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Changing Patterns of Epidemic Disease in New York City

Most nineteenth-century New Yorkers had a clear understanding of the word *epidemic*. It was not simply a metaphor but a grim and frightening reality. Although always high, mortality rates soared in some years because of diseases that in other years were either entirely absent or present only in much smaller numbers. In 1798, nearly 800 deaths from yellow fever increased the death toll for the year by nearly 50 percent.¹ More than 5,000 residents of New York died of cholera in 1849.² Smallpox killed only 26 of the city's inhabitants in 1868, but caused 920 deaths four years later.³ The numbers of deaths attributed to typhus and typhoid or to diphtheria and croup increased and decreased with some regularity. Such events were by no means limited to New York City; for example, nearly a quarter of Philadelphia's fifty thousand people contracted yellow fever in 1793, and about four thousand of them died. Because both the numbers of epidemics and the deaths attributed to them increased throughout the eighteenth century and for the first three-quarters of the nineteenth, these years have been described as the period of great epidemics.⁴

Labeling an historical period in terms of its mortality characteristics may be particularly appropriate. The changes in mortality that accompanied the process of industrialization and urbanization during the nineteenth and the early twentieth centuries profoundly affected individuals' lives and the organization of society. The accumulation of populations in large cities in the United States, exemplified most dramatically in its largest city, New York, radically altered disease patterns. Large cities were the sites first of rising and extremely high mortality levels and major epidemics, and then of declines in death rates. The transition from high to low mortality was a widespread phenomenon, occurring in much of Europe and in Canada, the United States, New Zealand, and Australia.⁵ The exact timing of the shift, uncertain because data are scarce prior to the mid-nineteenth century, especially outside large cities, probably varied somewhat from place to place, but the main features of the change were general.

All contemporary and historical studies underline the sharp differences between mortality in rural and urban areas. Rural mortality rates were probably declining by the end of the eighteenth or beginning of the nineteenth century in most of the early industrializing countries, and as long as these nations

remained overwhelmingly rural, overall mortality trends reflected rural mortality conditions. Cities, on the other hand, posed new threats to health and longevity. The decline in national mortality levels was alternatively attenuated, interrupted, or reversed by both a growth in the number of densely populated, high-mortality cities and a rise in mortality in these cities during the first half of the nineteenth century. By the end of that century, the more general and complete reporting of deaths indicates rapidly declining mortality even in the nation's largest cities. Urban death rates fell so rapidly during the first three decades of the twentieth century that by 1930 the inhabitants of large cities enjoyed a life expectancy comparable to that in the less densely populated countryside and longer than had been recorded previously in human history.⁶

Epidemic diseases were a prominent aspect of the high mortality that characterized nineteenth-century cities. They were differentiated from other diseases like tuberculosis and the diarrheal diseases of the young by their sudden and unexpected occurrence and their geographic and temporal limits.⁷ Outbreaks of epidemic disease could strike one city or only a few cities at any given time. Even within a city, epidemics were often limited to a circumscribed area. They were temporally specific events; contemporaries constructed well-defined beginnings and endings for each epidemic. As a consequence, epidemics elicited widespread fear and demanded both explanations and responses on the part of individuals, government agencies, and other social institutions. In contrast, endemic diseases, even the omnipresent tuberculosis, were likely to be defined as natural and accepted as unavoidable.⁸

Epidemics always evoked fear and panic, but the specific responses to them ranged widely by time, place, and the social condition of those who had to live through them. The well-to-do left the city of Philadelphia in 1793 at the first threat of yellow fever; the poor remained behind and warded off disease with camphor, vinegar, or tobacco. Meanwhile, the city's College of Physicians argued over what course to take and finally included in its list of recommendations that citizens should avoid infected persons, intemperance, and drafts. The city government cleaned the streets, provided an airy hospital for the stricken poor, burned gunpowder, and banned the tolling of church bells to mark a death because the sound was thought to lower the spirits of both the sick and the well.⁹ Cholera also elicited widely varying responses.¹⁰ Boards of health were quickly formed to design a response in many cities, and quarantine laws that had been largely neglected were hastily if casually enforced. Theaters, schools, and businesses were closed, and in some cases became emergency hospitals to accommodate the indigent sick. In at least one instance—in Chester, Pennsylvania, in 1832—infected persons were reported to have been murdered. Beyond immediate measures to combat the spread of illness and death, the orphaned, the widowed, and those thrust into poverty by an epidemic's effect on commerce demanded municipal support.

