Determinants of US Local Health Department Expenditures, 1992 through 1993

ABSTRACT

Objectives. This study examined local health department expenditures and their relationship to several departmental characteristics, including the size of the population in the department's jurisdiction.

Methods. Local health department characteristics were obtained from a 1992/93 nationwide mail survey and modeled by means of multiple linear regression.

Results. Great variability existed in the per capita expenditures of local health departments, and approximately 70% of the variability was accounted for by differences in jurisdiction population size. Additional characteristics of the health departments explained another 11%. The average unadjusted per capita expenditure by local health departments nationwide was $26.

Conclusions. Local health department expenditures that support essential public health services average a dime a day per person. (*Am J Public Health.* 1997;87:91–95)

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Introduction

Public health expenditures represent less than 4% of all health care expenditures.[1] Prospects for additional resources are limited because of the ever-increasing percentage of the nation's gross domestic product spent for health care, limited public resources, the shift of Medicaid revenue to private providers, and an emphasis on governmental accountability. In Los Angeles County and New York City, budget cuts in public health expenditures have had dramatic effects on personnel and services.[2] In such circumstances, effective strategies are needed to analyze the efficiency of public health spending and establish its value to the public.

A natural way to begin such analyses is to examine local health department funding and expenditures. As Haven Emerson has noted, local health departments are "the base, the foundation structure, and essential functioning element in all public health service."[3] They are found "where care is delivered, where patients actually live, where the environment affects health and where systems operate."[4]

Since the early 1900s, researchers and government officials have repeatedly used per capita expenditures to describe local health department spending patterns and compare different regions and individual departments.[5] We followed that approach and examined the most recent national data on local health department per capita spending through a model relating a health department's budget to the population size of its jurisdiction and several additional parameters describing its administrative and political environment.

Methods

Survey Instrument

The National Association of County and City Health Officials and the Centers for Disease Control and Prevention surveyed the nation's local health departments.[6] A local health department was defined as "an administrative or service unit of local or state government, concerned with health, and carrying some responsibility for the health of a jurisdiction smaller than the state."[6] The National Association of County and City Health Officials surveyed 2888 local health departments and completed two additional mailings to all nonrespondents. The final response rate was 72% (2079 local health departments).

Model Variables

The dependent variable was total expenditures; each respondent provided expenses for a single fiscal year. The medical care component of the Bureau of Labor Statistics Consumer Price Index was used in adjusting expenditures to 1993 dollars.[7] Population of the jurisdiction served by the local health department, the primary independent variable, was determined from 1990 US census data. The smallest local health department

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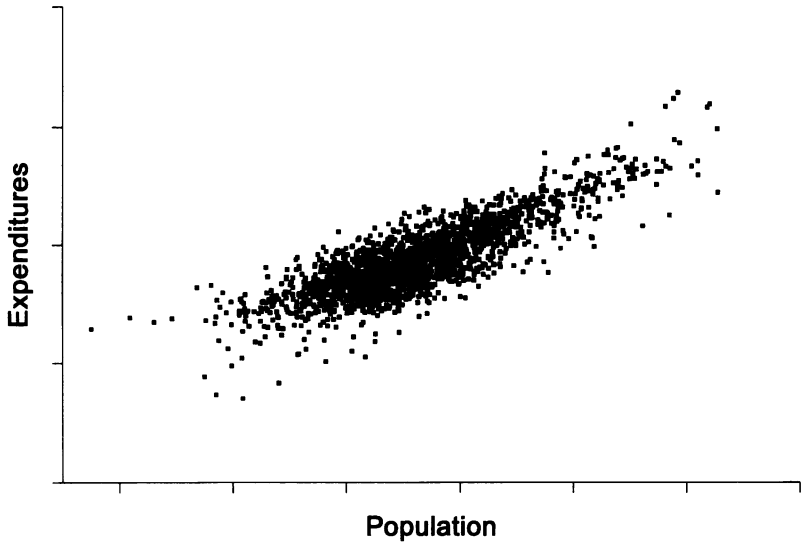

Note. A Box–Cox transformation was used in transforming expenditure and population values.

