Performance and Priorities: A Cross-sectional Study of Local Health Department Approaches to Essential Public Health Services

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Abstract

Objectives: Despite a push for increased local public health capacity, no clear baseline for performance of local health departments (LHDs) exists. The objectives of this study were to quantify the self-reported performance of LHDs on the 10 Essential Public Health Services (EPHSs) and describe the relationships between performance and characteristics of LHDs.

Methods: We used data on 2000 LHDs from the 2013 National Profile of Local Health Departments survey to develop principal components analysis–based scores to evaluate each LHD on the performance of EPHSs. Scores ranged from 0 to 100. LHDs that performed no activities within an EPHS had a score of 0, and LHDs that performed all activities within an EPHS had a score of 100. We explored the relationships between EPHS scores and LHD characteristics by using multivariate linear regression and cluster analysis.

Results: Performance scores varied greatly by LHDs and EPHSs; however, LHDs typically scored <50, indicating that they performed fewer than half of the activities evaluated. LHDs that served larger populations (vs smaller populations) and LHDs that had higher per-capita funding (vs lower per-capita funding) had higher EPHS scores. We identified 6 EPHS performance score–based LHD clusters, which suggests similarities in which EPHSs LHDs focused on.

Conclusions: Our results suggest weaknesses in many LHDs' fulfillment of the EPHSs, particularly in low-population and low-funding settings. LHDs should be given the resources to increase capacity and ensure the EPHSs are met in communities.

Keywords
local public health, Essential Public Health Services, public health practice, principal components analysis

The public health infrastructure in the United States comprises a network of federal, state, and local health agencies intended to work in concert.[1,2] The effectiveness of this system relies on agencies at each level having the capacity to complete the required tasks.[3] In 1994, the Public Health Functions Working Group defined the 10 Essential Public Health Services (EPHSs) that serve as a benchmark for public health practice (Table 1).[4] Fulfillment of the EPHSs by local health departments (LHDs) is vital, because LHDs are the most proximal health agencies to the communities they serve.[1,2] However, the current literature suggests that the capacity of LHDs varies greatly and may be weak overall.[1,7-17]

Concerns about lack of capacity have led to a push for public health infrastructure improvements through programs such as Healthy People 2020 and health department accreditation.[18,19] However, many Healthy People goals are unmet, and only 209 LHDs had achieved accreditation as of

November 20, 2018, with many indicating that the time and effort are too high for the benefit.[20-24] In addition, no clear baseline for performance of LHDs exists. Studies investigating the performance of LHDs tend to focus on the most populous cities or health departments that opted into programs such as the National Public Health Performance Standards Program and, hence, may overestimate nationwide capacity.[10,12,25,26]

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Table 1. Activities, in order of importance, that best capture performance of the Essential Public Health Services[a] and the combined variance in the activities used that is explained by the principal component, 2013 National Profile of Local Health Departments Survey[b]

Essential Public Health Service	Activities	Variance Explained,[c] %
1. Monitor health status to identify and solve community health problems.	Infectious disease surveillance, injury surveillance, behavioral risk factor surveillance, chronic disease surveillance, maternal and child health surveillance, syndromic surveillance, environmental health surveillance	56.7
2. Diagnose and investigate health problems and health hazards in the community.	Screening for diabetes, cardiovascular disease, cancer, tuberculosis, high blood pressure, HIV, and blood lead; provision of laboratory services	52.2
3. Inform, educate, and empower people about health issues.	Population-based primary prevention activities for physical activity, violence, chronic disease, nutrition, tobacco, substance abuse, injury, mental illness, unintended pregnancy	57.6
4. Mobilize community partnerships to identify and solve health problems.	Collaborate with other community partners on maternal and child health, infectious disease, chronic disease, environmental health, community health assessments, food safety, tobacco, alcohol or other drugs, emergency preparedness	42.0
5. Develop policies and plans that support individual and community health efforts.	Provision of technical assistance to policy makers, regulatory groups, or advocacy groups for drafting proposed legislation, regulations, or ordinances; preparation of issue briefs on proposed policy; provision of public testimony on proposed policy; participation on a board or advisory panel responsible for public health policy	51.5
6. Enforce laws and regulations that protect health and ensure safety.	Regulation, inspection, and/or licensing of food service establishments, groundwater protection, surface water protection, private drinking water, air pollution, public drinking water, schools and daycares, indoor air quality, health facilities	45.1
7. Link people to needed personal health services and assure the provision of health care when otherwise unavailable.	Provision of child immunization, family planning, sexually transmitted disease treatment, adult immunizations, tuberculosis treatment, WIC (Special Supplemental Nutrition Program for Women, Infants, and Children) food and nutrition services	41.0
8. Assure competent public and personal health care workforce.	Use of Core Competencies for Public Health Professionals[5] for conducting staff performance evaluations, assessing staff training needs, developing staff training plans, writing job descriptions	67.4
9. Evaluate effectiveness, accessibility, and quality of personal and population-based health services.	Performance of quality improvement (QI) activities, existence of agency-wide QI plan, QI committee, dedicated QI staff member, dedicated resources for QI, provision of QI resources and training to staff members on an ongoing basis, use of performance data to drive QI efforts	52.6
10. Research for new insights and innovative solutions to health problems.	Development of research protocols; dissemination of findings to stakeholders; collection, exchange, or report of study data; analysis and interpretation of study data; identification of research topics relevant to public health practice; recruitment of study participants; support of organizations applying research findings to practice; and application of research findings to practices within their own organization	68.5

[a]Data source: Centers for Disease Control and Prevention.[4]
[b]Data source: National Association of County and City Health Officials.[6]
[c]Percentage of the data's total variance explained by the principal component. For example, the principal component generated to represent Essential Public Health Service (EPHS) 1 explains 56.7% of the variability observed in all the activities categorized into EPHS 1.

