Geographic Variation in the Delivery of Public Health Services: Understanding Causes and Consequences

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Geographic Variation in the Delivery of Public Health Services: Understanding Causes and Consequences

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Washington University Dissemination & Implementation Seminar Series | April 1 2015
Failures in public health implementation

Many evidence-based public health strategies fail to reach large segments of U.S. populations at risk:

- Smoking cessation
- Influenza vaccination
- Hypertension control
- Nutrition & physical activity programs
- HIV prevention
- Family planning
- Substance abuse prevention
- Interpersonal violence prevention
- Maternal and infant home visiting for high-risk populations
- HPV vaccinations & cancer screening
Economics & public health implementation

>75% of US health spending is attributable to conditions that are largely preventable

- Cardiovascular disease
- Diabetes
- Lung diseases
- Cancer
- Injuries
- Vaccine-preventable diseases and sexually transmitted infections

<5% of US health spending is allocated to prevention and public health

CDC 2008 and CMS 2013
Complexity in public health delivery systems

Other Health & Social Organizations
- Needs
- Preferences
- Risks
- Threats
- Resources
- Perceptions

Population & Environment
- Resources & expertise
- Participation incentives

Public Health Agencies
- Legal authority
- Funding levels & mix
- Governing structure
- Leadership
- Inter-governmental relationships

Coordination mechanisms
- Scope of activity
- Compatibility of missions
- Distribution of effort
- Nature & intensity of relationships
- Scope of services
- Staffing levels & mix

Strategic Interactions
- Division of responsibility
- Staffing levels & mix
- Leadership
- Funding levels & mix
- Governing structure
- Inter-governmental relationships

Outputs and Outcomes
- Reach
- Effectiveness
- Timeliness
- Adherence to EBPs
- Efficiency
- Equity

Decision Support
- Accreditation
- Performance measures
- Practice guidelines
- Quality improvement

Mays et al 2009

- Complexity in public health delivery systems
- Coordination mechanisms
- Strategic Interactions
- Outputs and Outcomes
- Decision Support
- Public Health Agencies
- Other Health & Social Organizations
What’s the role of public health infrastructure?

Foundational Public Health Capabilities

– Epidemiologic surveillance & investigation
– Community health assessment & planning
– Public education and communication
– Community engagement & deliberation
– Environmental health monitoring & assessment
– Policy development and analysis
– Policy compliance monitoring & enforcement
– Convening and planning for school-based, worksite-based, and community-based health programming
– Workforce development & training
– Fundraising & entrepreneurship
– Financial analysis & resource allocation

A field of inquiry examining the **organization**, **financing**, and **delivery** of public health services at local, state and national levels, and the **impact** of these activities on **population health**

Strategies to promote health and prevent disease & injury on a population-wide basis: programs, policies, administrative practices

Mays, Halverson, and Scutchfield. 2003
Fundamental questions

How much variation across the U.S.?
- High-value programs & services
- Cross-cutting infrastructure and capabilities

Drivers of variation?
- Need
- Preferences & values
- Resource availability
- Delivery system attributes

Consequences of variation?
- Health impact
- Cost & efficiency
- Equity
Ongoing studies of implementation variation in public health

Macro

- National Longitudinal Survey of Public Health Systems
- Multi-network Practice and Outcome Variation Study (MPROVE)
- Public Health Delivery and Cost Studies (DACS)
- Costing Foundational Public Health Capabilities

Micro

PUBLIC HEALTH
SERVICES & SYSTEMS RESEARCH
PRACTICE-BASED RESEARCH NETWORKS
National Coordinating Center
Prior work: mortality reductions attributable to investments in public health delivery, 1993-2008

Infant mortality  Heart disease  Diabetes  Cancer  Influenza  All-cause  Alzheimers

Percent change

Hierarchical regression estimates with instrumental variables to correct for selection and unmeasured confounding

Mays et al. 2011
Prior work: medical cost offsets attributable to investments in public health delivery, 1993-2008

For every $10 of public health spending, ≈$9 are recovered in lower medical care spending over 15 years

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

Linked with organizational and financial data from NACCHO’s National Profile of Local Health Departments, Area Resource File, U.S. Census data
# Delivery of recommended public health activities in U.S. communities

