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Defragmenting Delivery Systems that Drive Population Health

Glen P. Mays, *University of Kentucky*

Defragmenting Delivery Systems that Drive Population Health

Systems for Action

National Coordinating Center

Systems and Services Research to Build a Culture of Health

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Center for Public Health Systems and Services Research

Systems that drive health often fail to connect

Medical Care

- Fragmentation
- Duplication
- Variability in practice
- Limited accessibility
- Episodic and reactive care
- Insensitivity to consumer values & preferences
- Limited targeting of resources to community needs

Social Services & Supports

Public Health

- Fragmentation
- Variability in practice
- Resource constrained
- Limited reach
- Insufficient scale
- Limited public visibility & understanding
- Limited evidence base
- Slow to innovate & adapt

Waste & inefficiency

Inequitable outcomes

Limited population health impact

Systems for Action: test novel mechanisms for aligning systems and services across sectors

- Innovative alliances and partnerships
- Inter-governmental and public-private ventures
- New financing and payment arrangements
- Incentives for individuals, organizations & communities
- Governance and decision-making structures
- Information exchange and decision support
- New technology: m-health, tele-health
- Community engagement, public values and preferences
- Innovative workforce and staffing models
- Cross-sector planning and priority-setting

Collaborating Research Centers

- ***University of Chicago:*** Randomized trial of a Comprehensive Care, Community and Culture program
- ***Arizona State University:*** Analysis of medical, mental health, and criminal justice system interactions for persons with behavioral health disorders
- ***IUPUI:*** Evaluating integration and decision support strategies for a community-based safety net health care and public health system
- ***University of Kentucky:*** Measuring multi-sector contributions to public health services and population health outcomes.

Individual Research Projects

- ***Michigan State/University of Texas San Antonio:*** Randomized trial of community complex care response teams to improve geriatric public health outcomes
- ***Los Angeles Department of Health:*** Housing for Health: estimating cross-sector impacts of providing permanent supportive housing to homeless high utilizers of health care services
- ***University of Delaware:*** Randomized trial of a multi-agency health and human services team for Delaware's probation population
- ***Drexel University:*** Impact of integrating behavioral health with income and employment support to build a culture of health across two-generations

Rural-Urban Differences in the Strength of Community Networks for Population Health Improvement

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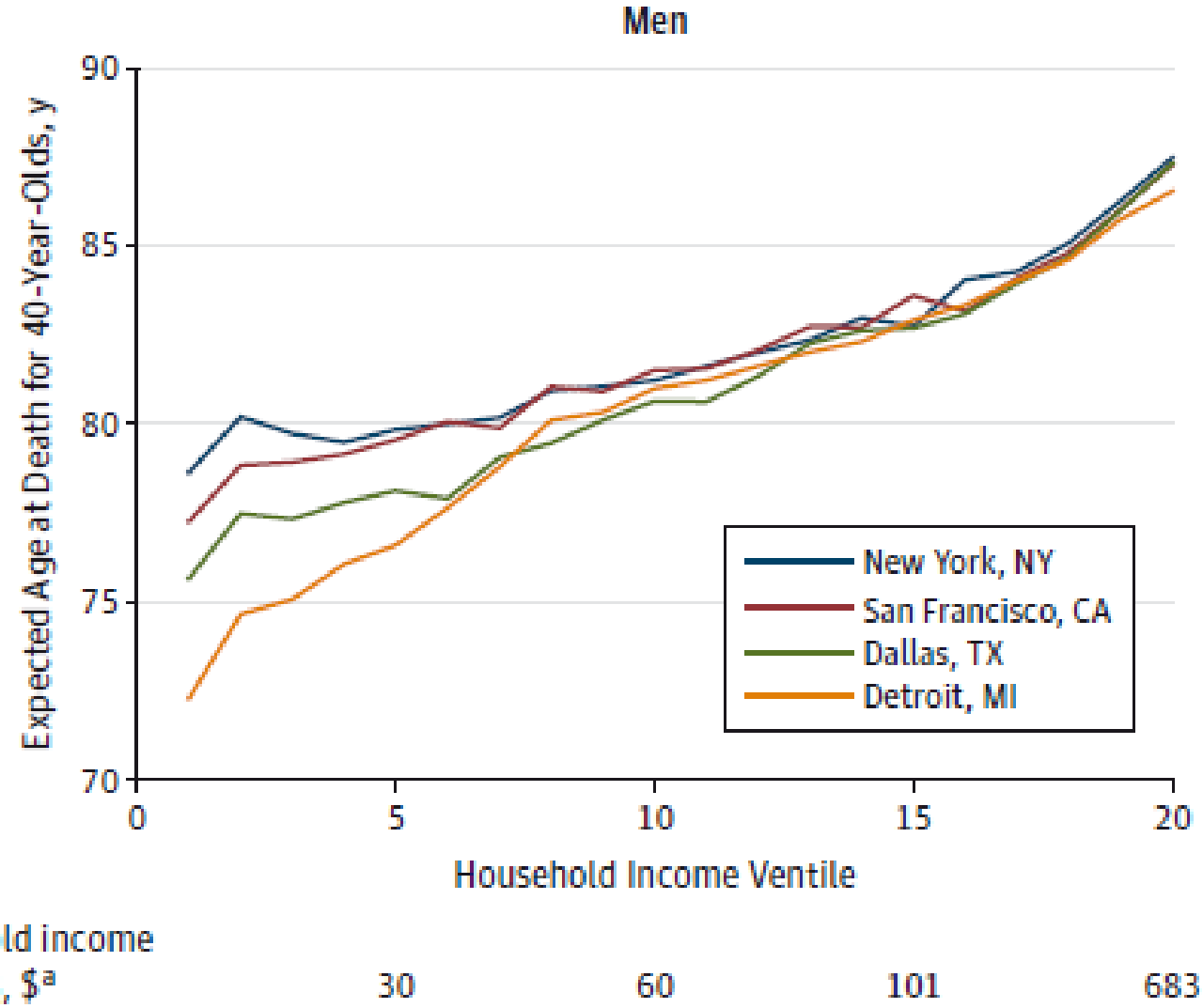
Income, geography and population health



Chetty et al. JAMA 2016

How do we support effective population health improvement strategies?

