Public Health Movements, Local Poor Relief and Child Mortality in American Cities: 1923-1932

Jonathan Fox
October 2009

Abstract

This paper examines both the relative and absolute effects of public health education and poverty relief spending. It does this in the context of the falling infant and child mortality rates during the period just prior to the New Deal and its large scale federal programs. Organizations like the Children's Bureau and programs such as Mothers' Pensions have been lauded for decreasing the mortality rates among the young. This paper uses data on two different types of social programs, one educational and another directed towards transfer payments, to separately estimate how effective each of these different types of programs were. A panel of 67 cities over 10 years is created, and the effects are identified using the variation between cities and years. With this approach, I can help answer which types of government spending were most effective for different age groups. Fixed effects results suggest that spending on both health education and poverty relief helped to reduce mortality rates for infants and school age children.

1. Introduction

During the early 20th century, infant mortality and child mortality declined substantially both in urban and rural areas. Prior to 1910, for every 1,000 babies born in the United States, 165 died, and the rate was even worse in the countryside (Newmayer 1911). However, by 1920 the infant mortality rate was cut in half to about 85 deaths per 1,000 live births, and by 1930 it dropped to 65. Child mortality experienced similar declines. Only part of the declines can be attributed to major sanitation and water projects in cities. Public health historians suggest that one reason for the decline was improvements in the education of the population about simple health procedures like hand washing and boiling water. This paper investigates these early 20th century public health education programs in the large municipalities and estimates their influence on declining mortality among children and infants. The educational programs of the state, municipal, and county health departments were much more cheaply implemented than the large scale public works projects occurring in the cities during the same time. Evaluating the effectiveness of such policies allows better understanding about how such low-cost policies might work in reducing child and infant mortality in countries facing conditions similar to those faced by industrializing cities in the early 1900s.

In the first few decades of the 20th century, the U.S. experienced great reductions in infant and child mortality rates. But the adjustments were uneven, and there existed substantial variation across locations in the mortality trends, as well as in the type and extent of government and public health programs. Before the New Deal of the 1930s, few federal welfare or public health programs existed, and those that did were either investigative bodies or mandated states to distribute benefits to certain classes of people. As was the case for decisions about poverty assistance, most health spending decisions were made at the state, city or county level. For this reason, this paper focuses on the period prior to the introduction of the New Deal in 1932. By choosing the decade of the 1920s, I can analyze the effectiveness of state and local public health and poverty assistance programs at saving the lives of

children without them being confounded by large-scale changes associated with the New Deal.[1]

Given the concurrence of the declines in child and infant mortality with the growth of public health work, it is natural to think the two related. Many believe that the public health education work played an important role in improving outcomes (Ferrell et al 1932, Rockefeller 1921, Blackburn 1927, Ewbank and Preston 1990), but as yet no one has tested their impact with modern econometric methods. Without data on the state and local health and education programs, researchers studying other determinants of the mortality decline have controlled for the influence of the public health education movement using techniques such as difference-in-differences (Cutler and Miller 2005) or year and geography fixed effects (Troesken 2004). With new data on municipal health education spending, I can separately evaluate its effects from those of other city spending.

Far removed from the large scale, highly publicized clean water projects occurring in many of the different cities prior to 1920, the public health programs were primarily concerned with the distribution of information. The state and city health education activities received less funding relative to the spending on sanitation and water filtration; therefore, the programs potentially were very cost-effective.

2. Public Health Education and Poverty Relief in the Early 20th Century

Public health and poverty assistance programs first started gaining support in the early 20th century as birth and death registration areas grew and the data collected on births and deaths were collected on a more consistent basis, becoming more reliable for comparisons. Demographers began to have a clearer picture of the how poorly children fared in the United States compared with other developed countries, and public health advocates began to question if perhaps the U.S. could possibly do better (see Newmayer, 1911). Research by scientists such as Louis Pasteur in the late 1800s on the

[1] The analysis is constrained to those years after 1923 because the level of financial detail necessary is not available between the years 1920-1922

relationship between sanitation and health, and by Paul Karrer on the importance of vitamins and nutrients offered ways in which these issues could be addressed. Several public programs were designed with the goal of reducing high child mortality rates. Child and woman advocacy groups (Skocpol et. al, 1993) influenced politicians to pass legislation such as mothers' pensions, form organizations such as the Children's Bureau, and encourage state and city departments of health to form child hygiene divisions and distribute information about how to improve health outcomes.

The Children's Bureau, formed in 1912, was charged with investigating and reporting on all matters pertaining to the welfare of children and child life. Through its publications and political presence, this federal body helped bring attention to the exceptionally high mortality rates in some U.S. cities and for certain classes of people. Although its mandate included investigation of the "whole child," a limited budget and reluctance to duplicate work done by other federal agencies induced the bureau to limit its initial focus to the causes and potential solutions of the high infant mortality rates. An inquiry into these causes and solutions in the city of Johnstown, PA was the first field study done by the Bureau, and for the first two years absorbed almost its entire attention (Department of Labor, 1915). Other cities were chosen for case studies to isolate factors associated with different types of industrialization.[2]

The studies led the Children's Bureau to conclude that high infant mortality rates were not only the result of poor hospital care or ignorance among birthing mothers but also the result of a range of socioeconomic factors related to poverty. In 1916, Julia Lathrop, chief of the Children's Bureau, mentions the "coincidence of a high infant mortality rate with low earnings, poor housing, mother's work and large families (Department of Labor, 1916)." She expanded on these ideas in her contribution to the 1920 Report of the Department of Labor:

[2] By 1918, the field studies included a steel city (Johnstown, PA), two textile cities (Manchester, N.H. and New Bedford, MA), a center for the manufacture of high grade shoes (Brockton, MA), a manufacturing city with no one dominant industry (Saginaw, MI), a city with the production of brass as its dominant industry (Waterbury CT), a rubber manufacturing center (Akron, OH) and lastly, a large cosmopolitan area (Baltimore, MD) (Lathrop, 1918).

> From the findings in Baltimore certain facts stand forth to which we as a Nation can no longer close our eyes. Without qualification – regardless of color, race or nationality – the infant death rate varies inversely with the father's income. When the father's income represented the ability to insure care and comfort ($1,850 a year or more) the infant death rate was one-fourth as high as when the father's earnings fell into the lowest wage group.

The bureau's findings stressed the importance of socioeconomic conditions and emphasized a middle class family ideal, for the most part ignoring the impact of medical causes. Since the Children's Bureau did not have a physician on staff for the initial field studies and wanted to avoid stepping on the toes of the American Medical Association, things such as the importance of proper medical care, clean milk and other sanitation related variables were left up to the Public Health Service to study (Lindenmeyer 1995).

The Children's Bureau did, however, encourage the development of maternal and child hygiene divisions within city and state health departments, and also lobbied strongly for the Sheppard-Towner Act, which passed Congress in 1921. This act constituted the first federal public health program and had its primary focus on health education. Federal matching grants were distributed to states with specific instruction in their use. Recipients were prohibited to use the money for the "purchase, erection, or repair of any building or equipment, or for the purchase or rental of any buildings or lands, or for any maternity or infancy stipend, gratuity or pension (Abbott 1922)." Instead, the money was intended to pay for the operation of health centers to instruct mothers in hygienic ways and to distribute pamphlets to new mothers about how best to care for their baby (Thompson 1921).

The Sheppard-Towner grants consisted of an initial $5,000 sum, and additional money in the form of matching grants up to some specified maximum based on a state's population. If a state chose to accept the Sheppard-Towner appropriations, it had to have a maternity and infant hygiene division within their health department. For this reason and others, Connecticut, Illinois, and Massachusetts chose not to accept the Federal grants.[3] Additionally, localities within participating states had to be

[3] Connecticut did not engage in county health work, but sent out literature on baby hygiene to new mothers and held "well-

prosperous enough to be able to match the grants, although counties and cities that did not directly receive Sheppard-Towner funds still felt its effects. Many of the maternal and child hygiene divisions arose in the state and municipal health departments shortly after the Act's passage (Ferrell et al. 1932, U.S. Public Health Service 1923), and in at least one state, North Carolina, the funds were the primary support for its Bureau of Maternity and Infancy.

The Children's Bureau studied the reasons behind the high child mortality rates because they knew that information was essential in designing policy to combat them. This perspective still holds. If poverty was the primary cause, then welfare-type social programs would be most effective at reducing the number of child deaths. Alternatively, if a general absence of nutritional and birthing information was the issue, then spending on health and mother's education would be more effective. Because I have data on two different types of social programs, one educational and another directed towards transfer payments, I am able to separately estimate how effective each of these different types of programs were, and give an empirically rigorous answer to the question pondered by the Children's Bureau. To accomplish this, I exploit the variation in spending between cities and years, as well as control for other factors related to mortality rates. Using that approach, I can help answer which types of government spending were most effective for different age groups.

3. Data

The variation between cities and years is exploited using a 10 year panel of 67 cities with populations over 100,000 in 1923. Those dates were chosen both for data availability reasons, and to eliminate the effect of any New Deal programs enacted after 1932.[4] City financial data, including

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child" conferences in various towns throughout the state. Illinois had established 6 county health organizations between 1922 and 1929 (although these all had been discontinued by 1930), subsidized clinics for treatment of indigents, and promoted maternal and infant hygiene through distribution of prenatal literature and sending out nurses for personal instruction to mothers. Massachusetts set up "well-child" conferences and had a law requiring the medical examination of all school children.

4 Fishback, Haines, and Kantor (2007) examine the time period from 1929 through 1940 to examine the role of the New

spending on sanitation, health, mothers' pensions, and other forms of poverty relief were collected from the *Financial Statistics of Cities* volumes, published by the Department of Commerce. Per capita summary statistics adjusted to 2007 dollars for each the spending variables are given in the top panel of Table 1. Population data were also collected from the *Financial Statistics of Cities* volumes, and when missing, estimated between the nearest two years.[5]

Two financial variables of primary interest are the spending on public health education in a city, and the spending on poverty assistance. Spending on public health education includes spending on the medical inspection of school children and spending for educating about proper hygiene, milk preparation techniques and other things that could be done to conserve child life. Money distributed under the "medical inspection for school children" category helped pay for physician and nurse visits to distribute information and perform physical examinations. School children were not treated, but their parents were informed if any defects were found. Spending on poverty assistance includes spending on mothers' pensions, funding for almshouses and orphanages and other charitable spending for children. Outdoor care[6] of the poor generally comprised the largest portion of poverty assistance, especially for cities with populations between 100 and 300 thousand, since many of those did not provide aid in the form of mothers' pensions.[7] Adjusted to 2007 dollars, an average city in the dataset spent about $3.15 per person on health for children and about $16.23 per person on poverty assistance.

The city spending data were matched with city mortality data entered from the *Mortality Statistics* volumes, published by the Department of Commerce. Figure 1 plots the death rates for infants, as well as for children aged 1 to 4, 5 to 9, and 10 to 14. These death rates are defined as the

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Deal in influencing infant deaths, noninfant deaths and births.