Because measures taken against epidemics were administratively incoherent and often short-lived—committees and boards of health appeared and disappeared, law enforcement tightened and waned—their immediate efficacy and their long-run effects are difficult to assess.¹¹ Regardless of the activities directed against them, epidemics always came to an end, and the urgent commitment to clean streets, quarantine ships, or isolate patients ended with them. Nonetheless, the responses to epidemics provide insight into the complex social context in which they occurred, a context that was undoubtedly altered by the demands that epidemics made on municipal governments, the medical establishment, and individual citizens. New York's history certainly illustrates this pattern of halting, inconsistent, yet cumulative change.

EPIDEMIC DISEASE IN NEW YORK CITY

The crude death rates for the city of New York from 1804 to 1930 shown in figure 1 illustrate a pattern of mortality change that New York shared with other large and growing cities. Although variations in the quality of the data and shifts in the age composition of New York City's population over time affected the observed mortality levels, both the trends in mortality and the large fluctuations in the death rates from year to year are accurately represented by the figure.¹²

Each of the high-mortality years in figure 1 can be explained by unusually

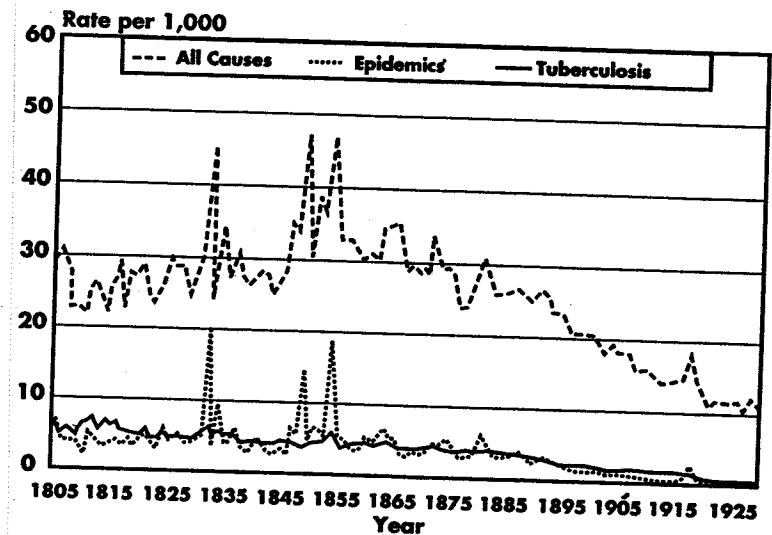


Figure 1. Death Rates, New York City, 1804 to 1930
All Causes, Epidemic Diseases, and Tuberculosis

large numbers of deaths from a particular epidemic disease. Table 1 contains a list of major outbreaks of epidemic disease in New York City from 1798 to 1918. Cholera dominated the first half century, while smallpox added to the epidemic death toll. Although an important source of the more familiar and somewhat less dramatic incursions of high mortality in the eighteenth century, and still cited as a threat in the early nineteenth, yellow fever contributed relatively few deaths after 1800. Typhus and typhoid account for the 1847 peak. Smallpox contributed most to the peaks of mortality after the 1866 cholera epidemic. Influenza and cerebrospinal meningitis were perceived as epidemics by the late nineteenth century and became important sources of exceptionally high mortality after the turn of the twentieth century, although changes in their classification may have contributed a great deal to the increase in deaths attributed to them.¹³

Neither the specific diseases that dominated particular points in time nor the yearly pattern of epidemic mortality can be easily explained. Both nineteenth-century and recent studies have shown close connections between cholera and the quality of a city's water supply. Similarly, there was undoubtedly some association between yellow fever and the extent and subsequent drainage of marshland (with the accompanying effect on local mosquito populations). Because general changes in living standards, the interconnections between causes of death, and the changes in diseases themselves probably played a role in the rise and fall of each of these diseases, it is impossible to assess the importance of any particular factor.

