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Spring February 29, 2012

Estimating Medical Cost Offsets Attributable to Public Health Spending

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Available at: https://works.bepress.com/glen_mays/15/

Estimating Medical Cost Offsets Attributable to Public Health Spending

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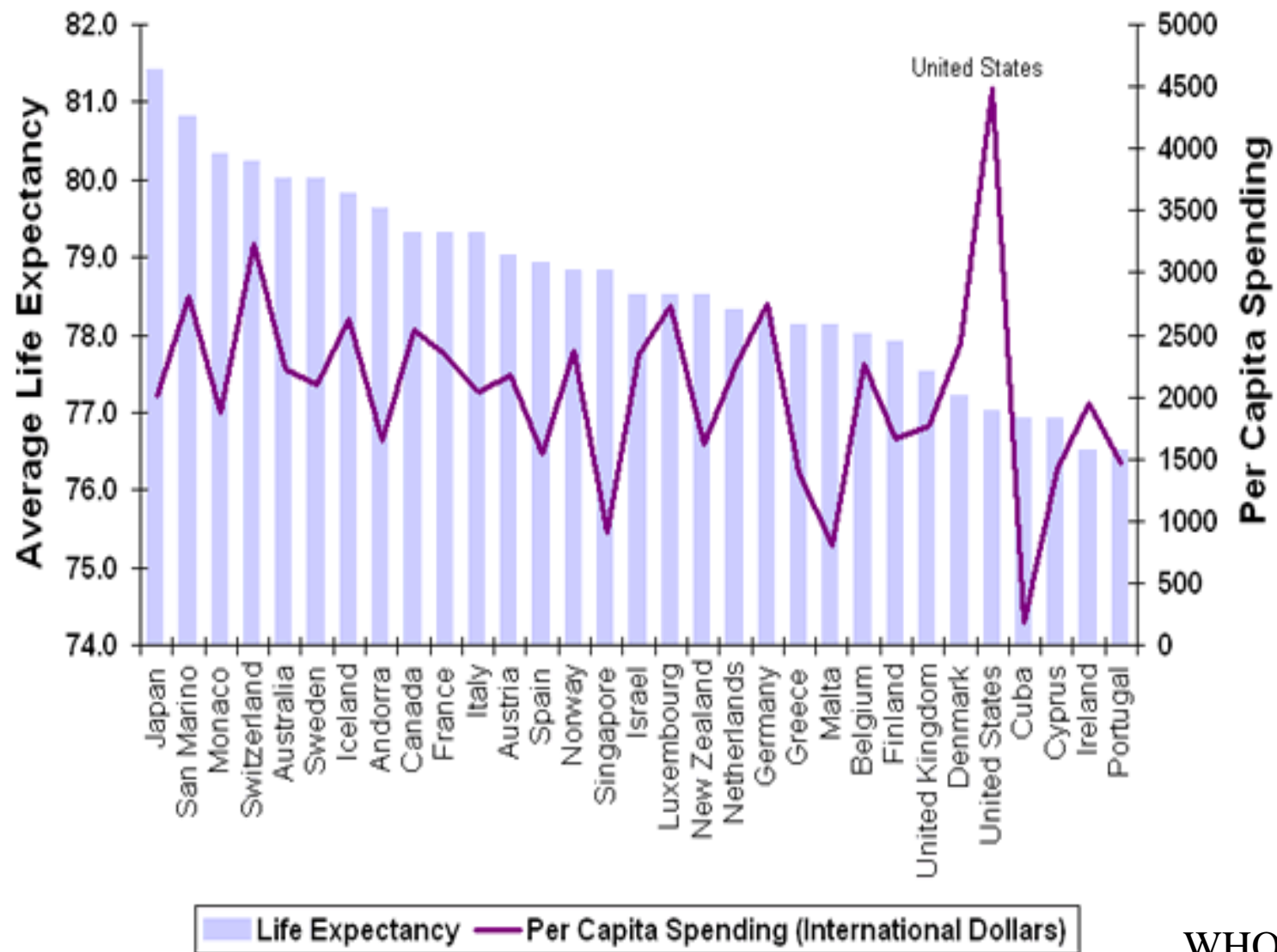
Acknowledgements

Research support provided by:

- ◆ Robert Wood Johnson Foundation's Changes in Healthcare Financing and Organization (HCFO) Initiative
- ◆ Robert Wood Johnson Foundation's Public Health Practice-Based Research Networks program
- ◆ National Institutes of Health Clinical and Translational Science Award

Getting what we pay for?

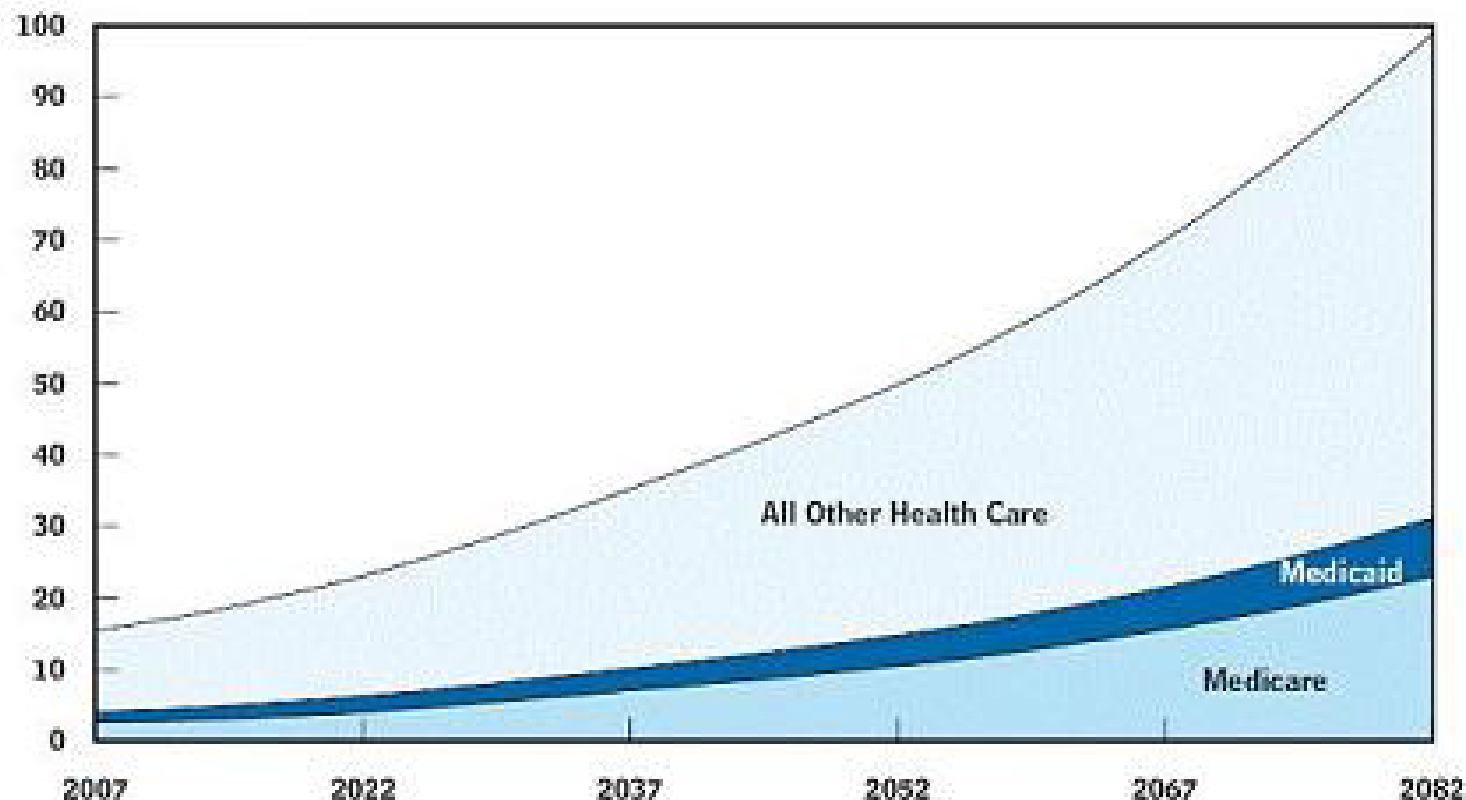
The Cost of a Long Life



Getting what we pay for?

