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Income, Life Expectancy & the Strength of Public Health Activities in American Communities

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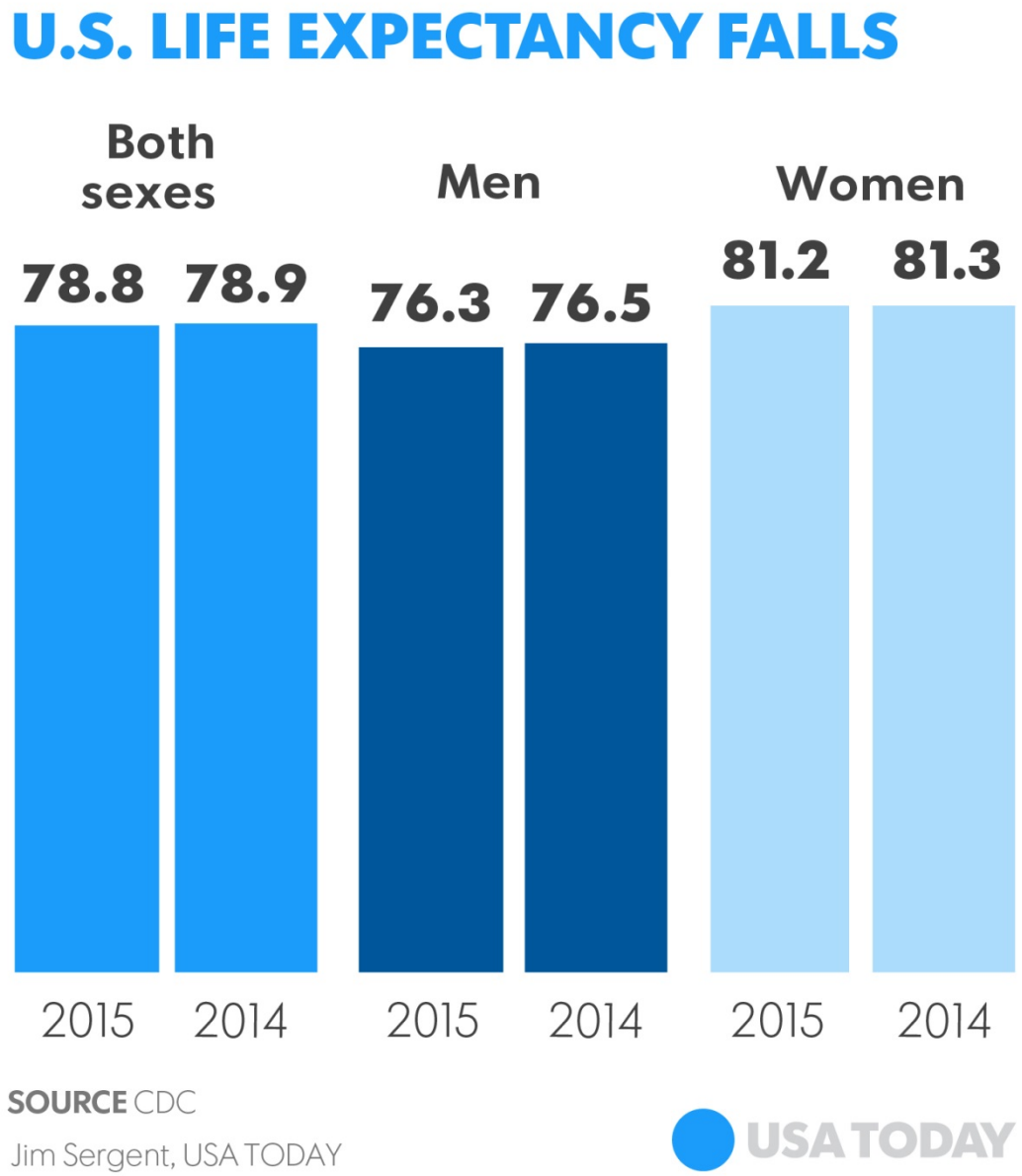
Losing ground in population health