[5] The cities interpolated were: Los Angeles, CA, 1924-1927; Seattle, WA, 1924-1927; Portland, OR 1925-1927; Akron, OH 1924-1927; Bridgeport CT, 1924-1927; New Bedford, MA, 1926-1927; Norfolk, VA , 1924-1925; Lowell, MA, 1926-1927; Lawrence, MA, 1926-1927; Elizabeth, NJ, 1924-1927; Erie, PA, 1924-1927; Waterbury CT, 1924-1927; Jackson, FL, 1926-1927; Hoboken, NJ, 1923-1925; Brockton, MA, 1926-1927; Davenport, IO, 1926-1927; Haverhill, MA, 1926-1927; Wheeling, WV, 1923-1927; Superior, WI, 1923-1927; Auburn, NY, 1926-1927; Newport, VA, 1923-1924.

[6] This typically involved relief to individuals or families that due to unemployment, illness, accident, or for perhaps some other reason, were temporarily dependent. It also sometimes involved the giving of aid more or less permanently, when it seemed desirable to keep a family together instead of scattering its members among institutions.

[7] 24 out of the 67 cities in the panel did not provide aid in the form of mothers' pensions.

number of deaths occurring in a city per 1,000 people. Although some age groups experienced greater drops in mortality than others, every child age group experienced mortality declines between 1923 and 1932. This is particularly interesting given that, except for Milwaukee, every city in the sample had developed their water and sewer systems prior to the start of my panel. The mortality rates for infants for cities in my sample dropped from about 1.8 infant deaths per 1,000 people in 1923 to about 1 infant death per 1,000 people in 1932. Note that this mortality rate differs from the standard infant mortality rate, calculated as infant deaths per 1,000 live births. I do not use the more conventional infant mortality rate in my analysis because the size of the birth registration area in 1923 was much smaller than the size of the death registration area. Specifically, usage of the more conventional infant mortality rate requires dropping those cities in Alabama, Georgia, Louisiana, and Texas that are currently in my sample. For the sample cities that were also part of the birth registration area, the infant mortality rate did decline substantially, from about 78.5 in 1923 to about 55.9 in 1932. Mortality rates for children aged 1-4 also decreased considerably over this period, dropping nearly 60% from their level in 1923. Meanwhile, mortality rates for children aged 5-9 and 10-14 decreased only slightly. Both in absolute terms, and relative to the other child age groups, mortality rates for infants experienced the greatest improvement. In 1923 the mortality rate for infants was at least twice as large as the mortality rate for any of the other child age groups, but by 1932, the gap had fallen significantly.

Figure 2 plots the annual mean-differenced number of infant deaths per thousand people within cities with relatively more and less health education spending. The two groups of cities were at the bottom and top quartiles of aggregate health education spending between 1923 and 1932. The trends show that cities which spent a relatively large amount on health education generally had infant death rates much greater than other large cities in the early 1920s, but by 1932 were performing better than the average.[8] Figure 3 plots the annual mean-differenced death rates for children aged 1 to 4 for the

[8] Plotting the infant mortality rate for the top and bottom quartiles for the subset of cities with birth data reveals a similar pattern.

same sets of cities, and a similar story occurs. Cities that spent more on health education between 1923 and 1932 on average experienced worse death rates in the early 1920s, while cities that spent less on average had child death rates below the mean. However, by 1926, this gap between the bottom and top quartiles had reversed.

Figures 4 and 5 perform the same exercise for cities at the top and bottom quartiles of poverty relief spending. Stratifying the cities by their level of poverty relief spending reveals an even more striking difference in trends. The number of infant deaths per thousand people fell substantially relative to the average within cities in the top quartile of poverty relief spending. However, cities that chose not to invest in this experienced a growing gap between them and the average large city in the United States. Figure 5 illustrates similar trends.

From figures 2-5 it seems that at least in the case of small children and infants, both spending on public health education and spending on poverty assistance were associated with improving health outcomes in the cities. To take this a step further, figures 6a and 6b plot the number of infant deaths per thousand people against per capita public health education spending (Figure 6a) and per capita poverty relief spending (Figure 6b). Figures 6a and b also include trendlines, which establish basic correlations between the death rate for infants and the amount of the different types of spending. These estimated trendlines display the raw correlations, and show what conclusions would have been drawn from the data with a method often used to evaluate the success of the policies in the 1920s and 1930s.[9]

The trendline in Figure 6a estimates for the public health education spending coefficient at about -0.046, implying that a reduction of one infant death would have been associated with an additional 21,645 2007 dollars of per capita public health education spending. The coefficient on poor relief spending given in Figure 6b is an order of magnitude smaller, estimated at -0.0049. About 204,000 2007 dollars of poverty relief spending was associated with the reduction of one infant death.

[9] See, for instance, the Department of Labor Annual Reports, as well as Lathrop 1919, Abbot 1922, Tobey 1925, Vaughn 1922, and Levy 1920

Figures 7 through 9 plot the health education and poverty relief spending against the death rates for children aged 1-4 (Figures 7 a and b), 5-9 (Figures 8a and b) and 10-14 (Figures 9a and b). From these basic correlations, it appears that smaller amounts of health education spending than of poverty relief spending are associated with lower mortality rates for each of the different age groups. Additionally, infant death rates respond the most to increases in either type of spending. The coefficients for the older age groups were much smaller in magnitude than those for the infants and small children.

For these basic correlations to estimate a causal effect, spending on public health education and poverty relief would need to be randomly assigned to the different cities, clearly a very strong a assumption. The spending could not be correlated with any other city characteristics such as per capita income or spending on education. Additionally, the level of spending distributed would need to be independent of the health outcomes in a given city. If charitable and public health spending was greater in cities with more per capita income and per capita income was correlated with lower mortality rates, then failing to include a measure of income would lead to estimating a much larger effect of the spending than was actually the case.

To control for the potential biases due to per capita income being both correlated with city spending and the mortality in that city, average annual earnings from the manufacturing sector were collected from each city. Additionally, information on the number of tax returns filed as a share of the municipal population in a year was collected to help control for the number of people on the upper tail of the income distribution. This gives the number of jointly filing couples in each city with incomes above $5,000 (about $60,000 in 2007 dollars), and individual filers with incomes over $2,000. Information on demographics, municipal spending on hospitals, education and other activities, and other data that could be related to both spending and mortality was also collected. These variables and their sources are explained in the data appendix.

4. Econometric Model and Results

4.1 Fixed effects

Including measures of incomes in the different cities over time, information on municipal spending on sanitation, hospitals, education and other charitable and health activities, demographics in the surrounding county, and the timing of suffrage enactment in each state I control for these potential omitted variable biases. Assuming this is an exhaustive set of variables jointly correlated with mortality rates and poverty and public health education spending, including these will remove the bias potentially affecting the coefficient estimates in figures 6 through 9.

Since income is likely positively correlated with spending on public programs and negatively correlated with child death rates, controlling for it should reduce the magnitude of the estimated coefficients in figures 6-9. Areas with higher income typically have lower mortality rates independently and those areas are also likely to spend more on public health education. The combination of the positive and negative correlations would have imparted a negative bias in the public health coefficient for all of the different age groups.

Even after controlling for income, municipal spending, county demographics, and the timing of suffrage enactment, there are still potentially other unknown variables correlated both with health spending and urban mortality. The standard approach to this problem is constructing an instrument correlated with public spending on health and poor relief, but not correlated with urban mortality. Unfortunately, efforts to discover a variable sufficiently correlated with health or poverty spending, but not with mortality, have proved unsuccessful.[10] If these omitted variables do not vary through time, then the biases imparted by them can be controlled using a fixed effects model. There is one potential correlate in particular that fits this description: the quality of water treatment and sanitation infrastructure. Better infrastructure would have tended to reduce death rates, implying a negative

[10] Some of the potential instruments tried, but which have shown little power, are state-level voting patterns, the timing of a state's women's suffrage enactment, and whether or not a state chose to participate in the Sheppard-Towner Act.

relationship between the sanitation facilities and death rates. The sign of the bias will therefore be determined by the relationship between sanitation and water treatment and a city's choice about public health education. If cities with better sanitation and water treatment infrastructure saw them as substitutes for public health education, they would have spent less on public health education. The combination of the negative relationship between infrastructure and death rates and the negative correlation between infrastructure and health education would impart a positive bias to the coefficient estimates in figures 6-9. On the other hand, if cities with better infrastructure saw the public health education as a complement to the infrastructure, they might have invested in more public health education. This would then lead to a negative bias for the coefficient of public health education in the regressions without city fixed effects.

The coefficient of the poverty relief variable might also be affected by the quality of sanitation and water treatment infrastructure. If areas with better sanitation infrastructure were areas with more poverty relief spending, the combination of this positive correlation and the negative correlation between infrastructure and death rates would have led to a negative omitted variable bias for the coefficient on poverty relief.

Annual city sanitation spending is included set of covariates, but this is mostly street sweeping, trash collection, and some maintenance. As a result, the city annual spending is not well correlated with quality of the infrastructure. In 66 of the 67 cities there were no major capital improvements to the water treatment and sanitation infrastructure over the period; therefore, absent depreciation, the quality of the infrastructure over the period was likely time-invariant in each city.[11] The analysis can therefore control for the differences in water treatment and sanitation infrastructure by using city fixed effects. To control for nationwide, annual shocks common across the sample cities, year fixed are also included in the analysis. The identifying equation is then:

[11] Milwaukee added a water treatment plant in 1926

$$UMR_{i,t}^{a} = \beta_1 PHE_{i,t-1} + \beta_2 CPR_{i,t} + \beta_3 PHE_{i,t-1} * CPR_{i,t} + \sum_{j=1}^{J} \beta_{j+3} X_{j,i,t} + \beta_{J+4} C_i + \beta_{J+5} Y_t + \varepsilon_{i,t}^{a} \qquad (1)$$

Where $UMR_{i,t}^{a}$ is the urban mortality rate for age group a in city i and year t. $PHE_{i,t-1}$ is the amount of spending on public health education occurring during the prior year in city i. This includes spending on the medical inspection of school children and spending distributed toward educating persons about proper hygiene, milk preparation techniques and other things that could be done to conserve child life. I include the lagged term because it likely took some amount of time for people to implement the education received into their pre- and post-natal practices and towards their children. $CPR_{i,t}$ is the amount of current year per capita poverty relief spending on children in city i. This variable includes spending on mothers' pensions, spending on almshouses and orphanages and other poverty relief spending directed towards children. Because there are potentially complementarities between spending on public health education and poverty assistance, (e.g. mothers need money to implement the public health procedures being advocated) the interaction term $PHE_{i,t-1} * CPR_{i,t}$ is included in one of the specifications. $\sum_{j=1}^{J} \beta_{j+2} X_{j,i,t}$ is a set of J covariates that include the county demographic variables percent black, percent illiterate, percent rural, and percent foreign born, as well as other city spending variables (spending on sanitation, hospitals, education, health other than child health, and other charitable spending). It also contains the proxies for income and income distribution (manufacturing wages and the proportion of people filing tax returns in the surrounding county) and the variables controlling for the amount of pollution within a city and the mortality rate of adults aged 20-29 to control for trends in mortality common across age groups. Where C_i and Y_t are vectors of city and year effects, respectively. The errors are assumed to have mean zero, conditional on the covariates in the mortality equations and defined as the unobserved characteristics affecting mortality in city i, year t for each of the different age groups. I allow these error terms to be correlated between the

different age groups, but because I estimate the mortality rate with the same covariates, this reduces to a basic OLS with covariates model (Wooldridge 2002).