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

  - Infrastructure

  - Information

  - Incentives

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

…But existing systems often fail to connect

Medical Care ⟷ **Social Services & Supports** ⟷ **Public Health**

- Fragmentation
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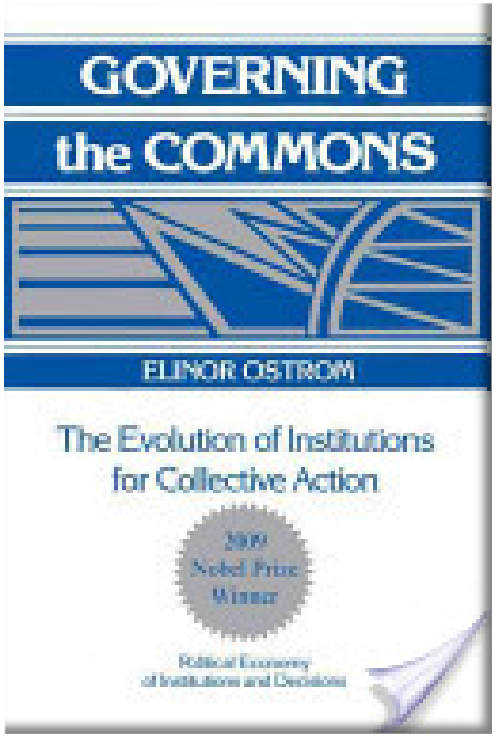
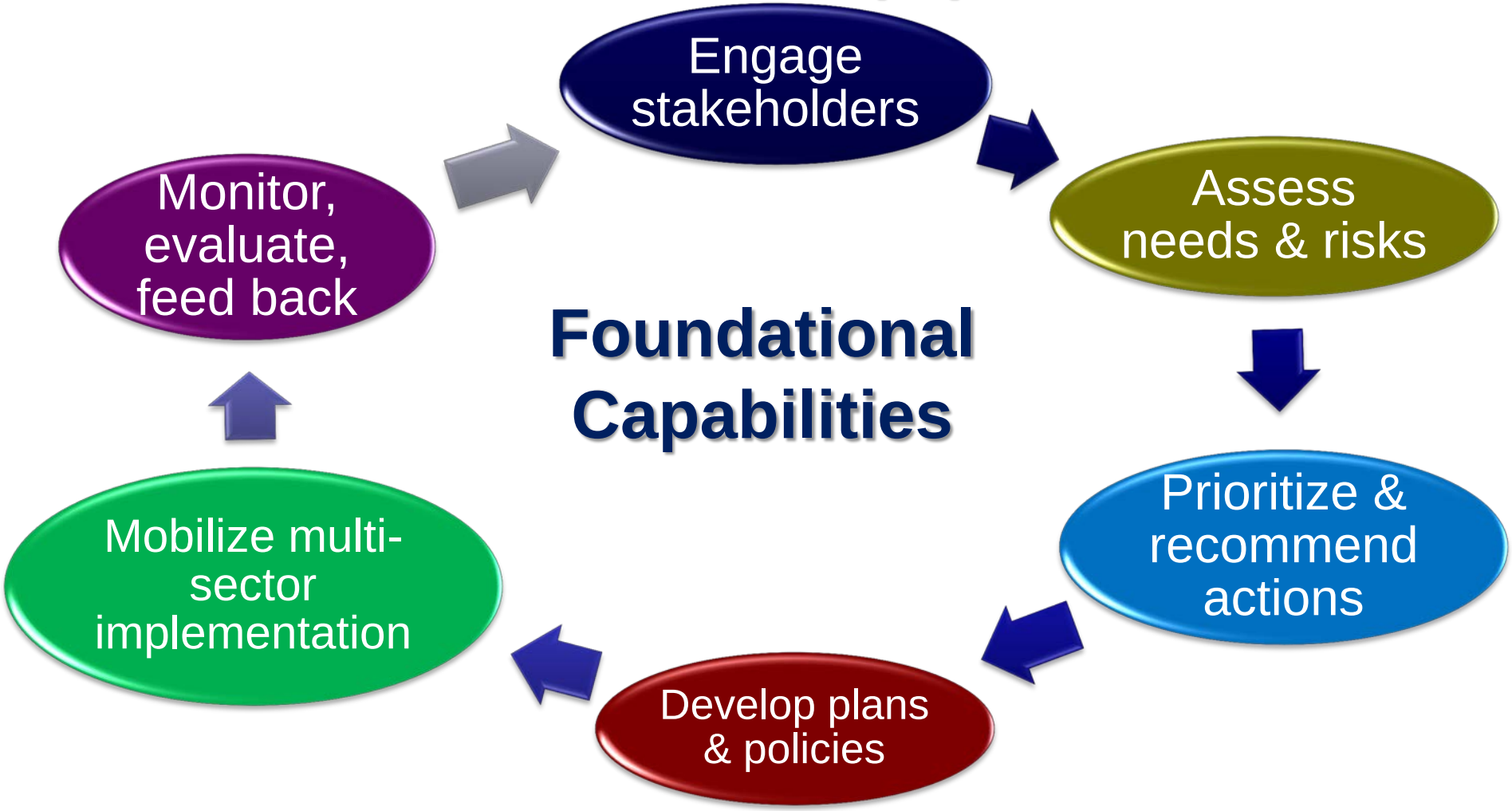
Challenge: overcoming collective action problems in public health

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



Ostrom E. 1994

Widely recommended activities to support multi-sector initiatives in population health



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

Questions of interest

- How strong are the delivery systems that support public health activities?
- How do these delivery systems change over time?
- How do these delivery systems relate to income and geographic disparities in population health?