In this study, we evaluated the self-reported capacity of LHDs by using scores derived from principal components analysis (PCA). We quantified the performance of 2000 LHDs on each of the 10 EPHSs to objectively measure performance across a heterogeneous group of LHDs. We further explored the relationships between the performance and characteristics of LHDs.

Methods

Study Data

We used data from the National Association of County and City Health Officials (NACCHO) 2013 National Profile of Local Health Departments Survey, which is the largest, most comprehensive source of data on LHD infrastructure and activities in the United States.[6] The NACCHO profile enumerated 2532 LHDs, 2000 (79.0%) of which responded to the NACCHO profile survey. Researchers selected health departments by population-based stratified random sampling to receive only the core questionnaire or the core plus 1 of 2 supplemental modules. The Johns Hopkins Bloomberg School of Public Health Institutional Review Board (IRB) Office determined this study was not human subjects research and did not require IRB oversight.

Measures of EPHS Performance

We categorized reported health department activities into EPHSs based on metrics used in previous health department evaluations.[2,27,28] The number of activities included in each EPHS category varied based on the number of relevant activities for each EPHS available in the data set. Some of the activities used to describe EPHS 4, EPHS 8, EPHS 9, and EPHS 10 came from module 1 of the questionnaire; therefore, the sample size for analysis of these EPHSs was reduced (n = 490). For EPHS 8, assurance of a competent workforce, we focused on the use of the Core Competencies for Public Health Professionals for workforce development.[5] For the purpose of this analysis, we included only activities that were directly performed by the LHDs. We excluded from further analysis LHDs with missing values for that EPHS. For the remainder of the analysis, these combinations of activities served as proxy measures for an LHD's capacity to provide the EPHSs.

Data Analysis

For each EPHS, we used PCA to derive a score (the principal component) from the activities categorized into each EPHS. We derived these scores from a linear combination of responses that captured most of the variability in the data on that EPHS. Because many variables of interest were discrete, we used polychoric correlation matrices to estimate correlations between the variables of interest.[29] Our analysis focused only on the principal components of each EPHS, which explained an average of 53.5% of the

combined variances in the variables used. Activity contributions to the EPHS scores were weighted by factor loadings, which represent the correlations between the activities and the principal component. We highlighted those activities with the largest contribution to the score (ie, those with a correlation >25%) (Table 1). We normalized each EPHS score to range from 0 to 100, such that LHDs performing all activities in a given EPHS would have a score of 100 and LHDs performing none of the activities in a given EPHS would have a score of 0.

We used multivariate linear regression analysis to examine the association between EPHS scores and LHD characteristics shown to be associated with performance in previous studies.[9,11,12,15,30,31] We examined the following characteristics: population size of jurisdiction, per-capita LHD expenditures, presence of a local board of health, and region as defined by the US Census Bureau (Midwest, Northeast, South, West).[32] We also examined health department governance, classifying decentralized structures as "local," centralized structures as "state," and combined structures as "shared governance." We modeled population size and per-capita expenditures on the log scale to maintain a linear relationship with the dependent variables. We accounted for correlations between health departments in the same state by using clustered standard errors.

To determine whether there were natural groupings of LHDs that shared similar strengths and weaknesses, we created clusters based on health department EPHS scores by using Gaussian finite mixture modeling, as implemented in the mclust R package.[33,34] To maximize the number of LHDs considered, we ran the cluster analysis by using only those EPHSs with activities included on the core questionnaire. We identified 6 performance-based LHD clusters. We compared the characteristics of EPHS-based clusters and assessed associations by using the Pearson χ^2 and analysis of variance tests of significance. We considered $P < .05$ to be significant. We analyzed data by using R version 3.3.2.[35]

Results

LHDs performed well on EPHS 1; most LHDs scored >50 (Table 2). A typical (ie, scoring closest to the median) LHD performed 4 of 7 surveillance activities and had completed a community health assessment within the previous 5 years. Infectious disease surveillance was the most frequently reported activity (91.2%; 1802 of 1975), and injury surveillance was the least frequently reported activity (27.3%; 522 of 1910).

For EPHS 2, a typical LHD performed 4 of 8 disease screening activities and provided no laboratory services. Tuberculosis screening was the most frequently reported activity (83.7%; 1650 of 1971), and cardiovascular disease screening was the least frequently reported activity (27.3%; 523 of 1915).

