Measuring Outcomes for NC Local Health Departments: Preliminary Results

R eturn on investment is a term we have heard a lot in the news recently, particularly as it relates to public spending. But what does the term “return on investment” mean in the field of public health? A team at the University of North Carolina at Chapel Hill is conducting research to help answer this question. The two-year study is examining the association between investments in local public health and community health outcomes in North Carolina. This report provides the context and initial findings from the first year of the study.

A primer on return on investment

The term “return on investment” (ROI) originates from the world of corporate finance. When used in that context, it refers to the benefit, usually profits or earnings achieved, from an investment. While profits or earnings are not the goal of public health, the ROI concept can be applied to public health to determine whether the benefits of an investment justify the costs or to compare benefits of different investments. There are several accepted approaches for evaluating economic efficiency in public health. Using a hypothetical community breast cancer screening program as an example, we describe each approach and illustrate how it might be used.

- **Cost benefit analysis (CBA)** answers the question of whether the benefits of an intervention are greater than the costs. A community breast cancer screening program might use CBA to assess whether the benefits of the screening program, measured in terms of reduced treatments costs due to earlier detection, are greater than the costs of the screening program. A key feature of CBA is that both costs and benefits are expressed in dollar amounts. If the benefit is a savings in treatment costs, a dollar value is assigned to each benefit accrued and all benefits are summed, and compared to the program costs, to complete a CBA.

- **Cost effectiveness analysis (CEA)** establishes the cost of each outcome of interest. In CEA, benefits are not converted to dollars but rather expressed in program appropriate units. The community breast cancer screening program might use CEA to describe the cost per woman screened or the cost per cancer case detected by the program.

- **Cost utility analysis (CUA)** is used to assess the effects of an intervention taking preferences into account. CUA might be used to compare two different programs using a non-monetary outcome such as quality adjusted life years (QALYs). CUA could be used to evaluate whether the money spent for the community breast cancer screening program was the best way to achieve a goal of increasing quality adjusted life years. QALYs and costs of different interventions, such as smoking cessation and breast cancer screening, could be compared in a CUA.

This study examines the relationship between spending by local health departments (LHD) in North Carolina and a number of community health measures of morbidity and mortality. The preliminary results show wide variation in LHD expenditures across North Carolina.
While each of these approaches answers a slightly different question, they have common data needs. For all of these economic evaluations, information about the costs and information about the expected benefits is necessary. Costs are usually measured in monetary terms, but may also be captured as staffing or other infrastructure necessary to implement the intervention. Benefits can be measured in monetary terms (such as dollars saved by prevention) or in terms of health or disease outcomes. These examples are considered direct costs and benefits. In addition to direct costs and benefits, indirect costs and benefits, such as productivity costs should also be considered, along with time frames and appropriate comparisons – all of which complicate public health ROI calculations.

Despite the difficulties of estimating return on investment for public health, it is becoming increasingly important to undertake such studies. Public health funding has diminished significantly due to the economic downturn as many states and communities have struggled to keep basic services in place. These cuts may have come at a high price. Recent studies have shown links between public health spending and improved community health outcomes as varied as infant mortality, cancer mortality and infectious disease morbidity. (1, 2) In this study, we are examining the relationship between spending by local health departments in North Carolina and a number of community health measures of morbidity and mortality.

**Study methods**

**Measuring costs**

In this study, we used total local health department (LHD) expenditures as a measure of the cost of public health services. The data on expenditures are derived from responses to the National Association of County and City Health Officials (NACCHO) National Profile of Local Health Departments. All LHDs in the country are invited by NACCHO to participate in periodic surveys to characterize LHD funding sources, staffing, programs and services. Our study uses data from the 2005 and 2008 profiles of North Carolina LHDs, with the goal of examining at how LHD expenditures changed as we approached the economic recession. To account for the differing population sizes served by LHDs, we are measuring expenditures on a per capita basis.