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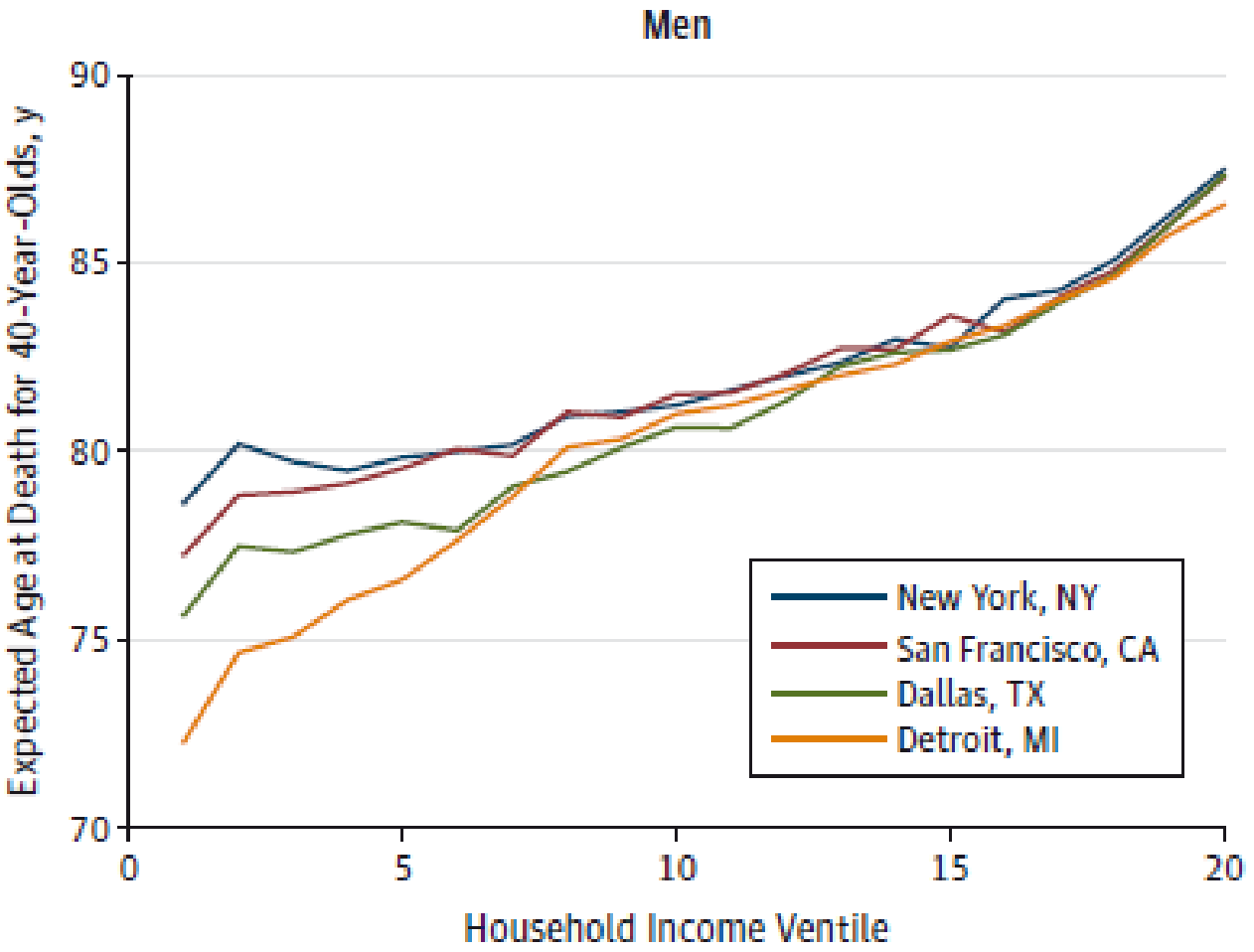
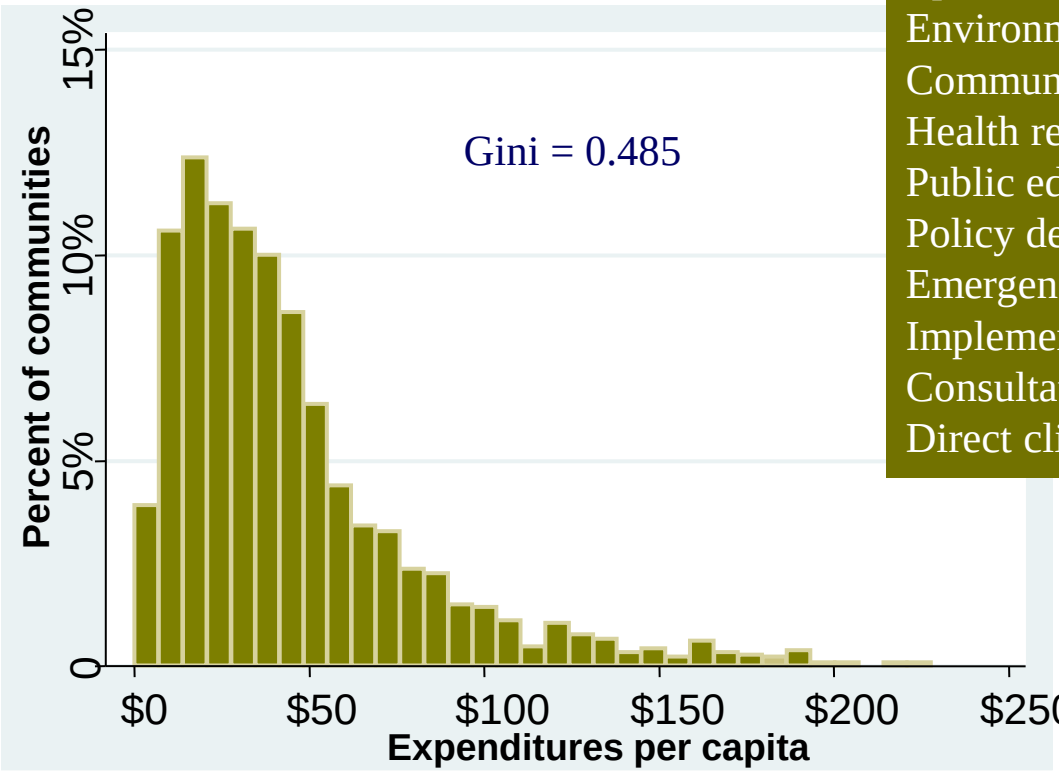
Income, geography and population health



