

The Effects of 'Improvements' in the Water Supply on the Mortality of Cities  
at the Turn of the Twentieth Century.

Gretchen A. Condran  
Rose A. Cheney  
Harold R. Lentzner

Public Health officials in American cities viewed the contamination of water supplies as an important source of disease and death. From 1870 to 1920, changes in the source, quantity and condition of the water supplied to cities were undertaken with an eye to lowering high urban mortality levels. In this paper we examine the addition of large municipal projects to the public health mix and the effects of these programs on mortality levels in large cities.

We have selected four cities, New York, New Orleans, Philadelphia and Chicago for analysis largely because they have the requisite data, however, they also represent cities of different size, climate and rate of growth. Responding to differences in population size and growth, each of the four cities dealt with the problem of providing water to its citizenry in different ways and at different times. In the late nineteenth century, each of the cities faced different problems. In New York, the Croton Aqueduct provided water that was probably less contaminated than that in the other two cities, but the growing population had already outstripped the available supply and per capita consumption was low especially in the city's tenements. In Chicago the water from Lake Michigan grew increasingly polluted as the city grew but was in plentiful enough to meet the needs of the population. Philadelphia, with two rivers, responded to upstream pollution with changes in the source of its water before the turn of the century. Finally, New Orleans had no central water supply system until after the turn of the twentieth century and dealt rather with more localized problems of polluted cisterns. In light of the differences in the problems confronted by the cities, the public health activities directed at them varied from place to place and it is these variations that allow some assessment of the efficacy of the activities.

**Data for Cross - City Comparisons of Water Supplies**

For our analysis we have collected time series data related to the quantity and quality of water, including miles of water mains, average daily per capita water use in gallons, various measures of household water availability, chemical analysis of the water, bacteriological analysis

of the water, and numbers of privy vaults whenever such data were collected and published. In addition, we have tracked the major public health activities aimed at improving water quality in each of the cities from the 1870s until 1920. These public health interventions varied from city to city and included, changing the sources of water, controlling the pollution of the areas surrounding water sources, building intercepting sewers, the construction of conduits and aqueducts to bring water from further areas, disinfection processes, and filtration. The presence and timing of these activities varied across the four cities and therefore make at least some evaluation of their efficacy possible.

### **Data for Within - City Comparisons of Water Supplies**

Philadelphia affords the best data for analyzing within-city variations in water supply. Philadelphia was divided into six water districts the areas of which corresponded closely to ward boundaries and in which filters were built over a span of 10 years. As we have shown in previous work, the introduction of water filters stopped the cycle of typhoid epidemics in a water district. We will continue our analysis of the Philadelphia water districts using other causes of death to evaluate the impact of water filtration on mortality levels in general and from specific causes of death.

### **Mortality Data by Cause of Death**

In this study we focus first on typhoid fever as the cause of death. With the end of the cholera epidemics in 1866, typhoid was the specific cause of death most often linked to the water supply at the end of the nineteenth century. Both its magnitude as a cause of death and its seasonal patterns are related to the changing water supplies in the four cities. While outbreaks of typhoid fever were dramatic and a cause for alarm, typhoid was the cause of only a small proportion of the deaths in the cities. For improvements in the water supply to have a major impact on mortality rates more generally they had to affect other causes of death as well. We examine the levels and seasonal patterns of the mortality rates from other diarrheal diseases among adults. In addition, we consider the summer mortality of young children, largely a result of diarrheal disease, and the leading cause of death among the very young. Finally, we consider the possibility that diarrheal diseases debilitated its survivors and produced higher levels of mortality from other diseases, such as tuberculosis and pneumonia.

In this paper we move beyond general descriptions of changes in the water supplies and rather attempt to link specific public health interventions to changing mortality rates both across cities and within cities. How infrastructure changes affected mortality in the past adds to both our understanding of the mortality transition and the role of public health activities in it.