For EPHS 3, a typical LHD performed 3 of 9 population-based primary prevention activities and provided food safety

Table 2. Number of local health departments (LHDs) with complete data for each Essential Public Health Service (EPHS)[a] activity and median score for each EPHS, 2013 National Profile of Local Health Departments Survey (n = 2000), United States[b]

EPHS	Sample Size, No. (%) (n = 2000)	LHDs That Performed No EPHS Activities, No. (%)	LHDs That Performed All EPHS Activities, No. (%)	Median Score[c] (IQR)
1. Monitor health status to identify and solve community health problems.	1834 (91.7)	32 (1.7)	178 (9.7)	63.5 (46.1-80.9)
2. Diagnose and investigate health problems and health hazards in the community.	1467 (73.4)	91 (6.2)	71 (4.8)	42.0 (28.1-72.0)
3. Inform, educate, and empower people about health issues.	1836 (91.8)	108 (5.9)	76 (4.1)	41.1 (17.9-66.6)
4. Mobilize community partnerships to identify and solve health problems.	451 (22.6)	1 (0.2)	7 (1.6)	65.4 (53.7-77.5)
5. Develop policies and plans that support individual and community health efforts.	1832 (91.6)	86 (4.7)	89 (4.9)	58.7 (26.9-81.7)
6. Enforce laws and regulations that protect health and ensure safety.	1796 (89.8)	151 (8.4)	18 (1.0)	42.0 (23.8-58.7)
7. Link people to needed personal health services and assure the provision of health care when otherwise unavailable.	1767 (88.4)	80 (4.5)	1 (0.1)	48.2 (34.1-58.7)
8. Assure competent public and personal health care workforce.	470 (23.5)	347 (73.8)	29 (6.2)	0 (0-22.9)
9. Evaluate effectiveness, accessibility, and quality of personal and population-based health services.	473 (23.7)	53 (11.2)	7 (1.5)	29.7 (12.2-55.7)
10. Research for new insights and innovative solutions to health problems.	463 (23.2)	183 (39.5)	21 (4.5)	10.6 (0-23.8)

Abbreviation: IQR, interquartile range.
[a]Data source: Centers for Disease Control and Prevention.[4]
[b]Data source: National Association of County and City Health Officials.[6]
[c]Distribution of health department scores ranging from 0 to 100, with 0 representing no activities performed and 100 representing all activities performed.

education. Food safety education was the most frequently reported activity (73.1%; 1428 of 1954), and mental illness programs were the least frequently reported activity (12.4%; 240 of 1933).

EPHS 4 had the highest median score overall, indicating that most LHDs were working with their community partners (Table 2). A typical LHD coordinated efforts with partners on most topics but rarely reported full collaboration on activities. Emergency preparedness was the most frequently reported collaboration activity (70.1%; 338 of 482), and land use collaboration was the least frequently reported collaboration activity (5.6%; 26 of 468).

For EPHS 5, a typical LHD had strategic and community health improvement plans, but these plans had not been updated in the previous 5 years. They also participated in some policymaking activities but had not passed a new public health ordinance in the past 2 years. Communicating with legislators was the most frequently reported activity (69.4%; 1350 of 1945), and adopting a new public health ordinance or legislation was the least frequently reported activity (36.8%; 719 of 1954).

For EPHS 6, a typical LHD performed 5 of 13 regulatory activities. Regulation, inspection, and/or licensing of food services establishments was the most frequently reported activity (78.5%; 1540 of 1962), and regulation, inspection, and/or licensing of cosmetology businesses was the least frequently reported activity (12.3%; 235 of 1913).

For EPHS 7, a typical LHD performed 8 of 20 health services. Adult immunization was the most frequently reported activity (90.6%; 1789 of 1975), and substance abuse services were the least frequently reported activity (7.4%; 143 of 1940).

EPHS 8 had the lowest scores overall, with a median score of 0 (Table 2). A typical LHD did not use the Core Competencies for Public Health Professionals for any employee hiring or training activities. Use of core competencies for evaluating training needs was the most frequently reported activity (directly performed by 18.9%; 89 of 470), and use of core competencies in job descriptions was the least frequently reported activity (13.4%; 63 of 470).

For EPHS 9, a typical LHD reported informal or ad hoc quality improvement activities, with no consistent resources dedicated to quality improvement. Formal or informal quality improvement activities were reported by most health departments (performed by 88.9%; 424 of 477); however, fewer than half of LHDs reporting quality improvement activities had dedicated resources to quality improvement activities (43.6%; 185 of 424).

LHDs scored poorly on EPHS 10; 39.5% of LHDs performed none of the research activities evaluated (Table 2). A typical LHD performed 1 of 8 research activities. Collecting, exchanging, or reporting data for a study was the most frequently reported activity (performed by 40.4%; 187 of 463), and developing or refining research plans and/or protocols was the least frequently reported activity (12.5%; 58 of 463).

