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Impact of Organizational Networks on the Cost of Core Services in Ohio's Local Health Departments

Jason E. Orcena
University of Illinois at Chicago & Union County Health Department, Ohio, jason.orcena@uchd.net

Michael Petros
University of Illinois at Chicago, mpetro6@uic.edu

Patrick M. Bernet
Florida Atlantic University, pmbernet@hinfo.org

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Abstract

Introduction: Although several studies have linked population size to the cost of service delivery in local health departments, none have looked at the network position of the LHD. This study expands the understanding of how the position of an LHD in Ohio's local health department network affects its expenditures in providing core, or nonclinical, services.

Methods: In 2014, 44% (55 of 124 eligible) of Ohio's health officers responded to the PARTNER survey, a web-based network analysis program, with the analysis completed by the spring of 2015. Network data were then included in a regression analysis of the Core Plus-Scale model developed by Bernet and Singh using the 2008 and 2010 National Association of County and City Health Officials (NACCHO) Profile of LHDs, Ohio's 2011 Annual Financial Report of LHDs, and the 2010 U.S. Census.

Results: The results demonstrated that higher levels of network interaction are associated with higher expenditures in the delivery of core services. A linear regression was conducted to predict core expenditures based on closeness centrality. A significant regression was found $F(1,116) = 21.557$, p <0.001 with an $R^2 = 0.157$.

Implications: While population size of a jurisdiction remained the best predictor of expenditures on core services, the addition of closeness centrality and value caused a significant increase in the adjusted R^2 of the entire model. The results suggested that the more central a local health department was within its own peer network, the greater its resources and expenditures on core services.

Keywords

social network analysis, core expenditures, local health departments

Cover Page Footnote

No competing financial or editorial interests were reported by the authors of this paper.

INTRODUCTION

While the issue of financing of local public health continues to be widely discussed, many studies have linked population size, breadth of service, and ability to meet standards to the cost of delivery.[1-4] What is often missing in the discussion is the role of LHD networks in the delivery of local services and the cost that such network relationships entail.

Previous regression analysis using data collected by the National Profile of Local Public Health Agencies found that per capita public health spending decreases as the population reaches approximately 100,000 covered lives.[3] However, further investigation by Bernet and Singh[2] using Annual Financial Reporting data in Ohio did not find the L-shaped relationship discovered in previous research. Instead, they reported that the relationship between per capita expense and population in Ohio was linear. They posited that Ohio had reached an "efficiency frontier." Their final model identified population characteristics, particularly size, breadth of services offered, and percent of staff dedicated to clinical care as key influencers on spending for core services in Ohio.

The current study expands the understanding of how the position of an LHD in Ohio's local health department network affects its costs for providing core services.[5]

METHODS

Data for the social network analysis were collected in the fall of 2014 through a survey of Ohio's 124 local health commissioners using PARTNER, a web-based network analysis tool, with the analysis completed in the spring of 2015. Of the 124 eligible, 55 (44%) of LHDs responded in whole or in part to the PARTNER survey. PARTNER provided both centrality and qualitative measures for relationships among all of Ohio's LHDs regardless of participation as long as one member of any given dyad participated in the survey. Closeness centrality was chosen to represent network centrality in the final model. Closeness is a measure of the degree to which an individual is near all other individuals in a network. Closeness, therefore, measures both an LHD's position within the network and its value to that network based on its reach and influence.

Core (services) expenditures were derived from previous work and represented the natural log of total expenditures on services considered core in the Public Health Futures report, including such items as expenditures on environmental health, health education, epidemiology, and administration while specifically excluding all clinical services.[1,2] As with previous studies, the natural log of core expenditures and the log of population were used to normalize the significant differences between small and large health departments in both jurisdictional size and funding in the multiple regression model.

Given the small sample size, several tests were conducted to ensure adequate representation of both regions and city–counties in the sample. Chi-square tests found no significant variation in respondents from expected in any category of region, $X^2(4, N = 124) = 7.293$, $p = 0.121$, or city-county, $X^2(1, N = 124) = 1.984$, $p = 0.159$.

The University of Illinois at Chicago Institutional Review Board granted a request for exemption (Research Protocol # 2014-0668) for the collection of the network analysis. To match previous work by Bernet and Singh,[2] additional data were provided by the 2008 and 2010 National Association of County and City Health Officials (NACCHO) Profile of LHDs, Ohio's 2011 Annual Financial Report of LHDs, and the 2010 US Census.[1]

RESULTS

Closeness centrality was found to have a low to moderate positive correlation to three of the independent variables, NACCHO breadth of services ($r=0.212$; $n=110$; $p<0.05$); NACCHO percent of services ($r = 0.317$; $n=117$; $p<0.01$); and population ($r = 0.354$; $n=119$; $p<0.01$), and a moderate, positive relationship with the dependent variable, core expenditures ($r=0.396$; $n = 118$; $p<0.01$). In all four cases, the more central an LHD was to the network, the more services they performed from the NACCHO list of services, the higher the population they served, and the more the agency spent on core services. The number of Ohio Department of Health (ODH) grants was also found to have a strong correlation with core expenditures ($r=0.789$; $n=123$; $p<0.01$) so that an LHD with a greater number of grants from the state department of health was more likely to spend more on core services regardless of the type of grant.

The results of the multiple regression examining network measures on Core Plus Scale model are presented in the Table, below.