Chetty et al. JAMA 2016

The U.S. public health sector

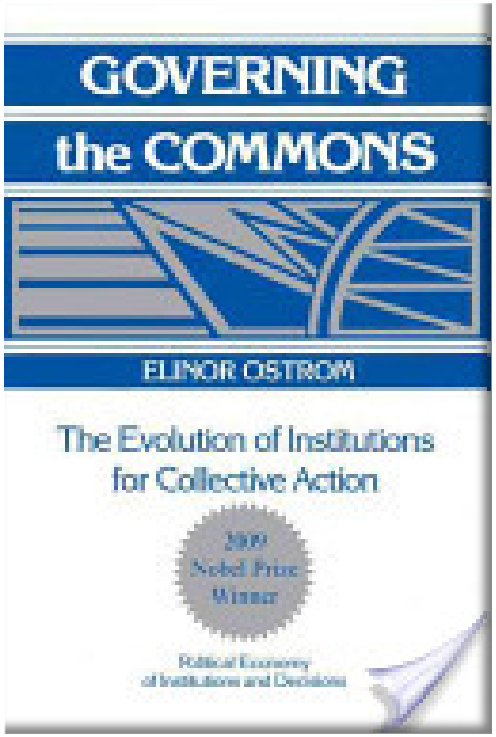
- Federation of 3000 local agencies, 50 states + federal agencies
- Broad scope of activity
- Decentralized authority
- Highly variable capacity



Community health assessment
Health surveillance
Epidemiologic investigation
Environmental health monitoring
Community health planning & priority-setting
Health regulation enforcement
Public education & risk communication
Policy development & assessment
Emergency preparedness & response
Implementation of prevention programs
Consultation for school & worksite health
Direct clinical service delivery

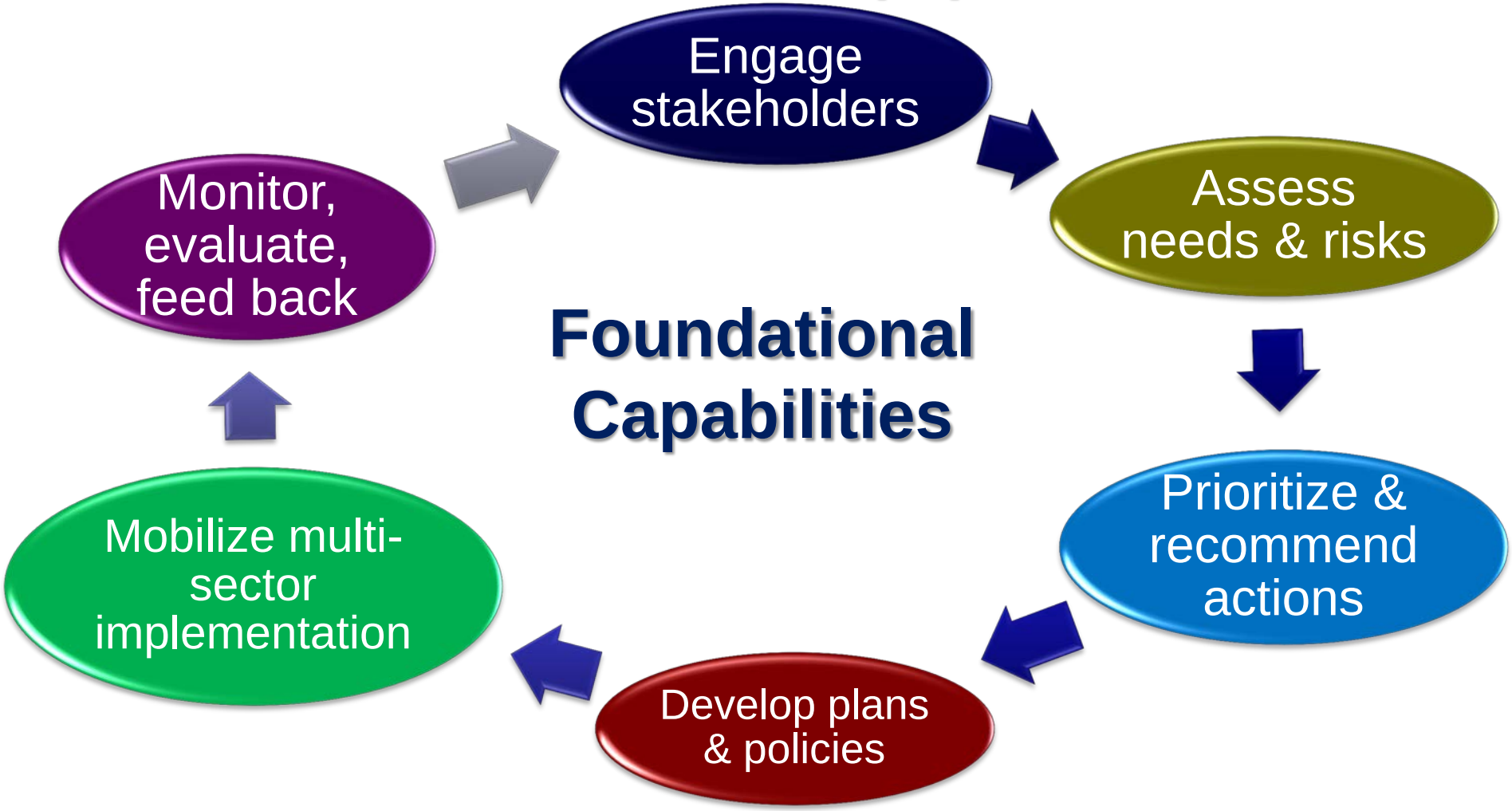
Challenge: overcoming collective action problems in public health