Table 3. Characteristics of local health departments that responded to the 2013 National Profile of Local Health Departments Survey[a] with complete data for Essential Public Health Service[b] score calculation (n = 1511), United States[a]

Local Health Department Characteristics	Value
Mean (SD) population of jurisdiction	155 200 (441 127)
Per-capita expenditures, mean (SD), $	55.54 (101.11)
Governance structure, no. (%)	
Local governance	1163 (77.0)
Shared governance	165 (10.9)
State governance	183 (12.1)
Local board of health, no. (%)	1116 (73.9)
Region, no. (%)	
Midwest	599 (39.6)
Northeast	244 (16.1)
South	461 (30.5)
West	207 (13.7)

[a]Data source: National Association of County and City Health Officials.[6]
[b]Data source: Centers for Disease Control and Prevention.[4]

LHDs included in the multivariate analysis had an average population of 155 200 and average per-capita expenditures of $55.54, although both distributions were right skewed (Table 3). Most of the 1511 LHDs included in the multivariate analysis were locally governed (77.0%; n = 1163) and had a local board of health (73.9%; n = 1116).

LHDs that served larger populations and had more funding tended to have higher EPHS scores than LHDs that served smaller populations and had less funding (Table 4). However, expenditures were unrelated to performance for EPHS 6 or EPHS 8. LHDs with a local board of health scored 3.0 points higher, on average, on EPHS 1 (95% confidence interval [CI], 0.5-6.0), 7.9 points higher on EPHS 3 (95% CI, 3.5-12.3), and 7.5 points higher on EPHS 9 (95% CI, 0.1-14.9) than LHDs with no local board of health.

State-governed LHDs scored an average of 31.0 points lower on EPHS 5 (95% CI, –45.4 to –16.6), 15.9 points lower on EPHS 6 (95% CI, –30.5 to –1.4), and 10.9 points lower on EPHS 10 (95% CI, –20.3 to –1.5) than locally governed health departments but 22.5 points higher on EPHS 8 (95% CI, 11.7-33.4) (Table 4). Health departments with shared governance scored higher than their locally governed counterparts: 12.2 points higher on EPHS 3 (95% CI, 1.4-22.9), 7.7 points higher on EPHS 5 (95% CI, 2.1-13.3), 16.9 points higher on EPHS 8 (95% CI, 3.4-30.4), and 17.4 points higher on EPHS 9 (95% CI, 1.5-33.4).

LHDs in the Northeast scored an average of 13.5 points lower on EPHS 2 (95% CI, –25.7 to –1.4) and 18.1 points lower on EPHS 7 (95% CI, –23.1 to –13.2) than LHDs in the Midwest (Table 4). However, compared with LHDs in the Midwest, LHDs in the Northeast scored 24.7 points higher on EPHS 6 (95% CI, 11.9-37.5) and LHDs in the South scored 11.2 points lower, on average, on EPHS 8 (95% CI, –20.7 to –1.7).

Of 6 performance-based LHD clusters, 2 had high mean EPHS scores, 2 had moderate EPHS scores, and 2 had low mean EPHS scores (Table 5). With few exceptions, high-scoring clusters had higher mean scores across all EPHSs. However, within scoring tiers, health departments could be divided between those that emphasized policy and regulation (eg, EPHS 5 and EPHS 6) and those that emphasized direct patient services (eg, EPHS 2 and EPHS 7).

The LHD clusters differed significantly by size of the population served; LHDs in the high-performance tier had the largest mean populations, and LHDs in the low-performance tier had the smallest mean populations ($P < .001$) (Table 4). Clusters also differed significantly by per-capita expenditures; LHDs in the high-performance tier spent the most overall ($P < .001$). The clusters differed significantly in their governance classifications; policy and regulation clusters tended to be more frequently locally governed than those that emphasized direct patient services ($P < .001$). In addition, the policy and regulation clusters were more likely to have a local board of health than were the direct patient services clusters ($P = .01$). The clusters also differed by their regional makeup; LHDs in the low-performance tier policy and regulation cluster were mostly in the Northeast, LHDs in the high- and moderate-performance tier direct patient services clusters were mostly in the South, and LHDs in the low-performance tier direct patient services cluster were mostly in the Midwest ($P < .001$).

Discussion

Our analysis indicates that LHDs have room for improvement on EPHS performance. Most health departments performed fewer than half of the activities that are key to the EPHSs. However, performance varied widely, with high performers and low performers in each EPHS category. On average, LHDs reported the highest performance in monitoring population health, mobilizing community partnerships, and developing public health policies. Health departments had the lowest scores overall for assuring a competent workforce, evaluating population-based health services, and performing research. Most health departments (73.8%) scored zero on EPHS 8, indicating that they do not use the Core Competencies for Public Health Professionals in any workforce recruitment or development activities.[5]

Findings from the multivariate model support previous studies that show health department performance increases with the size of the population served and per-capita health department spending.[9,11,12,15,30,31,36] The governance structure of LHDs had an interesting relationship with EPHS performance scores. State-governed health departments had significantly lower scores in local policymaking, enforcement of laws and regulations, and research than did locally governed health departments. However, state-governed health departments had significantly higher scores than locally governed health departments in assurance of a competent workforce. Health departments with shared governance often scored better than their locally governed

Table 4. Associations between Essential Public Health Service (EPHS)[a] scores and local health department (LHD) characteristics among LHDs that completed the 2013 National Profile of Local Health Departments Survey, United States[b]