Projected Spending on Health Care Under an Assumption That Excess Cost Growth Continues at Historical Averages

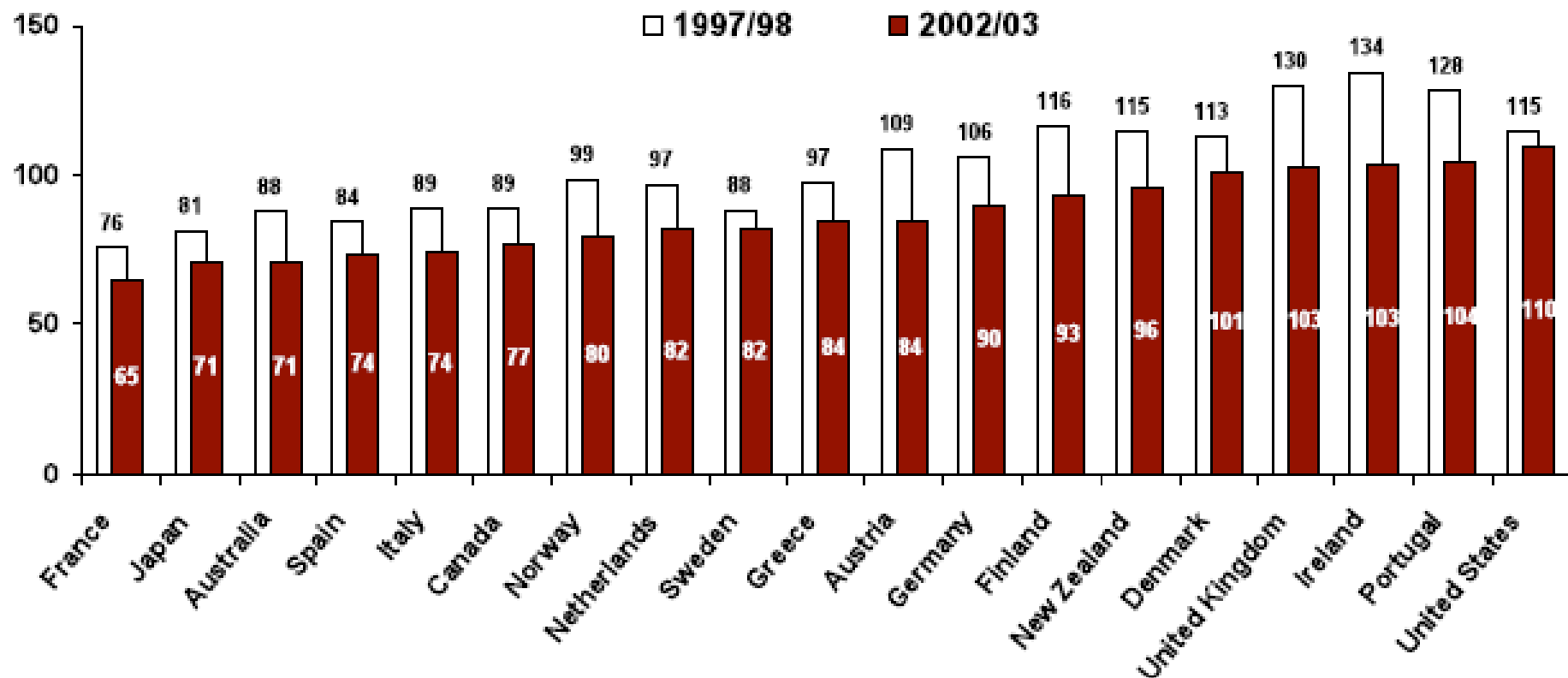
(Percentage of gross domestic product)



Source: Congressional Budget Office.

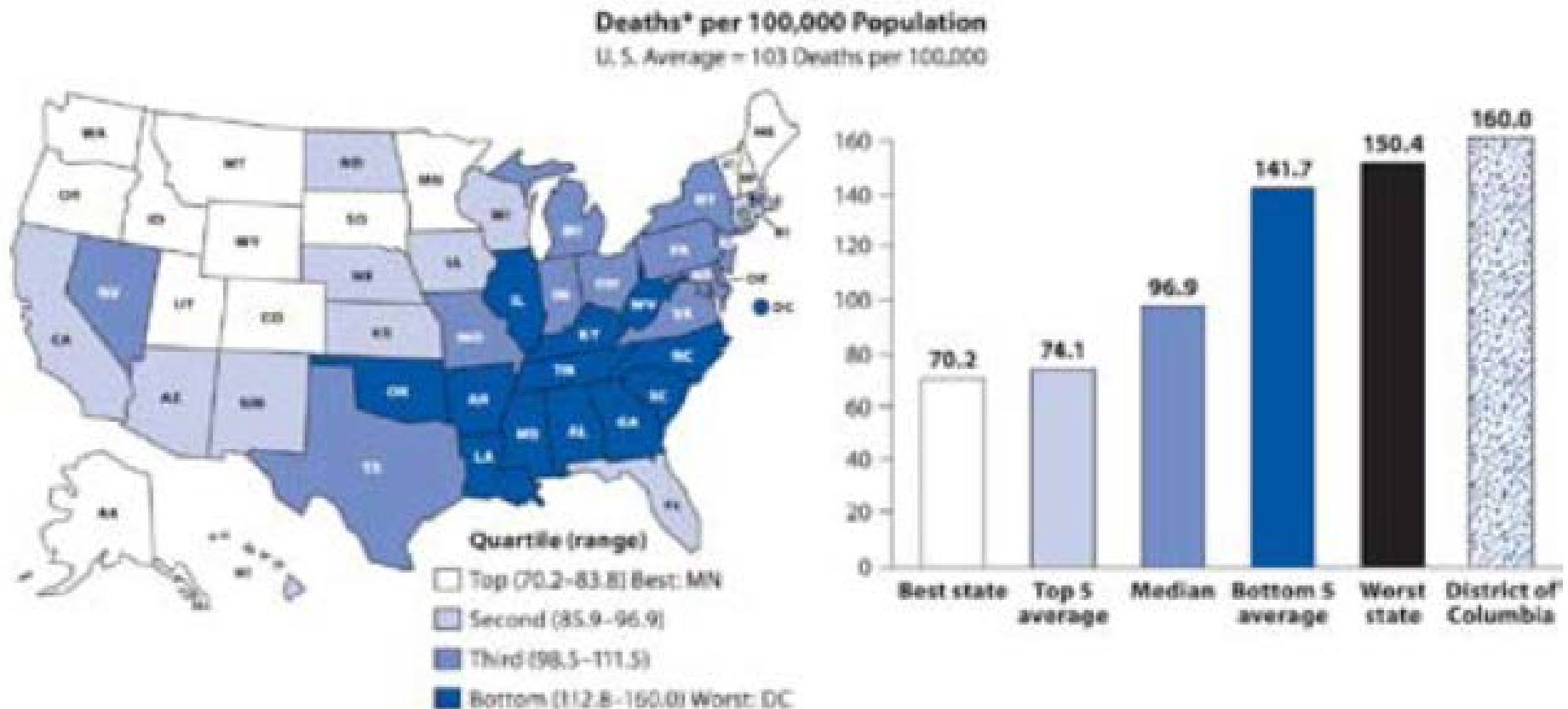
Preventable mortality in the U.S.

Preventable Deaths per 100,000 population



Countries' age-standardized death rates before age 75; including ischemic heart disease, diabetes, stroke, and bacterial infections. See report Appendix B for list of all conditions considered amenable to health care in the analysis.