Table 3 summarizes the coefficients for the spending variables of interests, and Tables 4 through 7 provide the full estimation output. Estimates from equation 1 are given in the first and second columns of each of these tables, with the first column omitting the interaction term $PHE_{i,t} * CPR_{i,t}$. Comparisons of the coefficients in Column 1 in Table 3 suggest that the poverty relief coefficients in figures 6a through 9a were biased in a negative direction. Once the set of covariates and city and year fixed effects are included in the specification, the coefficients on the poverty relief spending in Column 1 are all less negative than those displayed in the figures. The only Column 1 coefficient that is statistically significant is in the infant death rate equation.

Once the covariates and fixed effects are included and the level of sanitation and water treatment infrastructure controlled for in the analysis, public health spending is associated with reductions in infant deaths and to some degree deaths of children aged 1-4 (p-value of 0.11).

The negative relationship was much stronger for public health education spending than it was for city welfare spending for children. One dollar spent on child health education related activities in the prior year was associated with a .00347 point reduction in the mortality rate for infants. This implies that about an additional 29,000 2007 dollars were associated with one infant death avoided. A dollar spent on poverty relief for children, which included funds distributed outside almshouses, mothers' pensions and other spending for the aid of children was associated with a 0.000128 point reduction in the mortality rate for infants, implying that about 781,000 2007 dollars were associated with one infant death avoided. Compared to the estimates of the statistical values of life calculated in Costa and Kahn (2004) for 1940 (about 1 to 1.5 million in 2007 dollars), allocating money to either charitable spending or public health education would yield benefits much greater than the costs.[12]

[12] According to a 1912 County Health Organization pamphlet distributed in North Carolina, Irving Fisher also calculated the net worth of an American infant life, and found it to be worth about $90 in 1912, or about $1,000 when that number is

Comparing these estimates to the results in Fishback, Haines, and Kantor (2007) [13] suggest that the public health and poverty assistance programs prior to the 1930s saved a statistical infant life at a much lower cost than New Deal relief (although the New Deal relief was not specifically targeted at saving infant lives like the public health and poverty assistance spending in the 1920s was).[14] But while both public health and poverty relief appeared to reduce mortality at a good cost-benefit ratio, it was the spending on public health education, not the spending on transfer payments and other city relief spending that resulted in the largest benefits.

It also appears there were strong complementarities between public health education and poverty assistance. Column 2 in tables 3-7 includes the interaction between lagged public health education spending and poverty relief spending. For each of the different age groups, including this variable pressures the coefficients on poor relief and health education spending upward. In the infant age group, the inclusion of the interaction term attenuated the public health education coefficient by approximately 30 percent. The coefficient on poverty relief was no longer statistically significant.

4.2 City-Specific Trends

It is possible that the fixed effects model still does not control for all of the potentially confounding factors. By 1923, most of the cities in the sample have had their sanitation and water treatment infrastructure in place city for some time. Although it is unlikely the sanitation structure began to experience depreciation by this point, it is possible there is trended depreciation in the quality of the infrastructure that differs from city to city depending on when their infrastructure was built.

This decline in quality of infrastructure would be associated with higher death rates, a negative

converted to 1982-2984 dollars.

[13] Converted to 1982-1984 dollars, Fishback, Haines, and Kantor (2007) estimated the relief cost per infant death prevented to be about 1.06 million dollars.

[14] I expect the reasons for this are that (1) much of this public health education was aimed at the reduction of infant and maternal mortality and likely did not affect deaths from homicides and suicides as the New Deal relief spending did, and (2) the higher infant mortality rates offered more opportunities for reducing them with lower cost solutions.

relationship. If cities then spent more on public health education to offset the depreciation in infrastructure, the relationship is negative and the combination of the two negative relationships would lead to a positive omitted variable bias. If cities with deteriorating quality also spent less on public health education, due, for instance to them losing interest, the correlation between quality and public health education is positive. Combining the negative relationship between infrastructure quality and death rates and the positive correlation between infrastructure quality and public health education leads to a negative omitted variable bias.

To control for these differences in depreciation and their potential biases, I include a specification with a city-specific time trend. The coefficient estimates from this model are given in the third column in Tables 3 through 7. Not surprisingly, the coefficient estimates are no longer statistically significant. Because I am now identifying off of deviations in each city's mortality trend, it is likely there is not enough variation left to precisely estimate the coefficients for the different variables. After controlling for fixed effects, the variation in $PHE_{i,t}$ is reduced by about 70%, while the variation in $CPA_{i,t}$ is reduced by about 30%. Controlling for both fixed effects and city-specific trends, the variation in $PHE_{i,t}$ is reduced by about 92%, while the variation in $CPA_{i,t}$ is reduced by about 68%.

5. Concluding Remarks

Besides the collecting of birth and death registration certificates and treating cases of malaria and tuberculosis, public health education was the primary method of interaction between state health departments and the public in the early 20th century. During the 1920s, many different states and cities engaged in educating the public about proper ways to care for infants and how to keep children healthy. Many municipal health departments held "well-child" conferences set up infant-welfare stations to observe the health of newborns and sent out bulletins and newspaper press releases (American Public Health Service 1923). During the same period, infant and child mortality rates fell drastically. With

the cities in the sample, all of the age groups studied experienced declines of at least 25% in their mortality rates, with infants and children aged 1-4 respectively showing even greater drops of 50 and 60%.

This paper has attempted to estimate the relationship between these declining mortality rates and the public health education occurring in the different cities, and has found that using a fixed effects model, it is not only statistically significantly related to the drops in infant deaths, but was more efficient at saving a statistical infant life than was the poverty relief spending occurring during the same time. Adjusted to 2007, approximately $29,000 spent on public health education was associated with an infant death avoided, much less than the $780,000 in poverty relief spending associated with the same effect. Additionally, there appear to be strong complementarities in spending directed to poor relief and health education.

Including city-specific trends eliminated the statistical significance of public health education and poverty relief spending on infant death rates. I believe this was a result there simply not being enough remaining variation in spending to identify the effects. However, more work will need to be done to fully understand why this is the case.

Data Appendix

Demographic data by county, published by the Bureau of the Census in 1920 and 1930, is used to control for the number of black, illiterate and foreign born in and near a city. The lower panel of Table 1 provides summary statistics for these variables. Controlling for demographic trends will be important, since the foreign born and black populations generally had much higher mortality rates than the native white population, and were targeted by some of the social programs aimed to reduce child mortality (Lindenmeyer 1995). There was wide variation in the demographics between counties, with the populations over 40% black in some counties and populations over 45% foreign born in other counties in some years. The percentage of rural people in a county also varied widely, with counties such as Orleans or Suffolk (New Orleans and Boston, respectively) being measured as entirely urban, but others being a quarter or more rural. The number of illiterate people as a percentage of the county population varied less between cities and years, but enough so that it will important to control for it in the empirical specification.

To control for average income and income distributions, which the Children's Bureau initially believed were so crucial in determining child mortality rates, two measures are used. First, the number of tax returns filed as a share of the population in a year helps control for the number of people in a city who were part of the upper tail of the income distribution. This gives the number of families in a city with incomes above $5,000 (about $60,000 in 2007 dollars), and individuals with incomes over $2,000 in a city. After controlling for a measure of average income, as below, increases in the share of the population filing tax returns would be associated with lower shares of income for the population that was not earning enough to pay income taxes.

Average annual earnings in the manufacturing sector, compiled from the biannual Census of Manufactures were also included to help control for the overall wealth of a city. State per capita income, estimated by Robert Martin (1939), was used to help interpolate the missing years.[15] The interpolation formula used was $\mathrm{MW}_{i,t}=\mathrm{SPCI}_t\left(\frac{1}{2}\frac{\mathrm{MW}_{i,t-1}}{\mathrm{SPCI}_{t-1}}+\frac{1}{2}\frac{\mathrm{MW}_{i,t+1}}{\mathrm{SPCI}_{t+1}}\right)$, where $SPCI_t$ is state per capita income in year t. Average annual earnings per worker, calculated by dividing the average annual earning in manufacturing by the average number of wage earners employed, and the percentage of workers in polluting industries is given in middle panel of Table 1.

One potential problem with using average annual earnings to measure the average wages in the different areas is that they may be highly correlated with the amount of pollution in that area (Ruhm 2000). For this reason I look at the number of persons employed in each industry, separating polluting industries from non-polluting industries. I then count the number of workers in polluting industries such as steel, coal, automotive, leather, rubber, smelting and wood pulp, and include this number in the estimation to both control for and test the impact of the extent of industrial pollution, a severe problem in many cities in the early 1900s. For a list of those industries classified as "polluting," see Table 2. The 1931 and 1933 Census of Manufactures lack city by industry level data, so estimates from a linear trendline will be included in the estimation. Although this will miss the variation between years, it should still pick up the variation between cities. Because of the large drop off in manufacturing jobs between 1927 and 1929, for some cities the trendline estimated negative values. For these, I set the observation to zero.

[15] Martin (1939) does not give a good description of how he came to his estimates. Fishback and Kachanovskaya (2009) ran regressions for each state with the BEA state income data as a function of the Martin data without an intercept over the period from 1929 to 1938 when the two sets of series. The R-squareds from each of the regressions were all above 0.98. When they ran correlations of the growth rates for the overlap periods, they are all over 0.6 and most are over 0.9.