Cholera and yellow fever defined the practical and emotional meaning of epidemics during the late eighteenth and early nineteenth centuries. Virtually no deaths from these two diseases were recorded in the nonepidemic years. They arrived suddenly, ran their course in a matter of months, and then returned some years later with little or no warning. The symptoms of these two diseases were so spectacular that survivors were not likely to forget the experience of an epidemic. Diarrhea, spasmodic vomiting, and painful cramps followed by dehydration, cyanosis, and sudden death were characteristic of cholera.¹⁴ Those afflicted with yellow fever suffered from fever and associated headache, nausea, clamminess, weak pulse, and the identifying yellowish cast to the complexion. As with cholera, death often ensued within the day or even within hours of the onset of symptoms.¹⁵ That a person could be well in the morning and dead before nightfall, a stark contrast to the lingering illness associated with many endemic diseases like tuberculosis, added to the fear and panic that accompanied these epidemic diseases.

The prevalence of both cholera and yellow fever varied across the city. The New York City Board of Health noted that the "cholera fields" delineated in certain areas of the city were invariably characterized by "crowded and filthy dwellings, mostly tenant housing of the poorer classes; filthy streets, gutters and courts, obstructed and faulty house and privy sewerage, and a foul con-

Table 1. Years of Unusually Large Numbers of Deaths from Selected Epidemic Diseases, 1798 to 1918

Year	Epidemic disease	Number of deaths from disease	Percentage of excess deaths from disease
1798	Yellow fever	714	55.5
1804	Smallpox	199	10.6
1805	Yellow fever	270	13.5
1822	Yellow fever	166	5.8
1824	Smallpox	394	10.7
1832	Cholera	3,513	54.4
1834	Cholera	971	12.7
1834	Smallpox	233	2.8
1835	Smallpox	351	5.7
1847	Typhus/typhoid	1,396	10.4
1848	Smallpox	585	10.4
1848	Typhus/typhoid	953	10.4
1849	Cholera	5,071	28.9
1851	Smallpox	586	2.8
1851	Typhus/typhoid	1,103	2.8
1852	Smallpox	516	2.6
1853	Smallpox	681	3.3
1854	Cholera	2,501	10.2
1854	Smallpox	624	2.4
1864	Typhus/typhoid	1,425	2.4
1865	Smallpox	674	2.4
1865	Typhus/typhoid	1,074	2.4
1866	Cholera	1,137	4.5
1872	Smallpox	1,866	6.1
1872	Meningitis	782	6.1
1875	Smallpox	1,899	6.6
1881	Diphtheria	4,894	14.5
1887	Diphtheria	4,509	13.1
1893	Meningitis	489	.5
1901	Smallpox	410	.6
1902	Smallpox	310	.5
1904	Meningitis	1,083	.5
1905	Meningitis	1,110	.5
1906	Meningitis	600	.5
1918	Influenza	12,562	14.7

Note: The epidemics listed in table 1 are necessarily somewhat arbitrarily selected. I have used a similar table from Wilson G. Smillie, *Public Health* (New York: Macmillan, 1955), 382; a graph from the Health Department of the City of New York, *Summary of Vital Statistics* (New York, 1988); and the general cause of death listings. In general, I have included years of unusually large numbers of deaths from causes of death that were considered epidemic.

dition of privies."¹⁶ They were coterminous with those in earlier cholera epidemics, and also, although not perfectly, with former swamplands, streambeds, and basins that were drained by surface sewers. Factors and circumstances were interrelated and varied from city to city and from disease to disease, but the geographic distribution of epidemics was fairly consistently associated with poverty.

Other diseases classified as epidemic approximated the model defined by cholera and yellow fever. The numbers of deaths from smallpox, typhoid, typhus, and later diphtheria, influenza, and meningitis were not negligible in any year, but substantially higher numbers of deaths from these diseases in some years placed them in the category of epidemic, or at least potentially epidemic, diseases. The beginnings and endings of these epidemics were less clear than in cholera or yellow fever epidemics. Public health officials consistently classified measles among the epidemic diseases, although it differed from cholera and yellow fever in both the regularity of its occurrence and its nearly exclusive threat to children.

