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## 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.

### Study describes value of local health department services

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

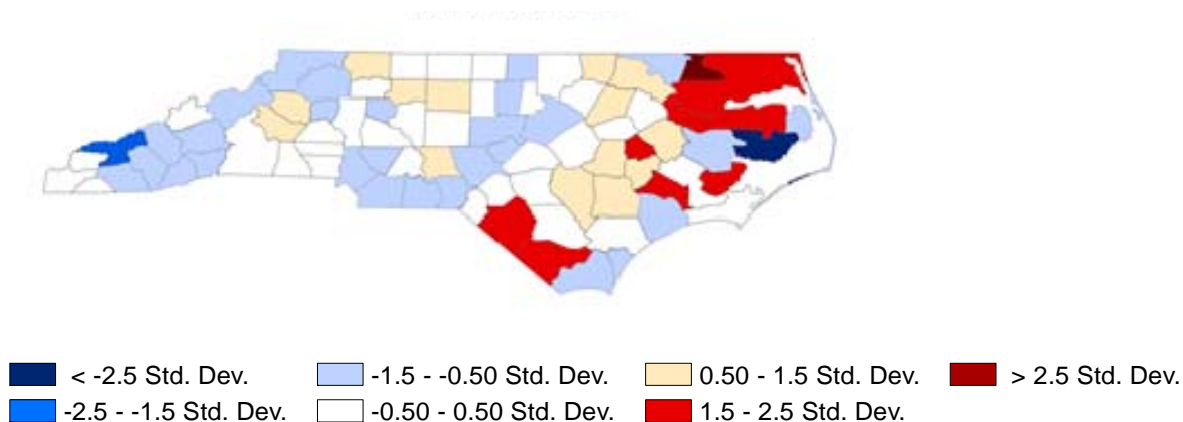
Eighty LHDs in NC participated in both the 2005 and 2008 NACCHO profile surveys. Spending in NC LHDs increased between 2005 and 2008, from \$74 per capita to \$87 per capita. However, the aggregate figures mask local variation - 10 LHDs experienced a decrease in the amount of spending.

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.<sup>1</sup>

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

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



Increases in spending were associated with increased provision of medical treatment services and specialty care services ( $p < 0.05$ ). No associations were observed between changes in spending and provision of other types of services.

Analyses examining the effect of changes in the provision of specific types of services revealed a significant association between an increase in the provision of women and children's services and a decrease in infant mortality rates ( $p < 0.05$ ). These services included: family planning, prenatal care, obstetric services and WIC services. No other associations were observed between services and other mortality outcomes, although given the short study period, it is unlikely that we could have detected change in conditions taking longer to develop.

## Discussion

Our study demonstrated that increases in LHD service provision were associated with reductions in infant mortality. In previous studies<sup>2-3</sup>, an association between LHD spending and improved outcomes was observed for additional types of mortality. While our study did not show associations with the other conditions we examined, our study covered a much shorter time period than the previous studies, so it may not have been possible to detect changes in other mortality outcomes that occur over a longer period of time. In addition, infant mortality is a unique mortality outcome because it may be influenced by factors occurring over a relatively short time window. Therefore, it is more likely that the effect of changes in services could be observed in infant mortality compared to other types of mortality in a short time period.

Our findings provide support for the work that LHDs are doing to improve infant health in their communities. While it is not possible to directly attribute the improved infant mortality outcomes to LHD services, the fact that this association was observed with a corresponding increase in the specific services designed to improve infant outcomes, and not for other, unrelated services, lends support to the conclusion that LHD services play a role in reducing the infant mortality rate. Our findings imply that provision of prenatal care by LHDs that offered the service saved 191 infant deaths in North Carolina in 2008.

In our analyses we controlled for community characteristics including demographic characteristics of the population served and medical care related resources. However, it is possible that some unmeasured characteristic may be contributing to the observed relationship.

This report is the second in a series of three research briefs. Our first report detailed the variation in spending by NC LHDs.<sup>4</sup> This report examined the effect of spending and services on mortality. The next report will provide results of similar analyses of the relationship between LHD spending and services and rates of selected preventive service use and morbidity rates. Results of these analyses will help provide the foundation for a better understanding of the return on investment for public health services.

## Authors & Acknowledgements

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## Footnotes

1. Infant death rates by perinatal region and county of residence, NC 2011, 2012 and 5-year totals 2008-2012. NC State Center for Health Statistics, Raleigh, NC. Available: <http://www.schs.state.nc.us/schs/deaths/ims/2012/PCRandCountyRates.pdf>, accessed 7/28/2014.
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