- 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

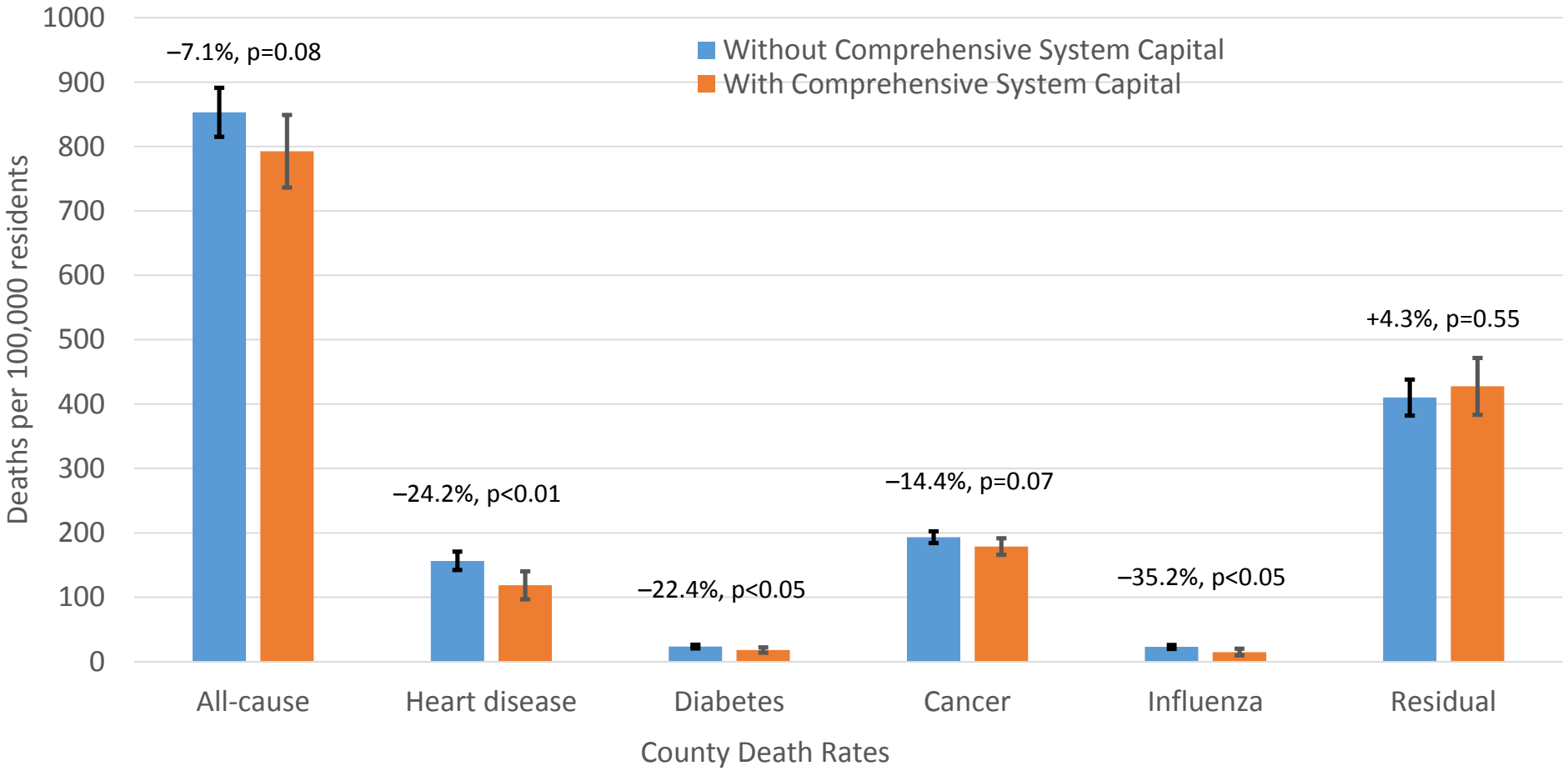
Widely recommended activities to support multi-sector initiatives in population health



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

Prior work: health affects attributable to delivery systems supporting strong health activities

Impact of Comprehensive System Capital 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

Questions of interest

- How strong are the delivery systems that support public health activities?
- How do these delivery systems change over time?