Characteristic	Average Difference in Score[c] on EPHS				
	EPHS 1 (n = 1407)	**EPHS 2 (n = 1148)**	**EPHS 3 (n = 1397)**	**EPHS 4 (n = 344)**	**EPHS 5 (n = 1403)**
Population of jurisdiction (log)	6.1 (4.3 to 7.9)	3.2 (1.6 to 4.8)	5.8 (4.5 to 7.1)	3.9 (2.6 to 5.2)	8.3 (6.8 to 9.8)
Per-capita expenditures (log)	8.2 (4.3 to 11.1)	8.7 (6.1 to 11.7)	11.1 (7.9 to 14.4)	3.8 (1.7 to 6.0)	5.4 (3.3 to 7.5)
Governance structure					
Local governance	−1.5 (−18.7 to 15.6)	−3.2 (−27.3 to 20.9)	9.7 (−15.9 to 35.2)	−0.9 (−10.3 to 8.6)	−31.0 (−45.4 to −16.6)
Shared governance	6.2 (−3.8 to 16.2)	9.6 (−6.8 to 26.1)	12.2 (1.4 to 22.9)	3.9 (−4.9 to 12.7)	7.7 (2.1 to 13.3)
State governance	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
Local board of health					
Yes	3.0 (0.5 to 6.0)	0.7 (−5.2 to 6.6)	7.9 (3.5 to 12.3)	−1.6 (−5.9 to 2.7)	3.1 (−0.6 to 6.8)
No	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
Region					
Northeast	−8.5 (−20.2 to 3.2)	−13.5 (−25.7 to −1.4)	−5.4 (−13.8 to 3.0)	2.1 (−4.2 to 8.4)	5.1 (−1.4 to 11.5)
South	−3.8 (−16.0 to 8.4)	11.6 (−3.3 to 26.6)	−6.0 (−19.6 to 7.8)	−1.4 (−8.9 to 6.1)	−5.1 (−12.0 to 1.8)
West	−4.0 (−11.5 to 3.5)	−8.4 (−17.0 to 0.2)	3.6 (−4.3 to 11.5)	2.1 (−4.8 to 9.1)	1.9 (4.3 to 8.1)
Midwest	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]

Characteristic	Average Difference in Score[c] on EPHS				
	EPHS 6 (n = 1378)	**EPHS 7 (n = 1364)**	**EPHS 8 (n = 366)**	**EPHS 9 (n = 366)**	**EPHS 10 (n = 358)**
Population of jurisdiction (log)	5.3 (3.2 to 7.4)	4.0 (2.9 to 5.0)	2.1 (0.4 to 3.8)	5.6 (3.3 to 7.8)	8.0 (6.8 to 9.3)
Per-capita expenditures (log)	2.8 (−1.4 to 7.0)	8.8 (6.9 to 10.6)	0.8 (−3.1 to 4.6)	3.9 (−0.7 to 8.5)	5.1 (2.9 to 7.3)
Governance structure					
Local governance	−15.9 (−30.5 to −1.4)	7.1 (−5.5 to 19.7)	22.5 (11.7 to 33.4)	14.7 (−13.1 to 42.5)	−10.9 (−20.3 to −1.5)
Shared governance	−5.7 (−18.8 to 7.3)	4.9 (−4.2 to 14.0)	16.9 (3.4 to 30.4)	17.4 (1.5 to 33.4)	−4.5 (−13.3 to 4.3)
State governance	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
Local board of health					
Yes	3.6 (−0.7 to 7.9)	0.4 (−2.4 to 3.3)	3.2 (−2.9 to 9.3)	7.5 (0.1 to 14.9)	−1.4 (−5.8 to 2.9)
No	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
Region					
Northeast	24.7 (11.9 to 37.5)	−18.1 (−23.1 to −13.2)	−1.0 (−11.3 to 9.3)	−8.8 (−19.9 to 2.3)	3.8 (−2.5 to 10.1)
South	12.6 (−2.8 to 27.9)	5.4 (−3.2 to 13.9)	−11.2 (−20.7 to −1.7)	−3.9 (−19.0 to 11.1)	2.7 (−4.8 to 10.2)
West	−1.9 (−11.1 to 7.4)	−2.4 (−6.8 to 1.9)	1.8 (−9.1 to 12.8)	−3.8 (−12.1 to 4.4)	1.9 (−5.0 to 8.9)
Midwest	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]

Abbreviation: Ref, reference.
[a]Data source: Centers for Disease Control and Prevention.[4]
[b]Data source: National Association of County and City Health Officials.[6]
[c]Calculated by using multivariate linear regression, the model provides the difference in mean EPHS scores between LHD characteristics.

