Volume Title: Fatal Years: Child Mortality in Late Nineteenth-Century America

Volume Author/Editor: Samuel H. Preston and Michael R. Haines

Volume Publisher: Princeton University Press

Volume ISBN: 0-691-04268-3

Volume URL: http://www.nber.org/books/pres91-1

Conference Date: n/a

Publication Date: January 1991

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Chapter Author: Samuel H. Preston, Michael R. Haines

Chapter URL: http://www.nber.org/chapters/c11541

Chapter pages in book: (p. 3 - 48)

ONE

THE SOCIAL AND MEDICAL CONTEXT OF CHILD MORTALITY IN THE LATE NINETEENTH CENTURY

BY THE LATE nineteenth century, epidemics of cholera, typhus, yellow fever, and plague were claiming many fewer lives in the modernizing states of Europe and North America. Governments had successfully asserted their rights to quarantine infected populations when these episodic horrors appeared, and improved standards of military hygiene had also blunted the diseases' spread (Kunitz 1983, 1986). Increasingly, the diseases of consequence were of an endemic infectious nature, the products of pathogens that were ever-present in communities and that took their greatest toll among infants and young children. These diseases were sufficiently dangerous to produce mortality levels that were, by present standards, appallingly high. Nearly two out of every ten children died before reaching their fifth birthday. American child mortality was substantially higher in 1900 than it is today in either Asia or Latin America.

Although the Death Registration Area (DRA) that was formed in 1900 covered only an unrepresentative 26 percent of the population, it is the only source of information about the medical causes of children's deaths. The published 1900 United States Census furnished information assembled by registrars and enumerators on deaths by age, sex, and cause for the DRA during the year preceding the census of June 1, 1900 (U.S. Bureau of the Census 1902b). Despite imperfect diagnoses and incomplete recording of deaths, the data are instructive regarding the orders of magnitude of various diseases.

Table 1.1 shows that, within the DRA, deaths below age 15 were highly concentrated at the youngest ages. Approximately 88 percent of these deaths occurred at ages 0–4, and 59 percent were infant deaths. Among the leading causes of death were gastrointestinal diseases, which caused 20 percent of all deaths for children aged 0–14 and 25 percent of deaths for infants. These diseases included such conditions as cholera infantum, enteritis, and diarrhea. Another leading group of causes was respiratory diseases, which included pneumonia and bronchitis. Proportionally, these struck children

TABLE 1.1

Leading Causes of Death among Infants and Children: U.S., Death Registration Area, 1899–1900.

	Below age 1		*Ages 1–4*		*Ages 0–4*		*Ages 5–14*		*Total ages 0–14*	
	N	%[a]	*N*	%[a]	*N*	%[a]	*N*	%[a]	*N*	%[a]
All causes	60,524	100.00	29,216	100.00	89,740	100.00	12,485	100.00	102,225	100.00
Cause unknown	903	1.49	131	0.45	1,034	1.15	81	0.65	1,115	1.09
Selected gastro-intestinal diseases	15,112	24.97	4,108	14.06	19,220	21.42	804	6.44	20,024	19.59
Colitis	282	0.47	106	0.36	388	0.43	12	0.10	400	0.39
Diarrhea	1,097	1.81	247	0.85	1,344	1.50	105	0.84	1,449	1.42
Dysentery	269	0.44	298	1.02	567	0.63	72	0.58	639	0.63
Enteritis	5,431	8.97	1,453	4.97	6,884	7.67	167	1.34	7,051	6.90
Gastritis	408	0.67	146	0.50	554	0.62	48	0.38	602	0.59
Peritonitis	137	0.23	143	0.49	280	0.31	326	2.61	606	0.59
Cholera morbus	196	0.32	155	0.53	351	0.39	74	0.59	425	0.42
Cholera infantum	7,292	12.05	1,560	5.34	8,852	9.86	0	0.00	8,852	8.66
Selected respiratory diseases	11,618	19.20	9,328	31.93	20,946	23.34	1,966	15.75	22,912	22.41
Influenza	317	0.52	165	0.56	482	0.54	96	0.77	578	0.57
Croup	211	0.35	994	3.40	1,205	1.34	277	2.22	1,482	1.45
Pneumonia	6,664	11.01	6,220	21.29	12,884	14.36	1,235	9.89	14,119	13.81
Bronchitis	3,322	5.49	1,469	5.03	4,791	5.34	145	1.16	4,936	4.83
Other respiratory diseases	1,104	1.82	480	1.64	1,584	1.77	213	1.71	1,797	1.76
Convulsions	3,200	5.29	780	2.67	3,980	4.44	86	0.69	4,066	3.98
Malformations, etc.	16,162	26.70	1,605	5.49	17,767	19.80	309	2.47	18,076	17.68
Premature birth	5,829	9.63	0	0.00	5,829	6.50	0	0.00	5,829	5.70
Malformation	1,117	1.85	20	0.07	1,137	1.27	6	0.05	1,143	1.12
Debility/atrophy	5,750	9.50	589	2.02	6,339	7.06	41	0.33	6,380	6.24

Hydrocephalus	813	1.34	905	3.10	1,718	1.91	246	1.97	1,964	1.92
Inanition	2,653	4.38	91	0.31	2,744	3.06	16	0.13	2,760	2.70
Selected childhood diseases	2,480	4.10	6,583	22.53	9,063	10.10	2,705	21.67	11,768	11.51
Measles	659	1.09	1,448	4.96	2,107	2.35	276	2.21	2,383	2.33
Scarlet fever	113	0.19	1,054	3.61	1,167	1.30	575	4.61	1,742	1.70
Diphtheria	359	0.59	3,090	10.58	3,449	3.84	1,775	14.22	5,224	5.11
Whooping cough	1,345	2.22	987	3.38	2,332	2.60	75	0.60	2,407	2.35
Smallpox	4	0.01	4	0.01	8	0.01	4	0.03	12	0.01
Tuberculosis	608	1.00	641	2.19	1,249	1.39	756	6.06	2,005	1.96
Other diseases										
Meningitis	2,262	3.74	2,011	6.88	4,273	4.76	711	5.69	4,984	4.88
Jaundice	251	0.41	16	0.05	267	0.30	12	0.10	279	0.27
Kidney disease	222	0.37	297	1.02	519	0.58	13	0.10	532	0.52
Erysipelas	289	0.48	37	0.13	326	0.36	8	0.06	334	0.33
Cerebro-spinal fever	390	0.64	449	1.54	839	0.93	257	2.06	1,096	1.07
Venereal disease	278	0.46	25	0.09	303	0.34	0	0.00	303	0.30
Brain diseases	404	0.67	222	0.76	626	0.70	123	0.99	749	0.73
Heart diseases	889	1.47	206	0.71	1,095	1.22	775	6.21	1,870	1.83
Tetanus	169	0.28	16	0.05	185	0.21	93	0.74	278	0.27
Bowel obstruction	213	0.35	67	0.23	280	0.31	80	0.64	360	0.35
Dentition	216	0.36	137	0.47	353	0.39	0	0.00	353	0.35
Accident/injuries	960	1.59	996	3.41	1,956	2.18	1,271	10.18	3,227	3.16
Death rates (per 10,000 population)	1496.3	—	179.8	—	458.0	—	36.0	—	184.9	—

Source: U.S. Bureau of the Census 1902b: Table 8.