FIGURE 1—A scatterplot of transformed total local health department expenditures and the transformed 1990 US Census population for the department's jurisdiction.

served a population of 558, and the largest served 2.8 million; half of the departments served between 14 000 and 73 000 people. To make the relationship between population and expenditures linear and to meet the other required assumptions of a linear regression model, we transformed both population and expenditures using a Box and Cox power transformation.[8]

From nine survey questions, 29 potential model variables were created. Twelve were continuous. We included the number of full-time staff members and the total of 52 services each local health department provided or provided by contract. The 10 remaining continuous variables indicated the percentage of local health department expenditures derived from 10 different sources: city/township/town, county, state (including pass-through federal funds), direct federal, Medicaid, Medicare, private foundation, private health insurance, patient fees, and regulatory fees.

Using dummy variables, we assigned each department one of five different jurisdiction types: county, city/county, city, town/township, or multicounty/region district. County observations were defined as the reference group. To measure the effect of the administrative relationship between the state and the local health department, we categorized every local health department as centralized (a unit of the state health department), independent, or shared. Dummy variables defined the centralized departments as the reference group.

A single yes/no variable indicated the presence or absence of a local board of health. Five other variables gauged the local board of health's involvement in local health department affairs and showed the board's statutory authority or lack of authority to (1) establish local health policy, fees, ordinances, and regulations; (2) recommend the budget; (3) approve the budget; (4) establish community health priorities; and/or (5) hire the agency head. Another binary variable indicated whether the health department had a long-term plan (5 to 7 years), and a final one indicated whether any of five planning tools (Healthy People 2000, National Health Promotion and Disease Prevention Objectives, Healthy Communities 2000, Planned Approach to Community Health, Healthy Cities, or Assessment Protocol for Excellence in Public Health) were used in the department's organizational efforts.

Response Rate and Sample Size

Of 2079 responses, we excluded 371 because they lacked an accurate population value, were missing an expenditure figure or fiscal year, had a response of "other" for one or more of the analysis questions, or had reported projected expenditures for 1994 instead of actual expended amounts or expenditures for 1990, 1991, 1992, or 1993. Three observations were eliminated because they were outliers in preliminary regression analyses (i.e., their studentized residuals were greater than four). The final data set involved 1708 observations and represented approximately 60% of all local US health departments and 68% of the US population.

Statistical Analyses

All analyses and graphics were prepared with SAS version 6.10 for personal computers.[9] Main effects for all parameters and interaction terms for the effects of jurisdiction and administrative relationship were included in initial model runs. Collinear variables were excluded in stepwise fashion until the remaining parameters were judged sufficiently independent. Collinearity was assessed by means of diagnostics provided by SAS, and criteria used to eliminate variables were those suggested by Belsley et al.[10] Remaining parameters were included in a forward selection procedure ($P = .05$) to obtain a final model. Predicted per capita expenditures were calculated by dividing the regression model's predicted local health department budget by the jurisdiction's population size.

Results

Unadjusted Per Capita Expenses

Unadjusted per capita expenses ranged from less than $1 to $227. Ninety percent of the per capita values were between $6 and $54, and 50% were between $10 and $33. The mean per capita expenditure for all departments was $26, and the median was $20.

Model Predictions

A regression of the Box–Cox transformed budget on population accounted for 71% of the scatter in local health department expenses (adjusted R^2) and was statistically significant, $F(1, 1851) = 4535$, $P < .0001$ (Figure 1). Predicted mean per capita expenditures plotted against population size formed an inverted U -shaped curve (Figure 2). Per capita expenditures increased with population size from $7 per capita for a population of approximately 200 to $20 for jurisdictions with between 190 000 and 250 000 individuals. Local health

departments serving areas with more than 250 000 individuals had smaller per capita expenditures. For the largest population in this study (approximately 3 million), predicted mean per capita expenditures were $18.

Fifteen parameters other than population were included in the final model (Table 1). Together, they accounted for 82% (adjusted R^2) of the variability in expenditures, F(14, 1707) = 544, $P <$ .0001. The mean predicted per capita expenditure for this model was $22, and the median was $19.

