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Finding Order in Complexity: A Typology of Local Public Health Delivery Systems

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Finding Order in Complexity: A Typology of Local Public Health Delivery Systems

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Public health decision-makers and researchers currently lack an evidence-based framework for describing, classifying, and comparing public health delivery systems based on their organizational components, operational characteristics, and division of responsibility. Related typologies developed in the health services sector have proven extremely valuable for policy and administrative decision-making as well as for ongoing research. Performance assessment, quality improvement, and accreditation activities are now blossoming in public health—adding urgency to the need for classification and comparison frameworks. This brief describes a newly-developed empirical typology for local public health systems and highlights its policy and managerial applications.

Needing a Framework for Comparison

Although a strong public health infrastructure is essential for preparing for and responding to health threats on a population-wide basis, studies from the past two decades have found evidence of substantial gaps and wide variation in the performance of essential public health services at state and local levels.[1-3] In the U.S., public health services are delivered through the collective actions of governmental and private organizations that vary widely in their resources, missions, and operations.[4,5] This complexity in inter-organizational and intergovernmental structure has led to the widespread perception among policy-makers and administrators that public health agencies defy meaningful description and comparison. Nevertheless, obtaining a better understanding of the organizational and operational attributes of public health delivery systems is a critical step in elucidating pathways for improving public health services.

To facilitate the development of such evidence, this brief presents a new empirical method of classifying and comparing public health delivery systems based on their organizational structure and functional characteristics. We follow the Institute of Medicine definition of a public health delivery system, which encompasses the full array of governmental and nongovernmental organizations that contribute to the delivery of essential public health services for a defined community or population. This typology focuses on delivery systems operating at the local level, but can be extended to state-level systems.

Related typologies developed in the health services research literature have proven extremely valuable for policy and administrative decision-making as well as for ongoing research. For example, the typologies of hospital networks and systems developed by Steven Shortell, Gloria Bazzoli and colleagues over the past two decades have served in numerous policy and administrative applications concerning the regulation, coordination, and improvement of hospital-based health care services.[6]

A typology of public health systems can enhance policy and administrative decision-making as well as public health research. A typology allows "apples to apples" comparisons across communities in how public health services are organized and delivered. Such comparisons can form the basis of public health performance assessment activities and inform the development of performance standards for public health agencies, such as those currently under

development as part of the voluntary national accreditation program for public health agencies.

Dimensions of Delivery Systems

Constructs from organizational sociology and industrial organization economics provide a foundation for identifying key structural and strategic attributes of complex enterprises such as public health delivery systems. Three general classes of these attributes apply specifically to inter-organizational service delivery systems: differentiation, integration, and centralization.[6] First, ***differentiation*** describes the range of different programs and services provided through the system. Highly differentiated public health systems perform a broad array of activities considered to be core functions of public health, including activities designed to assess population health needs and risks, develop and enforce polices that protect and promote health, and assure access to needed health services. Second, ***integration*** reflects the extent to which services are provided through relationships with other organizations. Highly integrated public health systems engage a wide range of organizational partners in the performance of public health activities. The degree of integration that exists within a given community depends on the range of organizations that operate within the community and the ability and willingness of each organization to contribute to public health activities.