**Measuring benefits**

Benefits are measured by calculating cause-specific mortality and morbidity rates within the service delivery areas associated with each NC LHD. The mortality measures we will examine include: infant mortality and cause-specific mortality from heart disease, diabetes, cancer, and influenza. Mortality rates come from aggregated mortality files produced by Centers for Disease Control and Prevention. To measure morbidity, we will examine hospitalization rates for heart disease, diabetes, cancer, influenza using public and private insurance claims. In addition, we will measure rates of food borne illnesses, vaccine preventable diseases, sexually transmitted diseases and cancer screening by examining insurance claims for services for any of these conditions provided in any setting, including physician offices, outpatient clinics and hospitals. These morbidity measures will leverage a newly created data resource, unique to NC, called ICISS (Integrated Cancer Information and Surveillance System). ICISS data include health insurance claims for North Carolinians covered under Medicare, Medicaid, a very large commercial insurer and the State Employees Health Plan.

**Study design and population**

This study uses a retrospective design. The recent economic recession provided the context for a “natural experiment” assessing the effect of public health spending reductions on public health outcomes. The LHDs in NC (n=85) constitute the study population. Eighty LHDs in NC participated in both the 2005 and 2008 NACCHO profile surveys.

**Preliminary results**

**Variation in expenditures**

In 2005, the average annual total expenditure for NC LHDs was $74 per capita. In 2008, the average annual total expenditure per capita increased to $87. Data from both years demonstrated a great deal of variability in spending across counties. In 2008, the lowest per capita amount was $35 and the highest was $218 (See Table 1 on next page).
Table 1. Variation in total public health expenditures by NC LHDs, 2008*

<table>
<thead>
<tr>
<th>Number of LHDs</th>
<th>Mean total expenditures</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
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<td>7</td>
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</tr>
<tr>
<td>&lt; $57</td>
<td>20</td>
<td>$49</td>
</tr>
<tr>
<td>$57 - $79</td>
<td>20</td>
<td>$69</td>
</tr>
<tr>
<td>&gt; $83 - $106</td>
<td>19</td>
<td>$93</td>
</tr>
<tr>
<td>&gt;$113 - $218</td>
<td>19</td>
<td>$142</td>
</tr>
</tbody>
</table>

*Values represent expenditures per capita

Changes in expenditures
While the average per capita total expenditures increased between 2005 and 2008, not all LHDs experienced an increase. Ten LHDs experienced a decrease in expenditures between the two time periods, with a decrease of $21 per capita representing the largest decrease (Table 2).

Table 2. Change in total public health expenditures by NC LHDs between 2005 and 2008*

<table>
<thead>
<tr>
<th>Number of LHDs</th>
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<th>Range</th>
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</thead>
<tbody>
<tr>
<td>No Data</td>
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<td>---</td>
</tr>
<tr>
<td>Decrease</td>
<td>10</td>
<td>-$7.10</td>
</tr>
<tr>
<td>&lt; $5 increase</td>
<td>15</td>
<td>$2.80</td>
</tr>
<tr>
<td>&gt; $5 increase</td>
<td>44</td>
<td>$16.90</td>
</tr>
</tbody>
</table>

*Values represent expenditures per capita

LHDs experiencing a decline in expenditures were located in all regions of the state (See Figure 1 on next page). The LHDs with decreased expenditures all served rural areas of the NC.
Discussion

These analyses illustrate wide variation in LHD expenditures across North Carolina. It is unclear whether or not LHDs with higher expenditures should be expected to have better health outcomes. LHDs may have higher per capita expenditures if they serve more rural communities or a population with a greater underlying burden of disease. The cost of delivering public health services is influenced by a number of variables, including the demographic and health characteristics of the population and the presence (or lack) of other health services. These preliminary analyses have not yet taken these factors into account. Future analyses will adjust for these characteristics. In addition, we will continue to explore other measures of LHD expenditures, such as examining local funding separately from other sources of funding.
The research was carried out by the North Carolina Institute for Public Health (NCIPH) at the University of North Carolina at Chapel Hill’s Gillings School of Global Public Health. Support for this research was provided by a grant from the Robert Wood Johnson Foundation.