A useful lens for studying multi-sector work

National Longitudinal Survey of Public Health Systems

- Cohort of 360 communities with at least 100,000 residents
- Followed over time: 1998, 2006, 2012, 2014**, 2016
- Local public health officials report:
  - ***Scope***: availability of 20 recommended population health activities
  - ***Network***: organizations contributing to each activity
  - ***Centrality of effort***: contributed by governmental public health agency
  - ***Quality***: perceived effectiveness of each activity

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

Chetty's data: life expectancy by income

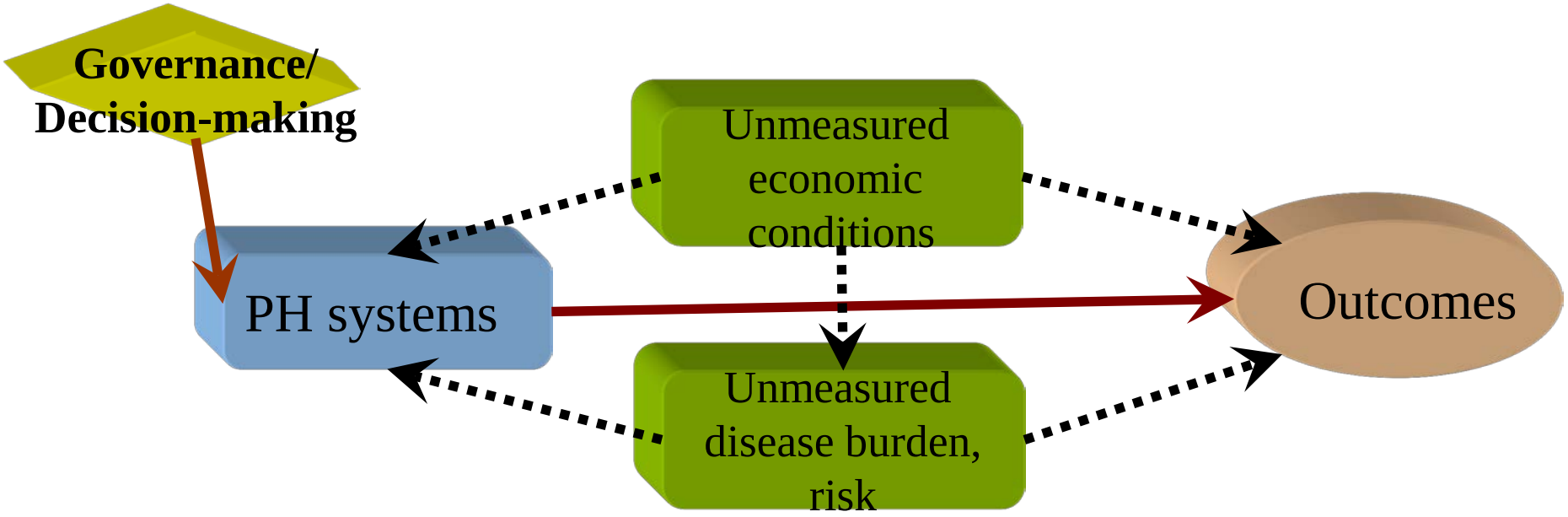
- **Income data**: federal tax records for every filer for every year 1999-2014 (pre-tax household earnings): 1.4B person-years
- **Mortality data**: SSA death records: 6.8M deaths
- **Period life expectancy**: estimated conditional on income percentile at 40 years of age
- **Geography**: Life expectancy by income quartile estimated for counties (n>3000) and for commuting zones (n=741) by year
- **Time**: annual estimates for 2001-14

Other data linkages

- **Area Health Resource File**: health resources, demographics, socioeconomic status, insurance coverage
- **NACCHO Profile data**: public health agency institutional and financial characteristics
- **CMS Impact File & Cost Report**: hospital ownership, market share, uncompensated care
- **Dartmouth Atlas**: Area-level medical spending (Medicare)
- **CDC Compressed Mortality File**: Cause-specific death rates by county

Analytical approach: IV estimation

- Identify exogenous sources of variation in system strength that are unrelated to outcomes
  - Governance structures: local boards of health
  - Decision-making authority: agency, board, local, state
- Controls for unmeasured factors that jointly influence systems and outcomes