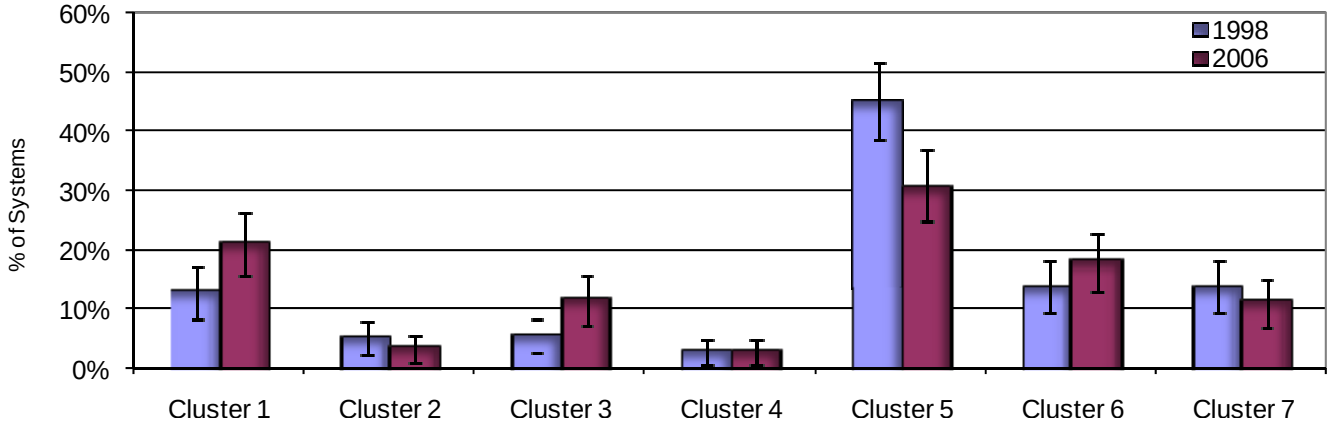
Third, ***concentration*** reflects the degree to which work within the system is distributed across the different organizational contributors. A concentrated public health system relies heavily on the governmental public health agency to shoulder much of the effort in performing public health activities, even if many other organizations contribute in relatively low-effort ways.

Data and Methods Used

A stratified random sample of the nation's 2900 local health department directors (n=497) were surveyed in 1998 (78% response) and again in 2006 (70% response) to determine the availability of 20 common public health activities within their jurisdictions and to identify the types of organizations participating in each activity. A survey instrument developed and validated by C. Arden Miller and Bernard Turnock was used as the base data collection instrument.[7] Survey data were linked with contemporaneous information on agency and community characteristics.

Principal components analysis and cluster analysis methods were used to classify communities into one of seven categories based on the structural characteristics of scope, concentration, and integration. Multivariate hierarchical regression models for panel data were estimated to test for changes in structural classifications over time and to identify system characteristics associated with structural change.

Figure 1: Public Health System Typology Clusters in 1998 and 2006



Seven Types of Systems Identified

Cluster analysis of the system measures revealed seven clusters of local public health systems that can be grouped into three tiers based on the scope of public health activities performed (differentiation). Three of the seven clusters of systems were identified as ***highly differentiated***, meaning that they offered a broad and encompassing scope of activities. These systems generally performed more than two-thirds of the activities in each of the three IOM domains of assessment, policy development, and assurance. As such, these systems were labeled as "comprehensive" in their scope of activities. Another two clusters of public health systems were identified as ***moderately differentiated*** because they performed about half of the activities in each IOM domain. These systems were labeled as "conventional" in differentiation because they align closely with the average scope of services performed in local communities. The final two clusters of public health systems performed a relatively narrow scope of activities and therefore were labeled as ***limited-differentiation*** systems. The prevalence of each cluster is shown above in Figure 1, and the attributes of each cluster are summarized in the table below.