With population as the only predictor, 99% of the predicted expenditures were between $13 and $21 per capita. With all predictors, 99% of the predictions were between $6 and $63 per capita. The difference between the predicted per capita expenditures for the two models increased with population and was nearly 40-fold for the largest jurisdictions.

After population size, the three largest contributors to the variability in transformed expenditures were number of full-time staff (4%), percentage of funds received from Medicare (3%), and number of programs provided by the department (2%). All were positively correlated with expenditures.

One other variable, the proportion of funding received from county sources, contributed more than 1% to the outstanding variability (1.2%). Predicted per capita expenditures decreased with an increasing proportion of county funds. Despite statistical significance, none of the other factors explained more than 0.6% of the remaining variability.

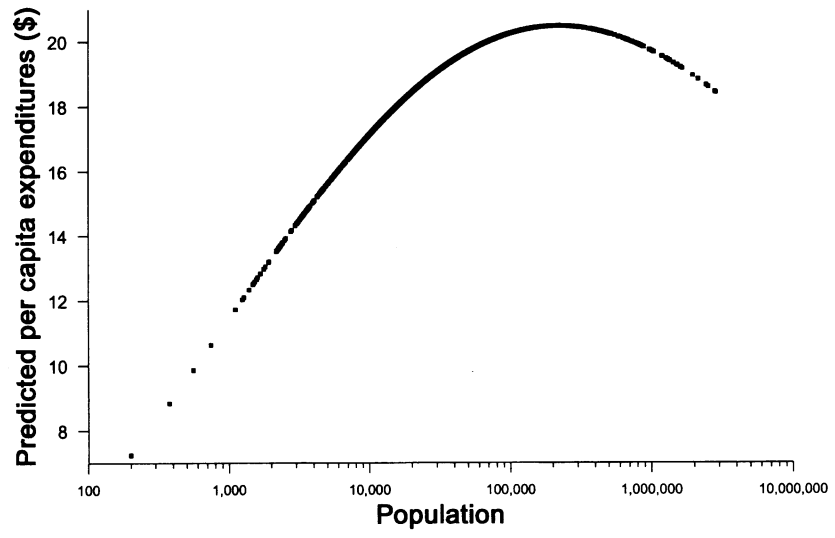

FIGURE 2—Predicted local health department per capita expenditures from the regression of transformed department expenditures on transformed 1990 population values.

TABLE 1—Parameter Estimates for the Final Regression Model: Variability in Local Health Departments' Expenditures

	Parameter Estimate	SE	Partial R^2
Population	1.371***	0.0282	.701
Full-time staff	0.005***	0.0003	.039
Medicare	0.021***	0.0026	.028
Programs provided	0.039***	0.0039	.023
County sources	−0.016***	0.0016	.012
City sources	−0.016***	0.0014	.006
Local board of health hires agency head	0.370***	0.0819	.003
City jurisdiction	0.481***	0.1344	.001
Regulatory fees	−0.012**	0.0040	.001
Local board of health recommends budget	−0.420**	0.0791	.001
Decentralized relationship	0.380**	0.0980	.001
Shared relationship	0.231*	0.0824	.001
Long-term plan	−0.138*	0.0603	.001
Medicaid	0.008*	0.003	.001

*$P <$ .05; **$P <$ .01; ***$P <$ .001.

Discussion

Approximately 70% of the variability in reported US local health department expenditures could be explained by the population size of the department's jurisdiction. The relationship between population and expenditure was nonlinear, and estimated per capita expenses were greatest in jurisdictions with populations between 190 000 and 250 000. Variables describing departmental staffing, programs, and funding sources explained an additional small but measurable portion of the variability in local health department expenditures.

Emerson suggested that effective local health departments would be organized to serve populations of at least 50 000.[11] Wissel found that departments serving populations of more than 65 800 were more likely to carry out the core public health functions.[12] Self-reported adequacy of performance scores in a six-state survey were highest in jurisdictions serving populations between 250 000 and 500 000.[13] Still, two thirds of the local health departments studied here served jurisdictions of less than 50 000. According to Koplin, such units represent "a major deterrent to efficient functioning of local health agencies."[14]

Shonick and Price reported "no clear-cut connection" between per capita expenditures and population size.[15] The differences between Shonick and Price's conclusions and those reported here are probably attributable to their study's smaller sample and use of categorical summaries and rank order statistics that may have obscured the nonlinear relationship reported in this paper.

