health Services Research within the College of Medicine. His research focuses on strategies for organizing and financing public health services, preventive care, and care management systems for underserved and high-risk populations. Dr. Mays earned PhD and MPH degrees in health policy and administration from the University of North Carolina-Chapel Hill, and completed a postdoctoral fellowship in health economics at Harvard Medical School. He previously chaired the Department of Health Policy and Management at the University of Arkansas for Medical Sciences for eight years.

Cezar Brian (CB) Mamaril, PhD, MS, is a senior research scientist at the RWJF Systems for Action National Coordinating Center and a research faculty member at the University of Kentucky College of Public Health. His research focuses on public health systems financing and economics. CB received his PhD in Public Policy and Administration from the University of Kentucky Martin School. Dr. Mamaril also holds an MS degree in Agricultural and Applied Economics from VirginiaTech.

Georgia Heise DrPH, is the Director for Three Rivers District Health Department, one of the first health departments in the nation to achieve PHAB accreditation. Three Rivers was designated one the 2015 Best Places to Work by the Kentucky Chamber of Commerce. Dr. Heise is involved in many initiatives across the Commonwealth. She serves on the Executive Committee and Legislative Committee for the Kentucky Health Department Association and chairs both its Strategic Planning Committee and Foundational Capabilities Workgroup. She has been a mentor for a Balderson Award winning Kentucky Public Health Leadership Institute Project and is a fellow of the institute. Dr. Heise serves on the Board of Directors and the Legislative Committee for the Kentucky Public Health Association. She is an adjunct faculty member for the University of Kentucky's College of Public Health, where she is a member of Delta Omega National Public Health Honor Society, Beta Gamma Chapter, and very active with many of the College's other projects. Additionally, Dr. Heise co-directs the newly established Kentucky Population Health Institute. Beyond Kentucky, Dr. Heise is the Immediate Past President of the National Association of County and City Health Officials (NACCHO). Three Rivers is one of six local health departments in a national pilot study for RESOLVE, an independent non-profit organization funded by the Robert Wood Johnson Foundation to study Public Health Foundational Capabilities. Dr. Heise is passionate about advancing public health through accreditation, governance, and policy development. She speaks and trains nationally on those topics and others.