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Changes in Public Health System Capital and Long-Run Health and Economic Outcomes: 1998 to 2014

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Rationale and Research Aims

The Affordable Care Act has created new resources and incentives for hospitals, insurers, public health agencies, and others to contribute to disease prevention and health promotion activities. These policies may shift the structure of public health delivery systems and could expand the implementation of activities that improve population health. The aims of this study are to:

- Identify patterns of ***geographic variation and longitudinal change*** in the implementation of core public health activities in local communities across the U.S. during 1998-2014.
- Identify variation and change in the constellation of organizations that contribute to the implementation of core public health activities, which we define as ***public health system capital***.
- Estimate the ***impact of public health system capital*** on rates of preventable mortality and on public health resource use.

Data: National Longitudinal Survey of Public Health Systems

The NLSPHS follows a nationally representative cohort of 360 U.S. metropolitan communities over time using survey data collected initially in 1998 and again in 2006, 2012 and 2014. A validated survey instrument asks local public health officials report:

- The ***availability*** of 20 recommended public health activities in the community, based on the Institute of Medicine's core functions of assessment, policy development, and assurance
- The ***range of organizations*** that contribute to each activity
- The ***proportion of effort*** contributed by the local public health agency
- The ***perceived effectiveness*** of each activity.

NLSPHS data are linked with public health agency data from the NACCHO ***National Profile of Local Health Departments Survey***; community characteristics from the ***HRSA Area Health Resources File***; and county-level mortality rates from ***CDC's Compressed Mortality File***.

Methods: Cluster and Network Analysis

We classify communities into one of seven categories of system capital based on a cluster analysis of the ***scope*** of activities contributed by each type of organization, along with network-analytic measures of inter-organizational connectedness in performing activities (density, degree and betweeness centrality) (Figure 1). We also generate network visualization graphs to display inter-organizational relationships in jointly contributing to public health activities (Figure 2)

Results: Cluster and Network Analysis

Figure 1. Prevalence of Public Health System Clusters in U.S. Metropolitan Areas: 1998 - 2014

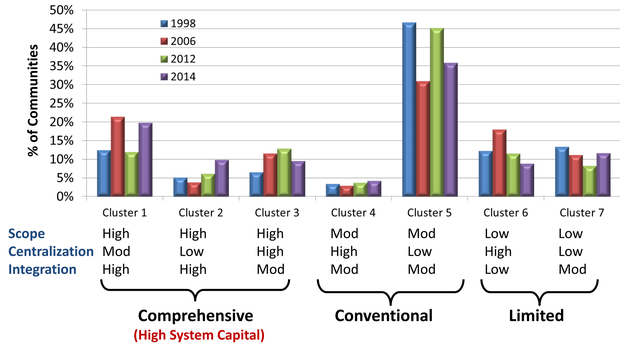
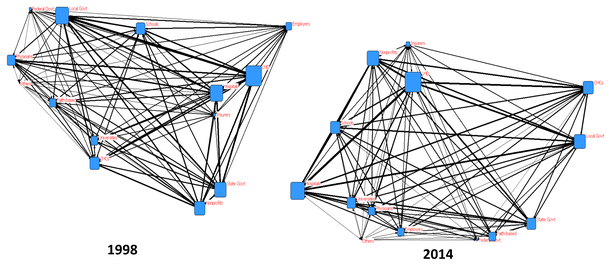


Figure 2. Network Structure of Public Health Delivery Systems: U.S. Average in 1998 vs. 2014



Node size = degree centrality; Line size = % activities jointly contributed

Table 1. Changes in System Capital Prevalence and Coverage: 1998 to 2014

System Capital Measures	1998	2006	2012	2014
Comprehensive systems				
% of communities	24.2%	36.9%	31.1%	32.7%
% of population	25.0%	50.8%	47.7%	47.2%
Conventional systems				
% of communities	50.1%	33.9%	49.0%	40.1%
% of population	46.9%	25.8%	36.3%	32.5%
Limited systems				
% of communities	25.6%	29.2%	19.9%	20.6%
% of population	28.1%	23.4%	16.0%	19.6%

Methods: Estimating Health and Economic Impact

Multivariate generalized linear and probit models with instrumental-variables (IV) are used to estimate changes in preventable mortality and expenditures that are attributable to changes in system capital, while controlling for both observable and unmeasured confounders that jointly influence system capital and outcomes:

(1) $\Pr(System_{ijt} = Comprehensive) = \alpha Governance_{ijt} + \beta Agency_{ijt} + \delta Community_{it} + \lambda State_{it} + \mu_i + \varphi_t + \phi_t + \varepsilon_{ijt}$