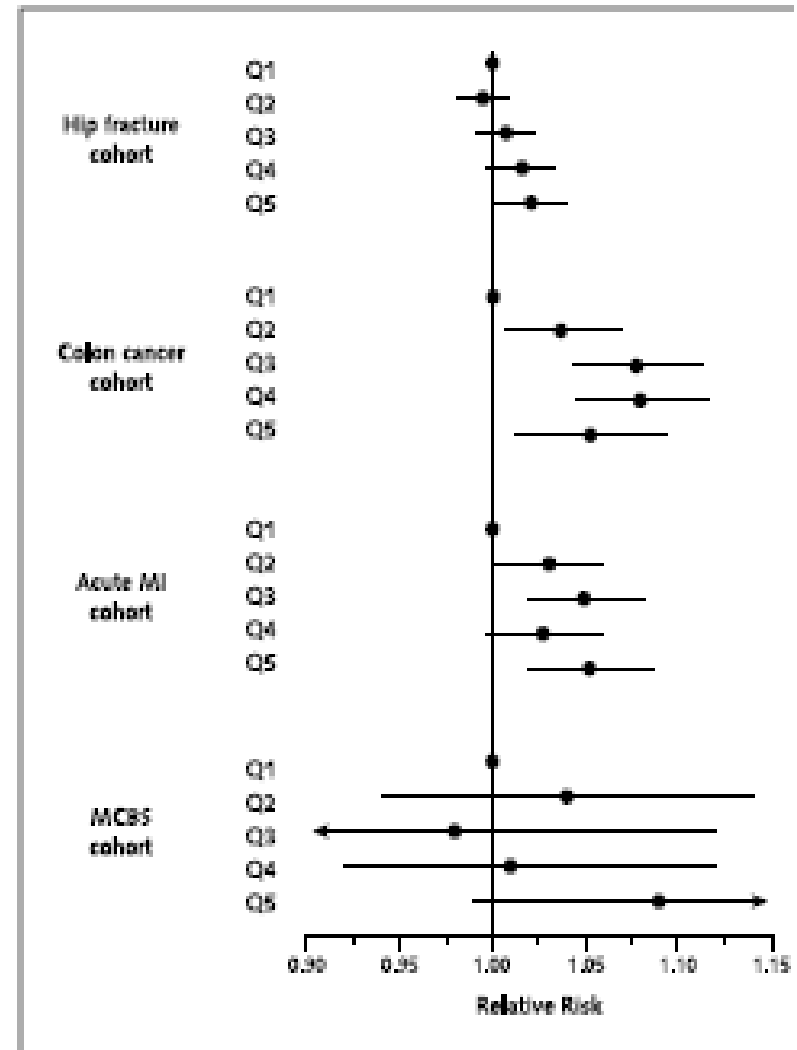
Geographic variation in preventable mortality



Geographic variation in medical care spending and mortality

Figure 1. Adjusted relative risk for death during follow-up across quintiles of Medicare spending.

- ◆ Medical spending varies by a factor of more than 2 across local areas
- ◆ Patients in high-spending regions receive more care but do not experience lower mortality
- ◆ What can we say about public health spending?



Value of medical spending

THE NEW ENGLAND JOURNAL of MEDICINE

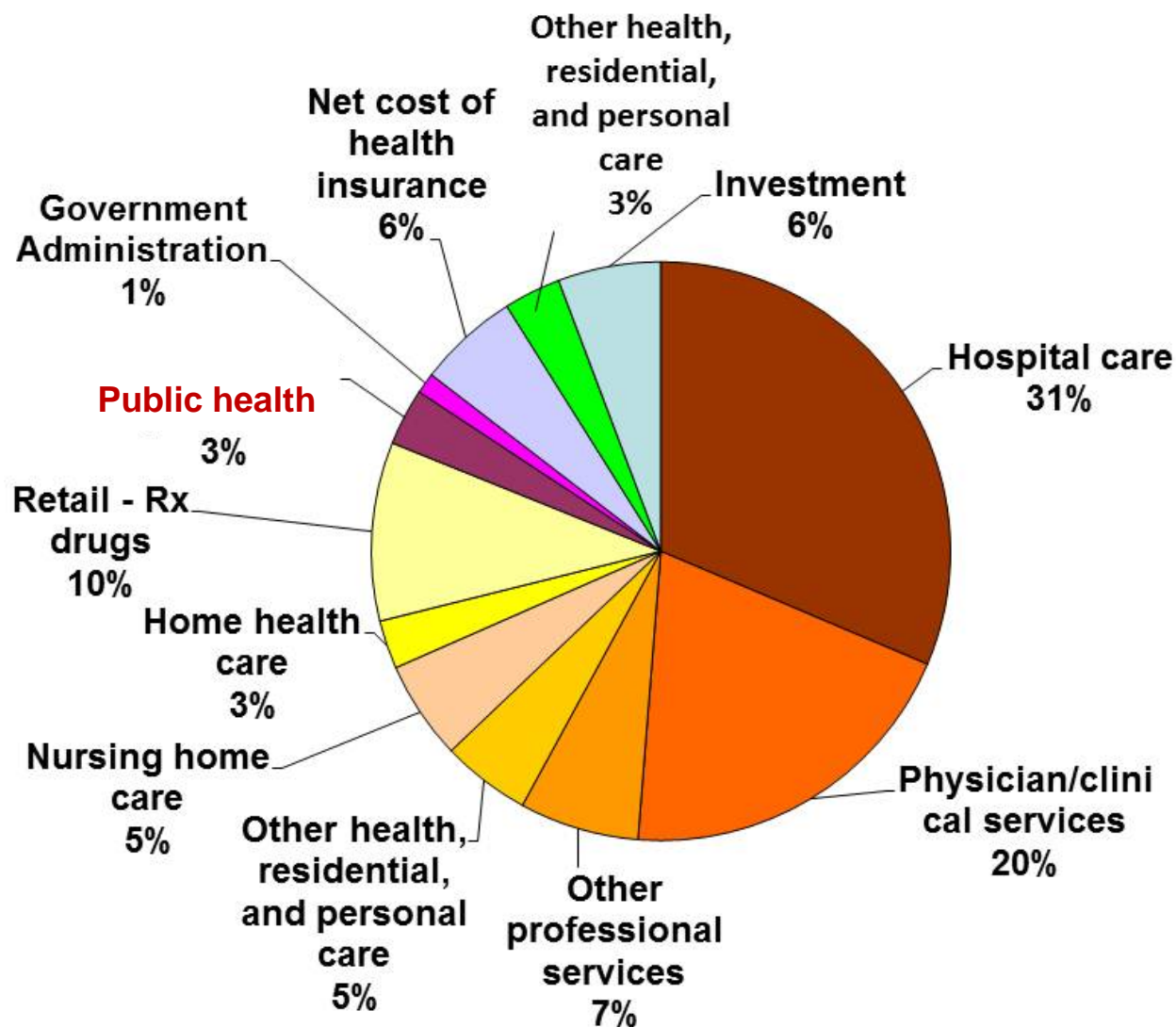
SPECIAL ARTICLE

The Value of Medical Spending in the United States, 1960–2000

David M. Cutler, Ph.D., Allison B. Rosen, M.D., M.P.H., Sc.D.,
and Sandeep Vijan, M.D.

- Half of all gains attributable to medical care
- \$36,300 per life-year gained

Components of national health spending



National Health Expenditure Accounts, 2012

Preventable disease burden and national health spending

>75% of national health spending is attributable to chronic diseases that are largely preventable

- 80% of cardiovascular disease
- 80% of diabetes
- 60% of lung diseases
- 40% of cancers

(not counting injuries, vaccine-preventable diseases)

<3% of national health spending is allocated to public health and prevention

Public health activities

Organized programs, policies, and laws to prevent disease and injury and promote health on a population-wide basis

- Epidemiologic surveillance & investigation
- Community health assessment & planning
- Communicable disease control
- Chronic disease prevention
- Health education
- Environmental health monitoring and assessment
- Enforcement of health laws and regulations
- Inspection and licensing
- Inform, advise, and assist school-based, worksite-based, and community-based health programming
- ...and legacy of assuring access to medical care

