Building the Science of Public Health Delivery: Advances in Public Health Services and Systems Research

Glen Mays, University of Kentucky
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Fundamental health system performance
Geographic variation in population health

Source: Commonwealth Fund 2012
Preventable disease burden and national health spending

>75% of national 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 national health spending is allocated to public health and prevention

CDC 2008 and CMS 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 and injury prevention
- Health education and communication
- 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 roles in assuring access to medical care
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

Mays, Halverson, and Scutchfield. 2003
Why study public health delivery?

“The Committee had hoped to provide specific guidance elaborating on the types and levels of workforce, infrastructure, related resources, and financial investments necessary to ensure the availability of essential public health services to all of the nation’s communities. However, such evidence is limited, and there is no agenda or support for this type of research, despite the critical need for such data to promote and protect the nation’s health.”

—I institute of Medicine, 2003
Fundamental empirical questions

Which programs, interventions, policies, strategies \((\textit{mechanisms})\)….

Work best \((\textit{outcomes})\)…

In which institutional & community settings \((\textit{contexts})\)…

For whom \((\textit{populations and subgroups})\)?
PHSSR’s place in the continuum

Intervention Research

- What works – proof of efficacy
- Controlled trials
- Guide to Community Preventive Services

Services/Systems Research

- How to organize, implement and sustain in the real-world
  - Reach
  - Enforcement/Compliance
  - Quality/Effectiveness
  - Cost/Efficiency
  - Equity/Disparities
- Impact on population health
- Comparative effectiveness & efficiency
Subtitle D—Support for Prevention and Public Health Innovation

Patient Protection and Affordable Care Act of 2010

SEC. 4301. RESEARCH ON OPTIMIZING THE DELIVERY OF PUBLIC HEALTH SERVICES.

(a) IN GENERAL.—The Secretary of Health and Human Services (referred to in this section as the “Secretary”), acting through the Director of the Centers for Disease Control and Prevention, shall provide funding for research in the area of public health services and systems.

(b) REQUIREMENTS OF RESEARCH.—Research supported under this section shall include—

(1) examining evidence-based practices relating to prevention, with a particular focus on high priority areas as identified by the Secretary in the National Prevention Strategy or Healthy People 2020, and including comparing community-based public health interventions in terms of effectiveness and cost;

(2) analyzing the translation of interventions from academic settings to real world settings; and

(3) identifying effective strategies for organizing, financing, or delivering public health services in real world community settings, including comparing State and local health department structures and systems in terms of effectiveness and cost.
Complexity in public health delivery

Public Health System
- Scale of operations
- Scope of activity
- Division of responsibility
- Compatibility of missions
- Participation incentives
- Distribution of effort
- Nature & intensity of relationships
- Strategic Decisions
- Breadth of organizations
- Scope of services
- Staffing levels & mix
- Intergovernmental relationships
- Legal authority
- Funding levels & mix
- Governing structure
- Leadership

Public Health Agency

Decision Support
- Accreditation
- Performance measures
- Practice guidelines

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

Population & Environment
- Needs
- Preferences
- Risks
- Threats
- Resources
- Perceptions

Mays et al 2009
A national research agenda

- Public health system organization and structure
- Public health financing and economics
- Public health workforce
- Public health information and technology

Cross-cutting elements
- Quality
- Law and policy
- Equity and disparities
- Metrics and data
- Analytic methods

http://www.publichealthsystems.org/research-agenda.aspx
Emerging evidence: organization and structure

- Who contributes to public health delivery?
- How are roles and responsibilities divided?
- How and why do delivery systems vary and change over time?
- How do system structures affect public health delivery and outcomes?
Public health delivery systems

National Longitudinal Survey of Public Health Systems

Delivery of recommended public health activities

% of activities

<table>
<thead>
<tr>
<th>Year</th>
<th>Assurance</th>
<th>Policy</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>60%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>2006</td>
<td>70%</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>2012</td>
<td>65%</td>
<td>15%</td>
<td>20%</td>
</tr>
</tbody>
</table>

↑ 10%  ↓ 5%
Organizations engaged in local public health delivery

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

% Change 2006-2012

Scope of Delivery 2012

Changes in health associated with delivery system

Percent Changes in Preventable Mortality Rates by System Typology

- Infant Deaths/1000 Births
- 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.
Economies of scale and scope in public health delivery systems

Source: 2010 NACCHO National Profile of Local Health Departments Survey
Empirical estimates of scale and scope economies

Scale (Population in 1000s)

Quality (Perceived Effectiveness)

Scope (% of Activities)
Simulated Effects of Regionalization

Per Capita Cost

Scope

Quality

Regionalization Thresholds

Percent Change

<25,000

<50,000

<100,000

<150,000
Emerging evidence: finance and economics

- 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?
- What are the opportunities for improving efficiency in public health delivery?
Public health’s share of national health spending

