Defragmenting Delivery Systems that Drive Population Health

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Available at: https://works.bepress.com/glen_mays/318/
Defragmenting Delivery Systems that Drive Population Health

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

systemsforaction.org
Systems that drive health 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
Systems for Action: test **novel mechanisms** for aligning systems and services across sectors

- Innovative alliances and partnerships
- Inter-governmental and public-private ventures
- New financing and payment arrangements
- Incentives for individuals, organizations & communities
- Governance and decision-making structures
- Information exchange and decision support
- New technology: m-health, tele-health
- Community engagement, public values and preferences
- Innovative workforce and staffing models
- Cross-sector planning and priority-setting
Collaborating Research Centers

- **University of Chicago:** Randomized trial of a Comprehensive Care, Community and Culture program
- **Arizona State University:** Analysis of medical, mental health, and criminal justice system interactions for persons with behavioral health disorders
- **IUPUI:** Evaluating integration and decision support strategies for a community-based safety net health care and public health system
- **University of Kentucky:** Measuring multi-sector contributions to public health services and population health outcomes.
Individual Research Projects

- **Michigan State/University of Texas San Antonio:** Randomized trial of community complex care response teams to improve geriatric public health outcomes

- **Los Angeles Department of Health:** Housing for Health: estimating cross-sector impacts of providing permanent supportive housing to homeless high utilizers of health care services

- **University of Delaware:** Randomized trial of a multi-agency health and human services team for Delaware's probation population

- **Drexel University:** Impact of integrating behavioral health with income and employment support to build a culture of health across two-generations
Rural-Urban Differences in the Strength of Community Networks for Population Health Improvement

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systemsforaction.org
Income, geography and population health

Chetty et al.  JAMA 2016
How do we support effective population health improvement strategies?

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

...But existing systems often fail to connect

**Medical Care**
- Fragmentation
- Duplication
- Variability in practice
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**Social Services & Supports**
- Fragmentation
- Variability in practice
- Resource constrained
- Limited reach
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**Public Health**
- Fragmentation
- 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 in public health

- 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
Widely recommended activities to support multi-sector initiatives in population health

Engage stakeholders

Assess needs & risks

Prioritize & recommend actions

Develop plans & policies

Mobilize multi-sector implementation

Monitor, evaluate, feed back

Foundational Capabilities

Questions of interest

- How strong are the delivery systems that support public health activities?
- How do these delivery systems change over time?
- How do these delivery systems relate to income and geographic disparities in population health?
A useful lens for studying multi-sector work

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
Chetty’s data: life expectancy by income

- **Income data**: federal tax records for every filer for every year 1999-2014 (pre-tax household earnings): 1.4B person-years
- **Mortality data**: SSA death records: 6.8M deaths
- **Period life expectancy**: estimated conditional on income percentile at 40 years of age
- **Geography**: Life expectancy by income quartile estimated for counties (n>3000) and for commuting zones (n=741) by year
- **Time**: annual estimates for 2001-14
Other data linkages

- **Area Health Resource File**: health resources, demographics, socioeconomic status, insurance coverage
- **NACCHO Profile data**: public health agency institutional and financial characteristics
- **CMS Impact File & Cost Report**: hospital ownership, market share, uncompensated care
- **Dartmouth Atlas**: Area-level medical spending (Medicare)
- **CDC Compressed Mortality File**: Cause-specific death rates by county
Analytical approach: IV estimation

- Identify exogenous sources of variation in system strength that are unrelated to outcomes
  - Governance structures: local boards of health
  - Decision-making authority: agency, board, local, state

- Controls for unmeasured factors that jointly influence systems and outcomes
Analytical approach: IV estimation

- Panel regression estimation with fixed and random effects to account for repeated measures and clustering of public health jurisdictions within states
- Two-stage IV model to estimate effect of system changes on life expectancy by income quartile (residual inclusion method)

\[
\text{Prob}(\text{System}_{ijt} = \text{Comprehensive}) = f(\text{Governance}, \text{Agency}, \text{Community})_{ijt} + \text{State}_j + \text{Year}_t
\]

\[
E(\text{Outcome}_{ijt}) = f(\text{System} + \text{resid}, \text{Agency}, \text{Community})_{ijt} + \text{State}_j + \text{Year}_t + \varepsilon_{ijt}
\]

All models control for type of jurisdiction, population size and density, metropolitan area designation, income per capita, unemployment, poverty rate, racial composition, age distribution, physician and hospital availability, insurance coverage, and state and year fixed effects. \(N=1019\) community-years
Variation in implementing population health activities

National Longitudinal Survey of Public Health Systems 2014

Percent of activities performed

Percent of U.S. communities

0 5% 10%

20% 40% 60% 80% 100%

Motivation  Approach  Results  Discussion
# Implementation of population health activities, 1998-2016

<table>
<thead>
<tr>
<th>Activity</th>
<th>1998</th>
<th>2016</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% to 77.7% (15.9%)
Mean performance of policy and planning activities (#7-15): 63.9% to 75.5% (18.3%)
Mean performance of implementation and assurance activities (#16-20): 61.1% to 56.6% (-7.3%)
Mean performance of all activities: 63.8% to 67.6% (6.0%)
Mapping who contributes to population health

Node size = degree centrality

Line size = % activities jointly contributed (tie strength)

Composite measure of system strength

Comprehensive System Capital

Mays GP et al. Health Affairs 2016
Comprehensive Systems
One of RWJF’s Culture of Health National Metrics

- **Broad scope** of population health activities
- **Dense network** of multi-sector relationships
- **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).

47.2% of population served by a comprehensive public health system

## Organizational contributions to foundational activities, 1998-2016

<table>
<thead>
<tr>
<th>Type of Organization</th>
<th>1998</th>
<th>2016</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>
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

Mays GP et al. Health Affairs 2016
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

Mays GP et al. Health Services Research 2017
Economic effects attributable to multi-sector work

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

<table>
<thead>
<tr>
<th>Bottom Quartile</th>
<th>Top Quartile</th>
<th>Difference</th>
</tr>
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<tbody>
<tr>
<td></td>
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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.
Rural-urban differences in comprehensive system capital
Rural-urban differences in comprehensive system capital

Differences in system capital may explain:

- 22-37% of the rural-urban disparity in mortality
- 1.1-1.7 years of the 3.2 year rural-urban disparity in life expectancy
Conclusions and implications

- Large health gains in places with strong system capital
- Larger gains for low-income populations
- Comprehensive systems do more than just plan: prioritize, invest, evaluate, repeat (crowd-sourcing)
- Equity and opportunity: more than half of communities currently lack comprehensive system capital
- ACA incentives and resources may help:
  - Hospital community benefit
  - Value-based health care payments
  - Insurer and employer incentives
- Sustainability and resiliency are not automatic
Ongoing work

- Robustness to alternative specifications
- Lagged and cumulative effects
- Trajectories of system strength over time
- Proximal outcomes
- Value-added of specific combinations of activities and organizations
For More Information

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Supported by The Robert Wood Johnson Foundation

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