Analytical approach: IV estimation

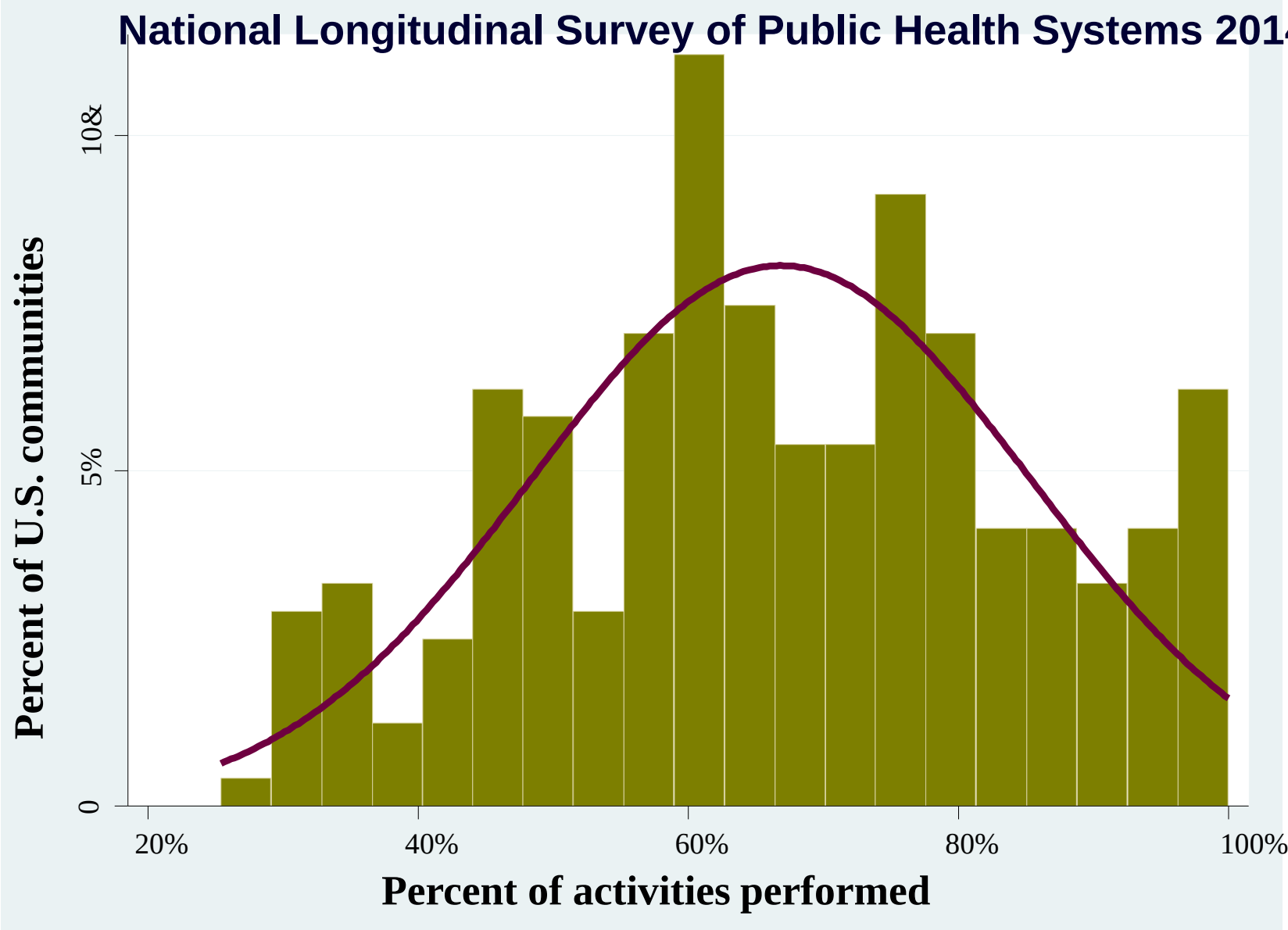
- Panel regression estimation with fixed and random effects to account for repeated measures and clustering of public health jurisdictions within states
- Two-stage IV model to estimate effect of system changes on life expectancy by income quartile (residual inclusion method)

$$\text{Prob}(\text{System}_{ijt}=\text{Comprehensive}) = f(\text{Governance}, \text{Agency}, \text{Community})_{ijt} + \text{State}_j + \text{Year}_t$$

$$E(\text{Outcome}_{ijt}) = f(\text{System+resid}, \text{Agency}, \text{Community})_{ijt} + \text{State}_j + \text{Year}_t + \varepsilon_{ijt}$$

All models control for type of jurisdiction, population size and density, metropolitan area designation, income per capita, unemployment, poverty rate, racial composition, age distribution, physician and hospital availability, insurance coverage, and state and year fixed effects. **N=1019 community-years**

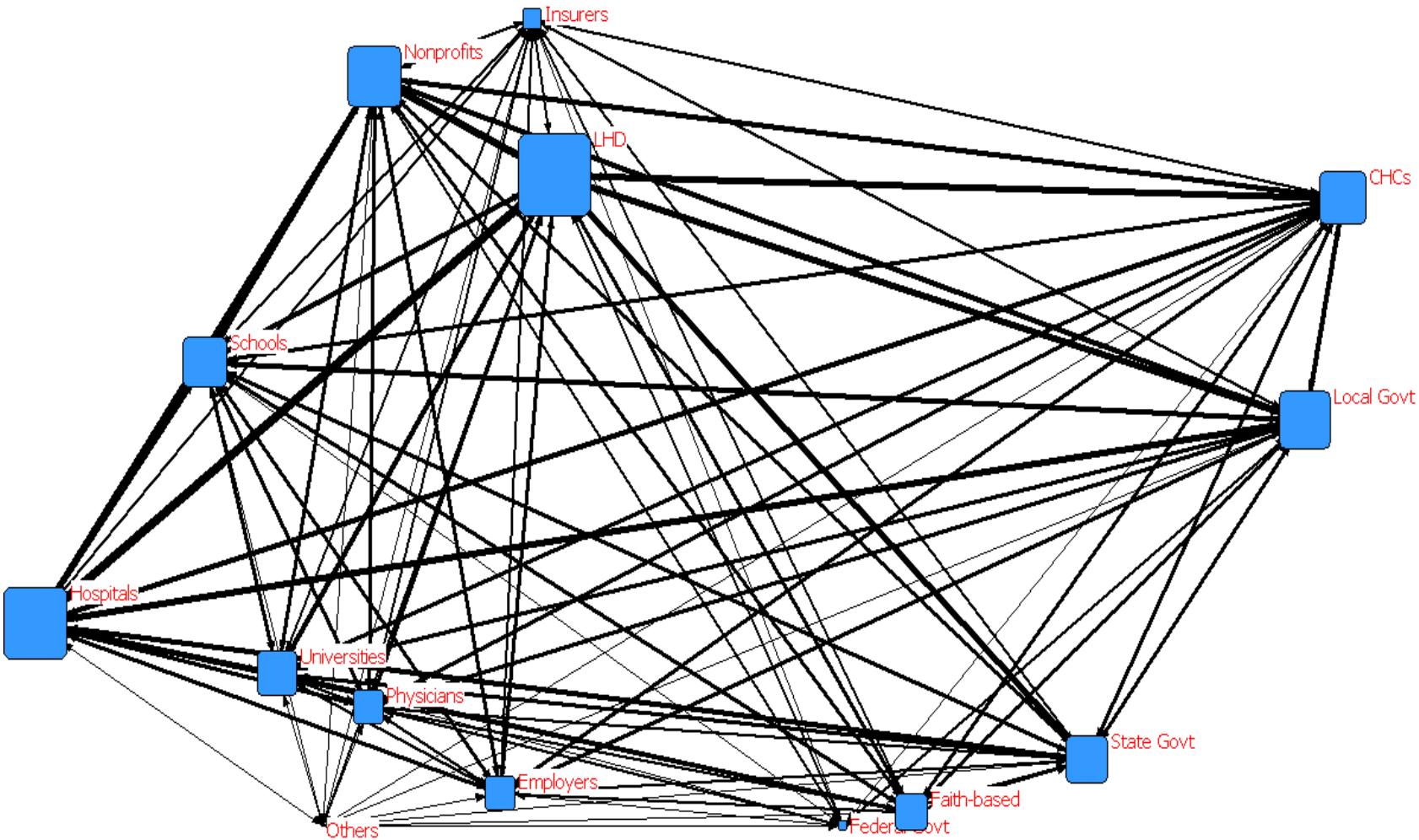
Variation in implementing population health activities