Public health's share of national health spending

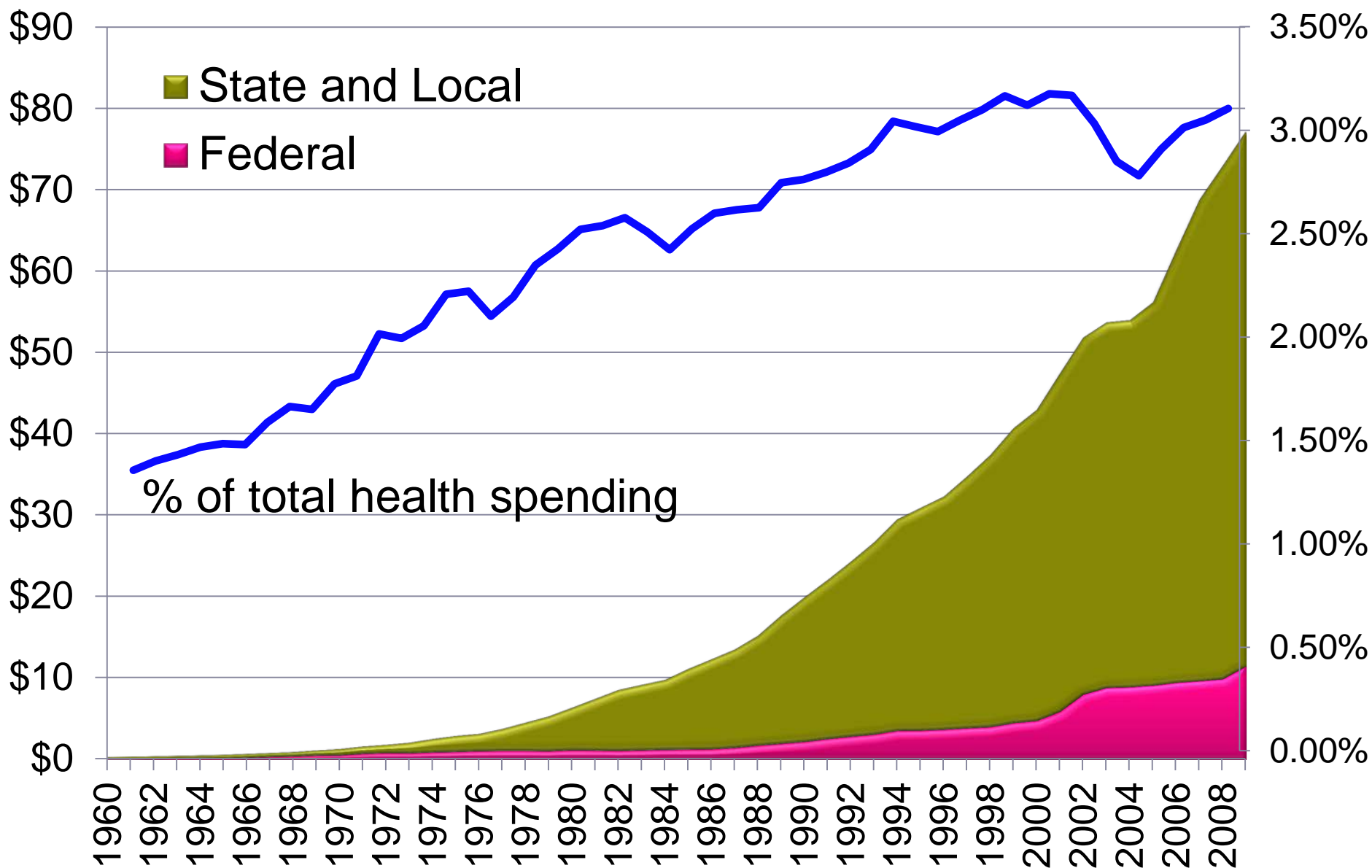
USDHHS National Health Expenditure Accounts

\$Billions

%NHE

■ State and Local
■ Federal

% of total health spending



Per capita public health spending

State health agency spending	<u>2008</u>
------------------------------	-------------

Median	\$153
--------	-------

Min	\$59
-----	------

Max	\$499
-----	-------

Local health agency spending	
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Median	\$29
--------	------

Min	<\$1
-----	------

Max	\$253
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Factors driving spending patterns in public health

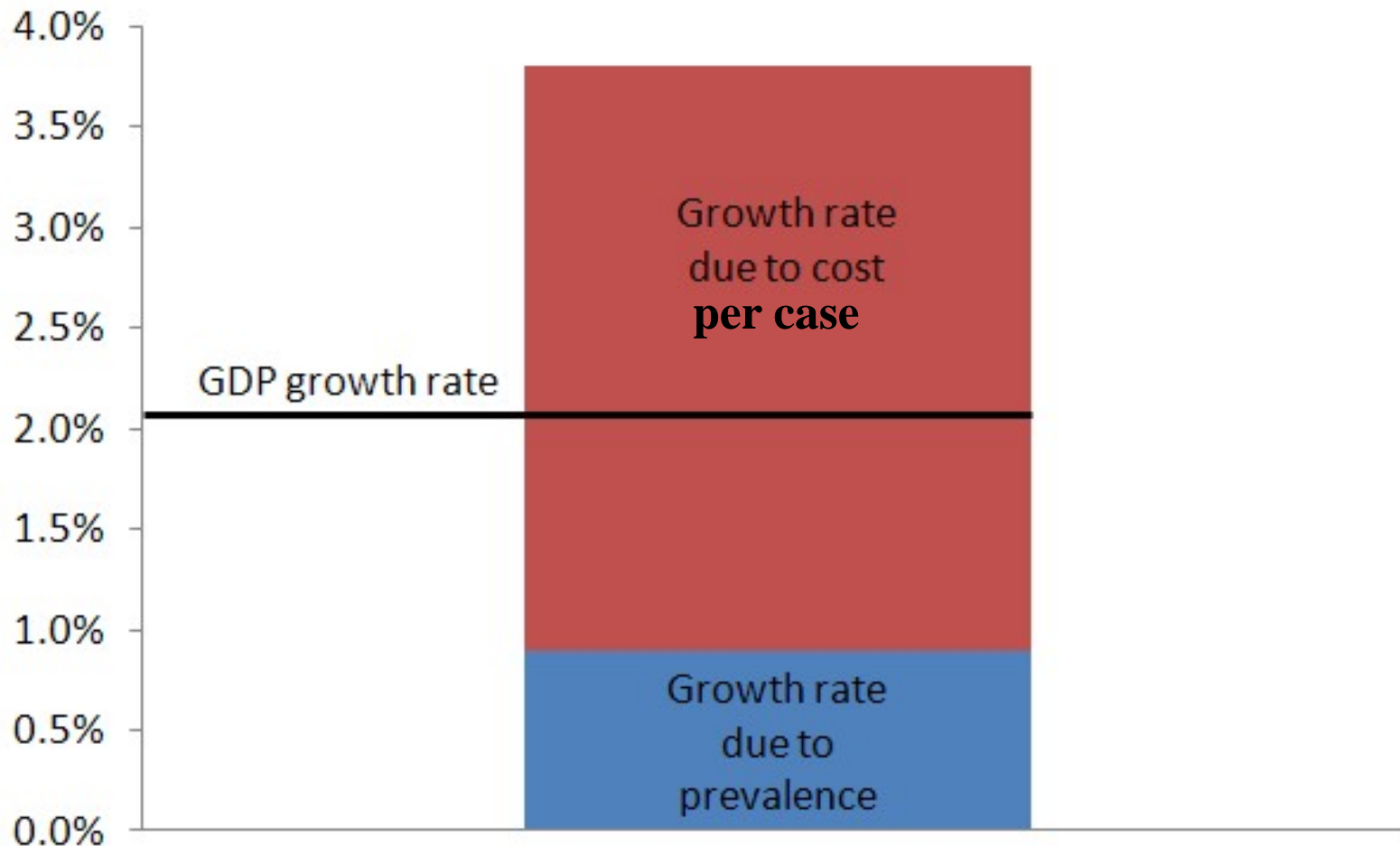
- ◆ Economic conditions
(tax receipts, labor costs, competing needs)
- ◆ Economies of scale and scope
- ◆ Division of responsibility
 - Intergovernmental
 - Private/voluntary contributions
- ◆ Disease risks and burden
- ◆ Policy priorities
(e.g. bioterrorism, pandemic flu, ACA)

Public Health in the Affordable Care Act

- ◆ \$15 billion in new federal public health spending over 10 years (cut by \$5B last week)
- ◆ Public Health and Prevention Trust Fund
- ◆ Incentives for hospitals, health insurers to invest in public health and prevention

Factors driving growth in medical spending

Health spending growth rate 1996-2006



Some research questions of interest...

- ◆ How does *public health* spending vary across communities and change over time?
- ◆ What are the health effects attributable to changes in public health spending?
- ◆ What are the medical cost effects attributable to changes in public health spending?