Table 5. Essential Public Health Service[a] performance score–derived local health department (LHD) clusters and differences in LHD characteristics between clusters among LHDs that completed the 2013 National Profile of Local Health Departments Survey (n = 1145), United States[b]

Cluster Description	High-Performance Tier		Moderate-Performance Tier		Low-Performance Tier		P Value[c]
	Policy and Regulation (n = 254)	Direct Patient Services (n = 167)	Policy and Regulation (n = 308)	Direct Patient Services (n = 214)	Policy and Regulation (n = 89)	Direct Patient Services (n = 113)	
Cluster mean score[d]							
1. Monitor health status to identify and solve community health problems.	83.0	72.4	66.5	52.4	33.1	39.7	—
2. Diagnose and investigate health problems and health hazards in the community.	59.6	89.9	38.3	37.9	6.4	31.7	—
3. Inform, educate, and empower people about health issues.	61.0	60.6	46.0	33.8	12.2	40.7	—
5. Develop policies and plans that support individual and community health efforts.	90.0	55.3	62.7	13.1	52.3	46.2	—
6. Enforce laws and regulations that protect health and ensure safety.	59.8	40.4	44.8	32.7	53.4	2.1	—
7. Link people to needed personal health services and assure the provision of health care when otherwise unavailable.	53.7	63.5	46.5	49.5	8.5	40.8	—
Characteristics of cluster members							
Mean (SD) population of jurisdiction, in thousands	326.3 (870.9)	138.5 (329.7)	116.5 (211.3)	82.2 (169.2)	69.4 (126.3)	114.5 (348.8)	<.001
Per-capita expenditures, mean (SD), $	84.5 (229.7)	72.3 (60.0)	51.9 (57.5)	48.2 (37.4)	17.3 (17.7)	60.4 (68.8)	.001
Governance structure, no. (%)							
Local governance	202 (79.5)	85 (50.9)	241 (78.2)	93 (43.5)	88 (98.9)	90 (79.6)	<.001
Shared governance	42 (16.5)	36 (21.6)	18 (5.8)	3 (1.4)	0	5 (4.4)	
State governance	10 (3.9)	46 (27.5)	49 (15.9)	118 (55.1)	1 (1.1)	48 (15.9)	
Presence of a local board of health, no. (%)	192 (76.5)	109 (65.3)	226 (73.6)	134 (63.2)	66 (74.2)	36 (66.4)	.01
Region, no. (%)							
Midwest	80 (31.5)	45 (26.9)	147 (47.7)	61 (28.5)	13 (14.6)	64 (56.6)	<.001
Northeast	45 (17.7)	2 (1.2)	27 (8.8)	18 (8.4)	71 (79.8)	11 (9.7)	
South	84 (33.1)	110 (65.9)	87 (28.2)	124 (57.9)	1 (1.1)	9 (8.0)	
West	45 (17.7)	10 (6.0)	47 (15.3)	11 (5.1)	4 (4.5)	29 (25.7)	

[a]Data source: Centers for Disease Control and Prevention.[4]
[b]Data source: National Association of County and City Health Officials.[6]
[c]Using the Pearson χ^2 and analysis of variance tests of significance for comparisons, with $P < .05$ considered significant.
[d]Distribution of health department scores ranging from 0 to 100, with 0 representing no activities performed and 100 representing all activities performed.

counterparts. These patterns in EPHS performance by governance structure are likely driven in part by differences in health department responsibilities, with state-governed and locally governed LHDs serving different purposes within a state's public health infrastructure. We also found significant relationships between EPHS scores and region. These regional differences may indicate that regional populations share similar needs, which the health departments are responding to, or may be a product of the differing roles of LHDs in the public health systems in various regions.

EPHS score–based cluster analysis indicated that LHDs may specialize in particular EPHS areas, consistent with findings of previous studies.[36-38] This finding suggests that given resource limitations or political limitations,

LHDs may be focusing on some areas and not on others. The associative analysis between structural characteristics and health department clusters also highlights important potential drivers of health department priorities. As expected, the high-performing LHD clusters had larger mean population sizes and higher mean per-capita expenditures than health departments with smaller mean populations and lower mean per-capita expenditures. Health department governance and presence of a local board of health also appear to be related to the types of services a health department provides. In addition, health departments within a given cluster tended to be from the same region. This finding again supports the notion of regional similarities in health departments.

Limitations

This study had several limitations. First, although this study drew from a sampling frame that included all LHDs, responses differed by population size, and LHDs serving smaller populations were less likely to respond than LHDs serving larger populations. Based on the associations between population size and LHD performance in our model, the differential response rate by population size may indicate that we overestimated nationwide EPHS performance.

Second, although activities included in the PCAs were informed by metrics used in previous evaluations, we were limited to the questions asked by the NACCHO survey and did not cover all activities necessary for fulfillment of each EPHS. Furthermore, many surveillance activities categorized to EPHS 1 are often included in EPHS 2. However, we felt these activities fit well within the "monitor health" description of EPHS 1. EPHS 7, which represents linkage to and provision of care, has typically been interpreted as a health department assuring access to care. In this analysis, we included activities that represented health departments not just linking to care but also providing clinical care. We believe the inclusion of these activities provides a more robust picture of the services being offered by LHDs to ensure access to care in their communities. In addition, scores were derived from statistical relationships identified in PCA and not on any indication that an activity was more or less important. That is, highly loaded variables should be considered indicators of performance rather than drivers of performance.