Table 1: Summary of the Local Public Health System Typology

Type of System & Prevalence	Description
Tier I: Comprehensive Systems	
1. Concentrated Comprehensive 1998: 12.5% 2006: 21.4%	▪ Broad scope of activities are performed ▪ Wide range of organizations participate in activities ▪ Local public health agency shoulders much of the effort in performing activities
2. Distributed Comprehensive 1998: 5.1% 2006: 3.9%	▪ Broad scope of activities are performed ▪ Wide range of organizations participate in activities ▪ Effort in performing activities is distributed across participating organizations
3. Independent Comprehensive 1998: 6.6% 2006: 11.6%	▪ Broad scope of activities are performed ▪ Narrow range of organizations participate in activities ▪ Local public health agency shoulders much of the effort in performing activities
Tier II. Conventional Systems	
4. Concentrated Conventional (Transitory System) 1998: 3.4% 2006: 3.0%	▪ Moderate scope of activities are performed ▪ Moderate range of organizations participate in activities ▪ Local public health agency shoulders much of the effort ▪ Highly transitory system
5. Distributed Conventional (Modal System) 1998: 46.7% 2006: 30.9%	▪ Moderate scope of activities are performed ▪ Moderate range of organizations participate in activities ▪ Effort in performing activities is distributed across participating organizations
Tier III. Limited Systems	
6. Concentrated Limited 1998: 12.3% 2006: 18.0%	▪ Narrow scope of activities are performed ▪ Limited range of organizations participate in activities ▪ Local public health agency shoulders much of the effort in performing activities
7. Distributed Limited 1998: 13.4% 2006: 11.2%	▪ Narrow scope of activities are performed ▪ Moderate range of organizations participate in activities ▪ Effort in performing activities is distributed across participating organizations

Comprehensive Systems

Cluster 1: Concentrated Comprehensive Systems: These systems performed a broad scope of public health activities and involved a wide range of organizations in performing these activities, yet the governmental public health agency shouldered much of the effort in performing these activities. As such, these systems appeared both highly integrated and highly concentrated in structure. Although many different organizations assisted in the delivery of public health services, the governmental agency assumed most of the responsibility and effort. In these systems, governmental agencies tended to partner with other organizations primarily through low-effort mechanisms such as advisory committees and planning groups that required relatively little investment of resources. Approximately 21 percent of local public health systems fell into this category in 2006, up from 13 percent in 1998.

Cluster 2: Distributed Comprehensive Systems: These systems provided a broad scope of public health activities and involved a wide range of organizational partners in these activities. These systems were distinguished from the first cluster of systems in that the effort expended in delivering public health activities was less concentrated in the governmental public health agency and more distributed across the range of organizational partners. This category represented approximately 4 percent of local public health systems nationally in 2006, down slightly from 5 percent in 1998.

Cluster 3: Independent Comprehensive Systems: A third category of systems performed a broad scope of services but involved a relatively narrow range of organizations in the delivery of these services. Like Cluster 1, these systems relied on the governmental public health agency to provide much of the effort in performing public health services. These systems tended to serve relatively small communities with a relatively limited supply of physicians, hospitals, and other organizational resources. This category represented approximately 12 percent of systems in 2006, up from 7 percent in 1998.

Conventional Systems

Cluster 4: Concentrated Conventional Systems: Two clusters of systems were classified as moderately differentiated or "conventional" based on delivering an intermediate scope of services closely corresponding to the average service mix observed among all local systems. The smallest cluster of these conventional systems relied on the governmental public health agency to provide much of the effort in performing public health services. As such, these systems were classified as concentrated in structure. These systems represented less than 5 percent of all systems in both 1998 and 2005. Moreover, this group of systems appeared highly transitory in nature, such all of the systems in this cluster as of 1998 had migrated to a different cluster by 2006. Most of the systems migrating out of this category did so either by expanding their scope of services to become an independent comprehensive system (cluster 3) or by narrowing their scope of services to become a concentrated limited system (cluster 6).

Cluster 5: Distributed Conventional Systems: This cluster was the most prevalent type of system identified in the analysis. These systems provided an intermediate scope of public health services and distributed the effort of performing these services across an array of contributing organizations. The range of organizations involved in delivering public health services generally was narrower than was the case among comprehensive systems (clusters 1 and 2). This category represented approximately 31 percent of public health systems in 2006, down from 47 percent in 1998.

Limited Systems

Cluster 6: Concentrated Limited Systems: The final two clusters of systems were classified as limited in differentiation based on their relatively narrow scope of public health activities. Systems in Cluster Six involved a relatively small range of organizations in the delivery of public health services, and relied heavily on the governmental public health agency to provide much of the effort in performing these services. These concentrated systems comprised 18 percent of local public health systems in 2006, up from 12 percent in 1998.