  Recession | Recovery | ACA implementation

- How do these delivery systems relate to income 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

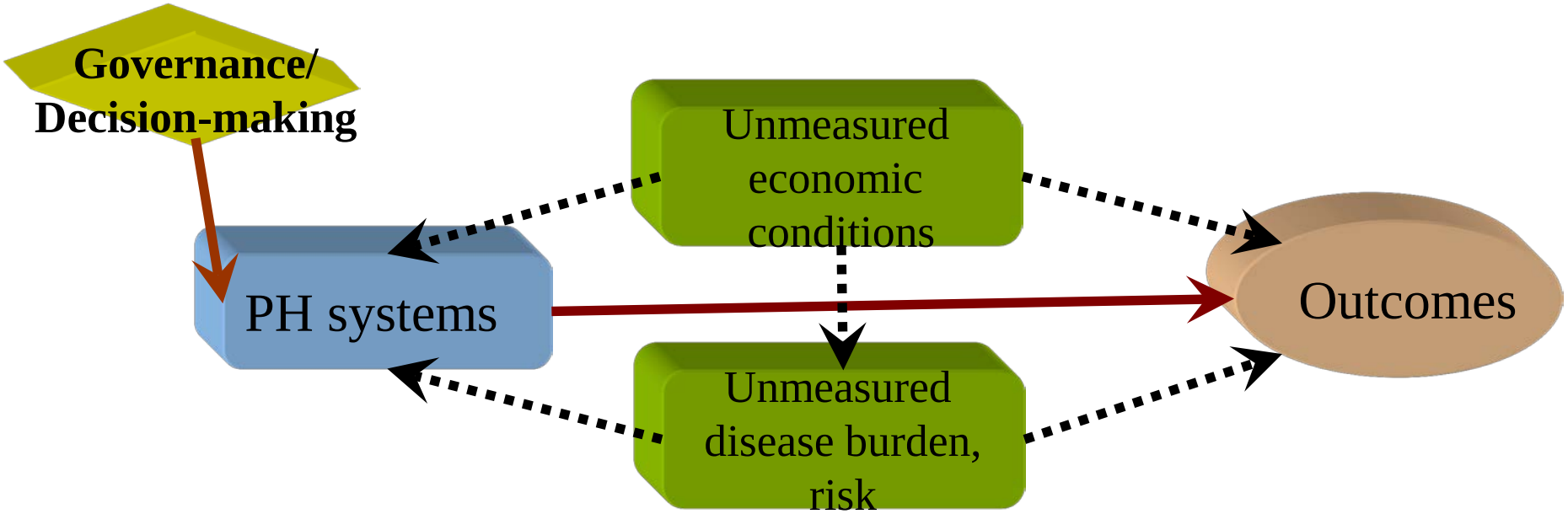
- **Income data**: federal tax records for every filer for every year 1999-2014 (pre-tax household earnings): 1.4B person-years
- **Mortality data**: SSA death records: 6.8M deaths
- **Period life expectancy**: estimated conditional on income percentile at 40 years of age
- **Geography**: Life expectancy 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