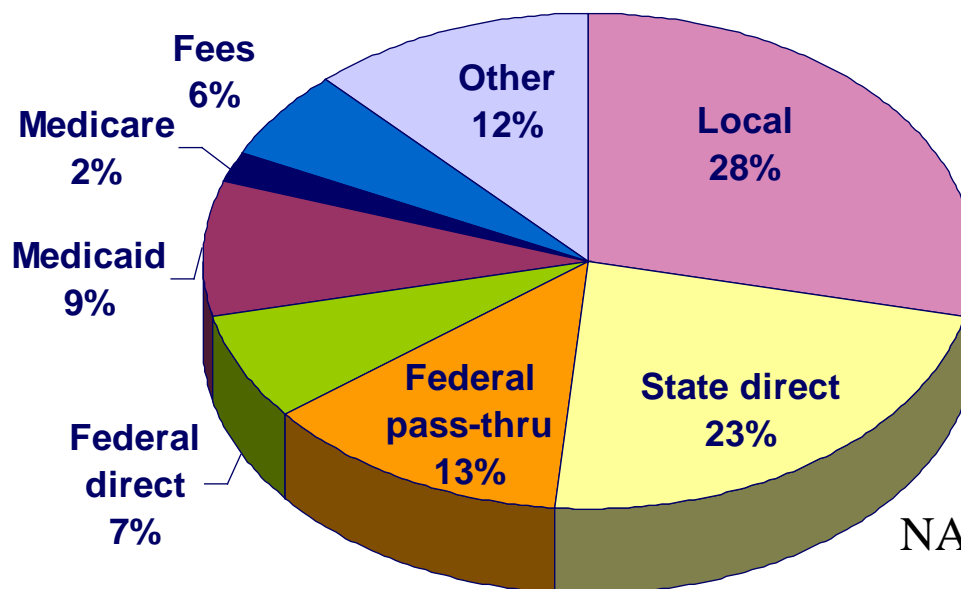
...But a plethora of empirical challenges

- ◆ Wide variation in how public health agencies are organized and what they do
- ◆ Few existing methods for measuring public health agency performance
- ◆ Spending data are scarce, imperfect, and infrequently used
- ◆ Confounding and selection issues exist in associations between spending and outcomes

The problem with public health spending

- ◆ Federal & state funding sources often targeted to communities based in part on disease burden, risk, need
- ◆ Local funding sources often dependent on local economic conditions that may also influence health
- ◆ Public health spending may be correlated with other resources that influence health

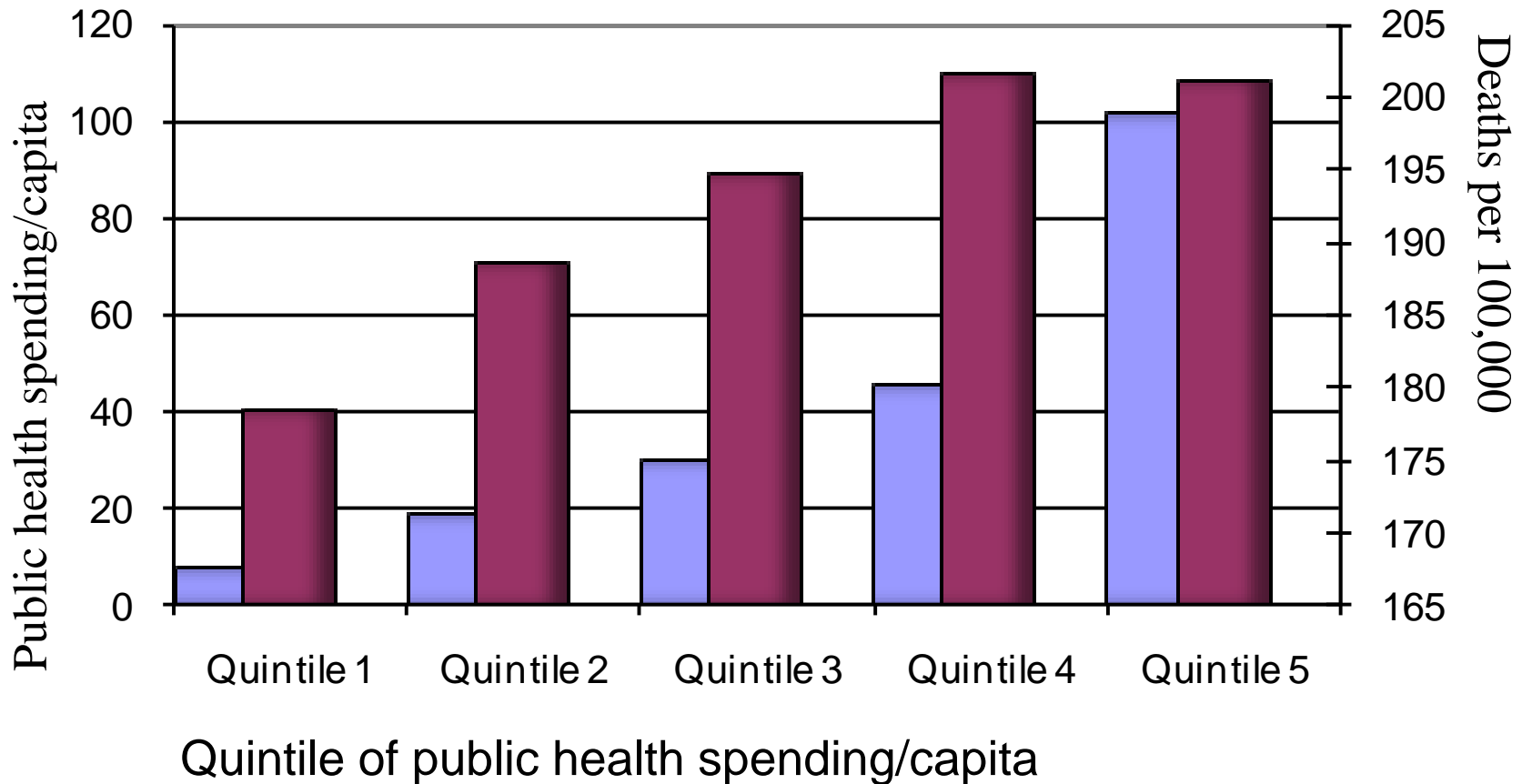
Sources of Local Public Health Agency Revenue, 2005