Diseases with a strong seasonal pattern, most notably the diarrheal diseases of infants and young children, shared some characteristics with epidemic diseases. Large numbers of deaths from diarrhea occurred in the summer, but the numbers varied little from year to year and the summer peak occurred each year in every large city in the country. The extreme variation in incidence across the year suggested some association with epidemic diseases whose incidence varied across time, and diarrheal diseases of young children were classified in mid-century in the same general category with epidemic diseases; they were not generally referred to as explicitly epidemic until the end of the nineteenth century, however, when it became accepted usage to say that an epidemic of infant deaths from diarrheal diseases occurred every summer.¹⁷

With the exception of cholera in a handful of years, epidemic diseases accounted for a small percentage of all deaths even in epidemic years. Deaths from endemic diseases like tuberculosis, bronchitis, and pneumonia were far more important determinants of the levels of mortality at any given time. Although they rarely exacted a higher toll than endemic diseases, epidemics nonetheless altered mortality levels in an epidemic year. During the months of the 1849 cholera epidemic, the citizens of New York City experienced mortality at levels that, had they continued, would have produced an expectation of life at birth nearly fifteen years less than the approximately forty-five years implied by the mortality rates in 1844, a nonepidemic year.¹⁸ Epidemics often changed the age pattern as well as the level of mortality. Cholera increased the death rates at all ages but especially those for young adults. Epidemics of diphtheria, meningitis, measles, and whooping cough, of course, added to the ranks of those who would not survive to adulthood. We cannot assess the significance of these diseases by their contribution to overall mortality alone.

They elicited such widespread fear and response that their psychological and political impact is only partially measured by the resulting death rate.

THE MORTALITY TRANSITION IN NEW YORK CITY

The crude death rates shown in figure 1 mask a great deal of variation in the timing and rate of mortality change by age and cause of death. In 1840, approximately 190 of every 1,000 infants born in New York City never reached their first birthdays; in 1870 that figure had passed 200. By 1930, however, fewer than 70 in 1,000 infants born in New York City died in the first year of life. Young adults also faced harsh mortality conditions in both 1840 and 1870—nearly one-quarter of those reaching the age of twenty would not live to thirty. Sixty years later, however, only 32 of 1,000 twenty-year-olds died before their thirtieth birthday. Although mortality rates dropped for all ages after 1870, the timing of the reduction differed by age group. Childhood mortality levels declined throughout the six decades from 1870 to 1930 but declined most rapidly between 1890 and 1900. Adult mortality remained high until after 1900, however, and for some middle-adult age groups rose between 1880 and 1890. The mortality rates of the elderly declined later than those for all other age groups; their death rates rose until the 1910–1920 decade and dropped dramatically between 1920 and 1930.

Data classified by cause of death illuminate the trends in age-specific mortality. In table 2 are the percentage contributions to the overall mortality decline from a number of causes of death in New York City for three time periods: 1840/45 to 1870; 1870 to 1900; and 1900 to 1930. The rates reported in table 2 are age-standardized death rates that remove the effects of changing age composition on mortality levels by assuming a constant age distribution over the time examined. Overall mortality levels increased between 1840/45 and 1870 but declined substantially during the two later time periods. Tuberculosis was the specific cause of death that explained the highest percentage of the decline in the age-standardized death rate for both periods of mortality decline. Tuberculosis accounted for 26 percent of the decline in mortality from 1870 to 1900 and 19.6 percent from 1900 to 1930. Smallpox played an important role in the early decline in overall mortality, but was a much less important source of decline after the turn of the twentieth century. Change in the rates of death from diphtheria and pneumonia made substantial contributions to the decline in the later period but, counter to the trend in overall mortality, actually rose slightly from 1870 to 1900. Diarrheal diseases were another important determinant of both the level of mortality and the changes in the level over time. They account for 15 percent of the decline in the age-standardized death rates shown in table 2 and were especially important to the decline in early death, accounting for nearly a quarter of the change in the infant and early childhood death rates.

Table 2. Age-standardized Mortality Rates by Selected Causes and Percentage Contribution to Overall Mortality Decline: New York City, 1840/45, 1870, 1900, and 1930

Cause of death	Central mortality rates (per 100,000)				Percentage of change explained by cause*		
	1840/45	1870	1900	1930	1840/45 to 1870	1870 to 1900	1900 to 1930
Diphtheria and croup	49.1	76.0	57.4	5.3	10.7	2.2	6.6
Diarrheal diseases	251.1	273.9	143.6	18.2	9.1	15.1	15.8
Epidemic meningitis	.0	63.9	25.9	3.4	25.5	4.4	2.8
Erysipelas	10.1	12.2	6.0	3.7	.8	.7	.3
Influenza	3.3	.0	17.6	11.5	-1.3	-2.9	.8
Malaria	22.4	23.8	5.1	.0	.6	2.2	.6
Measles	21.9	42.3	16.2	2.1	8.2	3.0	1.8
Pneumonia	161.1	193.5	241.7	126.6	12.9	-5.6	14.5
Scarlet fever	46.4	94.2	20.0	1.2	19.1	8.1	2.4
Smallpox	11.2	38.6	3.7	.0	10.9	4.0	.5
Tuberculosis	473.0	433.6	210.0	54.0	-15.7	25.9	19.6
Typhoid	38.8	39.3	17.5	1.0	.2	2.5	2.1
Whooping cough	32.5	30.0	11.0	3.5	-1.0	2.2	.9
Residual	1,260.6	1,310.7	992.6	743.0	20.0	36.8	31.4
Total	2,381.5	2,631.8	1,768.0	973.6	100.0	100.0	100.0

