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Estimating Medical Cost Offsets Attributable to Public Health Spending

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Estimating Medical Cost Offsets Attributable to Public Health Spending

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- 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
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.

Source: Commonwealth Fund 2008
Geographic variation in preventable mortality

Source: Commonwealth Fund 2008
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

CDC 2011
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

- State and Local
- Federal

% of total health spending

%NHE

$0
$10
$20
$30
$40
$50
$60
$70
$80
$90

Factors driving growth in medical spending

Roehrig et al. Health Affairs 2011
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
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?
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

- Medicaid 9%
- Medicare 2%
- Medicaid 9%
- Federal direct 7%
- Federal pass-thru 13%
- Other 12%
- State direct 23%
- Local 28%

NACCHO 2005
Example: cross-sectional association between PH spending and mortality

- Public health spending/capita
- Heart disease mortality

Quintile of public health spending/capita

Deaths per 100,000
Example: cross-sectional association between PH spending and Medical spending

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Mays et al. 2009
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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

- 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

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

\[ \ln(PH_{ijt}) = \beta_{\text{Agency}_{ijt}} + \delta_{\text{Community}_{ijt}} + \lambda_{\text{State}_{jt}} + \mu_j + \phi_t + \epsilon_{ijt} \]

\[ \ln(\text{Mortality}_{ijt}) = \alpha \ln(PH_{ijt}) + \beta_{\text{Agency}_{ijt}} + \delta_{\text{Community}_{ijt}} + \lambda_{\text{State}_{jt}} + \mu_j + \phi_t + \epsilon_{ijt} \]

\[ \ln(\text{Medical}\$_{ijt}) = \alpha \ln(PH_{ijt}) + \beta_{\text{Agency}_{ijt}} + \delta_{\text{Community}_{ijt}} + \lambda_{\text{State}_{jt}} + \mu_j + \phi_t + \epsilon_{ijt} \]

Sensitivity analyses using 1, 3, and 5 year lag structures
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

Gini = 0.485
Changes in Local Public Health Spending 1993-2008

- 62% growth
- 38% decline

Percent of communities vs. Change in per-capita expenditures ($)
# Determinants of Local Public Health Spending Levels: IVs

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

**Elasticity**

\[ F=13.4 \quad p<0.001 \]

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

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Cross-sectional model</th>
<th>Fixed-effects model</th>
<th>IV model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Elasticity</td>
<td>St. Err.</td>
<td>Elasticity</td>
</tr>
<tr>
<td>Infant mortality</td>
<td>0.0516</td>
<td>0.0181 **</td>
<td>0.0234</td>
</tr>
<tr>
<td>Heart disease</td>
<td>-0.0003</td>
<td>0.0051</td>
<td>-0.0103</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.0323</td>
<td>0.0187</td>
<td>-0.0487</td>
</tr>
<tr>
<td>Cancer</td>
<td>0.0048</td>
<td>0.0029 *</td>
<td>-0.0075</td>
</tr>
<tr>
<td>Influenza</td>
<td>-0.0400</td>
<td>0.0200 **</td>
<td>-0.0275</td>
</tr>
<tr>
<td>Alzheimer’s</td>
<td>0.0024</td>
<td>0.0075</td>
<td>0.0032</td>
</tr>
<tr>
<td>Residual</td>
<td>0.0007</td>
<td>0.0083</td>
<td>0.0004</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Model</th>
<th>Elasticity</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed effects</td>
<td>-0.010</td>
<td>0.002 **</td>
</tr>
<tr>
<td>Instrumental variables</td>
<td>-0.088</td>
<td>0.013 **</td>
</tr>
</tbody>
</table>

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

- 10% increase in public health spending in average community:

  Public health cost: $594,291
  Medical cost offset: -$515,114 (Medicare only)
  Deaths averted: 14.8
  LY gained: 148
  Net cost/LY: $534
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 appears to offset growth in medical care spending
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