Note: Death rates are for the period 1900–1902 and are calculated from data in Glover 1921.

[a] Percentage of all causes of death.

aged 1–4 most heavily, accounting for 32 percent of all deaths in this age group. Respiratory diseases also accounted for 19 percent of deaths among infants and 16 percent of deaths among children aged 5–14. Other identifiable infectious diseases, including measles, scarlet fever, diphtheria, whooping cough, and smallpox, were also important, constituting 11.5 percent of all deaths among children below age 15. Despite the availability of diphtheria antitoxin since the mid-1890s, this disease accounted for 11 percent of the deaths in the age group 1–4 and 14 percent in the group aged 5–14. Scarlet fever, measles, and whooping cough remained life-threatening to children in this era. Smallpox, on the other hand, had been largely eliminated as an important cause of death, almost certainly because of vaccination.

Other important causes of death were meningitis (5 percent of child deaths) and accidents/injuries (3 percent of child deaths). Tuberculosis, although significant as a cause of adult deaths (representing 15 percent of all deaths to persons aged 15 and over), contributed only 2 percent of all deaths below age 15. There is evidence, however, that tuberculosis was severely underestimated as a cause of, or contributor to, child and even infant mortality, because its symptoms in children were less apparent than they were among adults. Autopsies in several cities around the turn of the century showed that 10 percent or more of infants who died were infected with tuberculosis (von Pirquet 1909). Woodbury (1925:35) reports that offspring of tuberculous mothers in Baltimore in 1915 had 2.65 times the infant mortality rate of offspring of nontuberculous mothers.

Among the deaths attributed to malformations and other congenital conditions, some were undoubtedly truly congenital defects, largely affecting infants in the first days and weeks of life. Other terms within this category such as inanition (or inability to absorb nutrition, mostly affecting infants) and debility/atrophy were quite imprecise. This category ("Malformations, etc.") accounted for 27 percent of infant deaths, but only 5.5 percent of deaths to those aged 1–4 and 2.5 percent of deaths at ages 5–14. Finally, "Convulsions" represented about 4 percent of all deaths and about 5 percent of infant deaths. Death through convulsions was usually only the final and fatal effect of infection or some other condition, often (though it was not widely acknowledged at the time) including dehydration resulting from gastrointestinal disturbances.

Theories of Disease Causation

Table 1.1 depicts an overwhelming assault on young children by infectious diseases in 1900. Deaths were, of course, only the tip of the

iceberg, a signal of the enormous burden of morbidity that lay below. According to the prominent economist Irving Fisher, "Every observer of human misery among the poor reports that disease plays the leading role" (Fisher 1909:124). A 1908 survey of schoolchildren in New York found that 66 percent needed medical or surgical attention or better nourishment (cited in Fisher 1909:74).

Yet the late nineteenth century was also a time of dramatic discoveries in bacteriology. The nature of infectious disease came into much sharper focus as disease-causing agents, invisible to the naked eye but increasingly visible under the microscope, were identified as the source of many common afflictions. The germ theory received its first important empirical support in the early 1860s, when Louis Pasteur showed that the growth of microorganisms in a broth could be prevented by avoiding atmospheric contamination. This demonstration was quickly put to practical use in antiseptic procedures in hospitals, promoted especially by Joseph Lister (Rosenberg 1987: ch. 5). Lister's visit to the U.S. during the centennial year of 1876 was instrumental to the country's gradual acceptance of antiseptic procedures. Case fatality rates from surgery declined precipitously in the last decades of the nineteenth century, and surgical patients began to outnumber medical patients in some hospitals (Vogel 1980).

Although antiseptic practices came to be accepted in U.S. hospitals, the ideas on which they were based were not always greeted so warmly. Phyllis Richmond (1954) describes the indifferent and even hostile reception to the germ theory by American medical society. Medical journals carried little information about the European developments, and medical research was poorly organized and underfunded. Textbooks were slow to recognize the role of disease-causing microorganisms; an official health manual for the military in 1884 made virtually no mention of germs, and when they were mentioned the reference was usually erroneous. A survey of leading American physicians in 1877 by H. I. Bowditch, himself the developer and promoter of the "law of soil moisture" as an explanation of the geographic distribution of disease, asked, "Has any law of development of disease been discovered by attention to which, in coming centuries, we may hope to greatly lessen or destroy the disease?" Thirty-nine physicians replied "no," 6 "yes," and 3 did not reply (Bowditch 1877:117).

According to Charles Rosenberg (1987), the notion that diseases were caused by minute particles seemed meaninglessly random, a contradiction of collective wisdom distilled from centuries of medical experience. Briefly stated, that experience emphasized the importance of atmospheric miasma (or miasmata), produced by environmental filth, as agents of disease. Sources of filth included sewers,

cesspools, swamps, slaughterhouses, and decaying vegetation (Richmond 1954). Exposure to miasmata disrupted the body's balance, and physicians often attempted to restore its balance through purgatives, diuretics, and emetics.

The miasmatic theories focussed attention on what were often real nuisances and sometimes led to effective health interventions (Duffy 1971). Ridding the environment of foul odors often removed disease-causing agents as well. The 1850 Report of the Sanitary Commission of Massachusetts persuasively and accurately laid the cause of many public-health problems at the doorstep of contaminated water and improper ventilation (Rosenkrantz 1972). Careful empirical studies occasionally led to the establishment of more precise relationships between environmental agents and disease consequences, as in Semmelweis's 1848 demonstration of the role of unclean instruments in mortality from childbed fever. Likewise, careful epidemiologic investigations of yellow fever in the 1860s produced sensible decisions about preventive measures even without clear knowledge of the nature of the disease (Coleman 1987).

But confusion about the causes of infectious disease often led to misdirection and wasted effort, as best revealed by the preoccupation with sewer gas in the 1870s and 1880s. In his 1880 address to the Medical Society of the State of Pennsylvania, Benjamin Lee blamed sewer gas for most major diseases (Richmond 1954:447). Great emphasis was placed on the building of "stench traps." Evidently the concern was embraced by much of the populace. In his 1877 book, entitled *Public Hygiene in America*, Bowditch says, "There seems to be arising among citizens a kind of panic relative to the drains of their own house, and they have a great horror of the least odor of sewer gas" (Bowditch 1877:38). For George Waring, one of the most influential sanitary engineers in the last decades of the nineteenth century, sewer gas came to be what miasma had been to people of earlier eras. His anticontagionist platform was finally discredited only in 1898–1902, when the source of yellow fever was identified as mosquitoes rather than filth (Cassedy 1962b).

