Evolution in Public Health Systems and their Contributions to Population Health

Glen P. Mays, University of Kentucky

Available at: https://works.bepress.com/glen_mays/301/
Evolution in Public Health Systems and their Contributions to Population Health

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Systems for Action
National Coordinating Center
Systems and Services Research to Build a Culture of Health
Ripped from the headlines

U.S. LIFE EXPECTANCY FALLS

<table>
<thead>
<tr>
<th>Both sexes</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>78.8</td>
<td>81.2</td>
</tr>
<tr>
<td>2014</td>
<td>78.9</td>
<td>81.3</td>
</tr>
<tr>
<td>2015</td>
<td>76.3</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>76.5</td>
<td></td>
</tr>
</tbody>
</table>

SOURCE CDC
Jim Sergent, USA TODAY

Published December 8, 2016
Losing ground in population health

Mortality rates, 45 to 54 age group, per 100,000 people

- U.S. white
- France
- Germany
- U.K.
- U.S. Hispanic
- Canada
- Australia
- Sweden

Mortality by cause for white non-Hispanics, 45 to 54 age group, per 100,000 people

- Drug/alcohol overdoses
- Lung cancer
- Suicides
- Chronic liver diseases
- Diabetes

Case A, Deaton A. Proceedings of the National Academy of Sciences 2015
But poor health is not uniformly poor among the poor

Chetty et al.  JAMA 2016
Multiple systems & sectors drive health...

Proportional Contribution to Premature Death

- Genetic predisposition: 30%
- Behavioral patterns: 40%
- Social circumstances: 15%
- Environmental exposure: 5%
- Health care: 10%

...But existing systems often fail to connect

**Medical Care** ↔ **Social Services & Supports** ↔ **Public Health**

- Fragmentation
- Duplication
- Variability in practice
- Limited accessibility
- Episodic and reactive care
- Insensitivity to consumer values & preferences
- Limited targeting of resources to community needs

- Fragmentation
- Variability in practice
- Resource constrained
- Limited reach
- Insufficient scale
- Limited public visibility & understanding
- Limited evidence base
- Slow to innovate & adapt

**Waste & inefficiency**

**Inequitable outcomes**

**Limited population health impact**
Challenge: overcoming collective action problems across systems & sectors

- Incentive compatibility → public goods
- Concentrated costs & diffuse benefits
- Time lags: costs vs. improvements
- Uncertainties about what works
- Asymmetry in information
- Difficulties measuring progress
- Weak and variable institutions & infrastructure
- Imbalance: resources vs. needs
- Stability & sustainability of funding

Ostrom E. 1994
How do we support effective population health improvement strategies?

- Designed to achieve large-scale health improvement: neighborhood, city/county, region
- Target fundamental and often multiple determinants of health
- Mobilize the collective actions of multiple stakeholders in government & private sector
  - Infrastructure
  - Information
  - Incentives

Public health provides the catalytic functions to fuel multi-sector actions in health

Engage stakeholders

Assess needs & risks

Identify evidence-based actions

Develop shared priorities & plans

Commit shared resources & responsibilities

Coordinate Implementation

Monitor, evaluate, feed back

Foundational Capabilities

Guided by Culture of Health Action Framework

Comprehensive Public Health Systems
One of RWJF’s Culture of Health National Metrics

- Implement a **broad scope** of population health activities
- Through **dense networks** of multi-sector relationships
- Including **central actors** to coordinate actions

Access to public health

Overall, 47.2 percent of the population is covered by a comprehensive public health system. Individuals are more likely to have access if they are non-White (51.5 percent vs. 45.5 percent White) or live in a metropolitan area (48.7 percent vs. 34.1 percent in nonmetropolitan areas).

What do we know about multi-sector work in population health?

National Longitudinal Survey of Public Health Systems

- Cohort of 360 communities with at least 100,000 residents
- Local public health officials report:
  - **Scope**: availability of 20 recommended population health activities
  - **Network**: organizations contributing to each activity
  - **Centrality of effort**: contributed by governmental public health agency
  - **Quality**: perceived effectiveness of each activity

** Expanded sample of 500 communities<100,000 added in 2014 wave
Variation in implementing foundational public health activities

National Longitudinal Survey of Public Health Systems

Percent of activities performed

Percent of U.S. communities
## Implementation of public health activities, 1998-2014