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Figure 1
Mortality Rates by Age Group

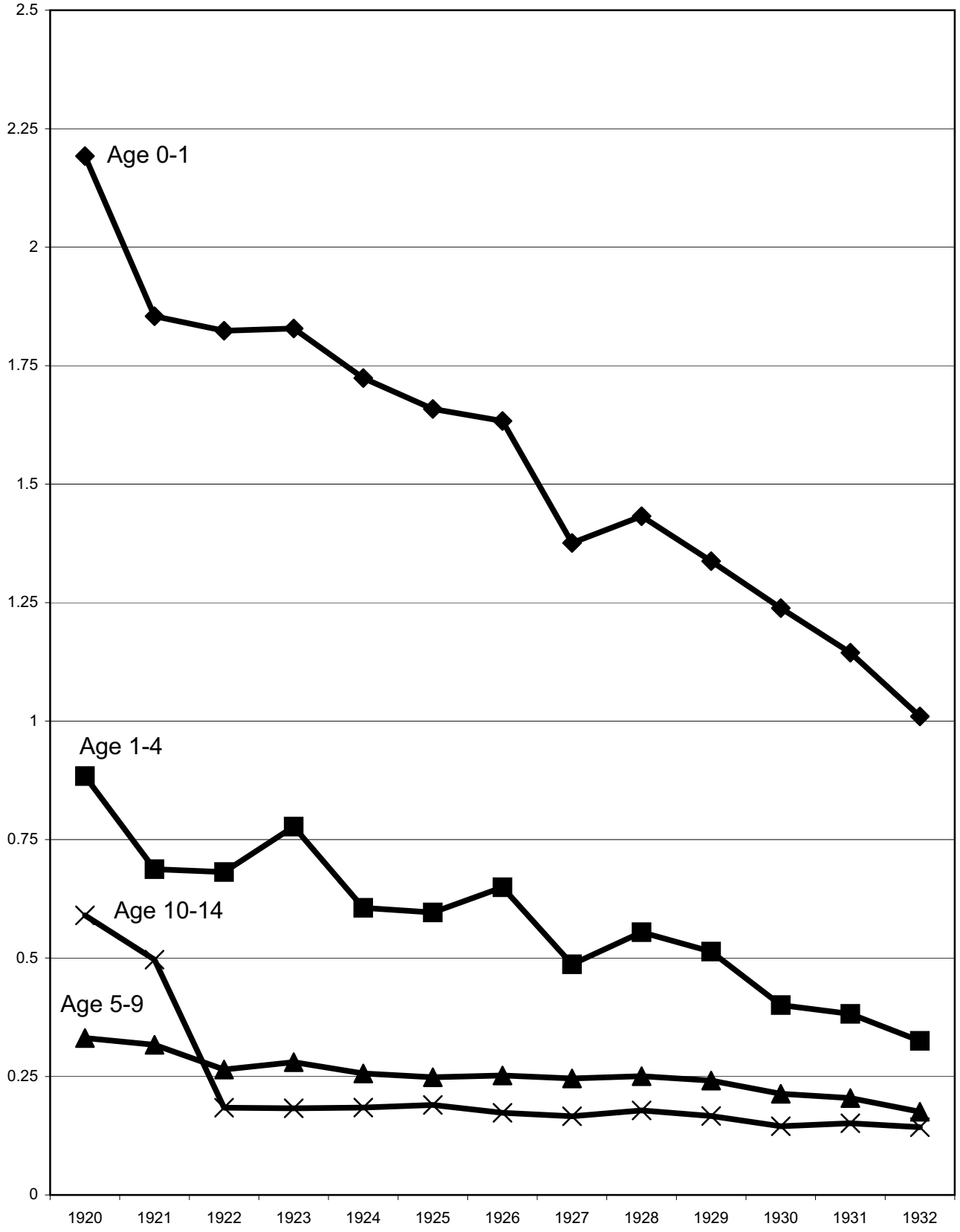

Figure 2
Infant Death Trends in Cities
with More and Less Public Health Education Spending

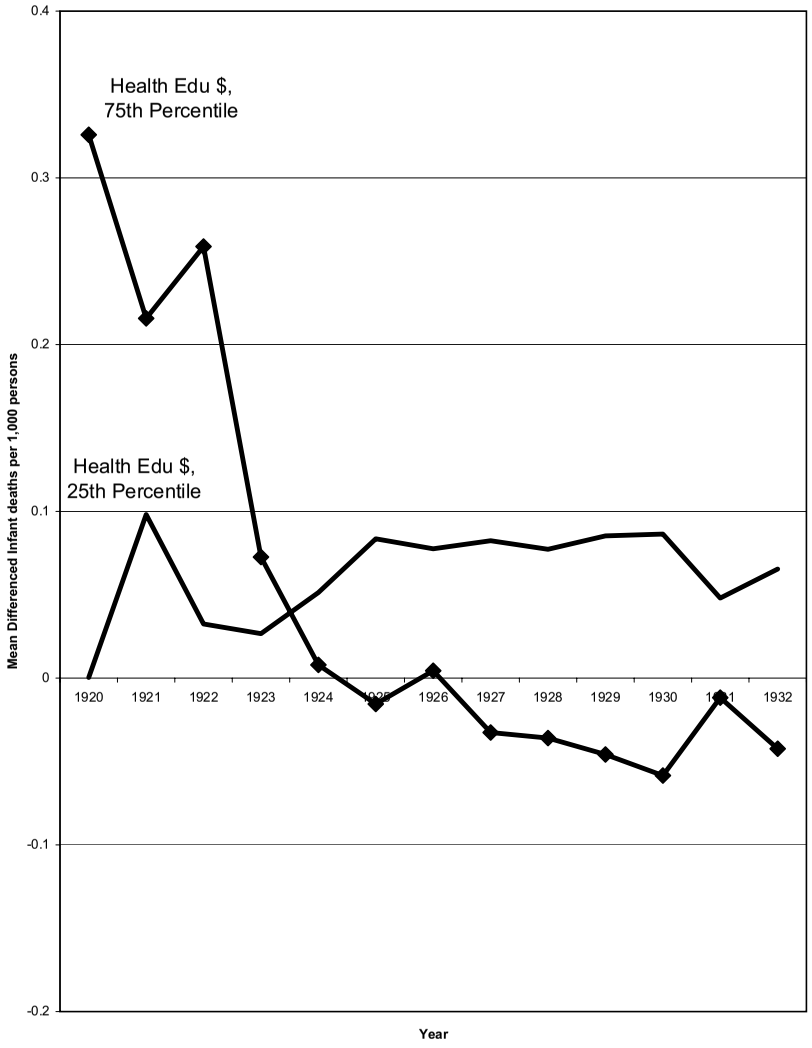

Figure 3
Infant Death Trends in Cities
with More and Less Poverty Relief Spending

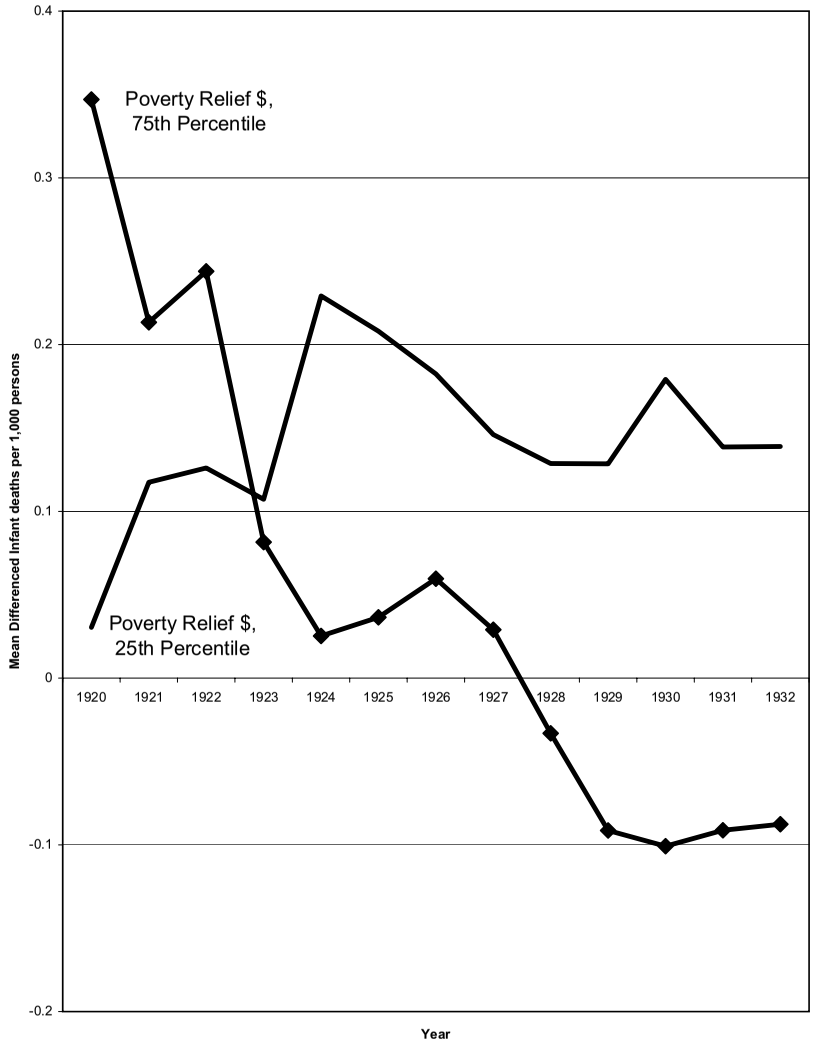

Figure 4
Children Age 1-4 Death Trends in Cities
with More and Less Health Education Spending

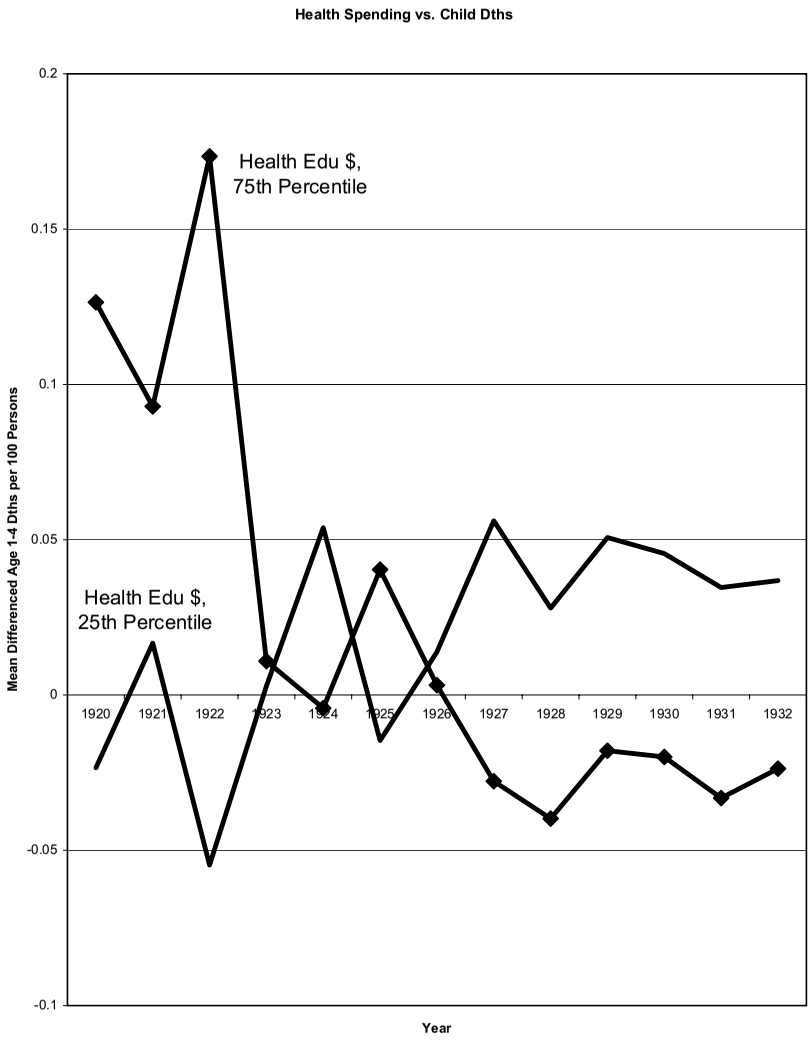

Figure 5
Children Age 1-4 Death Trends in Cities
with More and Less Poverty Relief Spending