Implementation of population health activities, 1998-2016

	Activity	1998	2016	% Change
Assessment	1. Conduct periodic assessment of community health status and needs	71.5%	87.1%	21.8%
	2. Survey community for behavioral risk factors	45.8%	71.1%	55.2%
	3. Investigate adverse health events, outbreaks and hazards	98.6%	100.0%	1.4%
	4. Conduct laboratory testing to identify health hazards and risks	96.3%	96.1%	-0.2%
	5. Analyze data on community health status and health determinants	61.3%	72.7%	18.6%
	6. Analyze data on preventive services use	28.4%	39.0%	37.3%
Policy/Planning	7. Routinely provide community health information to elected officials	80.9%	84.0%	3.8%
	8. Routinely provide community health information to the public	75.4%	82.3%	9.1%
	9. Routinely provide community health information to the media	75.2%	89.0%	18.3%
	10. Prioritize community health needs	66.1%	83.6%	26.5%
	11. Engage community stakeholders in health improvement planning	41.5%	68.8%	65.7%
	12. Develop a community-wide health improvement plan	81.9%	87.9%	7.3%
	13. Identify and allocate resources based on community health plan	26.2%	41.9%	59.9%
	14. Develop policies to address priorities in community health plan	48.6%	56.8%	16.9%
	15. Maintain a communication network among health-related organizations	78.8%	85.3%	8.2%
Assurance	16. Link people to needed health and social services	75.6%	50.0%	-33.8%
	17. Implement legally mandated public health activities	91.4%	92.4%	1.1%
	18. Evaluate health programs and services in the community	34.7%	37.9%	9.4%
	19. Evaluate local public health agency capacity and performance	56.3%	56.1%	-0.3%
	20. Monitor and improve implementation of health programs and policies	47.3%	46.4%	-1.9%
	Mean performance of assessment activities (#1-6)	67.0%	77.7%	15.9%
	Mean performance of policy and planning activities (#7-15)	63.9%	75.5%	18.3%
	Mean performance of implementation and assurance activities (#16-20)	61.1%	56.6%	-7.3%
	Mean performance of all activities	63.8%	67.6%	6.0%

Mapping who contributes to population health

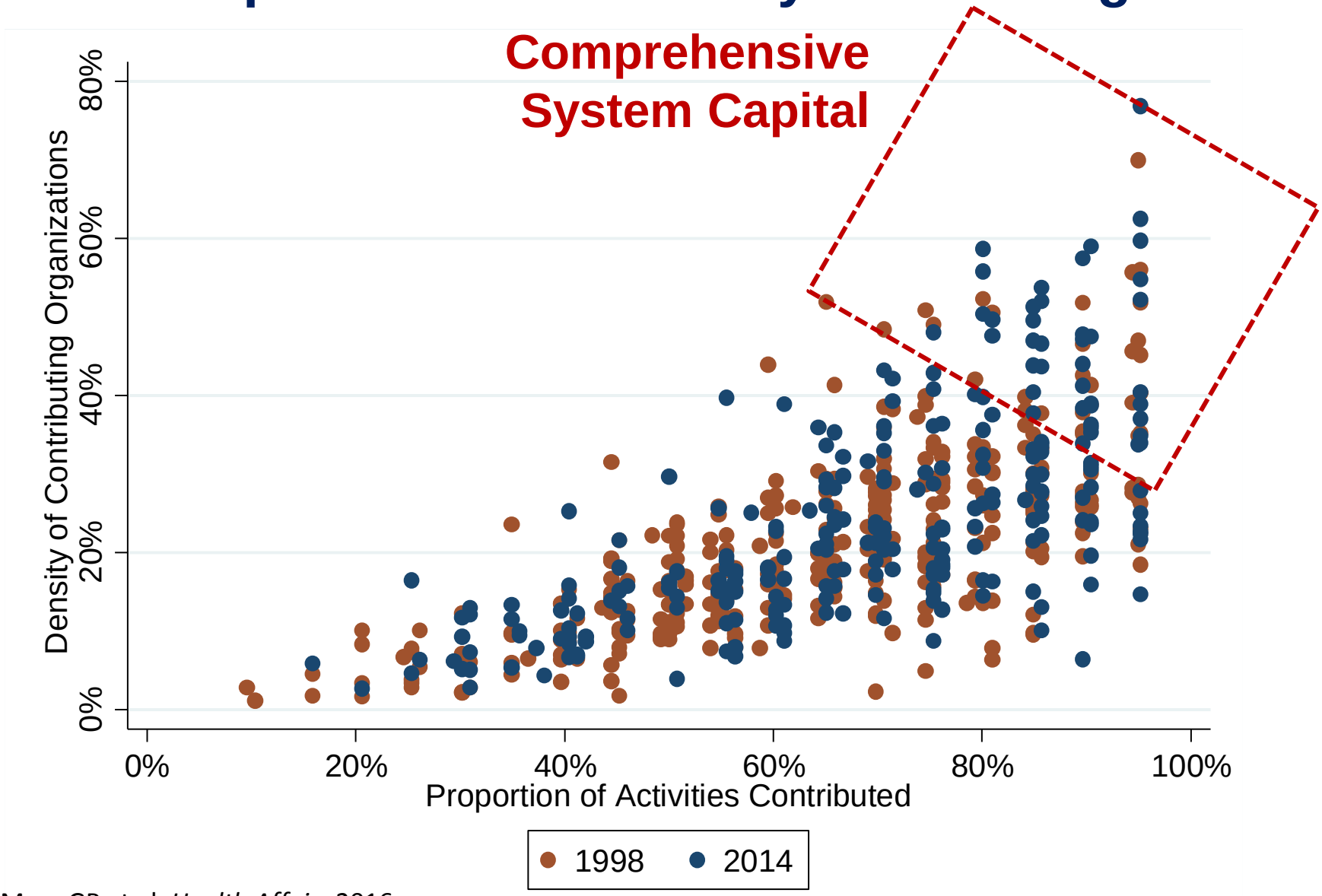


Node size = degree centrality

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.