Additionally, several LHDs were found to have zero reported connections, a reduced sample regression model was created including only those health districts who had at least one confirmed direct connection to another LHD. This model also required the elimination of one extreme outlier who reported more than twice the number of network connections as the next highest LHD. The final reduced model included Population (B = 0.920, $p<0.001$); NACCHO Breadth of Coverage (B = 0.015, $p<0.001$); percent staffing on direct care (B = 1.305, $p<0.01$); and closeness centrality (B = 2.165, $p<0.05$). The resulting linear regression model was found to be significant, $F(4, 78) = [105.825]$, $p<0.001$, with an adjusted R^2 of 0.836. Although not presented in the table, it is interesting to note that the standardized coefficients in the model are similar (closeness centrality, Beta = 0.106; NACCHO Breadth of Coverage, Beta = 0.145; and percent staffing on direct care, Beta = 0.143) with the exception of population (Beta = 0.778). This reinforces the supposition that jurisdictional characteristics, i.e., population, have a more profound influence on cost than anything within the control of the district.

Since 50% of Ohio's population is found within 14 large health jurisdictions, a reduced sample of LHDs with jurisdictions less than 195,000 was also examined. The reduction in the sample size had little impact on the predictive ability of the models, although closeness centrality was found to be a predictor of higher spending on core services only when the number of grants received by an LHD was included in the model.

Regardless of the variations to the dependent variable, core expenditures, population (log), closeness centrality, and count of ODH grants were significant predictors of increased spending on core services by an LHD.

IMPLICATIONS

The current study builds on the previous work of Bernet and Singh,[1] which found that size of jurisdiction is the strongest predictor of cost of service delivery. In the new model, network position and the number of grants were also predictors of expenditures on core services.

It is unknown from the study whether network relationships acted as a cost-containment mechanism or increased the ability of an LHD to provide services, as proponents of shared service models believe. The addition of the new variables improved the accuracy of the model and demonstrated that the more central an LHD is to the network, the more resources they have available to spend on core services. For public health leaders, given that the key linkage between expenditures on core services was population size of the jurisdiction, the use of network relationships to expand resources may be the next most viable option.

SUMMARY BOX

What is already known about this topic? Research has found evidence that size of jurisdiction has an impact on both the cost of providing public health services and the quality of those services. In this study, the impact of network relationships on those costs is explored.

What is added by this report? The study found that increasing embeddedness within the network of LHDs, i.e. relationships up to and including shared services were related to a net increase in expenditures on core services.

What are the implications for public health practice, policy, and research? What is not clear from the study is whether the costs are less than would have been experienced if the LHD had not engaged in those relationships. From the study, it is clear that interagency relationships increase expenditures on core services. While an LHD cannot control its jurisdictional size, it can control its network involvement.

REFERENCES

1. Bernet PM, Singh S. Economies of scale in the production of public health services: an analysis of local health districts in Florida. Am J Public Health. 2015;105 Suppl 2:S260–7.
2. Bernet P, Singh S. The Cost of Doing Business: Developing a Cost Model for the Minimum Local Public Health Services Package in Ohio. Columbus, Ohio: April 2013.
3. Santerre RE. Jurisdiction size and local public health spending. Health Serv Res 2009;44(6):2148–66.
4. Hajat A, Cilenti, D, Harrison LM, et al. What predicts local public health agency performance improvement? A pilot study in North Carolina. J Public Health Manag Pract 2009;15(2):E22–33.
5. Association of Ohio Health Commissioners. Public Health Futures: Considerations for a New Framework for Local Public Health in Ohio. Columbus, Ohio: Health Policy Institute of Ohio, 2012. http://www.healthpolicyohio.org/public-health-futures-considerations-for-a-new-framework-for-local-public-health-in-ohio/

Table. Regression of Bernet-Singh core spending model with closeness centrality

	Unstandardized Coefficients			Unstandardized Coefficients		
	Core Spending (ln), all LHDs			Only cases (jurisdictions) with less than 195,000 population		
	Bernet & Singh	New		Bernet & Singh	New	
(Constant)	4.253***	3.559**	5.501***	6.360***	5.589***	7.028***
Jurisdiction Characteristics						
Type of agency =city	-.192	-.094	.033	-.533	-.397	-.179
Type of agency =county						
Population size (log)	.879***	.846***	.692***	.769***	.741***	.625***
Percent pop. rural	.381	.475	.388	-.127	.037	.073
Percent pop. nonwhite	2.408**	2.344**	1.693*	1.404	.1446	1.161
Percent pop. non-English speaking	1.843	1.225	2.311	5.314	4.223	3.797
Percent pop. 65+ years old (%)	-2.241	-1.701	-3.426	-3.725	-3.197	-4.546
Percent pop. uninsured (%)	-2.652	-2.645	-2.377	-4.455	-4.412	-5.147
Physicians per 100,000 population	-.001	.000	-.001	-.001	-.001	.000
Core-Plus Scale Measures						
NACCHO breadth of coverage	.011**	.011**	.009*	.008	.008	.005
% Staffing on direct care	1.352***	1.189***	.990**	1.245***	1.120	.989
Network Measures						
Closeness Centrality		**1.457***	**1.528***		**1.491**	**1.438***
Contribution		.115	.030		.093	0.023
Count of ODH Grants			**.209***			**.235***
Run summary						
F	63.847***	56.820***	66.000***	29.494***	26.224***	31.566***
F Change		3.728*	22.421***		2.949	20.378***
r2 adjusted	.868	.878	.901	.780	.795	0.837
r2	.855	.862	.888	.754	.765	0.81
N	108	108	108	94	94	94

*** *p< 0.001;*   **p<0.01;*   *p<0.05*