The old ideas grew increasingly untenable after 1882 and 1883 when Koch identified the tuberculosis bacillus and the cholera organism. By 1890, the microorganisms causing typhoid, pneumonia, and diphtheria had also been identified. The germ theory produced a number of bogus cures for disease in the next decades, but it also scored a grand success with the development of diphtheria antitoxin, which could arrest the development of a case if caught at the very early stages. The discovery and rapid deployment of the antitoxin after 1894 had an enormous popular impact, and the physician's im-

age as a healer improved greatly (Vogel 1980; Rosenberg 1987: ch. 6). Rothstein (1972) argues that the success of diphtheria antitoxin brought about the triumph of bacteriology in medicine. In 1895, impressed by the new successes of bacteriology, Charles Buchanan could write, "Today the germ theory of disease is the very foundation upon which the magnificent superstructure of modern medicine rests—ay, we might almost say that it is at once the foundation and the structure" (cited in Brieger 1966:145).

But it would be incorrect to assume that the role of germs in disease was readily and universally acknowledged, let alone that a wide array of preventive and therapeutic procedures based on the germ theory were implemented. The last two decades of the nineteenth century were a period of tumult and contention among contrasting ideas of disease causation (Duffy 1967). Some theories attempted to combine contagious and miasmatic mechanisms (Meckel 1990: ch. 1). According to Hermann Biggs, who organized the first municipal department of pathology and bacteriology in New York City in 1892 and was later New York State Commissioner of Health, doctors were very slow to comprehend the meaning of Koch's discovery, and even in 1902 a large proportion of physicians failed to grasp the discovery's significance (cited in Rothstein 1972: 268). Tuberculosis and pneumonia, each responsible for massive loss of life, were typically considered "constitutional diseases" and were largely unnoticed by the general public, whose eyes were fixed on the much less consequential but more dramatic episodic killers such as Asiatic cholera and yellow fever. Likewise, the loss of so many infants from vague-sounding causes was generally accepted as the inexorable working of fate (Duffy 1967). Although the contagious nature of the epidemic diseases was obvious and led to quarantine measures that were often effective, the endemic diseases appeared to be a more constant component of the human condition. Sick patients expected their physicians to prescribe doses of cathartics or analgesics to restore the body's balance, and the physicians usually obliged (Rosenberg 1987: ch. 6).

Germs were strangely missing from many contemporary explanations of disease. Explanations of differences in death rates among racial and ethnic groups were typically couched in terms of the different "constitutions" of the various groups rather than the different intensities of disease to which they may have been subject. This was an era of extreme racism, fed by a misunderstanding of the new science of genetics. The Presidential Address to the first meeting of the American Pediatric Society in 1889 set the tone for much health-oriented discourse:

> [America's] self-assumed destiny is to raise humanitarian and social development to a higher plane by amalgamating, humanizing, and civilizing the scum of all the inferior races and nationalities which are congregating under the folds of our flag. (Jacobi 1889:898)

This sense of mission was not shared by all in the medical establishment. In 1897 George Shrady, editor of the *Medical Record*, told readers that the public-health movement was wasting vast sums of money on "worthless and undeserving persons" (cited in Starr 1982:182).

Constitutional explanations were most frequently invoked when considering mortality differences between blacks and whites. Frederick Hoffman, an actuary for the Prudential Insurance Company and a very prominent vital statistician in the early twentieth century (Cassedy 1965), published a monograph in 1896 for the American Economic Association entitled *Race Traits and Tendencies of the American Negro*. It ascribed the high mortality of blacks to constitutional inferiority and to immorality. Blacks had higher tuberculosis death rates because of their "smaller or tropical lung" (Hoffman 1896:76). They were constitutionally more susceptible to typhoid and malaria (now clearly seen as a disease against which blacks had a genetic advantage through the sickle-cell trait) (ibid.: 102). Parents broken down by disease consequent on vice, immorality, and debauchery imparted enfeebled constitutions to their offspring (ibid.: 67). Nowhere in the account are germs to be found, and only a grudging gesture is made towards the notion that the extreme poverty of blacks might figure into their high mortality:

> The facts here brought together for southern cities as well as for the islands of the West Indies so fully support each other as to warrant the conclusion that the excessive infant mortality among the colored population is largely a result of individual neglect, as well as in part due to inherited organic weakness, and only to a limited extent to the conditions of life. (Ibid.:69)

Hoffman's views were by no means exceptional for the period (cf. Kiple and King 1981). Southern physicians—those closest to the actual situation of blacks—were the group most inclined to blame the environment for high black mortality, whereas most other commentators viewed it as a product of an inevitable genetic weeding-out (ibid.:89). DuBois's classic study, *The Philadelphia Negro*, ridicules the genetic position and cites the wretched housing and sanitary conditions in which northern urban blacks were forced to live as the main

source of excessive black mortality. He also implicates deficient personal cleanliness (DuBois 1899:161, 163).

Assumptions of racial superiority that informed attitudes toward disease were not limited to black-white comparisons. Immigrant groups from southern and eastern Europe were widely assumed to be of inferior stock and to suffer excessive mortality as a result. These ascriptions were probably facilitated by the persistence of theories of disease that stressed the maintenance of balance among bodily parts and systems. The "holistic" theories of health made it easier to imagine that individuals varied in their vulnerabilities to an array of diseases, and genetics in its popular form of eugenics made it seem plausible that these vulnerabilities would vary along racial or ethnic lines. As a result, it was easy to blame the victim, especially if he or she came from "inferior" stock. In contrast, the germ theory stressed specific symptoms and clinical courses in relation to specific disease entities and focussed on discrete ways of preventing or treating discrete diseases (Maulitz 1979; Rosenberg 1987). By the middle of the twentieth century, it had eroded the basis for ethnic and racial labelling of disease susceptibilities.

The Practice of Medicine

Although the bacteriological discoveries of the late nineteenth century revolutionized medical science, they had a much smaller impact on medical practice (Rothstein 1972). Rosenberg (1987) concludes that digitalis, quinine, and especially opium and its derivatives were the medical profession's most effective drugs at the end of the nineteenth century, as they had been a half-century earlier. Diagnosis was aided by many new tools in 1900: chemical and bacteriologic tests for microorganisms that had been identified as disease-causing, microscopes, x-rays, stethoscopes and otoscopes. Yet the tests were not often applied in private practice, in part because there was little that could be done to alter the course of a disease once it was identified. A popular physician's handbook by Cathell, in its eleventh edition of 1902, warned that there was no bread and butter for the practicing physician in "histology, pathology, microscopical anatomy, refined diagnostics, and bacteriomania" (Rothstein 1972:266). Many physicians would walk out of scientific meetings in contempt when the subject of bacteriology arose (ibid.:265).