<table>
<thead>
<tr>
<th>Public Health Activity</th>
<th>% Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Community health needs assessment</td>
<td>71.5 77.5 72.6</td>
</tr>
<tr>
<td>2. Behavioral risk factor surveillance</td>
<td>45.8 70.2 73.9</td>
</tr>
<tr>
<td>3. Adverse health events investigation</td>
<td>98.6 97.9 99.6</td>
</tr>
<tr>
<td>4. Public health laboratory testing services</td>
<td>96.3 97.0 99.2</td>
</tr>
<tr>
<td>5. Analysis of health status &amp; health determinants</td>
<td>61.3 73.2 63.5</td>
</tr>
<tr>
<td>6. Analysis of preventive services utilization</td>
<td>28.4 26.1 33.2</td>
</tr>
<tr>
<td>7. Health information provision to elected officials</td>
<td>80.9 90.1 87.1</td>
</tr>
<tr>
<td>8. Health information provision to the public</td>
<td>75.4 88.8 80.9</td>
</tr>
<tr>
<td>9. Health information provision to the media</td>
<td>75.2 88.4 87.1</td>
</tr>
<tr>
<td>10. Prioritization of community health needs</td>
<td>66.1 71.7 66.8</td>
</tr>
<tr>
<td>11. Community participation in health planning</td>
<td>41.5 50.6 49.8</td>
</tr>
<tr>
<td>12. Development of community health improvement plan</td>
<td>81.9 86.7 69.7</td>
</tr>
<tr>
<td>13. Resource development &amp; allocation to implement health plan</td>
<td>26.2 37.3 27.8</td>
</tr>
<tr>
<td>14. Policy development to implement health plan</td>
<td>48.6 51.9 49.0</td>
</tr>
<tr>
<td>15. Communication with health-related organizations</td>
<td>78.8 87.2 89.6</td>
</tr>
<tr>
<td>16. Implementation of strategies to enhance access to services</td>
<td>75.6 68.7 60.6</td>
</tr>
<tr>
<td>17. Implementation of legally mandated PH activities</td>
<td>91.4 92.3 89.2</td>
</tr>
<tr>
<td>18. Evaluation of public health programs and services</td>
<td>34.7 37.5 33.2</td>
</tr>
<tr>
<td>19. Evaluation of local public health agency performance</td>
<td>56.3 56.2 55.2</td>
</tr>
<tr>
<td>20. Implementation of quality improvement processes</td>
<td>47.3 50.4 42.7</td>
</tr>
</tbody>
</table>
Delivery of recommended public health activities in U.S. communities

Mays et al. AJPH 2015
Variation in Scope of Public Health Delivery

Delivery of recommended public health activities, 2012

Variation and Change in Delivery
Delivery of recommended public health activities, 2006-12

Mays et al. AJPH 2015
Patterns of interaction in implementing recommended activities
Organizations contributing to local public health production

% Change 2006-2012

-50% -30% -10% 10% 30% 50%

Local health agency
Other local government
State health agency
Other state government
Hospitals
Physician practices
Community health centers
Health insurers
Employers/business
Schools
CBOs

Scope of Production 2012

Bridging capital in public health delivery systems
Trends in betweenness centrality

* Change from prior years is statistically significant at p<0.05
Seven types of public health delivery systems

<table>
<thead>
<tr>
<th>Scope</th>
<th>Centrality</th>
<th>Density</th>
<th>% of communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>High</td>
<td>High</td>
<td>1998</td>
</tr>
<tr>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td>2006</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
<td>Mod</td>
<td>2012</td>
</tr>
<tr>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td></td>
</tr>
</tbody>
</table>

Comprehensive
Conventional
Limited

Source: Mays et al. 2010; 2012
Integrated systems do more with less

Expenditures per capita

Type of delivery system

Comprehensive

Conventional

Limited

Very limited

% of recommended activities performed

Source: Mays et al. 2010; 2012
Integrated systems achieve better health outcomes

Percent Changes in Preventable Mortality Rates Attributable to Delivery System Type

- Cancer deaths/100,000 population
- Heart Disease Deaths/100,000
- Influenza Deaths/100,000
- Infectious Disease Deaths/100,000

Fixed-effects models control for population size, density, age composition, poverty status, racial composition, and physician supply
Integrated systems generate larger health & economic gains in low-resource communities

Impact in Low-Income vs. High Income Communities

Log IV regression estimates controlling for community-level and state-level characteristics

Mays et al. forthcoming 2015
Estimated crowd-out in hospital contributions to public health activities

Note: GLLAMM estimates, holding all other variables constant in the model
2 - Multi-Network Practice and Outcome Variation Examination Study (MPROVE)

6 states → 305 community settings

- Identify implementation measures high-value services:
  - Chronic disease prevention
  - Communicable disease control
  - Environmental health protection

- Create registry of measures: consistent across communities

- Profile geographic variation in the delivery of selected public health services across local communities

- Decompose variation into attributable components:
  - need-sensitive or preference-sensitive factors
  - supply-sensitive factors

- Examine associations between service delivery & outcomes
MPROVE measurement dimensions

- **Availability/Scope:** specific activities produced
- **Volume/Intensity:** Frequency of producing activity over period of time
- **Capacity:** Labor and capital inputs assigned to an activity
- **Reach:** Proportion of target population reached by activity
- **Quality:** timeliness of activity, guideline concordance
- **Efficiency:** resources required to produce given volume of activity
Overall Patterns of Variation in Local Public Health Implementation

Estimates from random effects regression models
Correlates of Variation in Local Public Health Implementation

% of Total Variance

Estimates from state fixed-effects regression models

*p<0.05
Adapt & apply established cost measurement/estimation methodologies to public health settings