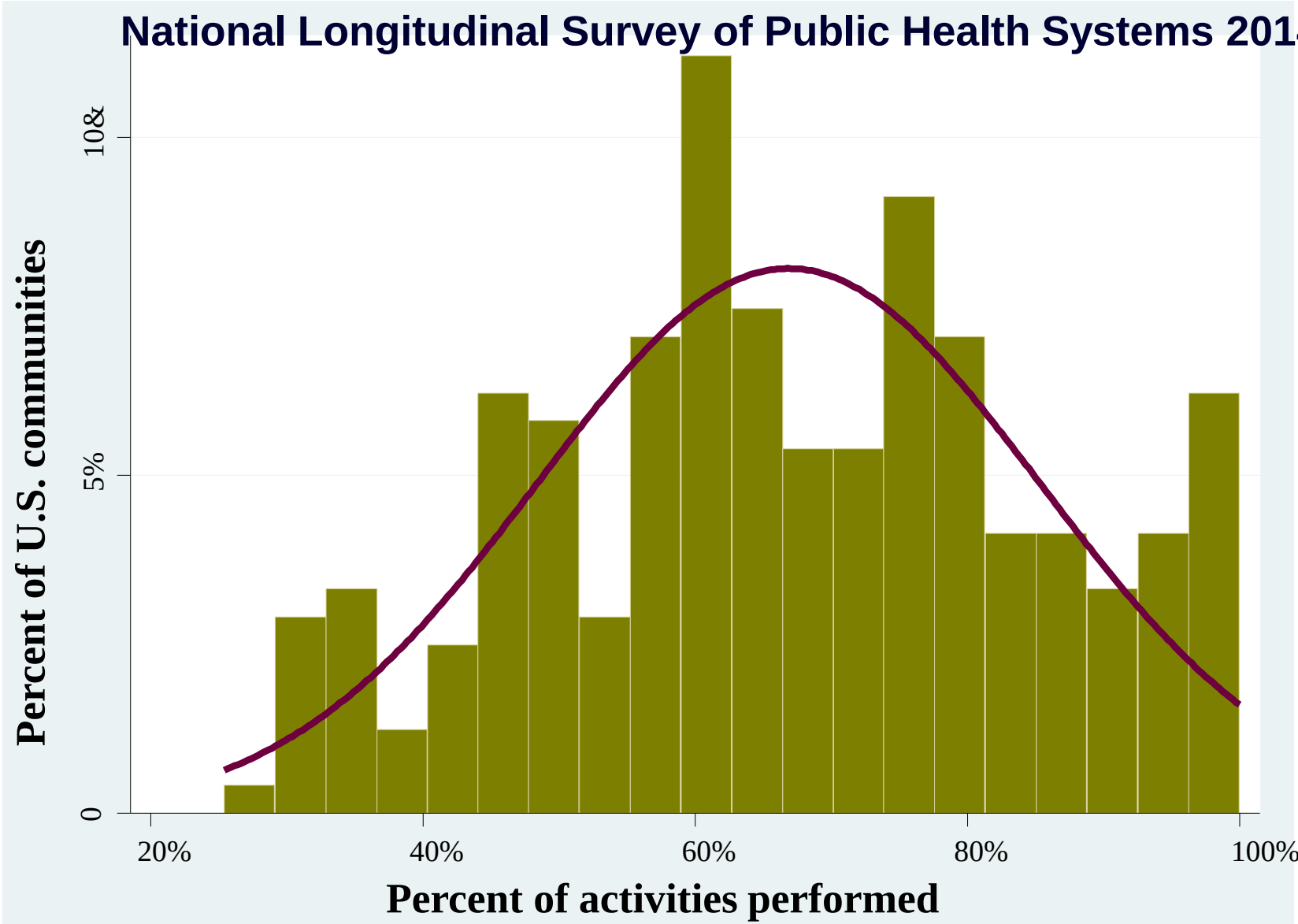
- Panel regression estimation with fixed and random effects to account for repeated measures and clustering of public health jurisdictions within states
- Two-stage IV model to estimate effect of system changes on life expectancy by income quartile (residual inclusion method)

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

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

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**

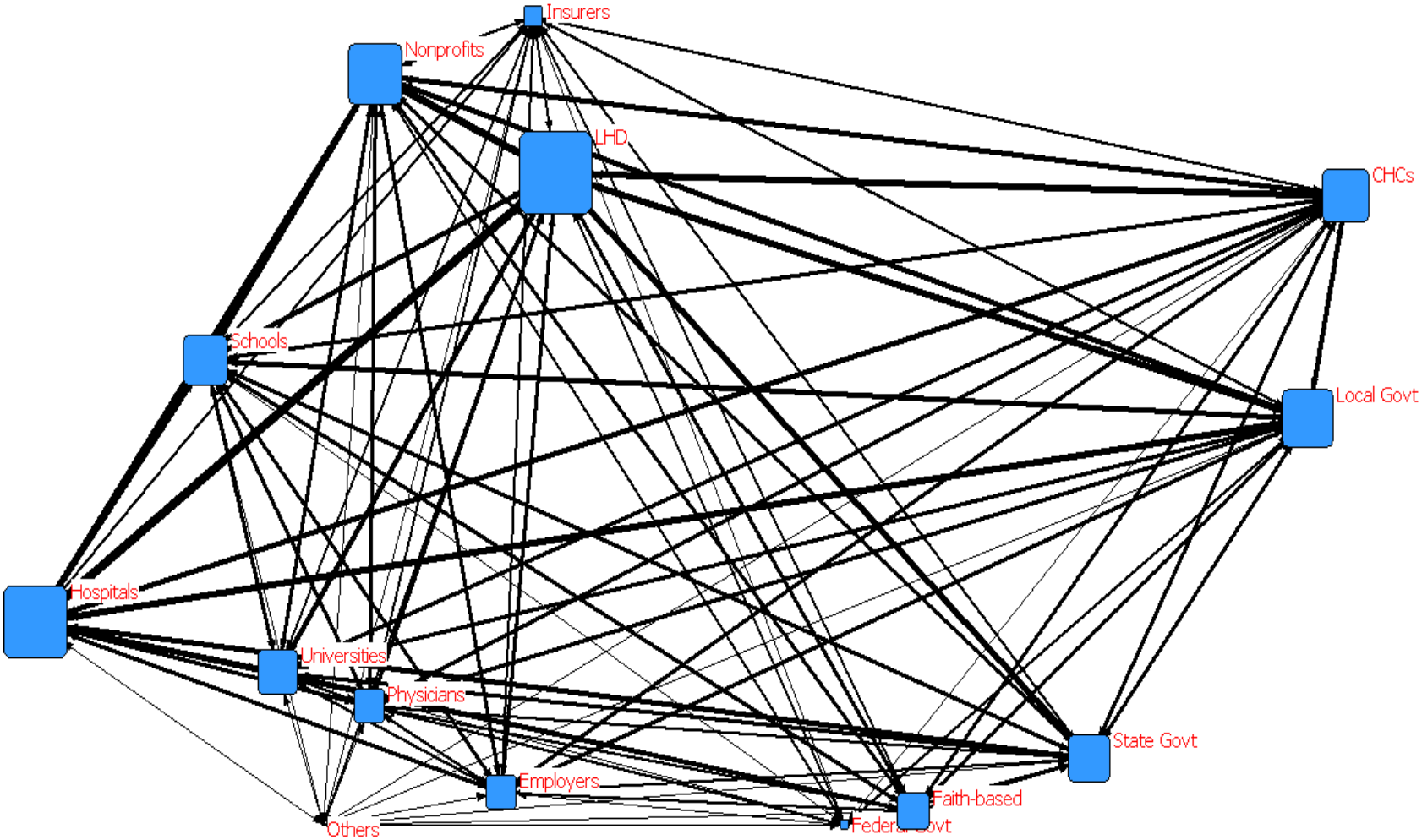
Variation in implementing population health activities