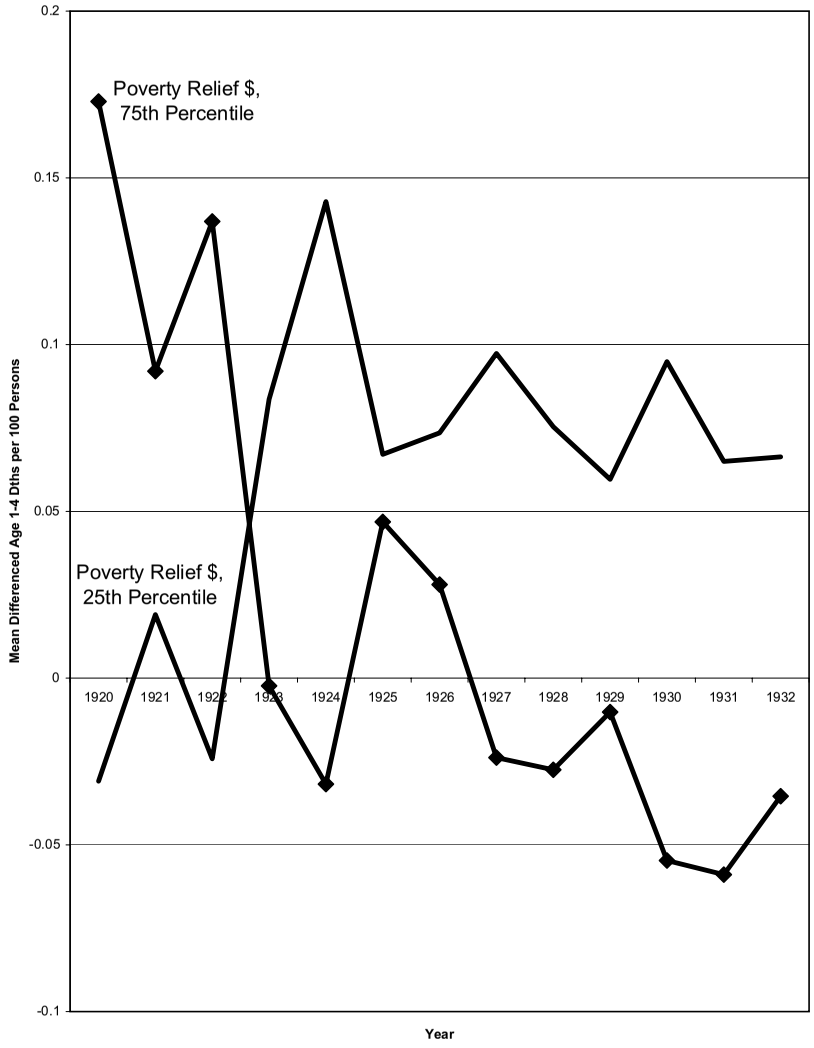

Figure 6a
Death Rate for Infants Against
Per Capita Health Education Spending (2007 $)

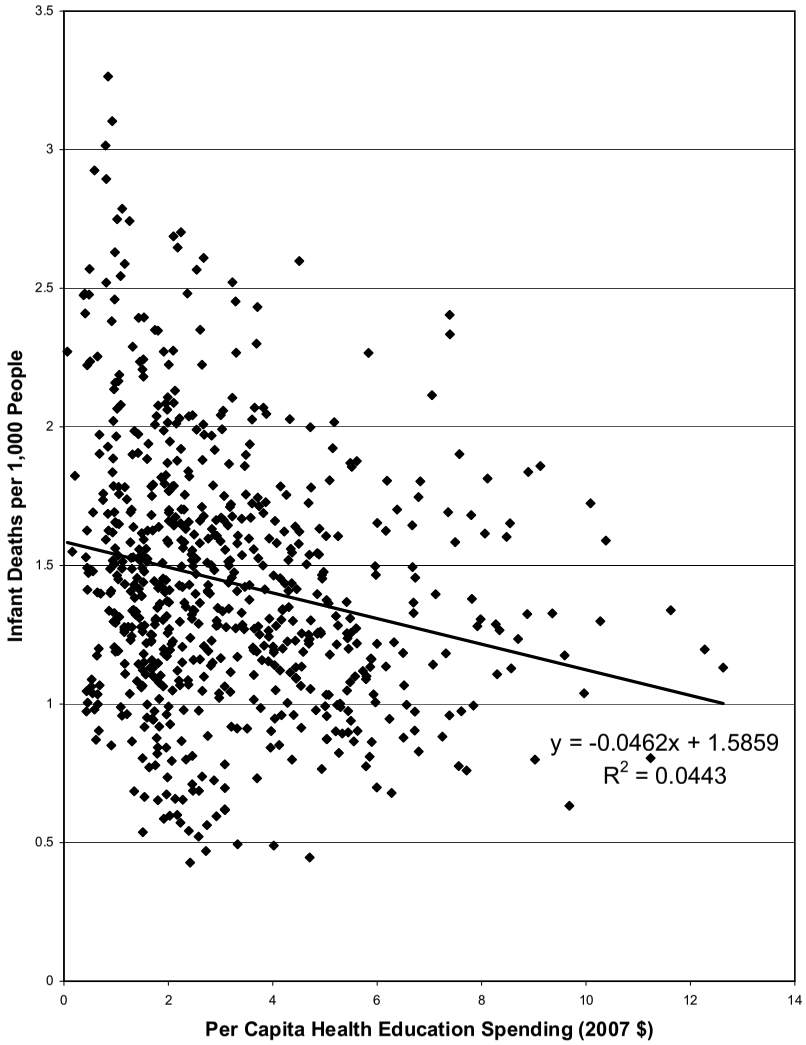

Figure 6b
Death Rate for Infants Against
Per Capita Poverty Relief Spending (2007 $)

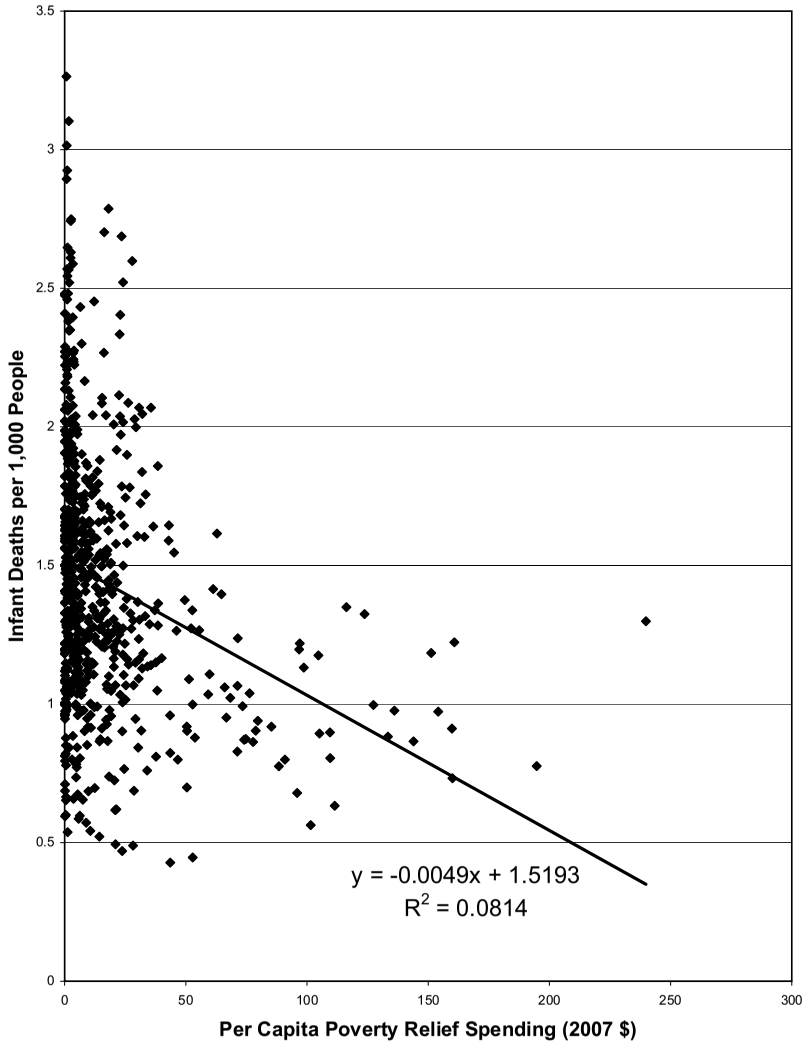

Figure 7a
Death Rate for Children Aged 1-4 Against
Per Capita Health Education Spending (2007 $)

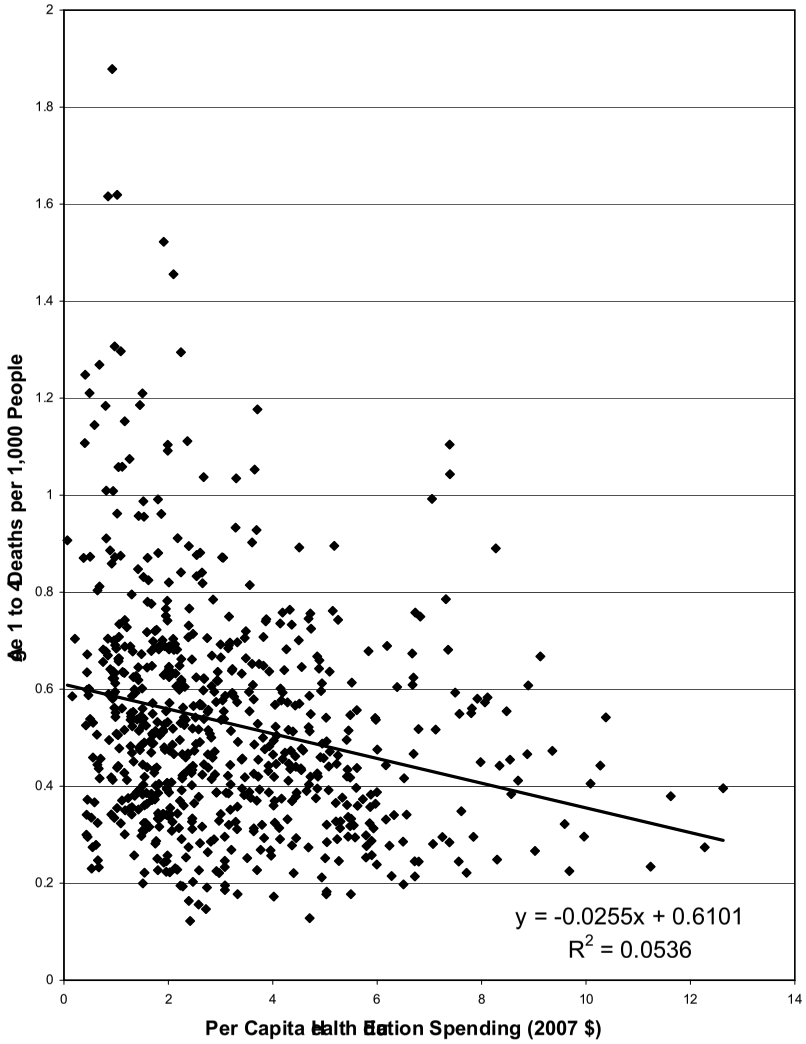

Figure 7b
Death Rate for Children Aged 1-4 Against
Per Capita Poverty Relief Spending (2007 $)