Physicians had reason to worry about their bread and butter because their profession did not enjoy the esteem and privileges that it does today. Although there are no definitive sources, income esti-

mates in 1899/1900 for groups of occupations presented in Appendix A show physicians to be in a group that earned more than manual workers, on average, but less than many other professionals such as surveyors, lawyers, and even college professors. At proprietary schools and some of the weaker university departments, physicians were being recruited from working men and the lower classes, to the dismay of professional leaders endeavoring to raise the status of doctors (Starr 1982:117). Although all jurisdictions had adopted a licensing statute of some sort by 1901, "the ports of entry into medicine were still wide open and the unwelcome passed through in great numbers" (ibid.:116). These entry points included openings for "irregulars" such as homeopaths, allopaths, osteopaths, and eclectics, who constituted some 16–24 percent of all practitioners (Leavitt and Numbers 1978:75). The famous Flexner Report of 1910 concluded that the country needed "fewer and better doctors" (Caldwell 1988:170).

Just as doctors had few drugs in their arsenal to cure disease, so too did hospitals have few means at their disposal to alter the clinical course of a disease. In fact, exposure in the hospital to others' infections often produced a turn for the worse. Writing a ten-year retrospective on the Babies Hospital of New York City, superintendent Luther Emmett Holt (1897) anguished over the difficulties facing children who required a prolonged stay because of the likelihood of their developing an acute disease while in the hospital. The population at large was aware of these dangers. Leavitt (1979) recounts an episode in Milwaukee in 1894 when a crowd of 3000 furious people, armed with clubs, assembled to protect a child whom health authorities intended to take to the hospital during a smallpox epidemic. The child's mother had already lost a child in the hospital, and she was frantic not to let the city "kill" another of her children. The mob prevailed, and the ambulance retreated. Members of the middle class quite sensibly preferred to avoid hospitals and to be treated at home whenever possible (Rosenberg 1987), although Vogel (1980) reports a change in middle-class attitudes in Boston beginning around the turn of the century. DuBois (1899:162) reports that, in part because of their brusque treatment, "Many a Negro would almost rather die than trust himself to a hospital."

While doctors and hospitals were poorly equipped to deal with the array of adult afflictions with which they were confronted, they were even more poorly equipped to deal with infants and children. The first professor of pediatrics at Harvard described the state of knowledge about diseases of children in 1891 as consisting of "a poor subterfuge of unreal facts forming structures of misleading results which in the scientific medicine of adults would not for a second be toler-

ated" (Rotch 1891:819). Abraham Jacobi, the first president of the American Pediatric Society, bemoaned the absence of attention in medical curricula to diseases of children, even though children would typically form the majority of a doctor's patients (Jacobi 1890:818). The high death rates of infants and young children seemed to many lay people and doctors alike to be an inevitable concomitant of this vulnerable stage of development. In 1887, less than a half-dozen general hospitals in the U.S. had wards for infants (Holt 1897). While children's hospitals were established in eight major cities during the 1880s, some of these would not accept patients below age 5 (Jacobi 1909:832).

Yet matters were to change rapidly. The first journal in English dealing with the specific medical problems of children, *Archives of Pediatrics*, was begun in 1884, and the American Pediatrics Society was formed in 1888 (Bremner 1971:811). In the 1890s, diphtheria antitoxin, the first successful therapeutic agent for a disease affecting children, became available. And diphtheria had become an important disease, rising in the course of the nineteenth century to a crude death rate approximately equal to that of cancer today. In Boston City Hospital, the fatality rate for diphtheria admissions declined from 47 percent in 1888 to 10 percent in 1899. Citywide, mortality from diphtheria fell from 18.03 deaths per 10,000 inhabitants in 1894 to 3.15 in 1898 (Vogel 1980:63). The antitoxin did much to enhance the esteem of physicians, and the recognition that a common affliction could be arrested through medical intervention seemed to reduce the fatalism that had surrounded diseases of children. By 1906, W. C. Hollopeter (a professor of pediatrics in Philadelphia) could write with some exaggeration that

> Pediatrics is second to no branch in energy, enthusiasm, and progress, not only in the annual literary output but in the teaching in the clinic and laboratory . . . diphtheria is now viewed with serenity. . . . in fact in most intelligent communities any appreciable number of cases of measles or scarlet fever is viewed with reproach as the result of faulty domiciliary, school, or public hygiene. Twenty years ago, such cases and epidemics were looked upon as unavoidable calamities." (Hollopeter 1906:820)

We have little quantitative information on the specific kinds of preventative or curative measures that were deployed at the turn of the century. By 1900, only two effective drugs were available: smallpox vaccine and diphtheria antitoxin. The high death rate from diphtheria in 1900–1902 is evidence that the deployment of the antitoxin had been far from completely effective. With regard to vaccination, a

broad-based 1930 survey of children's health showed that only 21 percent of city preschool children and 7 percent of rural preschool children had been vaccinated against smallpox (White House Conference on Child Health and Protection 1931:1082). The figures were unlikely to have been higher in 1900, although schoolchildren undoubtedly showed higher coverage than preschoolers. The poor coverage of this preventative measure was ironically revealed in 1899–1900, when 3 of 12 medical students at Tulane University died of smallpox (Duffy 1971:395). Nevertheless, smallpox mortality had declined rapidly because those vaccinated protected not only themselves but also many of the unvaccinated.

Obstetrics seemed little more developed than pediatrics, and undoubtedly a sizable fraction of infant deaths were attributable to problems of childbirth that today would be readily prevented. Even by the standards of the time, obstetrics seemed backwards. A 1912 survey of physicians showed that obstetrics was considered the weakest area in medical schools (Kobrin 1966:218). According to Meckel (1990: ch. 6), pregnant women in the late nineenth century rarely visited a physician for preventive reasons, and there was a special reluctance to do abdominal exams on women. Vaginal exams were out of the question. Forceps and anesthesia had improved somewhat the tools at an obstetrician's disposal, but their utilization was based more on trial and error than on systematic science (Leavitt 1986:144). Most obstetricians believed that antiseptic practices were nearly impossible to implement in private practice (Dye 1987:55). Standards of cleanliness in hospitals by 1900 were probably higher than what could be achieved in home deliveries, a state of affairs that was beginning to draw increasing numbers of births into hospitals (Leavitt 1986:161).