<table>
<thead>
<tr>
<th>Activity</th>
<th>1998</th>
<th>2014</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Conduct periodic assessment of community health status and needs</td>
<td>71.5%</td>
<td>87.1%</td>
<td>21.8%</td>
</tr>
<tr>
<td>2. Survey community for behavioral risk factors</td>
<td>45.8%</td>
<td>71.1%</td>
<td>55.2%</td>
</tr>
<tr>
<td>3. Investigate adverse health events, outbreaks and hazards</td>
<td>98.6%</td>
<td>100.0%</td>
<td>1.4%</td>
</tr>
<tr>
<td>4. Conduct laboratory testing to identify health hazards and risks</td>
<td>96.3%</td>
<td>96.1%</td>
<td>-0.2%</td>
</tr>
<tr>
<td>5. Analyze data on community health status and health determinants</td>
<td>61.3%</td>
<td>72.7%</td>
<td>18.6%</td>
</tr>
<tr>
<td>6. Analyze data on preventive services use</td>
<td>28.4%</td>
<td>39.0%</td>
<td>37.3%</td>
</tr>
<tr>
<td>7. Routinely provide community health information to elected officials</td>
<td>80.9%</td>
<td>84.0%</td>
<td>3.8%</td>
</tr>
<tr>
<td>8. Routinely provide community health information to the public</td>
<td>75.4%</td>
<td>82.3%</td>
<td>9.1%</td>
</tr>
<tr>
<td>9. Routinely provide community health information to the media</td>
<td>75.2%</td>
<td>89.0%</td>
<td>18.3%</td>
</tr>
<tr>
<td>10. Prioritize community health needs</td>
<td>66.1%</td>
<td>83.6%</td>
<td>26.5%</td>
</tr>
<tr>
<td>11. Engage community stakeholders in health improvement planning</td>
<td>41.5%</td>
<td>68.8%</td>
<td>65.7%</td>
</tr>
<tr>
<td>12. Develop a community-wide health improvement plan</td>
<td>81.9%</td>
<td>87.9%</td>
<td>7.3%</td>
</tr>
<tr>
<td>13. Identify and allocate resources based on community health plan</td>
<td>26.2%</td>
<td>41.9%</td>
<td>59.9%</td>
</tr>
<tr>
<td>14. Develop policies to address priorities in community health plan</td>
<td>48.6%</td>
<td>56.8%</td>
<td>16.9%</td>
</tr>
<tr>
<td>15. Maintain a communication network among health-related organizations</td>
<td>78.8%</td>
<td>85.3%</td>
<td>8.2%</td>
</tr>
<tr>
<td>16. Link people to needed health and social services</td>
<td>75.6%</td>
<td>50.0%</td>
<td>-33.8%</td>
</tr>
<tr>
<td>17. Implement legally mandated public health activities</td>
<td>91.4%</td>
<td>92.4%</td>
<td>1.1%</td>
</tr>
<tr>
<td>18. Evaluate health programs and services in the community</td>
<td>34.7%</td>
<td>37.9%</td>
<td>9.4%</td>
</tr>
<tr>
<td>19. Evaluate local public health agency capacity and performance</td>
<td>56.3%</td>
<td>56.1%</td>
<td>-0.3%</td>
</tr>
<tr>
<td>20. Monitor and improve implementation of health programs and policies</td>
<td>47.3%</td>
<td>46.4%</td>
<td>-1.9%</td>
</tr>
</tbody>
</table>

Mean performance of assessment activities (#1-6)                          | 67.0%  | 77.7%  | 15.9%    |
Mean performance of policy and planning activities (#7-15)                | 63.9%  | 75.5%  | 18.3%    |
Mean performance of implementation and assurance activities (#16-20)     | 61.1%  | 56.6%  | -7.3%    |
Mean performance of all activities                                        | 63.8%  | 67.6%  | 6.0%     |
# Organizational contributions to public health activities, 1998-2014

<table>
<thead>
<tr>
<th>Type of Organization</th>
<th>1998</th>
<th>2014</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local public health agencies</td>
<td>60.7%</td>
<td>67.5%</td>
<td>11.1%</td>
</tr>
<tr>
<td>Other local government agencies</td>
<td>31.8%</td>
<td>33.2%</td>
<td>4.4%</td>
</tr>
<tr>
<td>State public health agencies</td>
<td>46.0%</td>
<td>34.3%</td>
<td>-25.4%</td>
</tr>
<tr>
<td>Other state government agencies</td>
<td>17.2%</td>
<td>12.3%</td>
<td>-28.8%</td>
</tr>
<tr>
<td>Federal government agencies</td>
<td>7.0%</td>
<td>7.2%</td>
<td>3.7%</td>
</tr>
<tr>
<td>Hospitals</td>
<td>37.3%</td>
<td>46.6%</td>
<td>24.7%</td>
</tr>
<tr>
<td>Physician practices</td>
<td>20.2%</td>
<td>18.0%</td>
<td>-10.6%</td>
</tr>
<tr>
<td>Community health centers</td>
<td>12.4%</td>
<td>29.0%</td>
<td>134.6%</td>
</tr>
<tr>
<td>Health insurers</td>
<td>8.6%</td>
<td>10.6%</td>
<td>23.0%</td>
</tr>
<tr>
<td>Employers/businesses</td>
<td>16.9%</td>
<td>15.3%</td>
<td>-9.6%</td>
</tr>
<tr>
<td>Schools</td>
<td>30.7%</td>
<td>25.2%</td>
<td>-17.9%</td>
</tr>
<tr>
<td>Universities/colleges</td>
<td>15.6%</td>
<td>22.6%</td>
<td>44.7%</td>
</tr>
<tr>
<td>Faith-based organizations</td>
<td>19.2%</td>
<td>17.5%</td>
<td>-9.1%</td>
</tr>
<tr>
<td>Other nonprofit organizations</td>
<td>31.9%</td>
<td>32.5%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Other</td>
<td>8.5%</td>
<td>5.2%</td>
<td>-38.4%</td>
</tr>
</tbody>
</table>
Mapping who contributes to public health