USDHHS National Health Expenditure Accounts

$Billions

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


%NHE

0.00% 0.50% 1.00% 1.50% 2.00% 2.50% 3.00% 3.50%

State and Local

Federal

% of total health spending

USDHHS National Health Expenditure Accounts
Factors driving growth in medical spending

Roehrig et al. Health Affairs 2011
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, 2010

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

NACCHO 2010
Variation in Local Public Health Spending

Gini = 0.485
Changes in Local Public Health Spending 1993-2010

- 62% growth
- 38% decline
Determinants of Local Public Health Spending Levels

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

Mays et al. 2009
Mortality reductions attributable to local public health spending, 1993-2008

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

Mays et al. 2011
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>N</th>
<th>Elasticity</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>One year lag</td>
<td>8532</td>
<td>-0.088</td>
<td>0.013***</td>
</tr>
<tr>
<td>Five year lag</td>
<td>6492</td>
<td>-0.112</td>
<td>0.053**</td>
</tr>
<tr>
<td>Ten year lag</td>
<td>4387</td>
<td>-0.179</td>
<td>0.112</td>
</tr>
</tbody>
</table>

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

*p<0.10     **p<0.05     ***p<0.01
10% increase in public health spending in average community:

- Public health cost: $594,291
- Medical cost offset: -$515,114 (Medicare only)
- LY gained: 148
- Net cost/LY: $534
2012 Institute of Medicine Recommendations

- Double current federal spending on public health
- Allow greater flexibility in how states and localities use federal public health funds
- Identify components and costs of a minimum package of public health services
- Implement national chart of accounts for tracking spending & funds flow
- Expand research on costs and effects of public health delivery

Practice-based research in public health

- Examines the adoption, implementation & impact of public health practices in real-world public health settings.
- Addresses uncertainties and information needs of real-world public health decision-makers.
- Evaluates the implementation and impact of innovations in practice.
- Uses observations generated through public health practice to produce new knowledge (learning systems).
What are Public Health PBRNs?

A collection of *public health agencies* and their *partner organizations* engaged in an ongoing collaboration with an *academic research center* to conduct rigorous, applied studies of strategies for organizing, financing, and/or delivering public health services in *real-world community settings*. 
How can PBRNs help?

- Practice partners to help identify the most pressing questions to answer
- Multiple practice settings for analysis and comparison
- Research partners to help design studies that balance rigor, relevance, feasibility
- Collaborative interpretation of results
- Translating results to timely practice and policy actions
The Robert Wood Johnson Foundation’s Public Health PBRN Program

First cohort (December 2008 start-up)
Second cohort (January 2010 start-up)
Affiliate/Emerging PBRNs

[Map of the United States showing the distribution of the PBRN Program cohorts and affiliate/emerging PBRNs]
## PBRN Performance in Engaging Practice Settings

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><strong>N</strong></td>
<td>209</td>
<td>505</td>
</tr>
</tbody>
</table>
Examples: Economic Shocks and Decisions

- **Washington**: Variation in LHD budget reductions during the 2009-10 economic downturn, and how the reductions have affected service delivery and use of evidence-based practices.

- **Nebraska**: Estimating program-specific workforce shortages.

- **North Carolina**: LHD responses to Medicaid maternity case management funding cut, and impact on service delivery.

- **Connecticut**: Responses to elimination of state subsidies to small LHDs.

- **Ohio**: LHD enforcement of smoke-free workplace act (magnitude & frequency) in response to economic downturn.

- **Wisconsin & Florida**: Changes in LHD spending, funding sources and resource allocation during economic recession.
Examples: Regionalized Service Delivery

- **Massachusetts**: Local variation in decision-making and implementation regarding regional delivery models
- **Connecticut**: How do state-mandated services and funding reductions influence decision-making regarding regional models
- **Colorado**: Impact of state public health law reform on regional approaches to service delivery; variation in local legal instruments and approaches to regionalization
- **Georgia**: Effectiveness of regional district structures as quality improvement collaboratives
- **Wisconsin**: Prevalence and scope of shared service arrangements among local health departments
- **Ohio**: Costs and financial effects of consolidation
Examples: Studying Production Processes

Multi-Network Practice and Outcome Variation (MPROVE) Study, 2012-13

Measures of Interest

- **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**: effectiveness, timeliness, equity of activity
- **Efficiency**: resources required to produce given volume of activity
Examining effects of public health delivery system characteristics on the delivery of evidence-based programs and policies:

- Tobacco
- Diabetes
- Nutrition and physical activity
- Vaccination
- Food safety
- HIV and STI prevention
- Environmental health
Conclusions: getting inside the box

- Engagement of practice and research partners
- Better measures and data sources
- Research designs in real-world settings
- What works best in which settings and why
- Informed public health decisions
- Smarter investments and greater value
For More Information

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