Composite measure of system strength



Mays GP et al. *Health Affairs* 2016

Comprehensive Systems

One of RWJF's Culture of Health National Metrics

- ***Broad scope*** of population 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

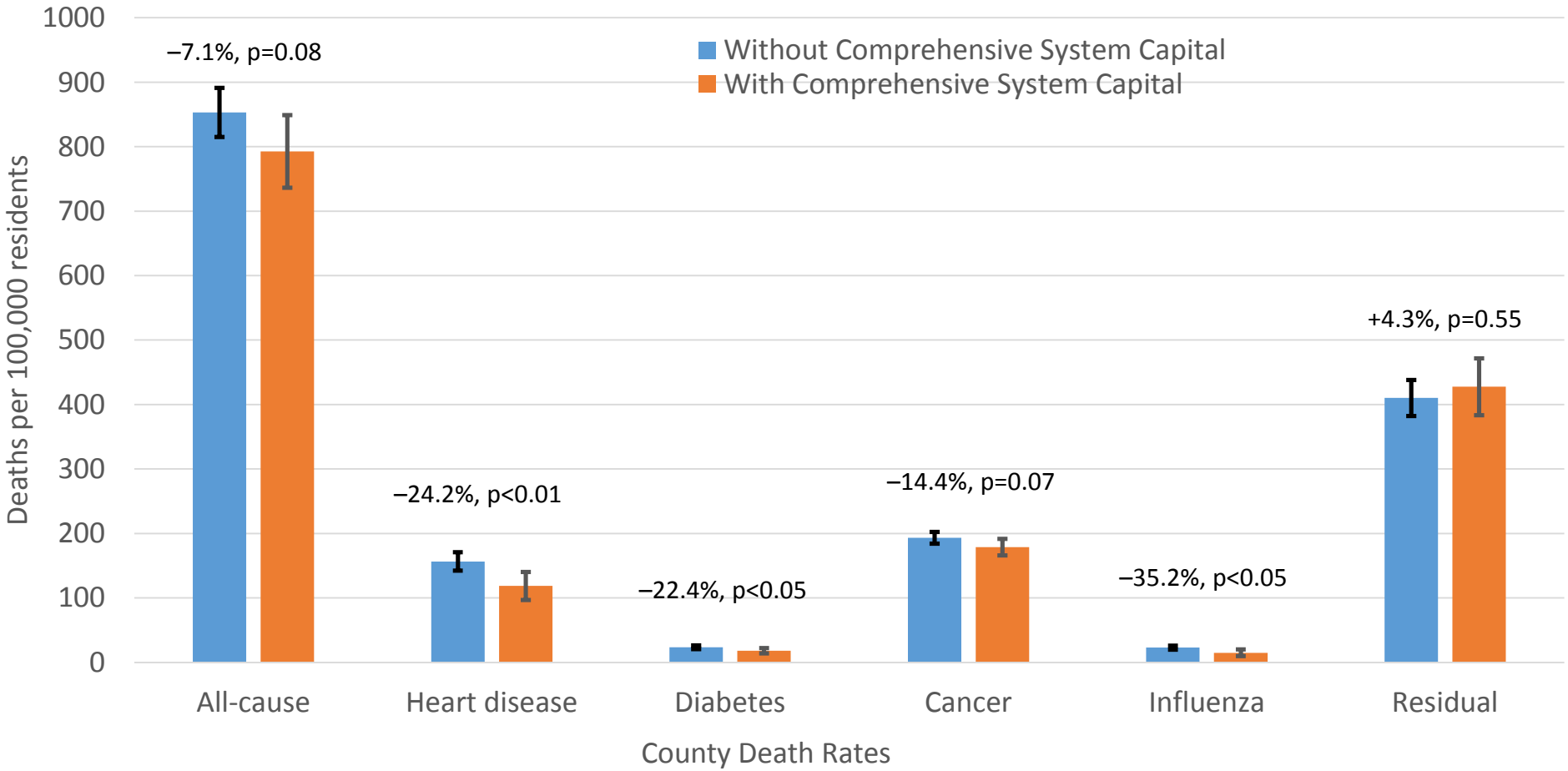
http://www.cultureofhealth.org/en/integrated-systems/access.html

Organizational contributions to foundational activities, 1998-2016

Type of Organization	% of Recommended Activities Contributed 1998	2016	Percent Change
Local public health agencies	60.7%	67.5%	11.1%
Other local government agencies	31.8%	33.2%	4.4%
State public health agencies	46.0%	34.3%	-25.4%
Other state government agencies	17.2%	12.3%	-28.8%
Federal government agencies	7.0%	7.2%	3.7%
Hospitals	37.3%	46.6%	24.7%
Physician practices	20.2%	18.0%	-10.6%
Community health centers	12.4%	29.0%	134.6%
Health insurers	8.6%	10.6%	23.0%
Employers/businesses	16.9%	15.3%	-9.6%
Schools	30.7%	25.2%	-17.9%
Universities/colleges	15.6%	22.6%	44.7%
Faith-based organizations	19.2%	17.5%	-9.1%
Other nonprofit organizations	31.9%	32.5%	2.0%
Other	8.5%	5.2%	-38.4%