Node size = degree centrality
Line size = % activities jointly contributed (tie strength)

Network density and scope of activities

Density of Contributing Organizations

Proportion of Activities Contributed

Comprehensive Systems

1998 2014
Classifying multi-sector delivery systems for public health 1998-2014

Scope
Centrality
Density

Comprehensive (High System Capital)

Conventional

Limited

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster 1</td>
<td>High</td>
<td>Mod</td>
<td>Mod</td>
<td>High</td>
</tr>
<tr>
<td>Cluster 2</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Cluster 3</td>
<td>High</td>
<td>High</td>
<td>Mod</td>
<td>High</td>
</tr>
<tr>
<td>Cluster 4</td>
<td>Mod</td>
<td>Mod</td>
<td>Mod</td>
<td>Low</td>
</tr>
<tr>
<td>Cluster 5</td>
<td>Mod</td>
<td>Mod</td>
<td>Mod</td>
<td>Mod</td>
</tr>
<tr>
<td>Cluster 6</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Cluster 7</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Mod</td>
</tr>
</tbody>
</table>
## Changes in system prevalence and coverage

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comprehensive systems</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of communities</td>
<td>24.2%</td>
<td>36.9%</td>
<td>31.1%</td>
<td>32.7%</td>
<td>25.7%</td>
</tr>
<tr>
<td>% of population</td>
<td>25.0%</td>
<td>50.8%</td>
<td>47.7%</td>
<td>47.2%</td>
<td>36.6%</td>
</tr>
<tr>
<td><strong>Conventional systems</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of communities</td>
<td>50.1%</td>
<td>33.9%</td>
<td>49.0%</td>
<td>40.1%</td>
<td>57.6%</td>
</tr>
<tr>
<td>% of population</td>
<td>46.9%</td>
<td>25.8%</td>
<td>36.3%</td>
<td>32.5%</td>
<td>47.3%</td>
</tr>
<tr>
<td><strong>Limited systems</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of communities</td>
<td>25.6%</td>
<td>29.2%</td>
<td>19.9%</td>
<td>20.6%</td>
<td>16.7%</td>
</tr>
<tr>
<td>% of population</td>
<td>28.1%</td>
<td>23.4%</td>
<td>16.0%</td>
<td>19.6%</td>
<td>16.1%</td>
</tr>
</tbody>
</table>

Equity in public health delivery systems

Delivery of recommended activities

<table>
<thead>
<tr>
<th>Quintiles of communities</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of recommended activities performed in 2014</td>
<td>40%</td>
<td>50%</td>
<td>60%</td>
<td>80%</td>
<td>100%</td>
</tr>
<tr>
<td>∆ 2006-14</td>
<td>-40%</td>
<td>-20%</td>
<td>0%</td>
<td>20%</td>
<td>40%</td>
</tr>
</tbody>
</table>

Changes in organizational centrality by ACA Medicaid expansion status, 2012-2014

- Local public health
- Other local agencies
- State agencies
- Federal agencies
- Physicians
- Hospitals
- CHCs
- Nonprofits
- Insurers
- Schools
- Higher ed
- FBOs
- Employers
- Other

* p<0.05
Health effects attributable to multi-sector work

Impact of Comprehensive Systems on Mortality, 1998-2014

Fixed-effects instrumental variables estimates controlling for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects. N=1019 community-years
Economic effects attributable to multi-sector work

Impact of Comprehensive Systems on Medical Spending (Medicare) 1998-2014

Models also control for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects. N=1019 community-years. Vertical lines are 95% confidence intervals.
Economic effects attributable to multi-sector work

Impact of Comprehensive Systems on Life Expectancy by Income (Chetty), 2001-2014

Models also control for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects. N=1019 community-years. Vertical lines are 95% confidence intervals.
Making the case for equity: larger gains in low-resource communities

Effects of Comprehensive Population Health Systems in Low-Income vs. High-Income Communities