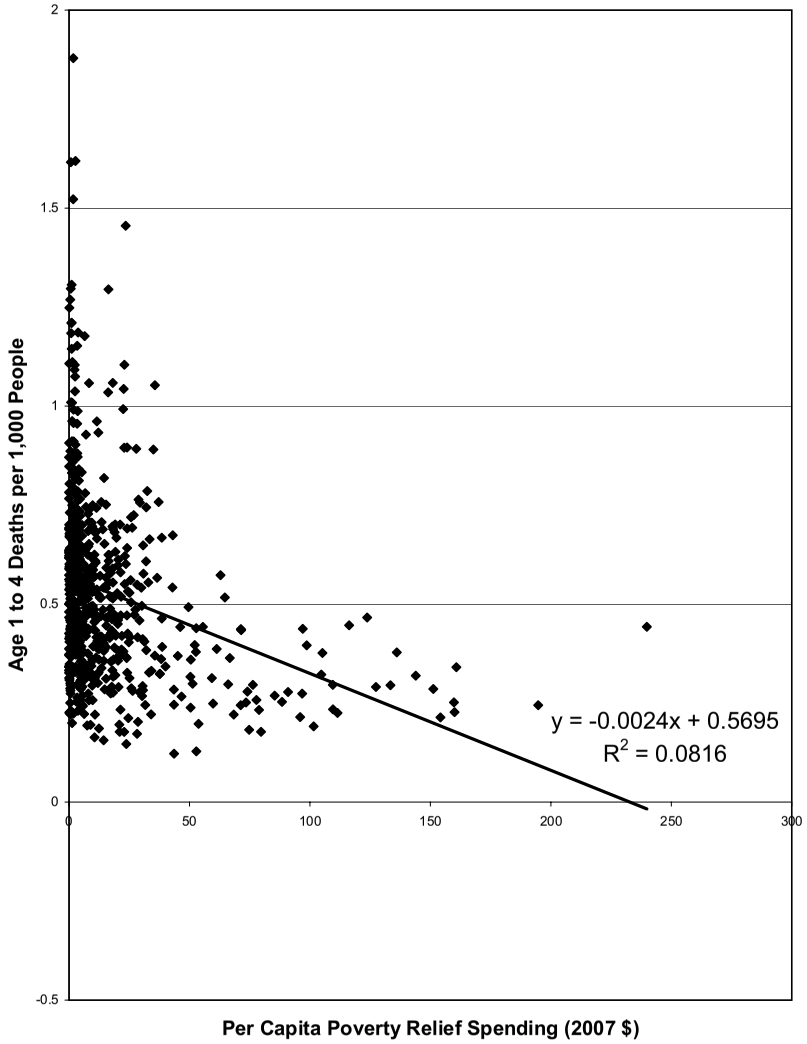

Figure 8a
Death Rate for Children Aged 5-9 Against
Per Capita Health Education Spending (2007 $)

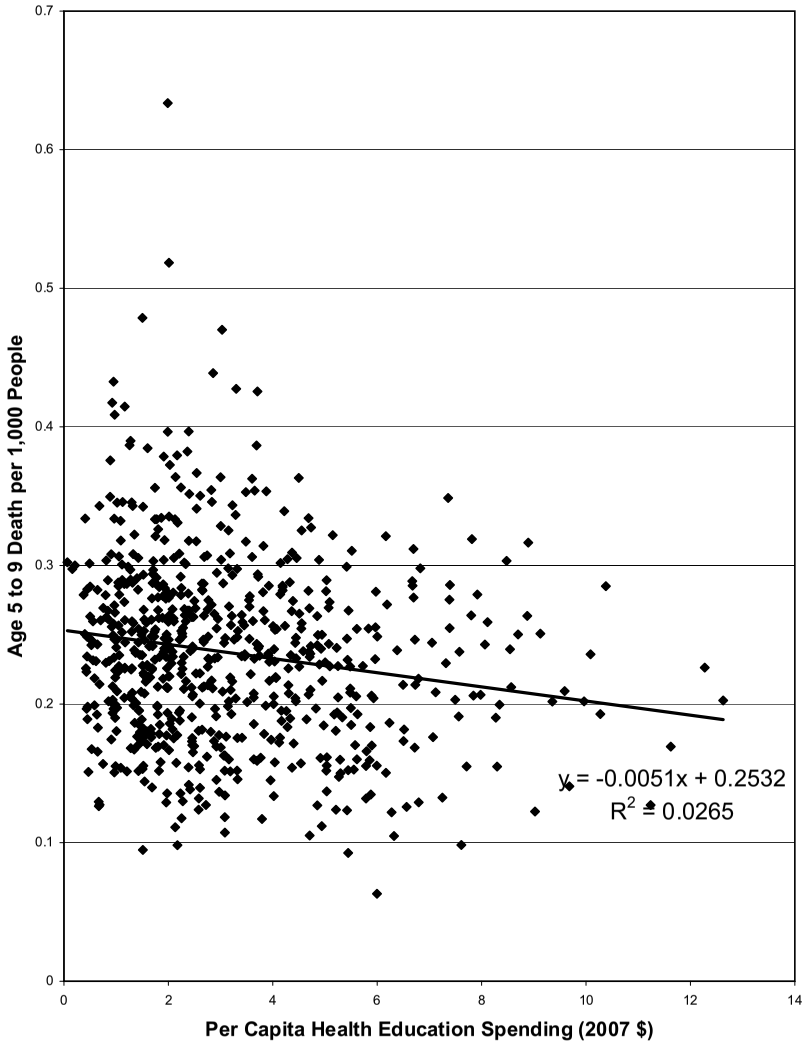

Figure 8b
Death Rate for Children Aged 5-9 Against
Per Capita Poverty Relief Spending (2007 $)

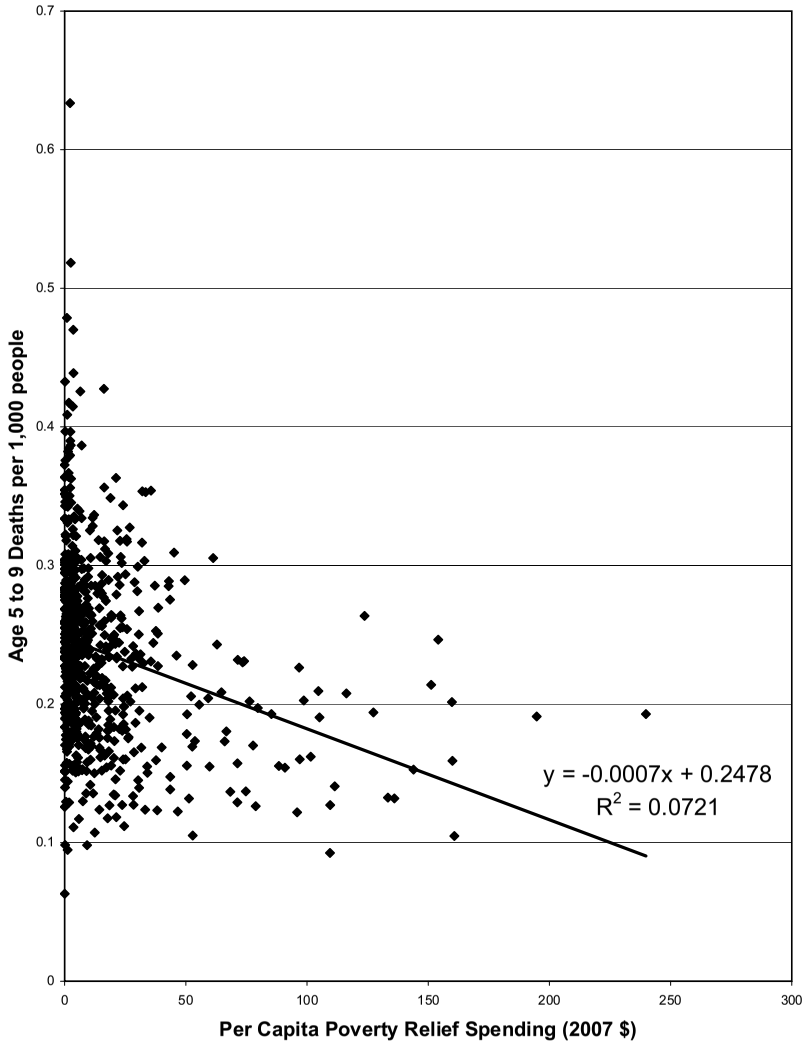

Figure 9a
Death Rate for Children Aged 10-14 Against
Per Capita Health Education Spending (2007 $)

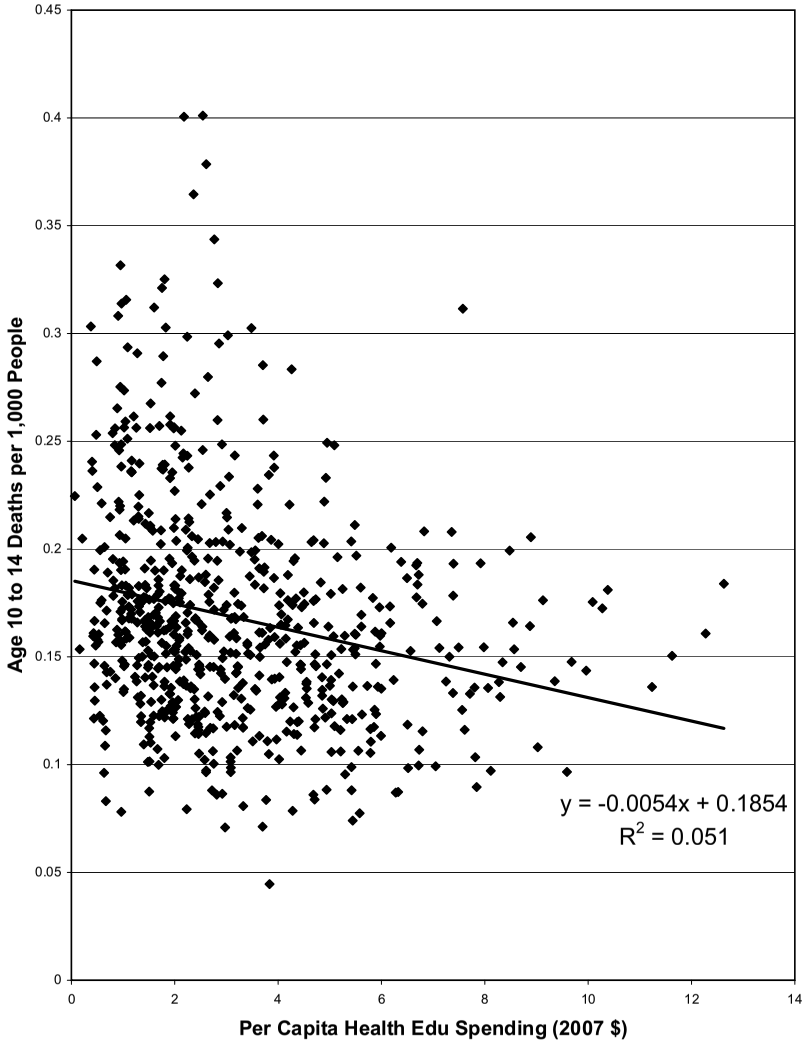

Figure 9b
Death Rate for Children Aged 10-14 Against
Per Capita Poverty Relief Spending (2007 $)