Implementation of population health activities, 1998-2014

	Activity	1998	2014	% 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

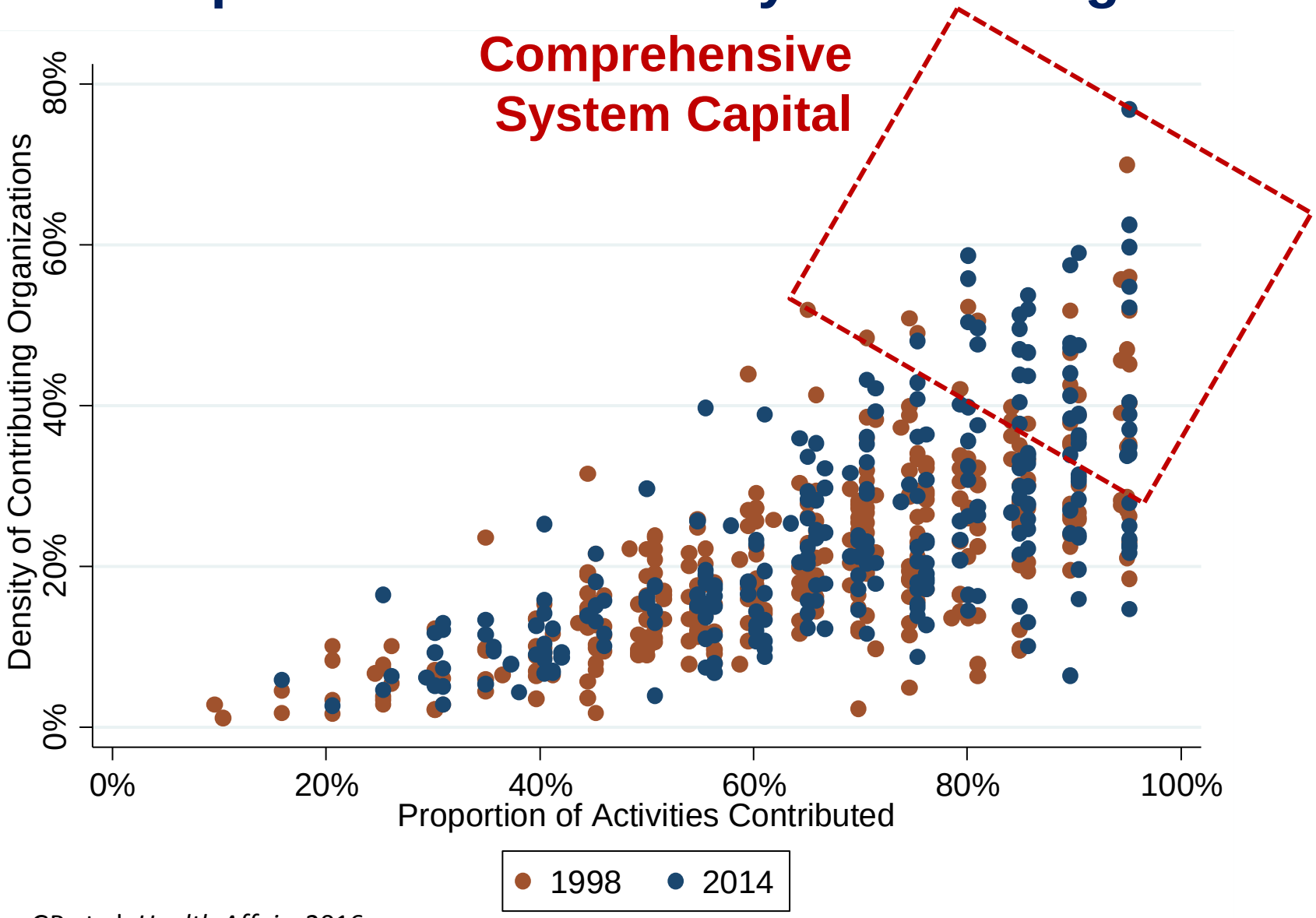


Node size = degree centrality

Line size = % activities jointly contributed (tie strength)