Note: Rates are standardized on the age distribution of the 1870 population. The years 1840 and 1845 were averaged, 1870, 1900, 1930 represent an average of three years around that year.

*A negative number indicates that the cause of death changed counter to the trend in overall mortality; that is, these causes declined from 1840/45 to 1870 and rose during the two later time periods.

Changing Patterns of Epidemic Disease 3

The epidemic diseases in this analysis made only a minor contribution to mortality decline after 1870 but were more important determinants of the upturn in mortality during the first half of the nineteenth century. Smallpox, scarlet fever, and diphtheria/croup, together account for 40 percent of the rise in the age-standardized death rate. Assessing the role of epidemics in mortality change is problematic because the presence or absence of an epidemic at the beginning or end of a time period affects the calculated importance of a disease. The contribution of epidemic diseases to the general mortality pattern can be shown more effectively by combining the death rates from a number of epidemic diseases and tracing the change in the combined death rate over time.¹⁹ The results of this strategy are shown in figure 1. The importance of these diseases increased markedly during the first six decades of the century and declined thereafter. The third line on figure 1 shows the course of the death rate from pulmonary tuberculosis. The obvious steady and slow decline in tuberculosis death rates for much of the nineteenth century was replaced by a more rapid decline at the turn of the century, a course of change followed by many other endemic diseases as well. Although a number of endemic diseases may already have begun to decline in the first half of the nineteenth century, the increase in epidemic diseases played an important demographic role by countering that decline and producing mortality levels that were either stagnant or rising until the late nineteenth century. After that, epidemic diseases also declined, but their contribution to the transition to low mortality was overshadowed by rapid declines in the major endemic causes of death.

UNDERSTANDING MORTALITY AND MORTALITY CHANGE

Historians and demographers have explanations for the high and rising urban mortality rates in the first half of the nineteenth century, for the presence of frequent and massive epidemics, and for the subsequent dramatic decline in both. The growth of cities and the increased density and changes in population composition that such growth entailed for most of the nineteenth century are viewed as precipitating or exacerbating a series of problems affecting the health of city dwellers. Bad housing, overcrowding, contamination of food, pollution of water supplies, and inadequate sanitary facilities conspired, in this view, to shorten the lives of children and adults alike. Epidemics could be understood in similar terms. Susceptible populations crowded in large cities, and the flow of new inhabitants provided the necessary conditions for the spread of epidemic diseases through contaminated water or food, close personal contact, or insect vectors.

Scholars have debated the reasons for the dramatic decline in mortality in the late nineteenth and early twentieth centuries. Influenced by the work of English social medicine advocate Thomas McKeown and his colleagues, many attribute the general decline in mortality in early industrializing nations

largely to economic growth and the improvements in nutrition that accompanied it. The decline in death rates is seen as a happy if largely unanticipated consequence of rising per capita income rather than a result of any purposive action to reduce mortality levels.²⁰ Empirical studies have not uniformly supported the McKeown hypothesis, and his critics have offered variables not necessarily related to income to explain mortality decline. One configuration of factors includes a series of public health activities: the building of sewers; filtration of water systems; activities of local boards of health in cleaning city streets, quarantining, inspecting, and regulating food and milk supplies; bacteriological screening of healthy carriers, and more. A second group of variables relates to individual hygiene and child-care practices, private as opposed to public health activities. Recognizing the interrelations among these variables, both demographers and historians increasingly find one-dimensional explanations of mortality change inadequate. Rather, the simultaneous change in many competing explanatory variables suggests that mortality decline resulted from complicated, sometimes locally specific interactions of many variables.