Cluster 7: Distributed Limited Systems: The systems in Cluster 7 engaged a somewhat larger array of organizations in the delivery of public health services compared to Cluster 6, and they distributed more of the effort of performing these services across the contributing organizations. The proportion of effort contributed by the governmental public health agency was generally

lower in these systems than in more concentrated systems. Approximately 11 percent of local public health systems were classified into this cluster in 2006, down slightly from 13 percent in 1998.

Transitions in System Classifications

Public health systems showed a high degree of structural fluidity during the study period. Concentrated comprehensive systems (Cluster 1) were the most stable over time, such that 50 percent of the systems classified into this category in 1998 remained in this category as of 2006 (Table 2). Interestingly, more than 25% of these systems transitioned into one of the limited-differentiation systems (Clusters 6 and 7) by 2006. Among the distributed comprehensive systems (Cluster 2), more than 40% remained in one of the highly-differentiated clusters as of 2006, but a third of these systems transitioned to a moderately-differentiated system (Cluster 5) and another 25% transitioned to a limited-differentiation system. Only 15 percent of the independent comprehensive systems (Cluster 3) remained in a highly-differentiated category by 2006, while most of these systems transitioned to a moderately-differentiated structure.

The concentrated conventional systems (Cluster 3) appeared highly transitory in structure, such that all of the systems in this category in 1998 moved to a different structure by 2006. Most of these systems appeared to transition by either (1) distributing more of their effort to other organizations within the system (Cluster 5) or (2) narrowing the scope of activities performed within the system (Cluster 6). The distributed conventional systems (Cluster 5) remained the most prevalent type of system throughout the period of study, and proved to be the second-most stable type of system after Cluster 1. More than a third of the systems in this category as of 1998 were still in this category in 2006, while another third transitioned to a limited-differentiation system and more than 25 percent transitioned to a highly-differentiated system.

The limited-differentiation systems in 1998 frequently transitioned to structures with higher differentiation by 2006. Nearly half of these systems moved into one of the highly-differentiated categories by 2006 (Clusters 1-3), and another 25% of these systems adopted a distributed conventional structure (Cluster 5).

Table 2: Changes in Local Public Health System Types: 1998 to 2006

Type of System in 2006	Type of System in 1998: High Differentiation Cluster 1 (n=30)	High Differentiation Cluster 2 (n=12)	High Differentiation Cluster 3 (n=13)	Moderate Differentiation Cluster 4 (n=7)	Moderate Differentiation Cluster 5 (n=105)	Limited Differentiation Cluster 6 (n=32)	Limited Differentiation Cluster 7 (n=32)
Cluster 1 (n=49)	**50.0**	16.7	0.0	14.3	13.3	28.1	25.0
Cluster 2 (n=8)	3.3	**8.3**	0.0	0.0	3.8	3.1	3.1
Cluster 3 (n=27)	6.7	16.7	**15.4**	0.0	9.5	21.9	12.5
Cluster 4 (n=7)	0.0	0.0	7.7	**0.0**	4.8	3.1	0.0
Cluster 5 (n=72)	13.3	33.3	46.2	42.9	**37.1**	25.0	25.0
Cluster 6 (n=42)	13.3	8.3	15.4	42.9	22.9	**9.4**	15.6
Cluster 7 (n=26)	13.3	16.7	15.4	0.0	8.6	9.4	**18.8**
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: Numbers indicate the proportion of systems in a cluster as of 1998 that changed to the indicated cluster in 2006

