The Science of Public Health Practice: Using PBRNs for Delivery System Research in Public Health Settings

Glen Mays, bepress (DC Admins)
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Missed opportunities in public health practice

Less than 50% of the population at risk is reached by:

- Smoking cessation
- Aspirin use
- Influenza vaccination
- Hypertension control
- Nutrition and physical activity programming
- HIV prevention
- Family planning
- Substance abuse prevention
- Interpersonal violence prevention
- Home visitation for high-risk mothers and infants
Why study public health practice?

“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.”

—Institute of Medicine, 2003
What is Public Health Services & Systems Research?

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
Developmental path for PHSSR

- Measuring practice & performance
- Detecting variation in practice
- Examining determinants of variation
  - Organization
  - Financing
  - Workforce
- Determining consequences of variation
  - Health outcomes
  - Economic outcomes
- Testing strategies to reduce harmful, wasteful, & inequitable variation in practice and outcomes
What is Practice-Based Research in Public Health?

- Research that tests effectiveness & impact of public health practices in real-world *public health settings*
- Research designed to address uncertainties and information needs of real-world public health *decision-makers*
- Research that evaluates the implementation and impact of *innovations in practice*
- Research that uses *observations generated through public health practice* to produce new knowledge
Examples: Adoption of evidence-based practices

Missed Opportunities
Local Health Departments as Providers of Obesity Prevention Programs for Adolescents
Sandy J. Slater, PhD, Lisa M. Powell, PhD, Frank J. Chaloupka, PhD

Percent of local health departments offering evidence-based obesity programs

Slater et al. 2007
Examples: Variation in agency performance

Local Variation In Public Health Preparedness: Lessons From California

Even in California—one of the best-prepared states—much work remains to ensure preparedness for a public health emergency.

by Nicole Lurie, Jeffrey Wasserman, Michael Stoto, Sarah Myers, Poki Narmkung, Jonathan Fielding, and Robert Burciaga Valdez

EXHIBIT 1
Characteristics Of Local Public Health Agencies (LPHAs) Participating In Test Of Response To Case Reports, 2004

<table>
<thead>
<tr>
<th>LPHA</th>
<th>Region</th>
<th>Population served</th>
<th>Urban/rural</th>
<th>Mean time until calls returned (minutes)</th>
<th>Longest period before calls returned (minutes)</th>
<th>Number of calls not returned</th>
<th>Percent “warm transfers”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Midwest</td>
<td>Small</td>
<td>Rural</td>
<td>93</td>
<td>630</td>
<td>2</td>
<td>44</td>
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<tr>
<td>2</td>
<td>Midwest</td>
<td>Medium</td>
<td>Rural</td>
<td>51</td>
<td>350</td>
<td>1</td>
<td>57</td>
</tr>
<tr>
<td>3</td>
<td>Midwest</td>
<td>Medium</td>
<td>Urban</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>88</td>
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<tr>
<td>4</td>
<td>Midwest</td>
<td>Large</td>
<td>Urban</td>
<td>14</td>
<td>30</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Midwest</td>
<td>Large</td>
<td>Urban</td>
<td>10</td>
<td>23</td>
<td>0</td>
<td>38</td>
</tr>
</tbody>
</table>

Lurie et al. 2004
Examples: Variation in agency practice

Mixed Results In Tracking Food Scares

Minnesota health officials investigate all reports of food-borne illness, but officials in many states do not. From 1990 to 2006, Minnesota reported 548 outbreaks, while Kentucky reported 18.

Reported outbreaks of food-related illness
Per 100,000 people, 1990 to 2006

Source: Centers for Disease Control and Prevention
Fundamental empirical questions

- Which programs, interventions, policies (*mechanisms*)…

- Work best (*outcomes*)…

- In which institutional & community settings (*contexts*)…

- For which populations (*equity/heterogeneity*)…

- And why?

Pawson and Tilley 1997; Berwick 2008
Variation in Local Public Health Spending

Gini = 0.472

“Local spending varies by a factor of 13 between the top 20% and bottom 20% of communities, even after adjusting for differences in demographics, SES, and service mix.”