Epidemic diseases, varying a great deal across time and place and affecting large numbers of people at the same time, called for different explanations and responses than endemic diseases. The explanation was more environmental than individual; the intervention emphasized public rather than private activity. The city government responded to epidemic disease through a series of activities that changed over the course of the nineteenth century but aimed to protect the residents from epidemics by altering the environment the city provided them. The waning of epidemics by the end of the century seemed a testament to the effectiveness of this strategy. Progress could be measured by tracking the size of epidemics and the importance of infectious diseases more generally. In its 1866 report, the newly formed Board of Health claimed responsibility for controlling the cholera epidemic in that year and attributed the small number of deaths (compared to the previous cholera epidemic) to its understanding of the nature of epidemics and the activities it had undertaken to control the spread of the disease. The 1866 report concluded with the optimistic assessment "that no labors, plans, or acts of local cleansing, sanitary care, abatement of nuisances, or special disinfection to prevent the propagation of cholera, have been in vain; and more that none of these could have been omitted without great peril to the inhabitants and the commerce of the metropolis and the continent."²¹ This activist response is more significant than its possible—and debatable—efficacy in New York's 1866 cholera outbreak.

The emotional and institutional response to epidemics far outweighed their significance as a source of mortality. Contemporaries no doubt overestimated the importance of the decline of epidemic diseases in the overall mortality decline and hence the importance of the measures they had taken against them. At least in part because of the presence of great epidemics, however, the structures for municipal response were in place. With the decline in epidemic

diseases, they were refocused on endemic diseases. By the late nineteenth century, municipal intervention had shifted from large-scale sanitation projects to programs of education in personal hygiene, care of the home, and child care. The shift in program accommodated new etiologic ideas and the rise of scientific medicine but also coincided with the end of large-scale epidemics and the subsequent emphasis on endemic disease, understood in terms of individual lifestyle or constitution.

REMEMBERING PAST EPIDEMICS

Although cholera and yellow fever defined the word *epidemic* for nineteenth-century New Yorkers, metaphoric uses have blurred the original meaning for their late-twentieth-century counterparts. The sudden appearance of Acquired Immune Deficiency Syndrome (AIDS) in the late 1970s, however, has reminded us that infectious diseases remain a threat despite their declining importance and forty years of antibiotic treatment. A series of twentieth-century epidemics, most notably the influenza epidemic of 1918 and a number of epidemics of poliomyelitis starting in 1916, weakens the discontinuity between the nineteenth century epidemics and the AIDS epidemic of the 1980s. More than 130,000 New Yorkers contracted influenza in the fall of 1918, and 12,532 deaths were recorded from the disease, while the deaths recorded from its sequela, pneumonia, doubled to nearly 14,000. Influenza appeared suddenly in the early fall and had run its course by the middle of November.²² Polio affected a much smaller segment of the population than influenza and consequently produced many fewer deaths. The response to polio, however, illustrates the link between nineteenth- and twentieth-century epidemics, as municipal health officials, remembering typhoid and typhus, directed preventive measures against the 1916 polio epidemic to the crowded slum areas of the city although polio was equally or more likely to affect the children of the affluent.²³ The limited nature of and successful prophylactic measures against polio coupled with the failure of influenza to recur in as virulent a form and the antibiotic treatment of pneumonia and other diseases contributed to the shared sense that the age of infectious-disease epidemics was indeed over. AIDS shatters that illusion, reminds us of the past, and invites comparison with earlier epidemics of infectious disease.

The demographic effect of AIDS on the current mortality conditions in New York City is shown in table 3. The number presented is the percentage added by AIDS to the total number of deaths in New York City from 1983 to 1988; it is directly comparable to the figures for epidemic diseases in table 1. By 1988, AIDS had added 5 percent to the total number of deaths in the city. The figures for some age groups are extremely grim. In 1988, AIDS raised the number of deaths in the male population age twenty-five to forty-four by 50 percent and added nearly 40 percent more deaths to women age twenty-five to

Table 3. Deaths from AIDS, New York City, 1983 to 1988

Year	Number of deaths	Percentage of excess deaths from AIDS*
1983	425	.6
1984	952	1.3
1985	1,663	2.3
1986	2,650	3.6
1987	3,159	4.3
1988	3,739	5.0

Source: Department of Health, City of New York, *Summary of Vital Statistics 1988: The City of New York*, (New York: Bureau of Health and Statistics and Analysis, 1988).