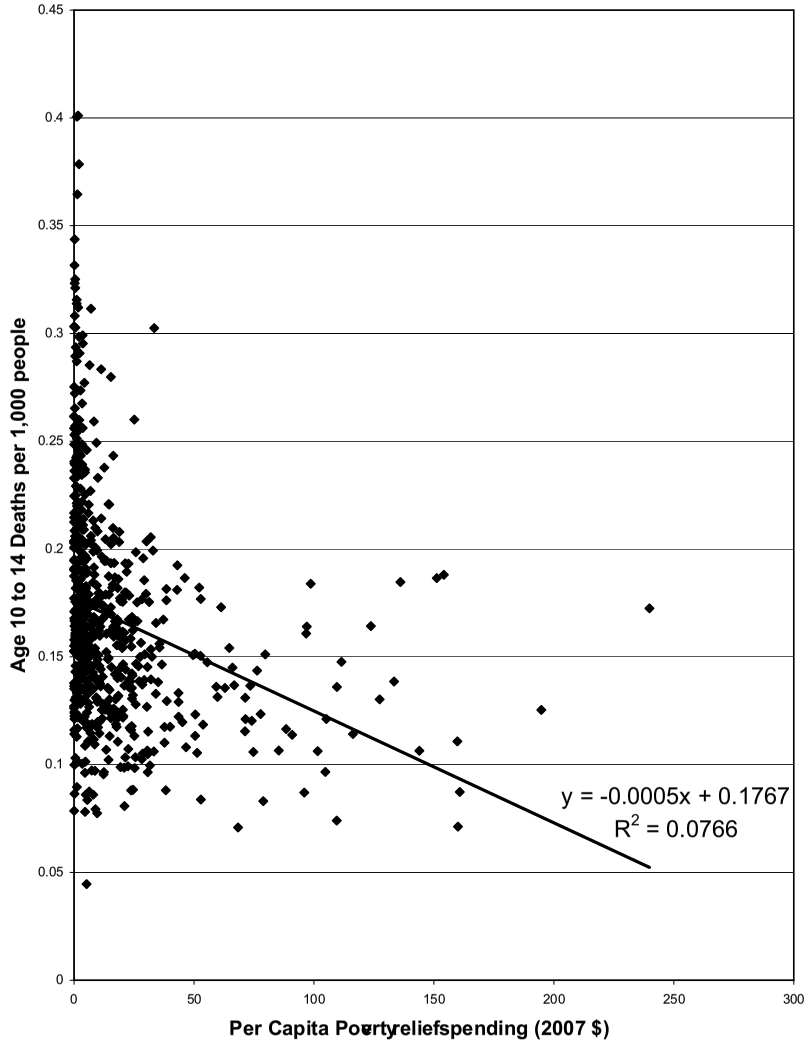

Table 1
Summary Statistics

Per Capita Spending Variables	Mean	Min	Max	Zeros
Key Spending Variables				
Health education spending	3.15	0.07	12.63	0
Child poverty relief spending	16.23	0	239.83	19
Other Spending Variables				
Other health spending	10.10	1.27	39.46	0
Sanitation spending	32.54	7.75	102.44	0
Other charitable spending	5.47	0	50.29	127
Spending on hospitals	12.66	0	106.99	92
Spending on schools and libraries	190.50	68.22	383.88	0

Income and Income Distribution Correlates	Mean	Min	Max	Zeros
Avg. annual mfg wages	15,174.34	3,403	28,341.15	0
Number of tax returns filed	0.07	0.01	0.22	0

Demographic Measures	Mean	Min	Max	Zeros
Percent black	0.08	0.00	0.43	0
Percent foreign born	0.19	0.00	0.46	0
Percent illiterate	0.03	0.01	0.11	0
Percent rural	0.12	0	0.39	113

Table 2
List of Industries Classified as Polluting

Industries classified as "heavy" and "polluting"

Heavy Industry

- Brass, bronze and other nonferrous alloys, and manufactures of these alloys and of copper
- Copper, tin and sheet-iron work, including galvanized-iron work
- Forgings, iron and steel, not made in steel works or rolling mills
- Foundry and machine shop products
- Iron and steel: Blast furnaces
- Iron and steel: Cast iron
- Iron and steel: processed
- Iron and steel: Steel works and rolling mills
- Leather: Tanned, curried and finished
- Motor vehicle bodies and motor vehicle parts
- Motor vehicles, not including motorcycles
- Rubber goods, other than tires or inner tubes
- Rubber tires and inner tubes
- Smelting and refining, metals other than gold, silver or platinum

Other polluting industries

- Belting, leather
- Lumber and Timber, not elsewhere classified
- Lumber, planing-mill products
- Paper and wood pulp
- Tanning materials, natural dyestuffs, mordants and assistants

Table 3
Summary of Important Spending Variable Coefficients
By Child Age Group

Panel A	Infants			Children 1 to 4		
	(1)	(2)	(3)	(1)	(2)	(3)
City spending variables of interest						
Lagged PHE	-0.0347	-0.0251	0.0026	-0.0080	-0.0034	0.0018
	(0.0095)***	(0.0086)**	(0.0045)	(0.0044)	(0.0040)	(0.005)
Poverty Relief	-0.00128	0.00017	-0.00041	0.00021	0.0009	0.0003
	(0.0003)***	(0.00102)	(0.00142)	(0.00020)	(0.0004)**	(0.0005)
(Lagged PHE)*(Poverty Relief)		-0.00025	-0.00016		-0.0001	-0.00003
		(0.0001)*	(0.00012)		(0.00006)*	(0.00009)
Covariates	Y	Y	Y	Y	Y	Y
City fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
City-specific trends	N	N	Y	N	N	Y

Standard errors in parentheses, clustered at census region

* significant at 10%; ** significant at 5%; *** significant at 1%

Panel B	Children 5 to 9			Children 10 to 14		
	(1)	(2)	(3)	(1)	(2)	(3)
City spending variables of interest						
Lagged PHE	-0.0001	0.00134	0.00774	-0.0021	-0.0016	0.0006
	(0.0026)	(0.0030)	(0.0035)*	(0.001)*	(0.0011)	(0.0021)
Poverty Relief	0.0002	0.00043	0.00082	-0.00009	-0.00003	-0.000021
	(0.00019)	(0.0002)	(0.0005)	(0.00011)	(0.00013)	(0.00012)
(Lagged PHE)*(Poverty Relief)		-0.00004	-0.00005		-0.00001	-0.000005
		(0.00005)	(0.00007)		(0.00001)	(0.00002)
Covariates	Y	Y	Y	Y	Y	Y
City fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
City-specific trends	N	N	Y	N	N	Y

Standard errors in parentheses, clustered at census region

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4
Infant Mortality Regressions

	(1)	(2)	(3)
City spending variables of interest			
Lagged PHE	-0.0347	-0.0251	0.0026
	(0.0095)***	(0.0086)**	(0.0045)
Poverty Relief	-0.00128	0.00017	-0.00041
	(0.0003)***	(0.00102)	(0.00142)
(Lagged PHE)*(Poverty Relief)		-0.00025	-0.00016
		(0.0001)*	(0.00012)
Women's suffrage ("Before 1914" omitted)			
1915-1919	-0.2291	-0.1783	-0.5321
	(0.4963)	(0.4968)	(0.3697)
1920	0.4227	0.4192	1.1031
	(0.2026)*	(0.2119)*	(0.2406)***
Other spending variables			
Other health spending	-0.00014	-0.00027	0.0008
	(0.0053)	(0.00500)	(0.0037)
Sanitation spending	0.0006	0.00021	-0.00092
	(0.0018)	(0.00165)	(0.00114)
Other charitable spending	0.0044	0.0049	0.0117
	(0.00062)***	(0.0012)***	(0.0035)**
Hospital spending	0.0007	0.0014	-0.0017
	(0.0022)	(0.0021)	(0.0020)
Education spending	0.0033	0.0034	0.0014
	(0.00075)***	(0.0007)***	(0.0005)**
City income variables			
Manufacturing wages	0.000005	0.000005	0.00003
	(0.00001)	(0.00001)	(0.000004)***
# of workers in heavy industry	-0.000045	-0.00005	0.00002
	(0.00003)	(0.00003)	(0.00003)
# of tax returns filed	1.729	1.991	-0.896
	(1.643)	(1.547)	(1.657)
Surrounding county demographics			
Percent black	-3.035	-3.350	
	(1.486)*	(1.429)**	
Percent illiterate	16.747	16.916	
	(2.922)***	(2.778)***	
Percent rural	-1.7521	-1.929	
	(1.3101)	(1.470)	
Percent foreign born	-0.3319	-0.3633	
	(1.0950)	(1.0867)	
State weather variables			
Avg. state temp.	-0.0088	-0.0093	-0.0157
	(0.0130)	(0.0130)	(0.0149)
Mths of extreme or severe wet	-0.0010	-0.0006	-0.0006
	(0.0055)	(0.0054)	(0.0063)
Mths of extreme or severe drought	0.0022	0.0020	0.0001
	(0.0045)	(0.0045)	(0.0043)
Other variables			
Mortality rate for adults aged 20-29	0.0168	0.0141	0.0003
	(0.0303)	(0.0297)	(0.0182)
Constant	-0.1004	-0.1777	1.2250
	(0.6515)	(0.6269)	(0.9603)
Includes city fixed effects	Y	Y	Y
Includes year fixed effects	Y	Y	Y
Includes city -specific trends	N	N	Y
Observations	603	603	603
Adjusted R squared	0.894	0.8947	0.9199

Standard errors in parentheses, clustered at census region

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5
Age 1-4 Mortality Regressions