Mays et al. 2009
Changes in Local Public Health Spending 1993-2008

- 62% growth
- 38% decline
Drivers of geographic variation in public health spending

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

Mays et al. 2009
Mortality reductions associated with changes in public health spending

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

Mays et al. 2011
Public health spending and medical spending

Quintiles of public health spending/capita

Mays et al. 2009
Effects of public health spending on medical care spending 1993-2008

Change in Medical Care Spending Per Capita Attributable to 10% Increase in Public Health Spending Per Capita

<table>
<thead>
<tr>
<th>Model</th>
<th>Elasticity</th>
<th>Std. Error</th>
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</thead>
<tbody>
<tr>
<td>Fixed effects</td>
<td>-0.10</td>
<td>0.02 **</td>
</tr>
<tr>
<td>Instrumental variables</td>
<td>-0.88</td>
<td>0.13 **</td>
</tr>
</tbody>
</table>

Semi-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

- $15B in new public health spending over 10 years:

  Deaths averted: 255,000 – 437,000

  Medical cost offset: $2.2B – $6.9B

  Cost/life-year gained $9,800 – $22,400
The Logic of Public Health PBRNs

1. Identify Common questions of interest
2. Research partner
3. Engaged practice settings
4. Data exchange
5. Analysis & interpretation
6. Translation & application
7. Apply Rigorous research methods
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 showing the geographical distribution of the Public Health PBRN Program, with states shaded in green, yellow, or blue to indicate the cohort they belong to, and the National Coordinating Center highlighted.

National Coordinating Center
Key elements of a Public Health PBRN

- State or local agency to serve as convener
- Multiple practice settings available for study
- Champion within each practice site
- Research partner with design and analysis expertise
- Regular communication among participants
- Feasible and relevant initial research projects
## Composition of Public Health PBRNs

<table>
<thead>
<tr>
<th>Network</th>
<th>State Agencies</th>
<th>Local Agencies*</th>
<th>Academic Units</th>
<th>Other</th>
<th>Total</th>
<th>Lead Institution</th>
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</thead>
<tbody>
<tr>
<td>I. Supported Networks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>CO</td>
<td>1</td>
<td>55</td>
<td>2</td>
<td>15</td>
<td>73</td>
<td>Association</td>
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<td>CT</td>
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<td>FL</td>
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<td>67</td>
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<td>3</td>
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<td>Local agency</td>
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<td>17</td>
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<td>1</td>
<td>20</td>
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<td>MN</td>
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<td>75</td>
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<td>1</td>
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<td>1</td>
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<tr>
<td>NE</td>
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<td>12</td>
<td>1</td>
<td>2</td>
<td>17</td>
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<td>56</td>
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<td>OH</td>
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<td>115</td>
<td>6</td>
<td>3</td>
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<tr>
<td>WA</td>
<td>1</td>
<td>36</td>
<td>2</td>
<td>1</td>
<td>40</td>
<td>Local agency</td>
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<td>WI</td>
<td>1</td>
<td>42</td>
<td>3</td>
<td>2</td>
<td>48</td>
<td>Association</td>
</tr>
<tr>
<td>II. Affiliate Networks with Funded Projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td>1</td>
<td>118</td>
<td>1</td>
<td>6</td>
<td>126</td>
<td>Academic</td>
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<tr>
<td>MO</td>
<td>1</td>
<td>115</td>
<td>3</td>
<td>1</td>
<td>120</td>
<td>Association</td>
</tr>
<tr>
<td>NJ</td>
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<td>100</td>
<td>2</td>
<td>1</td>
<td>104</td>
<td>Academic</td>
</tr>
<tr>
<td>TN</td>
<td>1</td>
<td>16</td>
<td>2</td>
<td>1</td>
<td>20</td>
<td>Academic</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>926</td>
<td>35</td>
<td>47</td>
<td>1028</td>
<td></td>
</tr>
</tbody>
</table>
Examples: Studying PBRNs as Mechanisms

Types of Public Health PBRN Participants

- Academic Institution: 27%
- Local government agency: 48%
- State government agency: 11%
- Other: 6%
- Professional association: 7%
- Federal agency: 1%
Roles played by participants in PBRN activities

- Identifying research topics/ideas
- Designing/planning studies
- Seeking funding for studies
- Implementing research studies
- Disseminating findings
- Applying findings within own organization
- Helping others apply findings