Midwives presided at a large percentage of births at the turn of the century and were still delivering about 50 percent of babies born in 1910, heavily concentrated among immigrants and blacks (Kobrin 1966:217). A 1902 deliberation by the secretary of the New York State Board of Medical Examiners about midwives in New York City, who were delivering 47 percent of babies born, referred to the "undivided opinion that great evils are wrought to the community by reason of the incapacity and negligence of the midwives" (Lewi 1902:984). Midwives in Providence, Rhode Island, presided at 42 percent of births in 1910. A commentator complained bitterly about their unsanitary practices, including dressing the cord with snuff and giving babies a mixture of molasses and urine to drink as a physic (Stone 1912:988). More systematic investigations into the knowledge and practices of midwives by the Children's Bureau found them largely unprepared

to deal with complications of childbirth and often uninformed about hygienic practices. In a predominantly black area of Mississippi, fewer than 10 percent of midwives used antiseptics as late as 1917 (Dart 1921). Midwives serving Polish women in Wisconsin often failed to wash their hands (Sherbon and Moore 1919:35). Yet obstetricians were often ill-prepared themselves. The advantages of midwives included their availability and cheapness and the possibility that they would help out in the early days of the infant's life.

We have found no data to support (or refute) the claim of inferior outcomes among children delivered by midwives, who disproportionately served immigrant mothers, blacks, and women in remote rural areas. Physicians undoubtedly had a professional interest in disparaging the work of midwives. In the twentieth century, various cities attempted to educate midwives toward better practice, and to make them intermediaries between mothers and public health facilities. Licensing requirements, the institution of which accelerated from 1890 to 1910, also improved the practice of midwifery. When these reforms were accomplished, babies delivered by midwives could have below-average mortality (Chapin 1919:157).

With physicians and hospitals having so few tools at their disposal in 1900, it is not surprising that people resorted to home remedies on a wide scale. Approximately $75 million worth of patent medicines were purchased in 1906 (Adams 1906:882). DuBois (1899:114) bemoaned the vast quantities of patent medicines purchased by blacks in Philadelphia, as well as their frequent resort to the "old class of root doctors and patent medicine quacks." In 1890, seventeen factories were busily producing "Microbe Killer," consisting nearly entirely of water except for traces of red wine and hydrochloric and sulfuric acids (Starr 1982:128). Patent medicines reached their apogee in the very age when reasonable explanations of disease first became available (ibid.). The two were perhaps not unconnected, since recognition that germs played a role in disease, however misunderstood, probably made a cure seem within closer reach.

While medical practice in the doctor's office, hospital, and home was by present standards ill-informed and often unwise, there were enlightened members of the medical profession who saw clearly the implications of the germ theory for medical practice, and who combined the theory with sensible empirical observation, especially about the importance of feeding practices. Two such individuals were authors of pediatric texts at the turn of the century. Dr. Luther Emmett Holt, superintendent of the Babies' Hospital of New York City, was the author of a popular home manual, *The Care and Feeding of Children* (1894), as well as a widely used pediatric text, *The Diseases*

of Infancy and Childhood (1897), which went through a number of subsequent editions. Dr. Henry Koplik had established the first infant milk dispensary in the United States in New York City in 1889 and was the author of *The Diseases of Infancy and Early Childhood* (1902), which also went through subsequent editions (Bremner 1971:812, 827). Here we review some of the information and advice contained in these texts to gain a sense of the best practice of the period.

Holt noted that gastrointestinal infections were epidemic in most large cities during the warm months and were believed to be bacterial in origin (Holt 1897:317). "In large cities more than one-half of deaths among infants under the age of twelve months are caused by summer diarrhea. . . . Th[e] high rate of mortality of bottle-fed infants, is not alone due to the difference in the nature of the food; no matter how carefully it is handled before it reaches the infant, milk passes through many channels, and in each of these it is exposed to infection. The intense heat of summer also favors the increase of infective agents" (Koplik 1902:316). Koplik probably overestimated the importance of summer diarrhea, as suggested by Table 1.1, although there is substantial evidence to support his conclusion that summer diarrhea was caused largely by contamination of artificial feeding media, especially cow's milk, and was most prevalent after weaning. There was, however, debate concerning the specific microorganisms involved, and some suspicion that normal intestinal bacteria (e.g., E. Coli) might become virulent. Mechanical irritation (caused by "improper food") was also suspected to be a cause.

Treatment, though sometimes crude and impractical, could have been effective. The first recommendation was prophylaxis: to keep the child from being exposed to infective organisms. Both Holt (1897:324–25) and Koplik (1902:321–22) felt strongly that providing pure food and milk was an important step. "No greater work of philanthropy can be done among the poor in summer than to provide means whereby pure, clean milk for young children can be supplied at the price now paid for an inferior article" (Holt 1897:325). Prompt attention to mild cases of diarrhea was encouraged, since many severe and fatal cases were felt to have been treatable at an earlier, milder stage. Sensible hygienic practices around sick people, e.g., washing of hands and changing and thorough washing of clothing and bedclothes, were also encouraged (Koplik 1902:333).

> In brief, prophylaxis demands (1) sending as many infants out of the city in summer as possible; (2) the education of the laity up to the importance of regularity in feeding, the dangers of overfeeding, and as to what is a proper diet for infants just weaned; (3) proper legal restrictions regard-

> ing the transportation and sale of milk; (4) the exclusion of germs or their destruction in all foods given, but especially in milk, by careful sterilization in summer, and scrupulous cleanliness in bottles, nipples, etc.; (5) prompt attention to all mild derangements; (6) cutting down the amount of food and increasing the amount of water during the days of excessive summer heat. (Holt 1897:325)

Once a child had become ill, rest, fresh air, quiet, and cleanliness were recommended, usually in a location outside the city. For feeding, a sugar solution with barley or rice water, or some other milk substitute such as wine whey, malted food, albumen water, acorn cocoa, or animal broths, were recommended. Cow's milk and all other foods were to be stopped, since they were believed to be irritating to the infant's gastrointestinal system. Elements of holistic balance theories remained, however, as purgatives and irrigation of the intestines, now considered damaging practices, were proposed to cleanse the intestinal tract (Holt 1897:325–32, 335–37; Koplik 1902:321–25).

In terms of actual treatment of sick infants (as opposed to prevention of illness), there seemed to be only partial recognition that dehydration and consequent systemic shock were the greatest dangers. Subcutaneous saline injections (sometimes from something resembling a modern intravenous apparatus) were recommended for the most severe cases, but there were recognized dangers of local infection from that treatment (Koplik 1902:323–24). Baths were seen as efficacious and necessary for the reduction of high fevers (Holt 1897:331, 336–37). Drug therapy, using alcohol, strychnine and atropine (to stimulate the heart), and bismuth and resorcin (to alleviate vomiting) were symptomatic and not very effective. Overall, medical advice was most helpful in prevention and early treatment. Therapy in severe cases was of limited effectiveness, even when medical advice and help was sought by mothers of sick infants. It was not until the 1920s and 1930s that fluid and electrolyte therapy was developed to deal with the dehydration and electrolyte imbalances that were shown in 1915 to be the immediate cause of death for infants and children with severe diarrhea (Meckel 1990: ch. 2).

