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Scale and Scope Effects in Public Health Delivery: Estimating Gains from Regionalization

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Scale and Scope Effects in Public Health Delivery: Estimating Gains from Regionalization

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Collaborators include Rachel Hogg, MA and Rick Ingram, DrPH
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

(also 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 in the Affordable Care Act

- $15 billion in new federal public health spending over 10 years (cut by $5B this year)
- Public Health and Prevention Trust Fund
- Incentives for hospitals, health insurers to invest in public health and prevention
Local public health delivery systems

Source: 2010 NACCHO National Profile of Local Health Departments Survey
Variation in Local Public Health Spending

Gini = 0.485
Some questions of interest...

- How can we derive greater value from existing and new public health resources?
- Are there economies of scale and scope in the delivery of public health services?
- Can regionalization improve availability, efficiency & effectiveness of public health services?
Sources of Scale and Scope Effects

Economies of Scale

- Spread fixed costs of public health activities
- Allow specialization of labor and capital
- Enhance predictability of infrequent events
- Pool surge capacity
- Learn by doing
- Internalize spill-over effects
- Network effects

Economies of Scope

- Use common infrastructure for multiple activities
- Cross-train workforce
- Realize synergies across activities
- Network effects
Sources of Scale and Scope Effects

Predicted Per Capita Public Health Expenditures

Population (in thousands)

Source: Santerre R; 2009
Sources of Scale and Scope Effects

Source: Mays GP et al; 2006
Analytic Approach

- Estimate the effects of **scale** (population served) and **scope** (array of activities delivered) on:
  - public health expenditures
  - health outcomes (preventable mortality)

- Address the potential endogeneity of scope, quality

- Simulate the effects of regionalizing jurisdictions that fall below selected population thresholds
  - <25,000
  - <50,000
  - <100,000
  - <150,000
Data used in empirical work

- National Longitudinal Survey of Public Health Systems
- Cohort of 360 communities with at least 100,000 residents

- Measures:
  - **Scope**: availability of 20 public health activities
  - **Effort**: contributed by the local public health agency
  - **Quality**: perceived effectiveness of each activity
  - **Network**: organizations contributing to each activity

- Linked with data from NACCHO Profile
  - **Scale**: population size served
  - **Cost**: Local public health agency expenditures
  - Agency characteristics
Data used in empirical work

- Survey data linked with secondary sources of area characteristics (Census, ARF)
- Small sample of jurisdictions under 100,000 (n=36) used to evaluate prediction accuracy
Analytical approach

Cost Function Model (semi trans-log)

\[ \ln(C_{ijt}) = \alpha_1 \text{Scale}_{ijt} + \alpha_2 \text{Scale}^2_{ijt} + \beta_1 \text{Scope}_{ijt} + \beta_2 \text{Scope}^2_{ijt} + \phi_1 \text{Quality}_{ijt} + \phi_2 \text{Quality}^2_{ijt} + \lambda X_{ijt} + \mu_j + \varphi_t + \varepsilon_{ijt} \]

Instrumental Variables Model

\[ \text{Scope}_{ijt} = \theta \text{Network}_{ijt} + \lambda \text{Agency}_{ijt} + \delta \text{Community}_{ijt} + \mu_j + \varphi_t + \varepsilon_{ijt} \]
\[ \text{Quality}_{ijt} = \theta \text{Network}_{ijt} + \lambda \text{Agency}_{ijt} + \delta \text{Community}_{ijt} + \mu_j + \varphi_t + \varepsilon_{ijt} \]

IVs: Network: degree centrality, average path length

All models control for type of jurisdiction, governance structure, centralization, population density, metropolitan area designation, income per capita, unemployment, racial composition, age distribution, educational attainment, physician and hospital availability
### Results: Scale and Scope Estimates

<table>
<thead>
<tr>
<th>Variable</th>
<th>Partial Elasticity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff.</td>
<td>S.E.</td>
</tr>
<tr>
<td>Population size</td>
<td>0.0184</td>
<td>0.0029***</td>
</tr>
<tr>
<td>Population size squared</td>
<td>-0.0014</td>
<td>0.0002***</td>
</tr>
<tr>
<td>Scope</td>
<td>3.89</td>
<td>1.41***</td>
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<tr>
<td>Scope squared</td>
<td>-2.58</td>
<td>0.99***</td>
</tr>
<tr>
<td>Quality</td>
<td>-2.98</td>
<td>1.39**</td>
</tr>
<tr>
<td>Quality squared</td>
<td>2.72</td>
<td>1.23**</td>
</tr>
</tbody>
</table>

**p<0.05   ***p<0.01
Results: Scale and Scope Estimates

Scale (Population in 1000s)

Quality (Perceived Effectiveness)

Scope (% of Activities)
Simulated Effects of Regionalization

Per Capita Cost
Scope
Quality

Regionalization Thresholds

-20%
-15%
-10%
-5%
0%
5%
10%
15%
Conclusions

- Significant scale and scope effects are apparent in local public health production
- Gains from regionalization may accrue through efficiency, scope, and quality
- Largest regionalization gains accrue to smallest jurisdictions
- If savings are re-invested in public health production, possibility of important health gains
Limitations and next steps

- Limited data on small jurisdictions
- Inability to observe existing “shared service” arrangements
- Aggregated cost data
- Lack of data on service volume/intensity