Using the System Typology

The typology presented here is anticipated to have several important applications. First, researchers studying issues in public health practice can use the typology as a framework for measuring system-level differences in structure across communities and detecting system-level changes in structure over time. In some cases, these measures can serve as control variables that help researchers isolate other relationships and associations of interest, such as in pre/post studies designed to estimate the effectiveness of specific public health interventions, quality improvement processes, or policy initiatives that are being tested in multiple settings. In other cases, the measures may serve as important, system-level interaction effects that allow researchers to determine the structural environments in which certain public health programs and interventions work best. In still other cases, structural measures from the typology may serve as the dependent variables of interest for studying the effects of exogenous policy changes, economic shocks, or organizational reconfigurations on local public health systems. Similarly, the measures can serve as the primary independent variables of interest for determining whether there are systematic differences in quality, efficiency, and health outcomes across alternative types of local public health systems. Collectively, these types of studies will provide a clearer understanding of the relative strengths and weaknesses of alternative approaches to organizing and delivering public health services, along with the political, economic, and institutional contexts in which these approaches appear to function best.

The typology is also expected to have utility for public health administrators and policy-makers. These decision-makers can use the typology developed through this study to identify what structural models of service delivery may be most feasible and desirable in their state or community given the array of current and potential organizational participants that exist within their systems. Moreover, the typology can provide decision-makers with insight into the structural models likely to be most productive in closing gaps that currently exist in their system's scope of activities. By moving up the typology from less-differentiated to more-differentiated structural models, decision-makers can chart a path of structural change toward more comprehensive delivery systems. Public health administrators can use the typology to identify "peer groups" of similarly-structured local public health systems that may be appropriate for benchmarking, networking, and collaborative service delivery. Similarly, the typology may provide a foundation for classifying systems into relatively homogenous groupings for the purposes of performance assessment and quality improvement initiatives. In these ways, the typology directly responds to the IOM's recent call for research that can be used to guide policy decisions that shape public health practice.

Applications of the System Typology

- Developing comparison groups for performance measurement and reporting initiatives
- Identifying peer groups for quality improvement programs and benchmarking applications
- Establishing tailored performance standards as part of accreditation and accountability initiatives
- Sampling/recruiting diverse settings in which to test and study new programs, services, and policies
- Analyzing variations in quality and efficiency across different types of systems
- Developing models and approaches for service expansion and improvement

To fully realize these potential benefits, it will be important to refine and enhance the typology over time by periodically applying it to new data on local public health systems and by developing refined measures of the core constructs of differentiation, integration, and concentration. For example, application of the typology within a single state may allow for access to more detailed data on structural characteristics, creating opportunities for refinement. Another important extension will be to apply the typology framework to state-level public health systems by developing measures of differentiation, integration, and concentration at that geopolitical level. Likewise, the typology may be extended to examine structural characteristics within specific and detailed domains of public health activity, such as public health preparedness, chronic disease prevention, or environmental health. These directions for further development will help to fill

important conceptual and methodological gaps in our ability to conduct research on public health systems and to make progress toward evidence-based decision-making.

Conclusions

Although local public health systems vary widely in their organizational composition and division of responsibility, it is possible to identify unique and coherent groups of systems based on their structural characteristics. The characteristics examined in this analysis reflect constructs that have been used widely in research on organizational behavior and industrial organization economics, but they have not been applied previously to public health organizations. This analysis demonstrates that these constructs can provide new insight into the organization and operation of public health delivery systems.

It is important to recognize that the typology developed through this analysis, like similar typologies developed in other fields, does not incorporate all of the structural characteristics likely to be important for understanding the organization and delivery of public health activities. This typology does not reflect some of the more commonly described characteristics of governmental public health agencies, such as those related to governance, financing, workforce, geopolitical jurisdiction, and intergovernmental structures. Rather, the typology developed in this analysis focuses on important ***system-level*** structural attributes that heretofore have been overlooked in studies of local public health delivery. As such, this typology complements and extends the more conventional ways of describing local public health agencies, in order to provide an improved framework for studying, monitoring, and managing public health delivery systems.

More Information about this Issue Brief

- For a tool to determine system classifications in your state or community, or for more information about the Typology and its applications, contact the authors below.
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