Third, there was likely unmeasured variability in both LHD performance and the LHD characteristics that we did not account for in our analysis. We based our analysis on self-reported performance of activities, not on how well those activities were performed. Therefore, we would expect additional variability in performance within each activity. Similarly, we lacked detailed information on the characteristics of LHDS evaluated. For example, although we could account for the presence of a local board of health, we had no information on the board of health's tasks, which may be meaningful for health department success.

Fourth, we focused on those activities being performed by LHDs directly. However, LHDs exist within a larger local health system in which other entities may be responsible for providing essential services to their communities. State or other local government agencies may be mandated to carry out 1 or more of the EPHSs rather than all EPHSs falling under the purview of the LHD. Therefore, low EPHS scores may indicate a sharing of responsibilities rather than a lack of EPHS provision. In addition, these data were collected from LHDs in 2013, and capacities may have changed since then.

Future research exploring temporal trends in LHD performance and the relationships between structural characteristics and performance is vital to further improve the understanding of LHD capacity needs. In addition to the NACCHO profile data, other data sets, such as the National Longitudinal Survey of Public Health Systems, offer opportunities to further investigate these relationships.[39]

Conclusions

Our analysis suggests that LHD performance on the EPHSs varies widely and is weak overall. Performance was positively associated with per-capita expenditures and size of the population served, which supports previous findings. Performance also differed by governance structure, suggesting that the governance structure affects the LHD's role in states' public health infrastructure. The clustering of LHDs by performance scores indicates that LHDs may be specializing in services.

Understanding the level of EPHS performance by LHDs, and the variations in that performance, is fundamental in evaluating population access to critical public health services. These findings allow us to identify underserved populations and evaluate correlates to health department performance, which serve to guide performance improvement efforts. Further research on LHD capacity and the changes in that capacity over time is necessary for identifying gaps in the provision of public health services. Finally, LHDs are an essential part of the public health infrastructure in the United States and require continued resources and support to provide EPHSs to their communities.

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Supplemental Material

Supplemental material for this article is available online.

References

1. Institute of Medicine. *The Future of the Public's Health in the 21st Century*. Washington, DC: National Academies Press; 2003.
2. National Association of County and City Health Officials. Operational definition of a functional local health department.

2005. https://www.naccho.org/uploads/downloadable-resources/Operational-Definition-of-a-Functional-Local-Health-Department.pdf. Accessed June 6, 2017.

3. Trust for America's Health. *A Funding Crisis for Public Health and Safety: State-by-State and Federal Public Health Funding Facts and Recommendations*. Washington, DC: Trust for America's Health; 2018. https://www.tfah.org/report-details/a-funding-crisis-for-public-health-and-safety-state-by-state-and-federal-public-health-funding-facts-and-recommendations. Accessed October 11, 2019.

4. Centers for Disease Control and Prevention. 10 Essential Public Health Services. Reviewed 2018. https://www.cdc.gov/stltpublichealth/publichealthservices/essentialhealthservices.html. Accessed May 5, 2015.

5. Council on Linkages Between Academia and Public Health Practice. Core competencies for public health professionals. 2015. http://www.phf.org/resourcestools/Documents/Core_Competencies_for_Public_Health_Professionals_2014June.pdf. Accessed January 9, 2017.

6. National Association of County and City Health Officials. National profile of local health departments survey, 2013: core and module 1. http://nacchoprofilestudy.org/data-requests. Accessed October 14, 2019.

7. Turnock BJ, Handler A, Hall W, Potsic S, Nalluri R, Vaughn EH. Local health department effectiveness in addressing the core functions of public health. *Public Health Rep*. 1994;109(5):653-658.

8. Turnock BJ, Handler AS, Miller CA. Core function-related local public health performance. *J Public Health Manag Pract*. 1998;4(5):26-32.

9. Richards TB, Rogers JJ, Christenson GM, Miller CA, Taylor MS, Cooper AD. Evaluating local public health performance at a community level on a statewide basis. *J Public Health Manag Pract*. 1995;1(4):70-83.

10. Mays GP, Halverson PK, Baker EL, Stevens R, Vann JJ. Availability and perceived effectiveness of public health activities in the nation's most populous communities. *Am J Public Health*. 2004;94(6):1019-1026. doi:10.2105/ajph.94.6.1019

11. Mays GP, McHugh MC, Shim K, et al. Getting what you pay for: public health spending and the performance of Essential Public Health Services. *J Public Health Manag Pract*. 2004;10(5):435-443.

12. Erwin PC. The performance of local health departments: a review of the literature. *J Public Health Manag Pract*. 2008;14(2):E9-E18. doi:10.1097/01.PHH.0000311903.34067.89

13. Frieden TR. Asleep at the switch: local public health and chronic disease. *Am J Public Health*. 2004;94(12):2059-2061. doi:10.2105/ajph.94.12.2059

14. Suen J, Magruder C. National profile: overview of capabilities and core functions of local public health jurisdictions in 47 states, the District of Columbia, and 3 U.S. territories, 2000-2002. *J Public Health Manag Pract*. 2004;10(1):2-12.