* indicates p<0.05
Examples: Studying PBRNs as Mechanisms

Benefits of PBRN participation

- Steer research to relevant questions
- Help others improve practice
- Raise stature of profession
- Motivate staff to improve
- Identify innovations in practice
- Compete for practice funding
- Compete for research funding
- Networking
- Demonstrate accountability
- Raise awareness about practice
- Improve practice
- Learning about research funding
- Learning about PHSSR
- Learning about PBRNs

Percentage of respondents:
- None
- Minimal
- Moderate
- Very
- Highest
Examples: Studying PBRNs as Mechanisms

- Baseline network analysis with 5 cohort I PBRNs to examine network structures for evidence production and translation
Examples: Studying PBRNs as Mechanisms

Network Structures Associated with Perceived Benefits

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Coeff.</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network density</td>
<td>0.341</td>
<td>0.112 **</td>
</tr>
<tr>
<td>Network centrality</td>
<td>-0.521</td>
<td>0.227 **</td>
</tr>
<tr>
<td>History of collaboration</td>
<td>0.148</td>
<td>0.108</td>
</tr>
<tr>
<td>Practice orientation</td>
<td>0.283</td>
<td>0.144 *</td>
</tr>
</tbody>
</table>

Estimates from ordered logit model controlling for PBRN random effects  **p<0.05     *p<0.10
**PBRN Research Projects**

- **Initial Projects**: Small-scale “proof-of-concept” studies conducted during initial 2 years of network development
- **Research Implementation Awards**: Larger-scale research projects of 18-24 months
- **Quick Strike Research Projects**: Time-sensitive, short-term research projects to study emerging issues in practice
**Examples: Obesity prevention practices in CO**

- **Question of interest:** How does the public health delivery system influence adoption and implementation of evidence-based strategies to promote healthy eating and active living through the LiveWell Colorado initiative?

- **Practice settings:** 25 local communities in CO

- **Factors examined:**
  - Use of local data
  - Adherence to evidence-based strategies
  - Success strategies measured in RE-AIM
  - Network characteristics associated with success

- **Study design:** observational practice variation study, mixed-method
Examples: Communicable disease protection in MA

- **Question of interest:** How does the public health delivery system influence adoption and implementation of evidence-based strategies for food safety and infectious disease investigation?

- **Practice settings:** 351 municipalities in MA

- **Factors examined:**
  - Adherence to consensus practices
  - Timeliness of investigation
  - Role of staffing, funding, IT, and partnerships

- **Study design:** observational practice variation study, mixed-method
Examples: Diabetes prevention in KY

- **Question of interest:** How does the public health delivery system influence adoption and implementation of evidence-based self-management strategies for diabetes?

- **Practice settings:** 6 health department jurisdictions serving 30 counties

- **Factors examined:**
  - Adherence to EBPs
  - RE-AIM measures of success
  - Strength of collaboration

- **Study design:** pre-post design with QI intervention
Two dominant themes in PBRN research: evidence-based management

- How best to prioritize and allocate resources in response to economic shocks
- What regionalized service delivery models produce gains in capacity, efficiency, effectiveness
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.

- **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

- **Nebraska:** How do organizational design and workforce issues affect implementation of regional health department 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
Examples: Studying Production Processes
Estimating the Production Functions for Public Health Services

- **Production studies**: Research on production processes for physician services, hospital services, and other medical providers have been conducted since the late 1960s.

- **Public health management issues to be addressed**:
  - Resources and staffing needed to produce a given bundle of public health activities
  - Efficiency and productivity metrics
  - Defining public health underserved areas
  - Forecasting future workforce needs
  - Estimating returns to regionalization, economies of scale, volume-outcome relationships
Examples: Studying Production Processes

Estimating the Production Functions for Public Health Services

Types of Output 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**: appropriateness, effectiveness, equity of activity
- **Efficiency**: resources required to produce given volume of activity
Implications and Next Steps

- Public health PBRNs can serve as effective mechanisms for implementing and disseminating research in public health settings.

- The structure of PBRN networks may shape the distribution of benefits and costs of research participation.

- Practice partners who are more marginal in their PBRN networks appear to benefit most.

- For sustainability, PBRNs must ensure that practice partners realize tangible benefits from research participation:
  - Decision support
  - Accreditation
  - Quality improvement
  - Efficiency
Conclusions: getting inside the box

- Engagement of practice and research partners
- Sensitive and specific measures
- 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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