Per capita expenditures increased as smaller departments added staff and services. At populations greater than 250 000, predicted per capita expenditures decreased. It is tempting to attribute the decrease to economies of scale, but this study provides no direct evidence for such an assertion.

Emerson recommended that $1 ($19.25 in 1993 dollars) per capita be spent to provide basic public health services.[11] Roughly half of the local health departments in this study spent less than that amount. Roper suggested that minimum funding in Alabama should be $10 per capita.[16] Washington State recently determined that total state and local public health financing should be $83 per capita.[17] Only 3.2% of the local health departments in this study expended that amount.

Measurements of public health funding have been equally varied. In 1982, the Association of State and Territorial Health Officials reported that per capita public health expenditures ranged between $8.12 and $72.62.[18] The nation's total health expenditure in 1993 was $884 billion, or more than $3000 per person. In the same year, total public health spending, including personal care services delivered by all public health agencies, was $25 billion, or nearly $100 per capita.[19] The Public Health Foundation recently estimated that $44 per capita is spent on providing the core public health functions.[20]

Comparing local health departments today is complicated because no standard defines which items should be included in a total public health budget, and the number and diversity of programs now offered by local health departments are vastly different from the well-defined set of programs present during public health's early years. Further complications arise because regional and local disparities exist in health care needs, costs, and expectations, even for departments serving similarly sized jurisdictions.

Despite the potential methodological and political pitfalls, much can be gained by inspecting per capita figures. They reflect the relative value ascribed to public health in comparison with other budget items. Using per capita estimates, it should be possible to define a range of funding that will support effective local health department management and within which the basic public health needs of most populations will be met.

Several statistically significant parameters were excluded from the model because their interdependence with model parameters precluded reliable estimates of their coefficients. The choice of parameters, while following statistical criteria, is, in fact, arbitrary. The need to use such procedures demonstrates our limited knowledge of the processes affecting expenditures and suggests that more proximal determinants are undisclosed.

Anomalous observations were eliminated from the final model. Their inclusion would have increased the estimated per capita costs and associated uncertainty. Variability may also have been underestimated and the model biased because only 60% of the nation's local health departments were included in this analysis and no attempt was made to weight the data for nonrespondents.

Factors other than those modeled here influence local health department budgets; the demand for health services, the quality of the services delivered, political constraints, community priorities, and the contributions that local civic and community health care organizations make to public health efforts are examples. Their effect is evident in the wide scatter of raw per capita expenditures beyond the range suggested by the model. At every population size, raw per capita expenses varied over a range that was at least three times as large as the predicted average value. Pickett's caution under these circumstances is extremely apropos: "When the units counted represent such diverse ecological and political systems, statistical analyses that result in a portrait of the 'average' unit tend to increase rather than decrease distortion of reality."[21] Thus, in any application of this model, one must be mindful of the underlying diversity and consider local political, economic, and health conditions.

Agencies other than local health departments, such as private organizations, public hospitals, community and migrant health centers, school-based clinics, maternal and child health clinics, family planning centers, private clinics and practitioners, and universities, also support and deliver local public health services.[22,23] Halverson estimated that such agencies complete 26% of local public health activities.[24] Their contributions often determine the effectiveness of local health departments and public health at the local level.

Our model does not account for costs associated with individual programs, the quality of the provided services, or differences in outcomes between different local health departments. For example, jurisdictions with large portions of Medicaid and Medicare funds and higher per capita expenditures provide more clinical care than others. To account for such differences and be able to specify optimal jurisdiction sizes or per capita expenses will require detailed tracking of individual programs and expenses.

Conclusions

Average annual per capita spending for the local health departments studied here was $26, or less than a dime a day. The truly remarkable finding of this study, however, was the broad range of local health department spending, even for jurisdictions of similar size. This finding reflects equally diverse needs and priorities characteristic of our local public health system and suggests that an opportunity exists to investigate relationships between health expenditures and health status. □

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