A second major cause of infant and child deaths in 1900 was respiratory infections (see Table 1.1). Chief among these were pneumonia and bronchitis. "In the early life the lungs are more frequently the seat of organic disease than any other organs of the body. Pneumonia is very common as a primary disease, and ranks first as a complication of the various forms of acute infectious disease of children. It is one of the most important factors in the mortality of infancy and

childhood" (Holt 1897:477). Lobar, pleuro-, and bronchopneumonia were recognized as bacterial infections; and the symptoms, diagnosis, and prognosis were reasonably well understood. The fact that pneumonia was also frequently a complication of another condition (e.g., measles, whooping cough, diphtheria) was known, as were possible consequent complications (e.g., meningitis) (Holt 1987:477–537; Koplik 1902:375–409). Pneumonia was observed to be serious, with a high case fatality rate.

But there was little that medical professionals could do about pneumonia and other respiratory diseases in the era prior to the discovery and use of sulfa drugs in the 1930s and antibiotics in the 1940s. "The treatment of lobar pneumonia is pre-eminently expectant. The disease is self-limited, and complications cannot be prevented. . . . The temperature should be treated not with a view to its actual reduction, but in order to mitigate its ill effects" (Koplik 1902:389). The term "self-limited" was used in medical literature at the turn of the century to describe conditions for which no effective intervention was available.

Acute bronchitis is fundamentally an inflammation of the bronchial tubes and was so recognized at the turn of the century (Koplik 1902:302). Again, treatment was symptomatic, or "supporting and expectant" (ibid.:364). The condition was seen as self-limiting. Prevention, by keeping children generally healthy and warm, was appropriately stressed. It was felt that mild attacks (i.e., bronchitis of the large tubes) should not be neglected and allowed to become life-threatening by moving down to the smaller bronchial tubes (Holt 1897:466–67). Croup was frequently another name for bronchitis (ibid.:470), although it was usually seen as a disease of the larynx. In general, respiratory diseases were known to be contagious, more common in colder months, and potentially very serious. Medical advice stressed prevention via good general health, warm clothing and shelter, and symptomatic treatment. But respiratory diseases, once contracted, had to be allowed to run their course.

Some considerable amount was known about the so-called "specific infectious diseases," if only that they were infectious. The latter implied isolation and quarantine as possible preventives. Among the diseases that were relatively well defined were measles, scarlet fever, diphtheria, whooping cough, mumps, rubella, typhoid fever, chicken pox, tuberculosis (in various forms), smallpox, and meningitis. Of these, smallpox had been greatly reduced as a childhood disease, mostly through vaccination (Koplik 1902:162–66). Among the remaining diseases, diphtheria alone had a specific treatment. The discovery of diphtheria antitoxin to counteract the effect of the

bacillus was made by Emil von Behring in 1890 and, as noted earlier, began to pass into widespread use after 1894 (Rosen 1958:330). In addition, prophylaxis via isolation, quarantine, and disinfection was quite effective. "In no infectious disease can so much be accomplished in the way of prevention as in diphtheria" (Holt 1897:981). Koplik notes large declines in the diphtheria case-fatality rate after the use of antitoxin therapy (Koplik 1902:223). In extreme cases, the membrane growth in the larynx, which was the proximate cause of death from diphtheria, could be successfully surgically removed or bypassed (ibid.:227–34). Nonetheless, as we have seen, diphtheria in 1900 still accounted for over 5 percent of total deaths among children below age 15 in the Death Registration Area. Here is a clear example of the slow diffusion of a medical innovation within the structure of American medicine at the turn of the century.

Although a good deal was known about the remaining specific infectious diseases, not much could be done about them in terms of prevention or specific therapy. Typically, the best that could be recommended was maintaining children in good health and preventing exposure via quarantine, and practicing good hygienic practices in the home and sickroom. Hospitalization was not necessarily a good alternative. "The result of hospital treatment in many diseases is notoriously bad" (Crandall 1896:532). In some cases the diseases were viral (e.g., smallpox, influenza, chicken pox, measles), and hence the microorganism had not been identified.

For several bacterial diseases as well, such as scarlet fever and whooping cough, the pathogens had not yet been found (Koplik 1902:118–19, 201). The tuberculosis bacillus had been identified by Koch, but "no specific remedy for tuberculosis has as yet stood the test of experience" (Holt 1897:1051). "It will be seen that treatment of tuberculosis of the lung in young infants and children must be simply symptomatic" (Koplik 1902:247). The same could be said for other, nonrespiratory forms of tuberculosis. Isolation of patients, use of tuberculosis tests to determine exposed and infected individuals and animal hosts, provision of pure milk (free from the tuberculosis bacillus), maintenance of good health among potential victims, and disinfection of areas where tuberculosis had been present were all urged as effective preventive measures. (Holt 1897:1050–51). The decline in tuberculosis death rates in the late nineteenth and early twentieth centuries, to the extent that they occurred in the United States, were probably partly due to such prophylactic activities.

Overall, for most diseases, prevention was more important than specific therapy in 1900. Isolation of infectious patients and disinfection of their quarters were becoming much more common in hospi-

tals and even homes (Chapin 1901:527; Rosenberg 1987). Specific treatments were effective in a few cases, namely diphtheria and some gastrointestinal infections. But medical advice was mainly effective in prevention, an activity that, of course, extends into the realm of public health. It was here that the new knowledge of disease mechanisms was beginning to have its greatest payoff.

The Practice of Public Health

In the last two decades of the nineteenth century, increased recognition that most diseases were spread from person to person provided a sounder basis for public preventative measures. And many government units did assume responsibility for such measures. S. W. Abbott (1900) cites an 1879 statement by sanitarian John Billings that "a standing committee on public health would be about the last committee that either congress or a state legislative would think of organizing." But Abbott notes that by 1900 such committees formed a part of the organization of state legislatures in many of the older states and were supplemented by committees responsible for water supply, sewerage, drainage, and other public health concerns. Only five states were without a board of health by 1900 (ibid.:11). In Abbott's mind there was no doubt that the discoveries of Pasteur provided the impetus for many such changes (ibid.:67). Rosenkrantz's (1972) account of public health in Massachusetts, on the other hand, suggests that governments would have assumed greater responsibility for public health even without the germ theory, as urbanization and immigration produced vivid social contrasts that activated humanitarian impulses. Increased governmental responsibility for health was a logical component of the Progressive Era of the 1890s and 1900s, when greater social responsibility for improving conditions of life was assumed in many areas (Wiebe 1967).