15. Hyde JK, Shortell SM. The structure and organization of local and state public health agencies in the U.S.: a systematic review. *Am J Prev Med*. 2012;42(5 suppl 1):S29-S41. doi:10.1016/j.amepre.2012.01.021

16. Willard R, Shah GH, Leep C, Ku L. Impact of the 2008-2010 economic recession on local health departments. *J Public Health Manag Pract*. 2012;18(2):106-114. doi:10.1097/PHH.0b013e3182461cf2

17. Davis MV, Bevc CA, Schenck AP. Declining trends in local health department preparedness capacities. *Am J Public Health*. 2014;104(11):2233-2238. doi:10.2105/AJPH.2014.302159

18. Riley WJ, Bender K, Lownik E. Public health department accreditation implementation: transforming public health department performance. *Am J Public Health*. 2012;102(2):237-242. doi:10.2105/AJPH.2011.300375

19. US Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Public health infrastructure. 2016. https://www.healthypeople.gov/2020/topics-objectives/topic/public-health-infrastructure. Accessed October 7, 2016.

20. Healthy People 2010. Healthy People 2010 final review. 2015. http://www.cdc.gov/nchs/healthy_people/hp2010/hp2010_final_review.htm. Accessed October 7, 2016.

21. Centers for Disease Control and Prevention. Public health's infrastructure; a status report. 2001. https://stacks.cdc.gov/view/cdc/11337. Accessed March 9, 2017.

22. Public Health Accreditation Board. Who is accredited? Updated 2019. https://www.phaboard.org/who-is-accredited. Accessed February 27, 2019.

23. Yeager VA, Ye J, Kronstadt J, Robin N, Leep CJ, Beitsch LM. National voluntary public health accreditation: are more local health departments intending to take part? *J Public Health Manag Pract*. 2016;22(2):149-156. doi:10.1097/PHH.0000000000000242

24. Beatty KE, Erwin PC, Brownson RC, Meit M, Fey J. Public health agency accreditation among rural local health departments. *J Public Health Manag Pract*. 2018;24(1):49-56. doi:10.1097/PHH.0000000000000509

25. Bhandari MW, Scutchfield FD, Charnigo R, Riddell MC, Mays GP. New data, same story? Revisiting studies on the relationship of local public health systems characteristics to public health performance. *J Public Health Manag Pract*. 2010;16(2):110-117. doi:10.1097/PHH.0b013e3181c6b525

26. Mays GP, Scutchfield FD, Bhandari MW, Smith SA. Understanding the organization of public health delivery systems: an empirical typology. *Milbank Q*. 2010;88(1):81-111. doi:10.1111/j.1468-0009.2010.00590.x

27. Schenck AP, Meyer AM, Kuo T-M, Cilenti D. Building the evidence for decision-making: the relationship between local public health capacity and community mortality. *Am J Public Health*. 2015;105(suppl 2):S211-S216. doi:10.2105/AJPH.2014.302500

28. Centers for Disease Control and Prevention. National Public Health Performance Standards. 2016. https://www.cdc.gov/stltpublichealth/nphps/index.html. Accessed January 14, 2016.

29. Kolenikov S, Angeles G. *The Use of Discrete Data in PCA: Theory, Simulations, and Applications to Socioeconomic Indices*. Chapel Hill, NC: MEASURE Evaluation, University of North Carolina at Chapel Hill, Carolina Population Center; 2004.

30. Mays GP, McHugh MC, Shim K, et al. Institutional and economic determinants of public health system performance. *Am J Public Health*. 2006;96(3):523-531. doi:10.2105/AJPH.2005.064253

31. Handler AS, Turnock BJ. Local health department effectiveness in addressing the core functions of public health: essential ingredients. *J Public Health Policy*. 1996;17(4):460-483.

32. US Census Bureau. Census regions and divisions of the United States. https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf. Accessed October 7, 2019.

33. Fraley C, Raftery AE, Murphy TB, Scrucca L. *mclust Version 4 for R: Normal Mixture Modeling for Model-Based Clustering, Classification, and Density Estimation*. Technical Report No. 597. Seattle, WA: University of Washington, Department of Statistics; 2012.

34. Fraley C, Raftery AE. Model-based clustering, discriminant analysis, and density estimation. *J Am Stat Assoc*. 2002; 97(458):611-631. doi:10.1198/016214502760047131

35. *RStudio: Integrated Development for R* [statistical software]. Boston, MA: R Studio, Inc; 2015.

36. Harris JK, Beatty K, Leider JP, Knudson A, Anderson BL, Meit M. The double disparity facing rural local health departments. *Annu Rev Public Health*. 2016;37:167-184. doi:10.1146/annurev-publhealth-031914-122755

37. Berkowitz B. Rural public health service delivery: promising new directions. *Am J Public Health*. 2004;94(10):1678-1681. doi:10.2105/ajph.94.10.1678

38. Bekemeier B, Pantazis A, Dunbar MD, Herting JR. Classifying local health departments on the basis of the constellation of services they provide. *Am J Public Health*. 2014;104(12): e77-e82. doi:10.2105/AJPH.2014.302281

39. Mays GP, Scutchfield FD. *National Longitudinal Survey of Local Public Health Systems, 1998-2014*. Ann Arbor, MI: Inter-University Consortium for Political and Social Research; 2015. doi:10.3886/ICPSR23420.v2