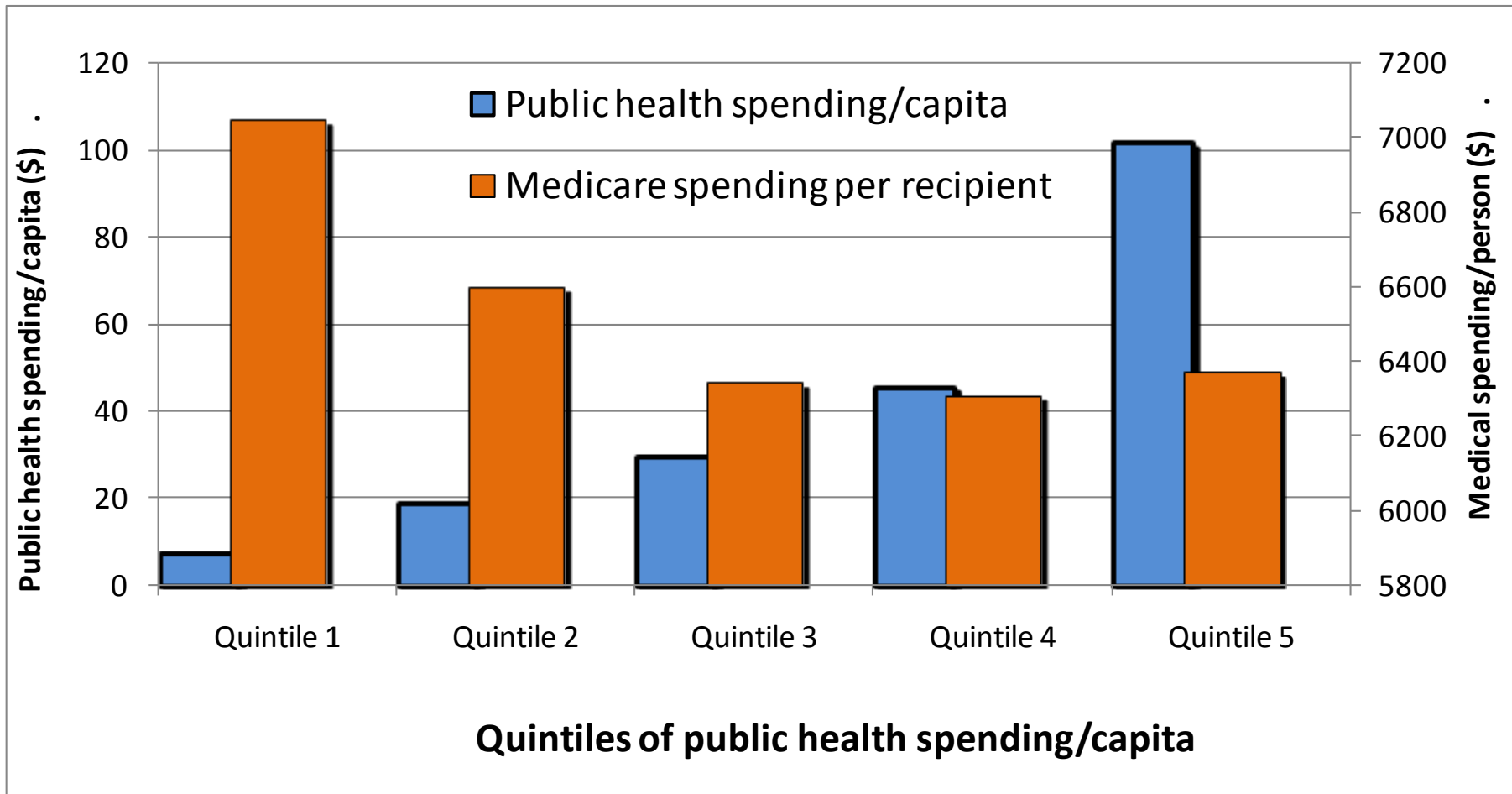
NACCHO 2005

Example: cross-sectional association between PH spending and mortality

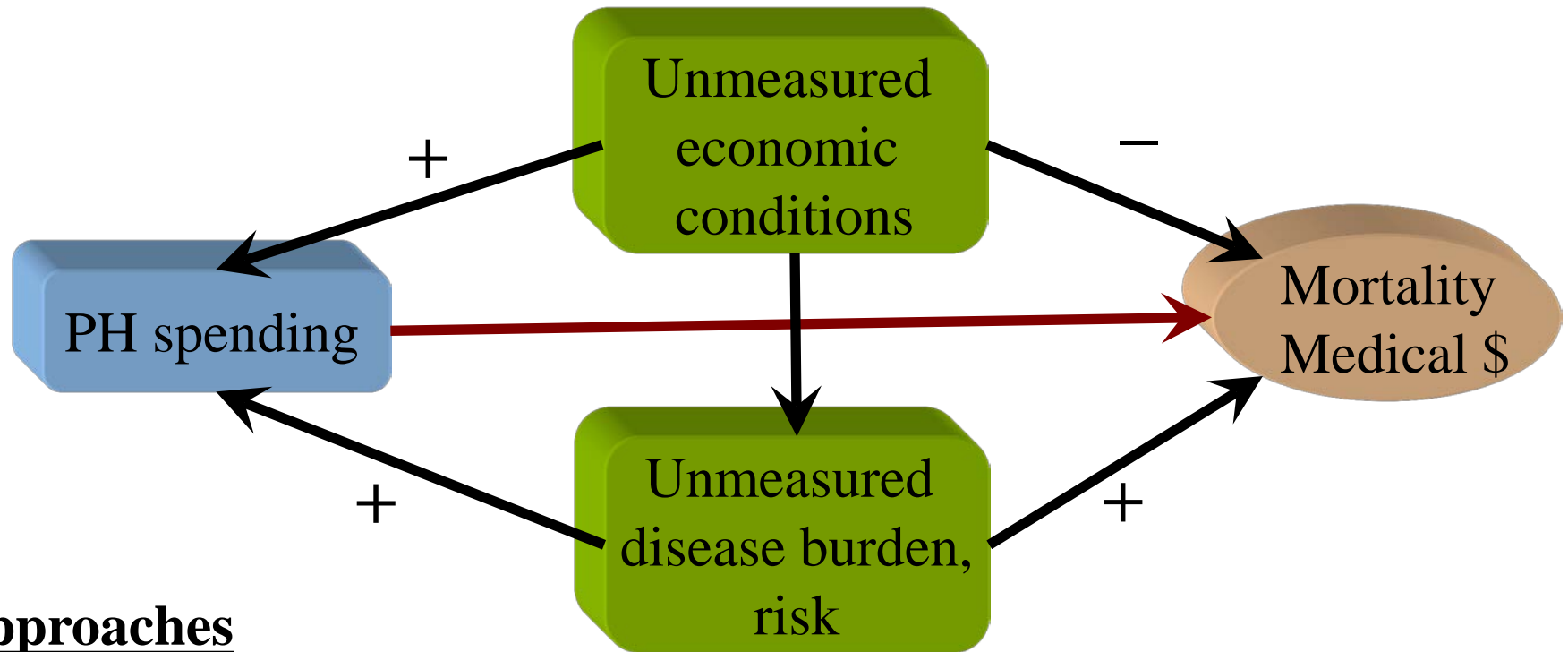
Public health spending/capita
Heart disease mortality



Example: cross-sectional association between PH spending and Medical spending



Analyzing spending effects



Approaches

1. Cross-sectional regression: control for **observable** confounders
2. Fixed effects: also control for **time-invariant**, **unmeasured** differences between communities
3. IV: use exogenous sources of variation in spending
4. Discriminate between causes of death amenable vs. non-amendable to PH intervention

Data used in empirical work

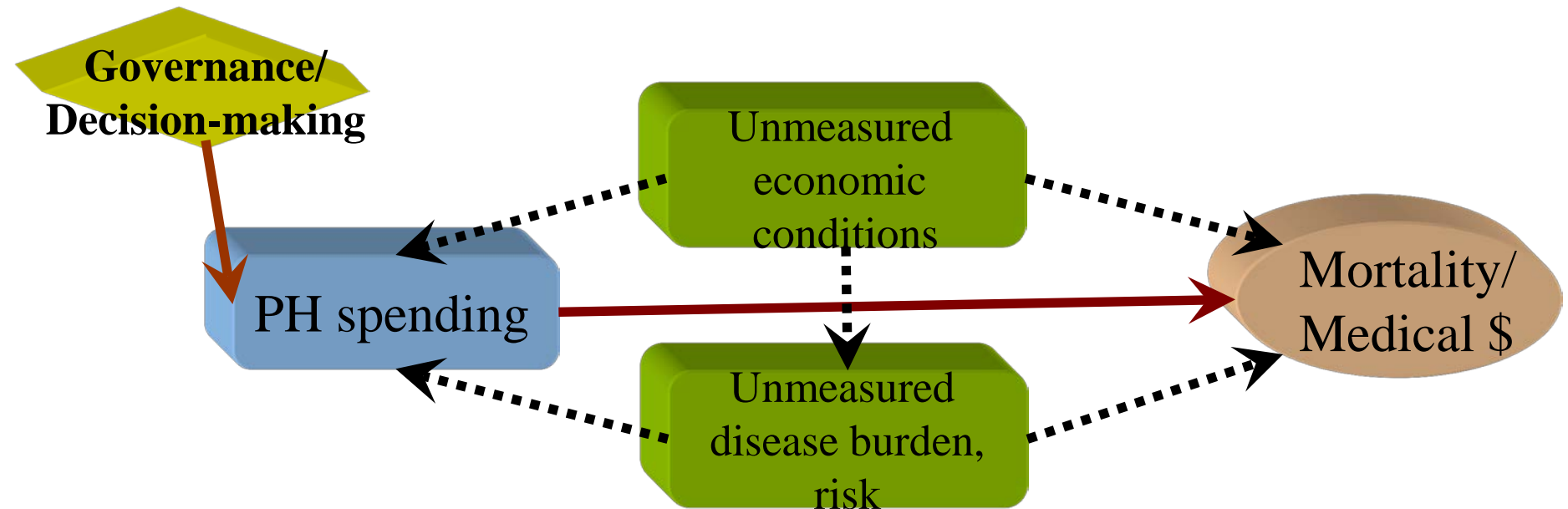
- ◆ NACCHO Profile: financial and institutional data collected on the national population of local public health agencies ($N \approx 3000$) in 1993, 1997, 2005, 2008
- ◆ Residual state and federal spending estimates from US Census of Governments and Consolidated Federal Funding Report
- ◆ Community characteristics obtained from Census and Area Resource File (ARF)
- ◆ Community mortality data obtained from CDC's Compressed Mortality File
- ◆ ***HSA-level*** medical care spending data from CMS and Dartmouth Atlas (Medicare claims data)