Health effects attributable to multi-sector work

Impact of Comprehensive Systems on Mortality, 1998-2014

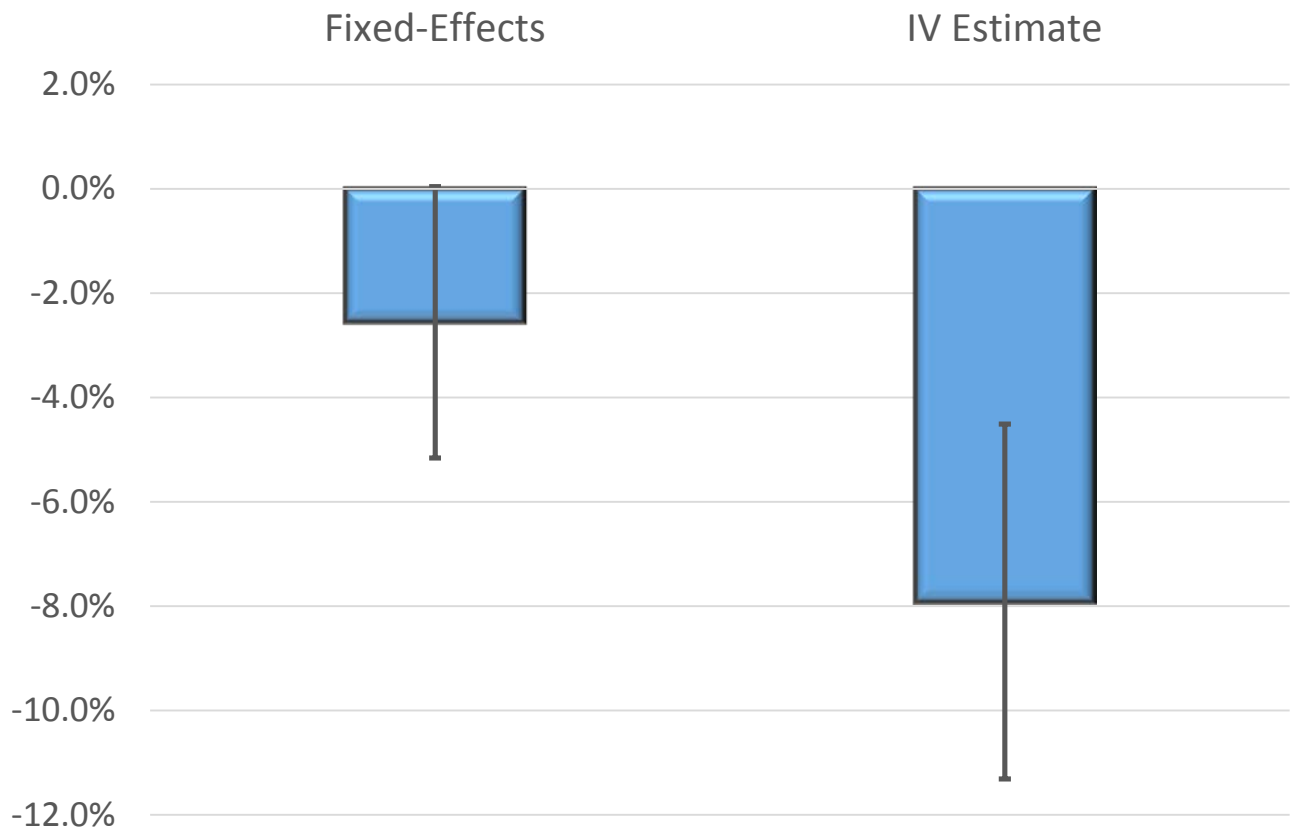


Fixed-effects instrumental variables estimates controlling for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects. N=1019 community-years