	(1)	(2)	(3)
City spending variables of interest			
Lagged PHE	-0.0080	-0.0034	0.0018
	(0.0044)	(0.0040)	(0.005)
Poverty Relief	0.00021	0.0009	0.0003
	(0.00020)	(0.0004)**	(0.0005)
(Lagged PHE)*(Poverty Relief)		-0.0001	-0.00003
		(0.00006)*	(0.00009)
Women's suffrage ("Before 1914" omitted)			
1915-1919	-0.2874	-0.2631	-0.0887
	(0.2179)	(0.2115)	(0.1024)
1920	0.1533	0.1516	0.5746
	(0.0849)	(0.0789)*	(0.2297)**
Other spending variables			
Other health spending	-0.0004	-0.0005	-0.00018
	(0.0034)	(0.0033)	(0.0029)
Sanitation spending	0.0009	0.0007	0.0016
	(0.0011)	(0.0011)	(0.0028)
Other charitable spending	-0.0008	-0.0006	-0.0004
	(0.0014)	(0.0015)	(0.0017)
Hospital spending	-0.0013	-0.0009	-0.0016
	(0.0008)	(0.0008)	(0.0013)
Education spending	0.0007	0.0008	0.00003
	(0.0002)***	(0.0002)**	(0.0006)
City income variables			
Manufacturing wages	-0.000001	-0.000001	0.000006
	(0.000002)	(0.000002)	(0.000006)
# of workers in heavy industry	0.00001	0.00001	0.000006
	(0.00002)	(0.00002)	(0.00001)
# of tax returns filed	0.5937	0.7188	1.2139
	(0.4601)	(0.4865)	(0.6337)*
Surrounding county demographics			
Percent black	-0.3066	-0.4569	
	(1.4948)	(1.4668)	
Percent illiterate	8.3524	8.4335	
	(3.098)**	(3.043)**	
Percent rural	-0.6805	-0.7651	
	(0.4639)	(0.5089)	
Percent foreign born	0.3282	0.3132	
	(0.6942)	(0.6834)	
State weather variables			
Avg. state temp.	-0.0063	-0.0065	-0.0094
	(0.0064)	(0.0062)	(0.0071)
Mths of extreme or severe wet	-0.0013	-0.0011	0.00002
	(0.0033)	(0.0034)	(0.0038)
Mths of extreme or severe drought	-0.00010	-0.00020	-0.0038
	(0.0016)	(0.0016)	(0.0023)
Other variables			
Mortality rate for adults aged 20-29	0.0057	0.0044	-0.0019
	(0.0129)	(0.0126)	(0.0081)
Constant	0.0820	0.0450	0.4791
	(0.4170)	(0.4072)	(0.3313)
Includes city fixed effects	Y	Y	Y
Includes year fixed effects	Y	Y	Y
Includes city -specific trends	N	N	Y
Observations	603	603	603
Adjusted R squared	0.7911	0.7917	0.7995

Standard errors in parentheses, clustered at census region

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6
Age 5-9 Regressions

	(1)	(2)	(3)
City spending variables of interest			
Lagged PHE	-0.0001	0.00134	0.00774
	(0.0026)	(0.0030)	(0.0035)*
Poverty Relief	0.0002	0.00043	0.00082
	(0.0002)	(0.0002)	(0.0005)
(Lagged PHE)*(Poverty Relief)		-0.00004	-0.00005
		(0.00005)	(0.00007)
Women's suffrage ("Before 1914" omitted)			
1915-1919	0.0228	0.0302	0.0655
	(0.0939)	(0.0892)	(0.0604)
1920	0.1410	0.1405	0.0808
	(0.0513)**	(0.0504)**	(0.1008)
Other spending variables			
Other health spending	-0.00059	-0.00061	-0.0019
	(0.0008)	(0.0008)	(0.0009)*
Sanitation spending	0.00004	-0.000015	0.00025
	(0.00042)	(0.0005)	(0.0006)
Other charitable spending	-0.00019	-0.00012	-0.0007
	(0.00018)	(0.0003)	(0.0009)
Hospital spending	-0.000851	-0.0007	-0.0009
	(0.00052)	(0.0006)	(0.0011)
Education spending	-0.00006	-0.00005	0.00018
	(0.00019)	(0.00021)	(0.0004)
City income variables			
Manufacturing wages	0.000003	0.000003	0.000005
	(0.000001)*	(0.000002)*	(0.000003)*
# of workers in heavy industry	0.00001	0.00001	-0.000001
	(0.0000033977)**	(0.000003)**	(0.000007)
# of tax returns filed	0.6122	0.6502	0.6188
	(0.2248)**	(0.2425)**	(0.19073)**
Surrounding county demographics			
Percent black	0.2889	0.2432	
	(0.4689)	(0.4465)	
Percent illiterate	0.4553	0.4799	
	(1.0796)	(1.0504)	
Percent rural	-0.6269	-0.6526	
	(0.3048)*	(0.3368)*	
Percent foreign born	-0.2930	-0.2976	
	(0.1873)	(0.1756)	
State weather variables			
Avg. state temp.	-0.00116	-0.0012	0.000014
	(0.00147)	(0.0015)	(0.00187)
Mths of extreme or severe wet	-0.0005	-0.00046	0.000027
	(0.0016)	(0.00159)	(0.00189)
Mths of extreme or severe drought	0.0007	0.00064	0.00052
	(0.0010)	(0.0010)	(0.0012)
Other variables			
Mortality rate for adults aged 20-29	0.0060	0.0056	0.0054
	(0.0045)	(0.0039)	(0.0046)
Constant	0.1815	0.1703	-0.2230
	(0.15)	(0.1601)	(0.1855)
Includes city fixed effects	Y	Y	Y
Includes year fixed effects	Y	Y	Y
Includes city -specific trends	N	N	Y
Observations	603	603	603
Adjusted R squared	0.5883	0.5884	0.6218

Standard errors in parentheses, clustered at census region

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7
Age 10-14 Regressions

	(1)	(2)	(3)
City spending variables of interest			
Lagged PHE	-0.0021	-0.0016	0.0006
	(0.001)*	(0.0011)	(0.0021)
Poverty Relief	-0.00009	-0.00003	-0.000021
	(0.00011)	(0.00013)	(0.00012)
(Lagged PHE)*(Poverty Relief)		-0.00001	-0.000005
		(0.00001)	(0.000018)
Women's suffrage ("Before 1914" omitted)			
1915-1919	0.0313	0.0335	0.0170
	(0.0705)	(0.0711)	(0.0498)
1920	0.0736	0.0735	0.0753
	(0.0553)	(0.0556)	(0.0475)
Other spending variables			
Other health spending	0.0009	0.0009	0.0004
	(0.0006)	(0.0005)	(0.0007)
Sanitation spending	0.0000	-0.00005	0.00044
	(0.00037)	(0.00037)	(0.00042)
Other charitable spending	0.00079	0.0008	0.0004
	(0.0004)*	(0.0004)*	(0.0002)*
Hospital spending	0.00018	0.00021	0.00006
	(0.00023)	(0.00021)	(0.0004)
Education spending	0.0002	0.0002	0.00014
	(0.0001)	(0.0001)	(0.00012)
City income variables			
Manufacturing wages	-0.0000006	-0.0000006	0.000003
	(0.000002)	(0.000002)	(0.000002)
# of workers in heavy industry	0.0000083	0.000008	-0.0000007
	(0.000004)*	(0.000004)*	(0.000004)
# of tax returns filed	0.3645	0.3759	0.0437
	(0.1408)**	(0.1471)**	(0.1813)
Surrounding county demographics			
Percent black	0.2833	0.2696	
	(0.4684)	(0.4712)	
Percent illiterate	1.2341	1.2415	
	(1.8257)	(1.8175)	
Percent rural	-0.1284	-0.1361	
	(0.3358)	(0.3372)	
Percent foreign born	-0.3390	-0.3404	
	(0.2709)	(0.2704)	
State weather variables			
Avg. state temp.	0.00266	0.0026	0.0020
	(0.0016)	(0.0016)	(0.0024)
Mths of extreme or severe wet	0.00138	0.0014	0.00085
	(0.00134)	(0.0014)	(0.00140)
Mths of extreme or severe drought	0.00038	0.00037	0.00051
	(0.00092)	(0.00093)	(0.0010)
Other variables			
Mortality rate for adults aged 20-29	0.0038	0.0037	0.0011
	(0.0042)	(0.0042)	(0.0028)
Constant	-0.0780	-0.0814	0.00186
	(0.1070)	(0.1088)	(0.0990)
Includes city fixed effects	Y	Y	Y
Includes year fixed effects	Y	Y	Y
Includes city -specific trends	N	N	Y
Observations	603	603	603
Adjusted R squared	0.6336	0.633	0.6551

Standard errors in parentheses, clustered at census region

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8
Age 20-29 (Placebo) Regressions

	(1)	(2)	(3)
City spending variables of interest			
Lagged PHE	0.0126	0.0307	0.0222
	(0.0172)	(0.0315)	(0.0383)
Poverty Relief	-0.0016	0.00116	0.00112
	(0.0013)	(0.0012)	(0.00)
(Lagged PHE)*(Poverty Relief)		-0.0005	-0.0007
		(0.0004)	(0.0005)
Women's suffrage ("Before 1914" omitted)			
1915-1919	0.0162	0.1118	-0.0816
	(0.4490)	(0.4578)	(0.4082)
1920	-0.3678	-0.3725	1.3615
	(0.2536)	(0.2789)	(0.3331)***
Other spending variables			
Other health spending	-0.0089	-0.0091	-0.0203
	(0.0061)	(0.0061)	(0.0218)
Sanitation spending	-0.0023	-0.0030	-0.0021
	(0.00)	(0.00)	(0.0040)
Other charitable spending	0.0077	0.0086	0.00035
	(0.0029)**	(0.0025)***	(0.0026)
Hospital spending	0.0055	0.0069	0.00436
	(0.0051)	(0.0060)	(0.0060)
Education spending	0.00281	0.0029	0.0035
	(0.00079)***	(0.0007)***	(0.00210)
City income variables			
Manufacturing wages	-0.000004	-0.000004	0.00001
	(0.000004)	(0.000005)	(0.000005)*
# of workers in heavy industry	-0.00004	-0.00005	-0.00002
	(0.00003)	(0.00004)	(0.00003)
# of tax returns filed	0.8550	1.3436	0.3314
	(1.470)	(1.332)	(0.6587)
Surrounding county demographics			
Percent black	-2.942	-3.520	
	(2.992)	(3.349)	
Percent illiterate	15.369	15.610	
	(6.1856)**	(5.8063)**	
Percent rural	1.9193	1.5765	
	(1.3790)	(1.3286)	
Percent foreign born	-1.4979	-1.5494	
	(0.8866)	(0.9360)	
State weather variables			
Avg. state temp.	0.0159	0.0149	-0.0006
	(0.0139)	(0.0132)	(0.0083)
Mths of extreme or severe wet	-0.0029	-0.0020	-0.0036
	(0.0023)	(0.0023)	(0.0041)
Mths of extreme or severe drought	-0.0011	-0.0014	-0.0063
	(0.0060)	(0.0058)	(0.0083)
Constant	-0.8650	-1.0063	-0.3667
	(0.8688)	(0.9252)	(0.9155)
Includes covariates	Y	Y	Y
Includes city fixed effects	Y	Y	Y
Includes year fixed effects	Y	Y	Y
Includes city -specific trends	N	N	Y
Observations	603	603	603
Adjusted R squared	0.4735	0.4751	0.4571

Standard errors in parentheses, clustered at census region

* significant at 10%; ** significant at 5%; *** significant at 1%