(2) $Ln(Mortality_{ijt}) = \psi \hat{System}_{ijt} + \beta Agency_{ijt} + \delta Community_{ijt} + \lambda State_{ijt} + \mu_i + \varphi_j + \phi_t + \varepsilon_{ijt}$

(3) $Ln(Expenditures/Capita_{ijt}) = \psi \hat{System}_{ijt} + \beta Agency_{ijt} + \delta Community_{ijt} + \lambda State_{jt} + \mu_i + \varphi_j + \phi_t + \varepsilon_{ijt}$

Results: Determinants of High System Capital

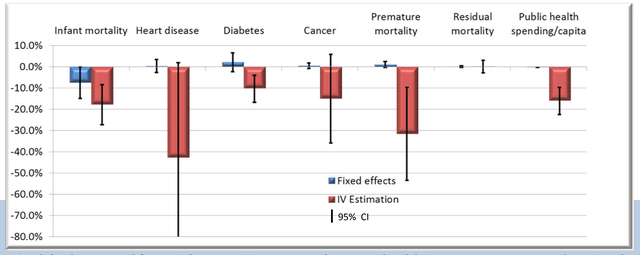
Table 2. Probit Estimates of Factors Influencing the Probability of Comprehensive System Capital

Variable	Marginal Effect on Probability of System Capital
Local board of health with decentralized governance	14.2%**
Local board of health with centralized governance	9.7%**
Centralized governance without local board of health	-4.5%**
Decentralized governance without local board of health	Reference
Population size (100,000s)	4.2%**
Population density (1000s)	4.9%*
Household income per capita (1000s)	2.5%**

Models also control for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects.
N=779 community-years **p<0.05 *p<0.10

Results: Health and Economic Impact of System Capital

Figure 3. Fixed Effects and IV Estimates: Effects of System Capital on Mortality and Spending



Models also control for racial composition, unemployment, health insurance coverage, educational attainment, age composition, and state and year fixed effects. N=779 community-years.

Conclusions

- Comprehensive and highly-integrated public health systems appear to offer considerable health and economic benefits over time.
- Communities that move from non-comprehensive to comprehensive system structures over the 16-year period experience 10-40% larger reductions in preventable mortality rates compared to communities that remain non-comprehensive.
- Governmental public health resource use is approximately 15% lower in communities that move to comprehensive system structures.
- Low-income communities are less likely to achieve comprehensive public health system capital, as are communities without local governance structures. Failure to account for this selection leads to biased estimates of impact on health and resource use.

Policy Implications

- Strategies to improve population health and health system efficiency should include initiatives to build public health system capital.
- The ACA's hospital community benefit provisions and the Institute of Medicine's call for financing a minimum package of public health services are possible policy mechanisms for building system capital.

Appendix: Public Health Activity Measures

	Public Health Activity	1998	2014	% Change
1	Community health needs assessment	71.5%	86.0%	20.2%**
2	Behavioral risk factor surveillance	45.8%	70.2%	53.2%**
3	Adverse health events investigation	98.6%	100.0%	1.4%
4	Public health laboratory testing services	96.3%	96.5%	0.2%
5	Analysis of health status and health determinants	61.3%	72.8%	18.7%**
6	Analysis of preventive services utilization	28.4%	39.4%	38.8%**
7	Health information provision to elected officials	80.9%	84.8%	4.8%
8	Health information provision to the public	75.4%	83.8%	11.1%*
9	Health information provision to the media	75.2%	87.5%	16.3%**
10	Prioritization of community health needs	66.1%	82.3%	24.6%**
11	Community participation in health improvement planning	41.5%	67.7%	63.0%**
12	Development of community health improvement plan	81.9%	86.2%	5.2%
13	Resource allocation to implement community health plan	26.2%	43.2%	64.9%**
14	Policy development to implement community health plan	48.6%	57.5%	18.4%*
15	Communication network of health-related organizations	78.8%	84.8%	7.6%
16	Strategies to enhance access to needed health services	75.6%	50.2%	-33.6%**
17	Implementation of legally mandated public health activities	91.4%	92.4%	1.0%
18	Evaluation of public health programs and services	34.7%	38.4%	10.8%**
19	Evaluation of local public health agency capacity/performance	56.3%	55.0%	-2.4%
20	Implementation of quality improvement processes	47.3%	49.6%	5.0%
	Composite availability of assessment activities (1-6)	66.7%	77.6%	16.4%**
	Composite availability of policy development activities (7-15)	60.2%	72.5%	20.4%
	Composite availability of assurance activities (16-20)	64.4%	52.8%	-18.0%*
	Composite availability of all activities (1-20)	63.8%	67.6%	6.0%*

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