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**References**


Assessing Return on Investment for NC Local Health Departments: Relationship between spending, services and mortality

The question of how investments in public health staff and services affect community health outcomes has recently garnered attention as public health programs compete for scarce resources. A research team at the University of North Carolina at Chapel Hill, with assistance from practice partners, is working to help answer this question with a study that will examine the association between investments in local public health and community health outcomes in North Carolina. A previous research brief provided the initial findings from the study. This report describes the results of analyses assessing the relationship between public health spending, services and community mortality rates for selected conditions.

Study Methods

This retrospective study was conducted to examine the effects of NC local health department (LHDs) investments on community outcomes over a five year window, from 2005 - 2010. Specifically, we were interested in the effects of changes in spending related to the economic recession; thus data were grouped into time periods reflecting before and after the 2008 economic recession. Data sources and measures used are detailed below.

LHD spending and services data were obtained from the National Association of County and City Health Officials (NACCHO) profile survey data from years 2005 and 2008. Spending was analyzed using a per capita expenditure measure constructed from the total reported LHD expenditures and the county, or service region population. A comparison between NACCHO profile survey data and North Carolina data from state expenditure reports validated the accuracy of the NACCHO data with respect to total public health spending. Services provided by LHDs were grouped into six categories: clinical preventive services, medical treatment, specialty care services, population based services, regulatory and licensing services, and environmental services. Within each category of service, we assessed the proportion of specific services in the category that were provided or contracted for by the LHD.

Our results show an association between local health department prenatal care services and lower infant mortality. Translating this finding into practice, the study results imply provision of these services by local health departments in 2008 was responsible for preventing 191 infant deaths.

Mortality data were obtained from aggregated mortality files from the Centers of Disease Control and Prevention (CDC) supplemented by de-identified raw NC Vital Statistics available from the Odum Institute (http://arc.irss.unc.edu/dvn/dv/NCVITAL). Five
cause-specific mortality rates were examined: heart disease, diabetes, cancer, pneumonia and influenza, and infant mortality. Age-adjusted rates per 100,000 population were used for each cause of death except infant mortality, which was calculated as the number of deaths for children under age 1 per 1000 live births. Rates were calculated separately for 2 time periods: 2005-2007 and 2008-2010.

Analyses were conducted to assess the relationship between changes in spending and the effect of those changes on the provision of services and mortality; and the association between changes in provision of services and the effect of those changes on mortality. Mixed models with random intercepts for LHDs were used to assess the associations in the two time points, controlling for community characteristics identified from previous literature as important factors in explaining variations in community health outcomes.

Results

Eighty LHDs in NC participated in both the 2005 and 2008 NACCHO profile surveys. Spending in NC LHDs increased between 2005 and 2008, from $74 per capita to $87 per capita. However, the aggregate figures mask local variation - 10 LHDs experienced a decrease in the amount of spending.

The extent of services provided by NC LHDs varied by the category of service. Clinical preventive services, such as family planning, prenatal care, and well-child visits, were the most extensively provided category of services, with LHDs on average, providing or contracting for nearly all (90%) of the potential services in this category. Specialty care services, such as speech and hearing for children with special health care needs, were the least likely to be offered, with LHDs providing on average only 30% of the potential services in this category. The overall level of services provided by LHDs changed very little from 2005 to 2008. However, about a quarter of LHDs reduced the number of services offered in 2008.

Age-adjusted mortality rates for heart disease, cancer, diabetes, pneumonia/influenza and infant mortality fell between 2005 and 2008 in the jurisdictions served by more than two-thirds of the LHDs. The burden of mortality, however, varied by location over the three-year time period depicted in Figure 1. Excess infant mortality was observed in eastern areas of NC. Although our time window of 3 years is shorter than the 5-year window typically used to account for small numbers of infant deaths at the county level, the pattern of elevated infant mortality rates in the eastern region of NC we observed has been previously noted.

Figure 1.
Infant mortality rates for 2008-2010 in NC counties.

Infant Mortality Rate in 2008-2010
Mean = 7.9 Std. Dev. = 3.1
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**Footnotes**