Mays GP et al. *Health Affairs* 2016

Economic effects attributable to multi-sector work

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

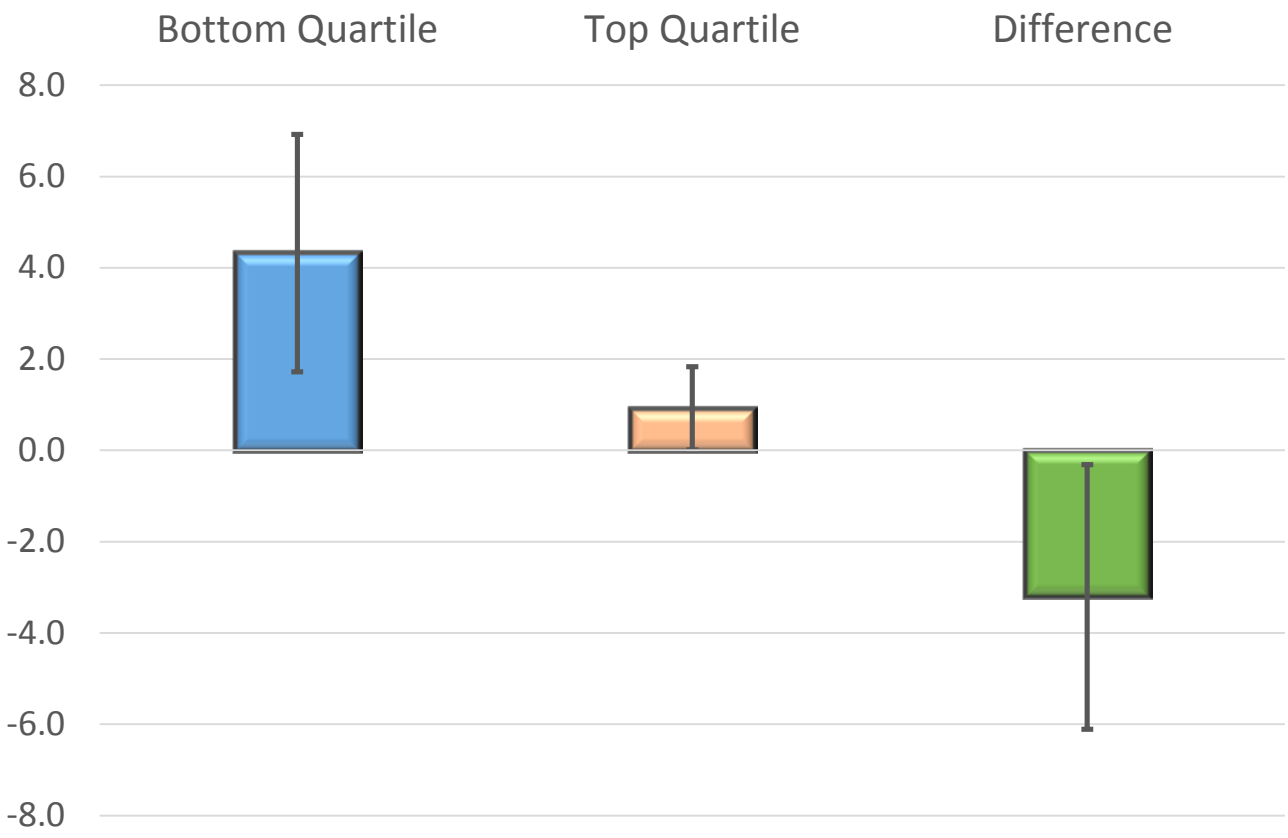


Models also control for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects. N=1019 community-years. Vertical lines are 95% confidence intervals

Mays GP et al. *Health Services Research* 2017

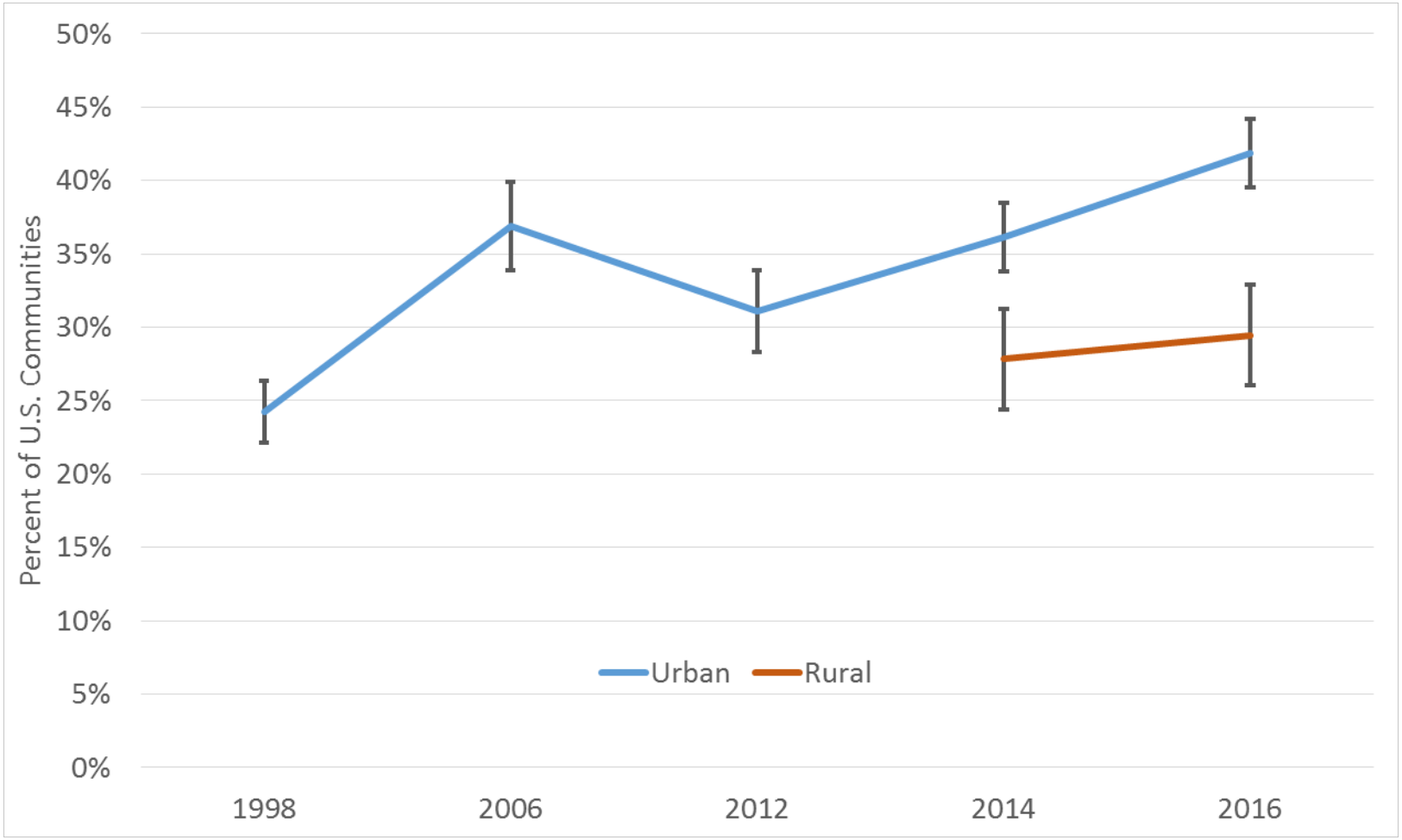
Economic effects attributable to multi-sector work

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. N=1019 community-years. Vertical lines are 95% confidence intervals

Rural-urban differences in comprehensive system capital



Rural-urban differences in comprehensive system capital

Differences in system capital may explain:

- 22-37% of the rural-urban disparity in mortality
- 1.1-1.7 years of the 3.2 year rural-urban disparity in life expectancy

Conclusions and implications

- Large health gains in places with strong system capital
- Larger gains for low-income populations
- Comprehensive systems do more than just plan: prioritize, invest, evaluate, repeat (crowd-sourcing)
- Equity and opportunity: more than half of communities currently lack comprehensive system capital
- ACA incentives and resources may help:
  - Hospital community benefit
  - Value-based health care payments
  - Insurer and employer incentives
- Sustainability and resiliency are not automatic

Ongoing work

- Robustness to alternative specifications
- Lagged and cumulative effects
- Trajectories of system strength over time
- Proximal outcomes
- Value-added of specific combinations of activities and organizations

For More Information

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Supported by The Robert Wood Johnson Foundation

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