Analytical approach

- ◆ Dependent variables
 - Age-adjusted mortality rates, conditions sensitive to public health interventions
 - Medical care spending per recipient (Medicare as proxy)
- ◆ Independent variables of interest
 - Local PH spending per capita, all sources
 - Residual state spending per capita (funds not passed thru to local agencies)
 - Residual federal spending per capita
- ◆ Analytic strategy for panel data: 1993-2008
 - Fixed effects estimation
 - Random effects with instrumental variables (IV)

Analytical approach: IV estimation

- ◆ Identify exogenous sources of variation in spending 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 spending and outcomes



Analytical approach

- ◆ Hierarchical multivariate regression models used to test associations between spending, service delivery, and outcomes while controlling for other factors

$$\text{Ln}(\text{PH\$}_{ijt}) = \beta \text{Agency}_{ijt} + \delta \text{Community}_{ijt} + \lambda \text{State}_{jt} + \mu_j + \varphi_t + \varepsilon_{ijt}$$

$$\begin{aligned} \text{Ln}(\text{Mortality}_{ijt}) &= \alpha \text{Ln}(\widehat{\text{PH\$}_{ijt}}) \\ &+ \beta \text{Agency}_{ijt} + \delta \text{Community}_{ijt} + \lambda \text{State}_{jt} + \mu_j + \varphi_t + \varepsilon_{ijt} \end{aligned}$$

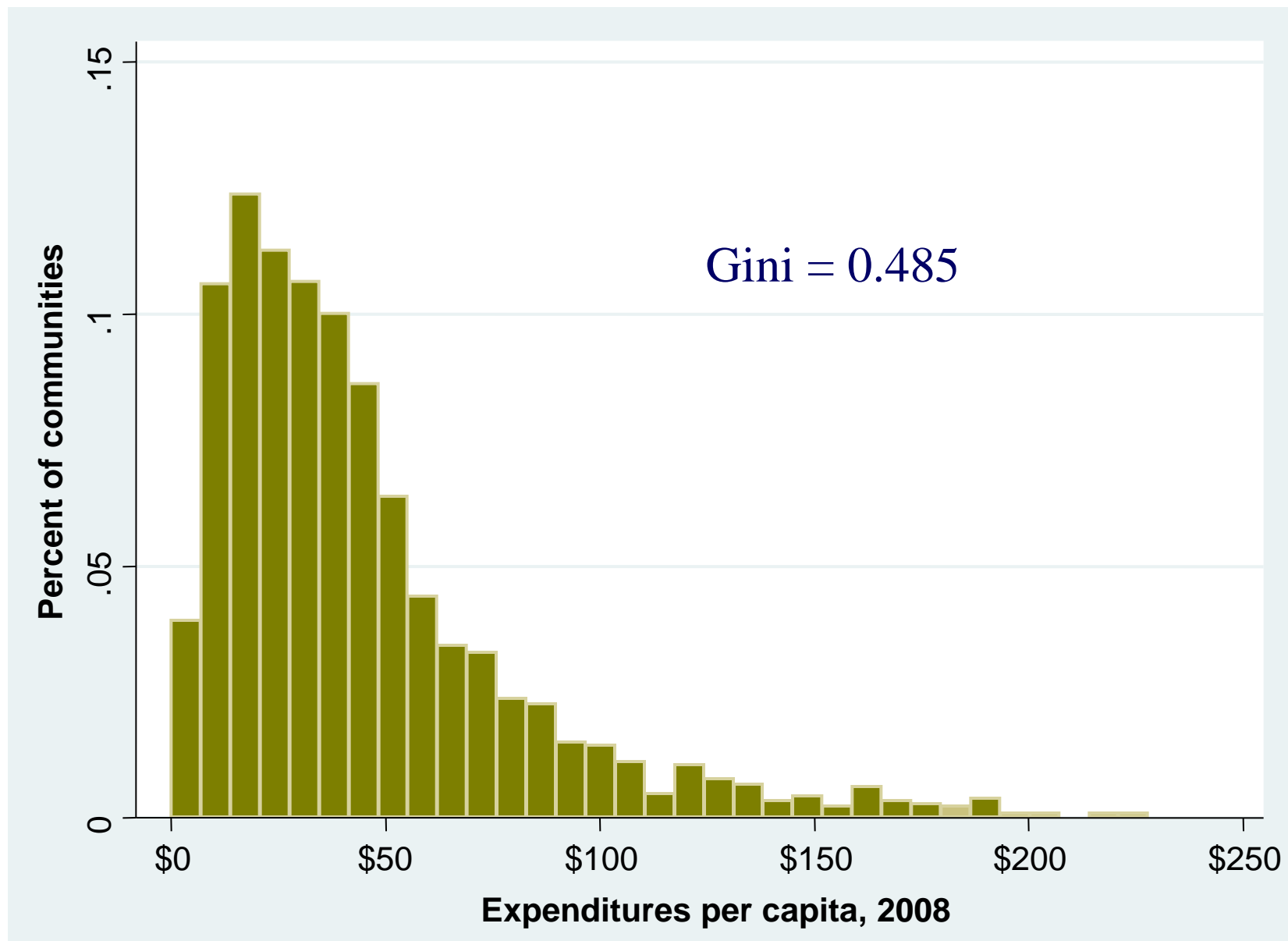
$$\begin{aligned} \text{Ln}(\text{Medical\$}_{ijt}) &= \alpha \text{Ln}(\widehat{\text{PH\$}_{ijt}}) \\ &+ \beta \text{Agency}_{ijt} + \delta \text{Community}_{ijt} + \lambda \text{State}_{jt} + \mu_j + \varphi_t + \varepsilon_{ijt} \end{aligned}$$