John Duffy (1971:401) suggests that the germ theory awakened the upper classes to the realization that bacteria did not respect social or economic conditions and that a person's health was dependent on that of others. This realization gave impetus not only to the institution of public-health programs but also to social reforms and antipoverty programs. Evidence of the public's support for public-health initiatives, whatever its source, was vividly revealed in a Chicago referendum. In 1889 the Illinois legislature created the Chicago Sanitary District with boundaries well beyond those of the city. The purpose of the Chicago Sanitary District was to address the technical problems of sewerage disposal and to avoid political impediments to

sanitary reform. Further, the twenty-five-mile Sanitary and Ship Canal was authorized to drain more of the city's wastes away from its water supply in Lake Michigan. The canal was begun in 1892 and completed in 1900. In a combined referendum on the Sanitary District and the canal and the election of Sanitary District trustees in 1889, the people of Chicago endorsed the project by a vote of 70,958 to 242 (Galishoff 1980:48). Public acceptance of such large and expensive projects is some evidence that they were considered effective by contemporaries in reducing sickness and death rates (Cain 1977; Galishoff 1980; Tarr, McCurley, and Yosie 1980; Anderson 1984). The great sanitary engineer Charles Chapin wrote in 1901 that the need for sewers was so well appreciated by the public that health officers scarcely needed to press the case for them (Chapin 1901:297).

Such public support did not extend to all potentially valuable health programs. Several commentators despaired at the public's apparent indifference to sanitizing the milk supply (Chapin 1901:399; Coit 1893:867). The greater support for improvements in sewers than in milk supplies may reflect the continued grip of miasmatic theories on the public's consciousness. Health officers frequently felt the need to galvanize public opinion in favor of health reform. In these matters they often had little support from physicians, who sometimes saw public intervention in health as a usurpation of their authority (Starr 1982: ch. 5). Chapin (1901) repeatedly stressed that health officials were more advanced in their recognition of the value of bacteriology than physicians of the era. Other special interest groups such as dairymen also resisted state intervention on behalf of the public's health (Rosenkrantz 1972).

The implementation of public-health measures was, of course, a political process, and subject to the vagaries of the polling place and political alliances. The federal government played a minor public-health role in the nineteenth century, although some urged an expanded role upon it. The Supreme Court, for example, had declared a federal role in compulsory vaccination to be unconstitutional (Chapin 1901:573). And although state governments had often formed committees to oversee public health, the state's role was mainly didactic (Abbott 1900:12), and it had little power to enforce decisions (Chapin 1901:269). Expenditures by state boards of health rarely reached one cent per capita in 1898 and never exceeded nine cents (Abbott 1900:36).

As in England (Szreter 1988), the principal burden of instituting public health-programs fell on municipal governments. Some $2.1 million was spent by municipal health departments in 32 large cities around 1900, about twenty cents per capita (Abbott 1900:92). But mu-

nicipal governments were not always enlightened. Hollopeter wrote despairingly in 1906 that, "so long as politics as a distinct profession remains on so low a plane in our cities, so long will crime and graft crush out young life and retard the advance of true hygiene" (Hollopeter 1906:821). Judith Leavitt (1979) presents a provocative account of the politics of public health in Milwaukee. During the smallpox epidemic of 1894, patronage, class, and ethnic divisions in the city were responsible not only for depriving the health department of its most effective means of controlling the epidemic—forcible isolation of infective patients—but also for impeaching the competent, but politically unpopular, health commissioner. Leavitt argues that the incident permanently damaged Milwaukee's ability to advance the public's health. A more successful example of health officials' political acumen is the relationship established between Herman Biggs, health commissioner of New York City, and the Tammany Hall political machine (Duffy 1974).

The activities of public officials in health improvement took many forms. Charles Chapin's marvelous 969-page work, *Municipal Sanitation in the United States* (1901), is a compendium of the activities of state and municipal officials and of legislation bearing on public health, as well as a guidebook to proper practice at the time. The last two decades of the nineteenth century witnessed advances on a wide front, although there is probably no area of public health where a majority of the progress between 1850 and 1950 occurred by 1900. Public water supplies were available to 42 percent of the nation's population in 1896 (up from 17 percent in 1870), although many of those to whom public water was available remained unconnected. Sewers were available to only 29 percent of the population (Abbott 1900:37, 40).

Bacteriologic testing of New York City's water began in 1891, but tests showed no improvement over the decade. Despite the referendum of 1889, the last two decades of the nineteenth century were a dark period for water quality in Chicago, with typhoid death rates reaching their all-time high of 1.74 per 1000 in 1892. In New Orleans, there was no public water supply until 1906, and there were no sewer hook-ups until 1907. Cisterns collecting rainwater were the main source of water, and they often ran dry or became contaminated with dirt on the roofs of dwellings that served as collectors (Lentzner 1987).

Even when public water supplies were available, the water was often unfiltered or improperly filtered. At the turn of the century, there was still a debate over whether slow sand filtration or mechanical filtration was more effective against bacterial contamination.

Chlorination was not begun until 1902 and sedimentation not until 1904. Although aeration of drinking water was recommended, it was later determined to be ineffective against many of the most dangerous waterborne human pathogens. In 1870 there was virtually no filtered water in the United States. By 1880, about 30,000 persons in cities with populations over 2,500 were using filtered water. This number grew to 310,000 by 1890 and to 1,860,000 by 1900. But the major improvements came thereafter. By 1910 approximately 10,800,000 persons were served by filtered water, and the number had risen to over 20 million by 1920 (Whipple 1921:166–68). For Chapin, there was no question about what the aim of water improvement programs should be: "The most serious contamination of water is disease germs. Of these the typhoid bacillus is by far the most important. It is possible that certain diarrheal affections may be carried in drinking water, but the evidence is not clear" (Chapin 1901:263). But he also suggests that it is important to rid the water of color, suspended matter, taste, and odor (ibid.:274).

Probably of greater importance than water quality for infant and early child mortality is the quality and cleanliness of the milk supply. Milk could and did spread typhoid, scarlet fever, diphtheria, strep throat, and tuberculosis (North 1921). Progress in improving milk supplies was quite slow in the nineteenth century, perhaps in part because of the sheer technical difficulties of monitoring the supply in its many stages from the birth of a calf to its final consumption by babies and children. Chapin (1901:366) argues that milk was far more urgently in need of protection than any other food, but that little progress had been made in that direction. In addition to the difficulties of monitoring the supply, Chapin cites a widespread apathy on the part of consumers concerning the quality of milk. They were said to be far more attentive to price than to quality (ibid.:399), a refrain echoed in many other accounts of the period. Pasteurization was also widely believed to harm the taste of milk (North 1921:274).