*The percentage of excess deaths is calculated using the number of deaths attributed to AIDS in the numerator and the total deaths minus the AIDS deaths in the denominator.

thirty-four.²⁴ Although the contribution of AIDS to the general mortality level is small compared to many, although certainly not all, epidemics in the past, we are shocked by the importance of an infectious disease to mortality conditions that have been dominated for nearly half a century by cancer, heart disease, and trauma.

As this demographic analysis shows, epidemic diseases were never as important as endemic diseases in explaining the level of mortality; deaths from tuberculosis among adults and diarrheal diseases among young children were always more important sources of mortality, even in most epidemic years. In addition, although epidemic diseases declined precipitously after 1870, they were not the leading source of mortality decline. That role was played by the major endemic diseases. Epidemic diseases were most important determinants of New York City's mortality conditions in the nineteenth century than at any time before or since, but their significance even during the period of great epidemics lay as much in the responses they elicited as in their demographic role as a source of urban mortality. Recently, AIDS has given the history of epidemics an unhappy and unexpected saliency, and as with epidemics of the past, its importance will be measured not only by its death toll but by our reaction to it.

Notes

1. *Annual Report of the Board of Health for the Year Ending December 31, 1890* (New York: Martin B. Brown Company, 1891).

2. *Ibid.*

3. *Annual Report of the Department of Health of the City of New York for the Years 1911-1912* (New York: Martin B. Brown Company, 1913).

4. C.-E. A. Winslow, Wilson G. Smillee, James A. Doull, and John E. Gordon, *The History of American Epidemiology* (St. Louis: C. V. Mosby, 1952), 52-73.

5. The movement from high to low mortality was only part of the general demographic transition, which involved a downward shift in fertility as well. The relationship between fertility and mortality decline was complicated at both the individual household and the aggregate population levels. Morbidity was also changing in some relation to mortality and is relevant to the topic of epidemic disease. Data on morbidity, however, are sufficiently scarce that I have used mortality as the key indicator of prevailing health conditions.

6. The more rapid decline in mortality in large cities than in smaller places has been documented in many studies, including Gretchen A. Condran and Eileen Crimmins, "Mortality Differences between Rural and Urban Areas of States in the Northeastern States, 1890-1900," *Journal of Historical Geography* 6 (1980): 179-202, and Samuel H. Preston, "Resources, Knowledge, and Child Mortality: A Comparison of the U.S. in the Late Nineteenth Century and Developing Countries Today," *Proceedings, International Population Conference, International Union for the Scientific Study of Population* 4 (June 5-12, 1985): 373-388.

7. For a description of the use of the term epidemic both historically and currently see Charles E. Rosenberg, "What Is an Epidemic? AIDS in Historical Perspective," *Daedalus* 118 (Spring 1989): 1-17.

8. Nineteenth-century etiologic notions about epidemics were reflected in their classification, along with several other causes of death, as zymotic diseases. In the early 1840s, the city inspector of New York reported not only the traditional alphabetical list of deaths by cause but also a listing of deaths categorized under a number of general headings, among them the zymotic disease category that included epidemic diseases along with diarrheal diseases and all fevers. The classification scheme at first differentiated zymotic diseases from other categories that classified the remaining diseases only generally by body site (for example, diseases of the respiratory system). Later, the classification scheme clarified the characteristics of zymotic diseases by contrasting them to a second major disease category: constitutional diseases, which included most of the leading endemic sources of mortality.

The city inspector explicitly stated the rationale for classifying deaths in Board of Alderman, *The Annual Report of the City Inspector*, Document 23 (February 1, 1851), 456: "to afford materials for an investigation of the characteristics of diseases, to ascertain under what circumstances, or in what seasons they prove most fatal; to observe what are the causes of mortality to which our citizens are most liable, and to deduce therefrom practical rules in regard to the best means of prevention."

9. J. H. Powell, *Bring Out Your Dead: The Great Plague of Yellow Fever in Philadelphia in 1793* (Philadelphia: University of Pennsylvania Press, 1949).

10. See Charles E. Rosenberg, *The Cholera Years* (Chicago: University of Chicago Press, 1962).

11. In Philadelphia, the threat of cholera in 1891 led the Board of Health to employ a large corps of disinfectors and inspectors, but when cholera failed to appear they were used to combat an outbreak of diphtheria instead. Edward T. Morman, "Scientific Medicine Comes to Philadelphia: Public Health Transformed, 1854-1899" (Ph.D. diss., University of Pennsylvania, 1986).