Analytical approach

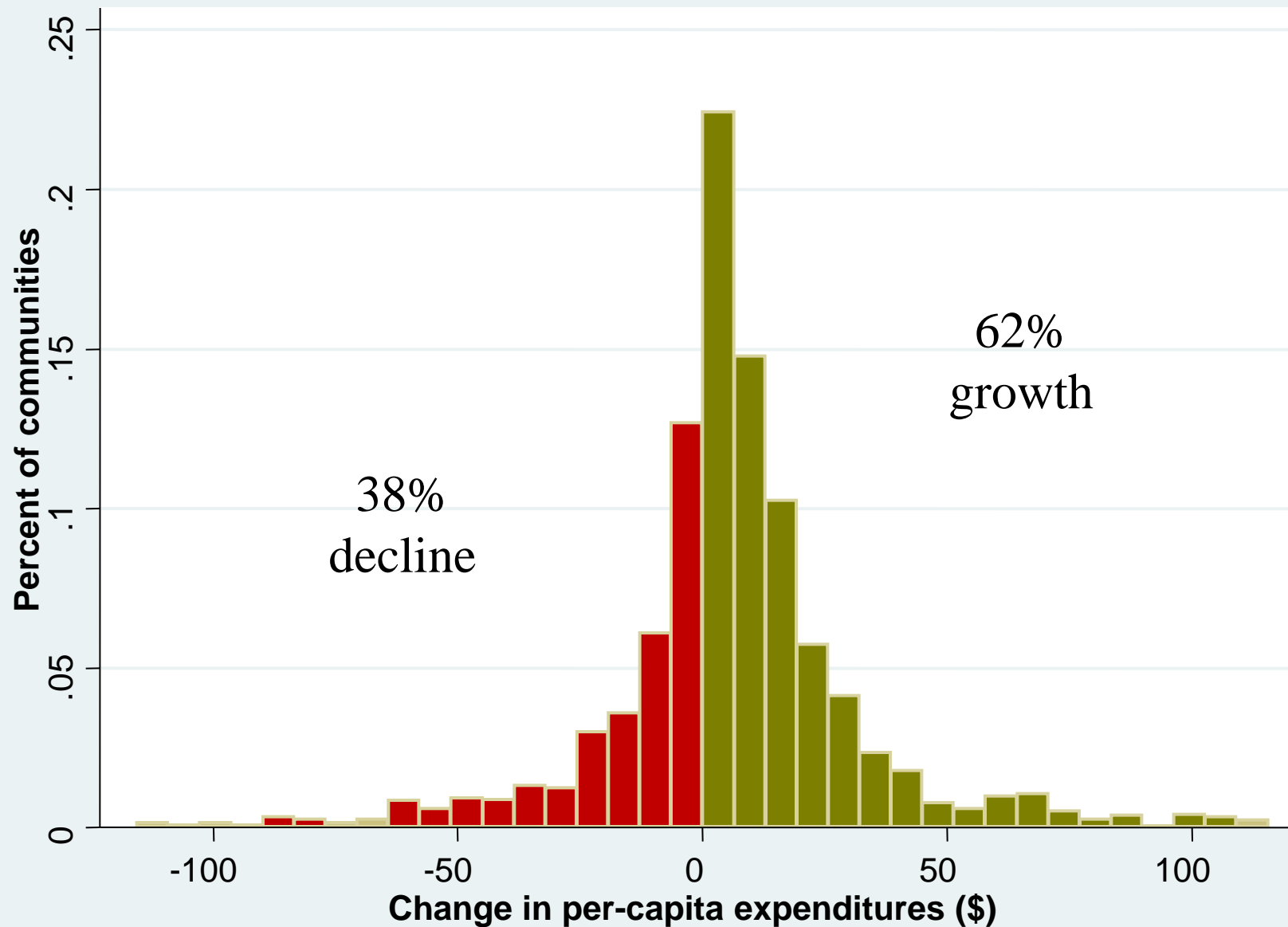
Other Variables Used in the Models

- ◆ ***Agency characteristics***: type of government jurisdiction, scope of services offered, ***local governance and decision-making structures***
- ◆ ***Community characteristics***: population size, rural-urban, poverty, income per capita, education attainment, unemployment, age distributions, physicians per capita, CHC funding per low income, health insurance coverage, local health care wage index
- ◆ ***State characteristics***: Private insurance coverage, Medicaid coverage, state fixed effects

Variation in Local Public Health Spending



Changes in Local Public Health Spending 1993-2008



Determinants of Local Public Health Spending Levels

<u>Governance/Decision Authority</u>	<u>Elasticity Coefficient</u>	<u>95% CI</u>
Local board of health exists	0.131**	(0.061, 0.201)
State hires local PH agency head [†]	-0.151*	(-0.318, 0.018)
Local govt approves local PH budget [†]	-0.388***	(-0.576, -0.200)
State approves local PH budget [†]	-0.308**	(-0.162, -0.454)
Local govt sets local PH fees	0.217**	(0.101, 0.334)
Local govt imposes local PH taxes	0.190**	(0.044, 0.337)
Local board can request local PH levy	0.120**	(0.246, 0.007)

Semi-log regression estimates controlling for community-level and state-level characteristics. *p<0.10 **p<0.05 ***p<0.01

[†]As compared to the local board of health having the authority.

Determinants of Local Public Health Spending Levels

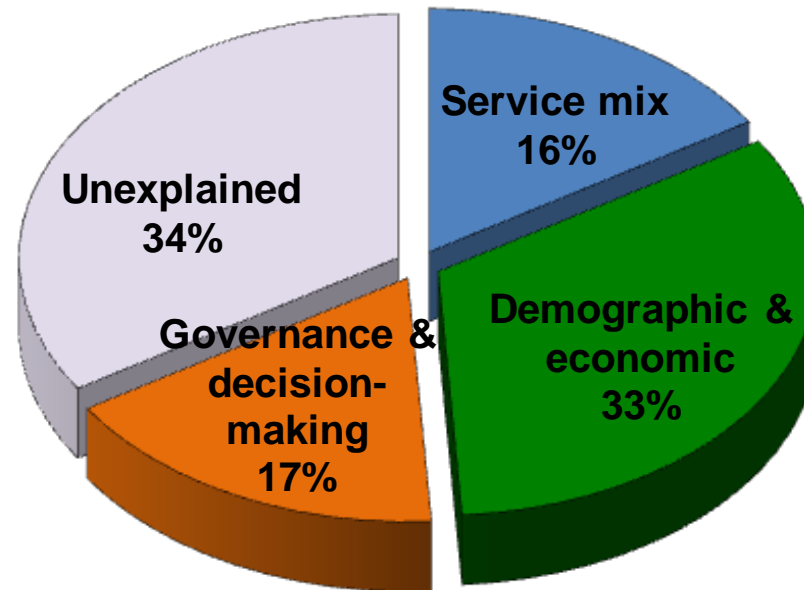
<u>Variable</u>	<u>Elasticity</u>	<u>95% CI</u>
Population size (log)	-0.136***	(-0.168, -0.103)
Income per capita (log)	0.196**	(0.001, 0.392)
Local tax burden (% of income)	0.234**	(0.032, 0.436)
Scope of services offered		
Clinical preventive (%)	0.818***	(0.666, 0.970)
Population-based (%)	0.217**	(0.066, 0.369)
Regulatory/licensing (%)	0.223***	(0.103, 0.344)

**p<0.05

***p<0.01

Semi-log regression estimates controlling for community-level and state-level characteristics

Determinants of Local Public Health Spending Levels



- Delivery system size & structure
- Service mix
- Population needs and risks
- Efficiency & uncertainty

Multivariate estimates of public health spending effects on mortality 1993-2008

	<u>Cross-sectional model</u>		<u>Fixed-effects model</u>		<u>IV model</u>	
<u>Outcome</u>	<u>Elasticity</u>	<u>St. Err.</u>	<u>Elasticity</u>	<u>St. Err.</u>	<u>Elasticity</u>	<u>St. Err.</u>
Infant mortality	0.0516	0.0181 **	0.0234	0.0192	-0.1437	0.0589 ***
Heart disease	-0.0003	0.0051	-0.0103	0.0040 **	-0.1881	0.0292 **
Diabetes	0.0323	0.0187	-0.0487	0.0174 ***	-0.3015	0.0633 **
Cancer	0.0048	0.0029 *	-0.0075	0.0240	-0.0532	0.0166 **
Influenza	-0.0400	0.0200 **	-0.0275	0.0107 **	-0.4320	0.0624 **
<hr/>						
Alzheimer's	0.0024	0.0075	0.0032	0.0047	0.0028	0.0311
Residual	0.0007	0.0083	0.0004	0.0031	0.0013	0.0086

Semi-log regression estimates controlling for community-level and state-level characteristics

*p<0.10 **p<0.05 ***p<0.01

Effects of public health spending on medical care spending 1993-2008

Change in Medical Care Spending Per Capita Attributable to
1% Increase in Public Health Spending Per Capita

<u>Model</u>	<u>Elasticity</u>	<u>Std. Error</u>
Fixed effects	-0.010	0.002 **
Instrumental variables	-0.088	0.013 **

Semi-log regression estimates controlling for community-level and state-level characteristics

*p<0.10 **p<0.05 ***p<0.01

Projected effects of ACA public health spending

- ◆ \$15B in new public health spending over 10 years:

Deaths averted: 255,000 – 437,000

Medical cost offset: \$2.2B – \$6.9B

Cost/life-year gained \$9,800 – \$22,400

Conclusions

- ◆ Local public health spending varies widely across communities
- ◆ Communities with higher spending experience lower mortality from leading preventable causes of death
- ◆ Growth in local public health spending offsets growth in medical care spending (modestly)

Implications for Policy and Practice

- ◆ Mortality reductions achievable through increases in public health spending may equal or exceed the reductions produced by similar expansions in local medical care resources
- ◆ Increased federal investments may help to reduce geographic disparities in population health and bend the medical cost curve.
- ◆ Gains from federal investments may be offset by reductions in state and local spending

Limitations and next steps

- ◆ Aggregate spending measures
 - Average effects
 - Role of allocation decisions?
- ◆ Mortality – distal measures with long incubation periods
- ◆ Medical care spending relies on Medicare as a proxy measure (20% of total medical \$)
- ◆ Ongoing exploration of lag structures