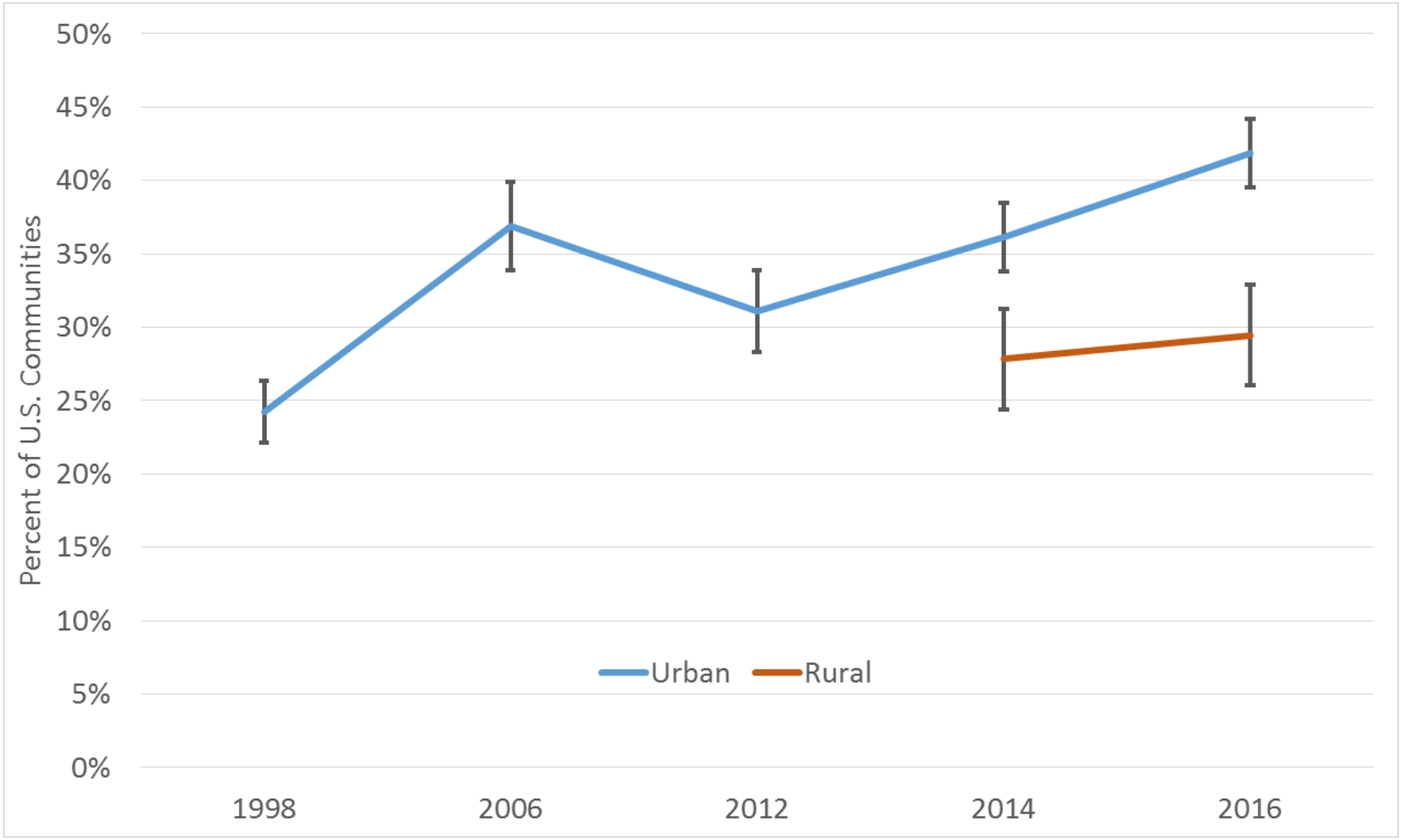
Mays GP et al. Understanding the organization of public health delivery systems: an empirical typology. *Milbank Q.* 2010;88(1):81–111.

Composite measure of system strength



Mays GP et al. *Health Affairs* 2016

Variation and change in comprehensive system capital



Predictors of Comprehensive System Capital

First Stage Logit Results

Variable	Marginal Effect	S.E.	
Population size (10,000s)	0.033	0.009	***
Poverty rate (10%)	-0.033	0.016	**
Policy-making local BOH (0,1)	0.046	0.016	***
Centralized local health agency (0,1)	-0.087	0.036	**
Local control of health budget (0,1)	0.043	0.022	*
Local health tax/fee authority (0,1)	0.028	0.011	**

IVs

Models also control for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and year fixed effects. N=1019 community-years

Effects of Comprehensive System Capital on Life Expectancy by Income Quartile

Second Stage Regression Results

Variable	Coeff.	S.E.	
Single-equation estimates			
Bottom income quartile	2.36	1.21	
Top income quartile	-0.04	0.09	
Difference	-2.21	1.09	
IV Estimates			
Bottom income quartile	4.11	1.86	**
Top income quartile	0.85	0.48	
Difference	-3.02	1.44	**

Models also control for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and year fixed effects. N=1019 community-years

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

Systems for Action

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Systems and Services Research to Build a Culture of Health

Supported by The Robert Wood Johnson Foundation

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