Health System Contributions to Public Health Activities Amid Policy and Economic Change: Estimating Complementarities, Substitutions, and Network Effects

Glen P Mays, University of Kentucky
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Why inter-organizational contributions are important

Other organizations may:

- Complement or substitute for PH agency work
- Extend the reach of PH agencies
- Bring new resources and expertise

Improve quality
Enhance efficiency
Reduce disparities
Why inter-organizational contributions are important

Also some potential problems:

- Lack of clarity/accountability about responsibilities
- Duplication, competition, or rivalry
- Gaps in service due to incomplete coordination
- Instability in contributions over time
  
  Diminished quality
  
  Inconsistent service
  
  Inefficiency/waste
Forces of change

Public Health Delivery Systems

- Hospital community benefit regs
- Funding constraints
- Accountable care organizations
- Employer wellness incentives
- Patient centered medical homes
- Health insurance expansions
- Health information exchange
- Accreditation
Public Health & Health Care Integration in the Affordable Care Act

- Community Transformation Grants
- CMMI Innovation Awards
- Medicaid Health Homes
- Tax-exempt hospital community benefit regs
- Health insurer medical loss ratio regs
- Employer wellness incentives
- Community health center enhanced funding
Research questions of interest

- To what extent do health care organizations contribute to public health production?
- How do these contributions change over time?
- How do health care and public health contributions interact to influence quantity, quality, and cost of delivery?
  - Complementarities
  - Substitutions
Data: public health production

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

Measured from local public health official’s perspective:
- **Scope**: availability of 20 recommended public health activities
- **Network**: types of organizations contributing to each activity
- **Effort**: contributed by designated local public health agency
- **Quality**: perceived effectiveness of each activity
Data: community & market characteristics

- **Area Resource File**: community and market characteristics
- **NACCHO Profile data**: public health agency characteristics
- **Medicare Cost Report** data files: hospital ownership, market share, uncompensated care
- Hospital data aggregated to hospital service areas (HSAs) and linked with survey data
Analytic Approach

**Dependent variables:**

- **Quantity**: Percent of recommended PH activities performed in the community
- **Quality**: Perceived effectiveness of PH activities
- **Resources**: Local governmental expenditures for PH activities

**Independent variables:**

- **Contribution scores**: percent of activities contributed by each type of organization
- **Network influence**: degree centrality, betweenness centrality
Analytic Approach

**Estimation:**

- Log-transformed Generalized Linear Latent and Mixed Models
- Account for repeated measures and clustering of public health jurisdictions within states
- Instrumental variables to address endogeneity of contributions

\[
\ln(Q\text{uantity/Quality/Cost}_{ijt}) = \sum \alpha_z \ln(\text{Contribution}_{zijt}) + \beta_1 \text{Agency}_{ijt} + \beta_2 \text{Community}_{ijt} + \mu_j + \phi_t + \epsilon_{ijt}
\]

\[
\ln(\text{Contribution}_{z,ijt}) = \sum \alpha_z \ln(\text{Betweenness}_{zijt}) + \beta_1 \text{Agency}_{ijt} + \beta_2 \text{Community}_{ijt} + \mu_j + \phi_t + \epsilon_{ijt}
\]

All models control for type of jurisdiction, population size and density, metropolitan area designation, income per capita, unemployment, racial composition, age distribution, educational attainment, physician availability, and public health agency governance.
Analytic Approach

Network Analytics:

- Two-mode networks (organization types X activities) transformed to one-mode networks with tie strength indicated by number of activities jointly produced

- **Betweenness centrality** measures used as instruments: for how many activities does each organization lie on the shortest path connecting each pair of other organizations

<table>
<thead>
<tr>
<th>Orgtype</th>
<th>Activities</th>
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<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 ...</td>
</tr>
<tr>
<td>LHD</td>
<td>X X X X X</td>
</tr>
<tr>
<td>Hospitals</td>
<td>X X X X</td>
</tr>
<tr>
<td>Physician practices</td>
<td>X X</td>
</tr>
<tr>
<td>CHCs</td>
<td>X X X</td>
</tr>
<tr>
<td>Insurers</td>
<td>X X</td>
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<tr>
<td>...</td>
<td></td>
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</tbody>
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Results:
Delivery of recommended public health activities

<table>
<thead>
<tr>
<th>Year</th>
<th>Assurance</th>
<th>Policy</th>
<th>Assessment</th>
</tr>
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<tbody>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
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</tbody>
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↑ 10%  
↓ 5%
Results: organizations contributing to local public health production

<table>
<thead>
<tr>
<th>% Change 2006-2012</th>
<th>Scope of Production 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50%</td>
<td>50%</td>
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<tr>
<td>-30%</td>
<td>30%</td>
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<tr>
<td>-10%</td>
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<tr>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>50%</td>
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</tbody>
</table>

Local health agency
Other local government
State health agency
Other state government
Hospitals
Physician practices
Community health centers
Health insurers
Employers/business
Schools
CBOs
Estimated Complementarity and Substitution Effects on Local Health Department Contributions

Results from Multivariate GLLAMM Models

- CHCs
- Physicians
- Employers
- Insurers
- Hospitals

![Graph showing estimated effects](image)
Estimated Contribution Effects on Quantity of Public Health Services

Results from Multivariate GLLAMM Models
Estimated Contribution Effects on Quality of Public Health Services

Results from Multivariate GLLAMM Models
Estimated Contribution Effects on Local Public Health Expenditures

Results from Multivariate GLLAMM Models
Conclusions

- Public health contributions by health care organizations appear more recession-resistant than governmental contributions.

- Employer and CHC contributions appear to offset LHD efforts (substitution).

- Hospital contributions appear to complement LHD efforts and may expand overall supply and quality of services.

- No evidence for LHD cost offsets attributable to health care contributions.
Policy and Practice Implications

- Public health delivery has become increasingly reliant on nongovernmental & health care contributions
- Increased resiliency during economic shocks
- Heightened need for coordination, monitoring, and accountability
- Vulnerability to instability in contributions over time
- May not lower overall resource use
Limitations and Next Steps

- Organization types – lacking institutional granularity
- Single perspective – local health officials

Future possible comparisons:
- CTG and CMMI sites
- Hospital community benefit activities
- CHA and CHIP implementation
- PHAB accreditation
For More Information

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