12. The mortality rates shown in figure 1 were calculated using the reported deaths and the estimates of the midyear population of New York City. Both the deaths and

population estimates for the years 1804 to 1890 were obtained from the *Annual Report of the Board of Health for the Year Ending December 31, 1890*. Deaths and population estimates for the period from 1891 to 1928 are from Haven Emerson, *Population, Births, Notifiable Diseases, and Deaths, assembled for New York City, New York, 1866-1938* (New York: Columbia University, Delamar Institute of Public Health, 1941). The two series are somewhat discrepant when they overlap; however, the general features of mortality change would not be altered by substituting one for the other except in the years 1866, 1867, and 1869, for which Emerson appears to have erroneously included the deaths in Brooklyn, then not part of the city, in his figures.

All figures for the years prior to 1898 refer to the old City of New York, the present boroughs of Manhattan and the Bronx. After 1898, figures are for all five boroughs. The death rates for Brooklyn, Queens, and Richmond combined were slightly lower than those for the old city; therefore, the discontinuity in the area covered by the data may have a small effect on the reported trends.

13. Epidemic meningitis was confused with typhus and a number of other epidemic diseases during the entire nineteenth century according to Wilson G. Smillie, *Public Health* (New York: Macmillan, 1955). A serious outbreak in New England was described as "spotted fever," a category that appears throughout the first half of the nineteenth century in the city inspector's reports of causes of death in New York City.

14. Rosenberg, *The Cholera Years*, 2-3.

15. Powell, *Bring Out Your Dead*, 8-9.

16. *Annual Report of the Metropolitan Board of Health* (Albany, 1866), 370.

17. See Harold Lentzner and Gretchen A. Condran, "Seasonal Patterns of Infant and Childhood Mortality in New York, Chicago, and New Orleans: 1870-1920" (Paper presented at the meetings of the Population Association of America, Boston, 1985); and Gretchen A. Condran and Harold Lentzner, "An Analysis of Excess Summer Mortality of Infants and Young Children, New York City, 1820-1920" (Paper presented at the meetings of the Population Association of America, Washington, 1991).

18. The estimates of life expectancy are made by fitting North Model Life Tables to the mortality rates calculated for each of these years. The model life tables are in Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (1966; reprint, New York: Academic Press, 1983). High infant and childhood mortality have a large effect on life expectancy at birth. The expected remaining years of life for those reaching age fifteen shows about a ten-year difference between the cholera year of 1849 and the nonepidemic year of 1844.

19. The diseases included in this grouping were scarlet fever, cholera, measles, smallpox, diphtheria, croup, typhoid, typhus, influenza, yellow fever, malaria, and meningitis.

It is difficult to trace the level of mortality from even a few disease categories over time. The path between the physical cause of someone's death and its appearance in a municipal summary of vital statistics is long and involves a complex set of agreements on the part of the patient, the family, the physician certifying the death, and the city government recording it. During the nineteenth century, changes in disease concepts affected the manner of recording even many of the quite distinctive symptoms manifest in these epidemic diseases. Thus, changes in disease categories influence the disease-specific death rates calculated for different points in time. How much of the rise in the

death rate from diphtheria from 1840 to 1900 resulted from an actual change in the clinical incidence of a particular set of symptoms in the population and how much resulted from a more frequent diagnosis of diphtheria is largely unknowable.

In constructing the series of death rates from epidemic diseases in figure 1, I have taken account of obvious changes in disease categorization and have included in the analysis several categories in which deaths from epidemic diseases may have been hidden in the early part of the century. The figures are thereby deliberately biased against a rise in the importance of these epidemic diseases over time, an outcome that nonetheless appears in the data for the early nineteenth century.

20. See, for example, Thomas McKeown, *The Role of Medicine: Dream, Mirage, or Nemesis?* (Princeton, N.J.: Princeton University Press, 1979).

21. *Annual Report of the Metropolitan Board of Health*, 448.

22. See causes of death, nos. 11 and 16, in Emerson, *Population, Births*.

23. Naomi Rogers, "Screen the Baby, Swat the Fly: Polio in Northeastern United States, 1916" (Ph.D. diss., University of Pennsylvania, 1986).

24. Department of Health of the City of New York, *Summary of Vital Statistics 1988: The City of New York* (New York: Bureau of Health Statistics and Analysis, n.d.).