Identify the costs of implementing selected high-value public health services

Assess how costs vary across institutional and community settings

Examine the determinants and consequences of variation in the costs of implementation
  - Economies of scale and scope
  - Efficiency & productivity
  - Equity

11 states → 250 community settings
DACS cost estimation methods

- Retrospective “cost accounting” methods
  - Modeling and decomposition using administrative records
  - Surveys with staff and/or administrators

- Concurrent “actual cost” methods (micro-costing)
  - Time studies with staff
  - Activity logs with staff
  - Direct observation

- Prospective “expected cost” methods
  - Vignettes
  - Surveys with staff and/or administrators
  - Delphi group processes
DACS Example: Returns to Scale in Implementing Disease Investigation in Colorado

Atherly et al. University of Colorado and Colorado Public Health PBRN.
http://www.ucdenver.edu/academics/colleges/PublicHealth/research/centers/RMPRC/projects/Pages/COPHPBRN.aspx
4 – Costing Foundational Capabilities

2012 Institute of Medicine Recommendations

- Identify the components and **costs of a minimum package** of public health services
  - Foundational capabilities
  - Basic programs

- Examine variation in costs across community and institutional settings

- Identify population and delivery system attributes that influence costs

Costing Methodology Targets

- Foundational Capabilities (FCs) Costs
  - Health Assessment
  - Emergency Preparedness
  - Communications
  - Policy Development and Support
  - Community Partnership Development
  - Organizational Competencies

- Foundational Program Areas (FA) Costs
  - Communicable Disease Control
  - Chronic Disease & Injury Prevention
  - Environmental Health
  - Maternal and Child Health
  - Access and Linkage to Clinical Care

- Total costs = $\sum FC + \sum FA$
Estimation of “projected” costs from current implementation ratings

A. Cost at current implementation level
B. Projected cost of full implementation
Pilot Estimates: Current and Projected Costs of Foundational Capabilities

**Current**

Mean = 65.036
5% = 52.750
95% = 78.323

**Projected**

Mean = 101.820
5% = 76.750
95% = 127.460
Sampling for national cost estimates

- National stratified, nested sample of state and local jurisdictions
- Selection of 9 states stratified by administrative structure:
  - Centralized: AR, SC
  - Shared: FL, GA, (KY)
  - Decentralized: NY, CA, OH, (WA)
- Selection of 3 local jurisdictions in each state, stratified by population: <50k | 50-299k | >=300k
- Supplement data already collected from KY, WA
- Web-based survey administration with telephone support
Learning from variation: Dissemination & Translation

- Customized reporting of results
- Collaborative interpretation of patterns & determinants
  - Disentangling demand (need) from supply
  - System structure
  - Geospatial
  - Within and across domains of activity: composite measures
- Follow-on studies: qualitative & quantitative
- Many dissemination channels
  - Rapid-cycle journal: www.FrontiersinPHSSR.org
  - Research archive: works.bepress.com/glen_mays
  - Blog: PublicHealthEconomics.org
  - Web: publichealthsystems.org
  - RE-ACT podcast series
  - Annual Keeneland Conference
Public Health PBRNs: mechanisms for research production & translation

- >1900 public health agencies
- 56 universities
- >60 CBOs

- First cohort (December 2008 start-up)
- Second cohort (January 2010 start-up)
- Affiliate/Emerging PBRNs (2011-14)
## PBRNs and Research Translation

### Local Health Departments Engaged in Research Implementation & Translation Activities During Past 12 months

<table>
<thead>
<tr>
<th>Activity</th>
<th>PBRN Agencies Percent/Mean</th>
<th>National Sample Percent/Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying research topics</td>
<td>94.1%</td>
<td>27.5%</td>
</tr>
<tr>
<td>Planning/designing studies</td>
<td>81.6%</td>
<td>15.8%</td>
</tr>
<tr>
<td>Recruitment, data collection &amp; analysis</td>
<td>79.6%</td>
<td>50.3%</td>
</tr>
<tr>
<td>Disseminating study results</td>
<td>84.5%</td>
<td>36.6%</td>
</tr>
<tr>
<td>Applying findings in own organization</td>
<td>87.4%</td>
<td>32.1%</td>
</tr>
<tr>
<td>Helping others apply findings</td>
<td>76.5%</td>
<td>18.0%</td>
</tr>
<tr>
<td>Research implementation composite</td>
<td>84.04 (27.38)</td>
<td>30.20 (31.38)</td>
</tr>
<tr>
<td>N</td>
<td>209</td>
<td>505</td>
</tr>
</tbody>
</table>

Toward a “rapid-learning system” in population health

In a learning health care system, research influences practice and practice influences research.

Evaluate
Collect data and analyze results to show what does and does not work

Adjust
Use evidence to influence continual improvement

Implement
Apply the plan in pilot and control settings

Design
Design care and evaluation based on evidence generated here and elsewhere

Disseminate
Share results to improve care for everyone

Internal and External Scan
Identify problems and potentially innovative solutions

Internal
External

More Information

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