Log IV regression estimates controlling for community-level and state-level characteristics
Comprehensive systems do more with less

Type of delivery system

Local PH Expenditures per capita

- Comprehensive
- Conventional
- Limited
- Very limited

Expenditures per capita

Recommended activities performed

% of recommended activities performed

$0

$10

$20

$30

$40

$50

$60

$70

$80

90%

80%

70%

60%

50%

40%

30%

20%

10%

0%
Toward a deeper understanding of implementation costs in public health

2012 Institute of Medicine Recommendations

- Identify the components and **costs of a minimum package** of public health services
  - Foundational capabilities
  - Basic programs
- Implement a **national chart of accounts** for tracking spending and flow of funds
- Expand **research on costs and effects** of public health delivery

How much do foundational capabilities cost?

A. Cost at current attainment level
B. Projected cost of full attainment
C. Unmet resource gap

https://works.bepress.com/glen_mays/270/
How much do foundational capabilities cost?

<table>
<thead>
<tr>
<th>FPHS Domain</th>
<th>Current Resource Use</th>
<th>Expected Costs of Full Attainment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>5th</td>
</tr>
<tr>
<td><strong>Foundational Capabilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment</td>
<td>1.70</td>
<td>0.45</td>
</tr>
<tr>
<td>Emergency Preparedness</td>
<td>2.57</td>
<td>0.66</td>
</tr>
<tr>
<td>Communication</td>
<td>0.63</td>
<td>0.02</td>
</tr>
<tr>
<td>Policy Development</td>
<td>1.52</td>
<td>0.35</td>
</tr>
<tr>
<td>Community Partnerships</td>
<td>2.22</td>
<td>0.52</td>
</tr>
<tr>
<td>Org. Competencies</td>
<td>9.82</td>
<td>4.38</td>
</tr>
<tr>
<td>Total Foundational Capabilities</td>
<td>18.46</td>
<td>11.99</td>
</tr>
<tr>
<td><strong>Foundational Areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicable Disease</td>
<td>3.40</td>
<td>1.11</td>
</tr>
<tr>
<td>Chronic Disease/Injury Prevention</td>
<td>3.30</td>
<td>0.85</td>
</tr>
<tr>
<td>Environmental/Occupational Health</td>
<td>7.49</td>
<td>2.92</td>
</tr>
<tr>
<td>Maternal Child Health</td>
<td>10.93</td>
<td>3.03</td>
</tr>
<tr>
<td>Access/Linkage to Clinical Care</td>
<td>4.56</td>
<td>1.10</td>
</tr>
<tr>
<td>Total Foundational Areas</td>
<td>29.68</td>
<td>18.84</td>
</tr>
<tr>
<td><strong>TOTAL FPHS</strong></td>
<td>48.14</td>
<td>35.32</td>
</tr>
</tbody>
</table>

https://works.bepress.com/glen_mays/270/
Estimating ROI

Establishing strong PH systems across the U.S.:

- Produce 1.5M additional life-years
- Require $10.9B in additional spending
- Cost $7335 per life-year gained
- Offset by reductions in medical care spending
  - 1.6 percentage point reduction in hospital uncompensated care costs = $2B in offsets

https://works.bepress.com/glen_mays/270/
## Getting to sustainable financing

<table>
<thead>
<tr>
<th>Structural element</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Strong multi-sector governance model</td>
<td>Do I have a seat at the table?</td>
</tr>
<tr>
<td>2. Clear goals, activities, division of responsibility</td>
<td>What are we buying?</td>
</tr>
<tr>
<td>3. Clarity on implementation costs</td>
<td>What is the investment?</td>
</tr>
<tr>
<td>4. Credible estimates of health &amp; economic outcomes</td>
<td>What are the returns?</td>
</tr>
<tr>
<td>5. Robust evaluation and monitoring systems</td>
<td>How will we know success?</td>
</tr>
</tbody>
</table>

**Willingness to Pay**
Financing sources & models

- Dedicated state and local government allocations
- Medicaid administrative match/claiming
- Hospital community benefit allocations
- AHC/ACO shared savings models
- Community health trusts
- Public/private joint ventures
Conclusions: What we know and still need to learn

- Large potential benefits of system integration
- Inequities in integration are real & problematic
- Integration requires support
  - Infrastructure
  - Institutions
  - Incentives
- Sustainability and resiliency are not automatic
Finding the connections

- Act on aligned incentives
- Exploit the disruptive policy environment
- Innovate, prototype, study – then scale
- Pay careful attention to shared governance, decision-making, and financing structures
- Demonstrate value and accountability to the public
New research program focuses on delivery and financing system alignment

http://www.systemsforaction.org
For More Information

Systems for Action
National Coordinating Center
Systems and Services Research to Build a Culture of Health

Supported by The Robert Wood Johnson Foundation

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