In 1911, only 15 percent of the milk supply in New York City—one of the most progressive cities in public health—was pasteurized, even though the process had been known since the 1860s (Lentzner 1987:229). Before 1908, when pasteurization was made compulsory in Chicago, only a fifth of the milk sold had been pasteurized (ibid.:246). Pasteurization was made compulsory in New York in 1912. Other strategies were available for improving the quality of milk: the inspection of dairies, first instituted in Minnesota in 1895 (Chapin 1901:401), and licensing of milk sellers, begun in New York City in 1895 (Lentzner 1987:216). This latter effort did not appear to have much impact on mortality, as Lentzner shows. Greater purity

of milk was sometimes attained by heating it in the home, a practice introduced from Germany in the late 1880s (Ewbank and Preston 1989). No mention of bacteria in regard to milk supplies was made by the New York City Board of Health until 1896, and it was not until 1909 that the Board enlarged its concept of adulterated milk to include bacteria (Shaftel 1978:283). Samples of milk supplies intended for consumption from around the country in 1905–10 showed that 8.3 percent contained tubercle bacilli (North 1921).

State and municipal health authorities took other steps in the last two decades of the nineteenth century. As noted above, all states had physician licensing regulations by 1901. Licensing of midwives also began late in the nineteenth century, and the percentage of infants delivered by midwives in Washington, D.C. declined from 50 percent in 1896, when licensing was instituted, to less than 10 percent in 1915 (Chapin 1919:159). School health programs were begun in some municipalities. Boston began organized medical examinations in schools in 1894, and New York City introduced compulsory vaccination for schoolchildren in 1897 (Bremner 1971:813). Rochester, New York, established the first municipally operated milk station in 1897 (ibid.:812). New York City fostered the removal of tuberculous patients from their households in the 1890s, leading (according to Herman Biggs) to a sharp decline in tuberculosis mortality for children under age 15 (Morse 1906:891). The first municipal bacteriologic laboratory was established in Providence in 1888, and free distribution of diphtheria antitoxin by cities was common by 1901 (Chapin 1901:598).

Health education was also a component of public-health efforts. Chapin (1901:520) stresses the key role that sanitary officials were playing in disseminating the results of biological research even among the medical profession. As early as the 1870s, the Bureau of Health in Philadelphia issued a pamphlet on the care and feeding of children, stressing the advantages of breastfeeding; 40,000 copies were distributed (Condran, Williams, and Cheney 1984). The focus on education campaigns, however, was to become much sharper in the first decade of the twentieth century. The proceedings of a 1909 Conference on the Prevention of Infant Mortality (1909) is principally devoted to the question of how to convince mothers to use better health practices in the home, especially with regard to infant feeding. C.E.A. Winslow noted at the conference that less progress had been made in reducing infant mortality than mortality at other ages, and argued that the reason is that the campaign must be preeminently one of popular education. "It is much harder to bring education to the mothers of a community than it is to lead pure water into its

houses" (Winslow 1909:224). The educational efforts were to become prominent in the twentieth century, particularly after the formation of the Children's Bureau in 1912. A 1914 pamphlet on infant care issued by the Children's Bureau became the largest seller of any publication ever issued by the Government Printing Office (Bremner 1971:36).

Governmental efforts to improve the public's health in the nineteenth century undoubtedly reduced infant and child mortality, along with that of other age groups. But the connections have been hard to demonstrate. Writers of the time were quick to attribute mortality improvements to their favorite health programs, but systematic analysis of impact was rarely undertaken. Inadequacies of mortality data were partly to blame. Sanitary engineers were on solid empirical ground when they attributed declines in typhoid death rates to improvements in the water supply, and some professed to find a "multiplier effect" on other causes of death as well (e.g., Sedgwick and MacNutt 1910). Preston and van de Walle (1978) identify an apparent link between nineteenth-century water supply and sewage improvements in the three largest cities of France and cohort-specific mortality gains. But Lentzner (1987) is unable to draw such a close connection in three major American cities. As Condran, Williams, and Cheney (1984) stress in their fine study of Philadelphia, many changes were often occurring simultaneously, social and economic as well as those specifically in the health sector, and disentangling the diverse influences is often difficult. By concentrating on several specific linkages between diseases and public-health activities, some of which were regionally differentiated within Philadelphia, the authors are able to show the effects of public-health programs on mortality from typhoid, smallpox, and infant and child diarrhea.

Public-health activities were not confined to the largest cities. Swedlund (1985) documents the late nineteenth-century work of public-health authorities in Franklin County, Massachusetts, an area consisting mainly of small urban agglomerations. Chapin (1901) claims that rural hygienic efforts were most effective in states with a township system, where traditions of local government were better developed. Whether a state department of health was "energetic" was a key factor in the effectiveness of township health authorities. He adds that "while a scheme of sanitary administration is normally provided for the larger portion of our population, it must be admitted that it is not as a rule very efficient in really rural communities. Little attention is paid to sanitation in the country, and it is almost entirely in compact villages, towns, and cities that effective administration is found" (Chapin 1901:13).

Privies were typically used in rural areas to concentrate human waste, although they were altogether absent among blacks in rural East Virginia, where shallow surface wells—merely holes dug in swampy land—compounded the hazards (Frissell and Bevier 1899). Later studies in rural areas by the Children's Bureau found a wide variety of practices regarding drinking water. Wells were the typical source, but often they were too shallow or inadequately protected from contamination by surface water. Rivers, rainwater, and melted snow were also sources of water in rural areas (Paradise 1919; Bradley and Williamson 1918; Dart 1921; Sherbon and Moore 1919; Moore 1917). Despite the often primitive conditions, the rural health environment may not, of course, have been inferior. Whereas municipal authorities were beginning to protect urban residents from one another by legislation and public works, rural residents were already substantially protected from one another by distance.

The late nineteenth century was unquestionably a period of accelerated activity in urban public health, and some of this activity became more precisely targeted and effective as a result of the emergent germ theory. But one receives a somewhat distorted view of these activities by relying on enlightened classics such as Chapin's (1901) work. Acceptance of the germ theory and of state responsibility for health was quite slow, and the period was full of contention about the best ways to advance health. According to the medical historian James Cassedy (1962b:305):

> [In the 1890s] a handful of far-seeing health officers like Charles V. Chapin of Providence and Herman M. Biggs of New York were already looking into the potent implications of the newly proved germ theory for their day-to-day sanitary work. Yet, these pioneers did not find quick success or ready acceptance in the United States for their contagionist conclusions. On the contrary, for most of the last quarter of the 19th century it was the concept of anti-contagionism which continued to hold the dominant position in the thinking of American doctors and sanitarians.

In a fifty-year retrospective on the American Public Health Association, the editor writes ruefully that "miasma theory is just today giving up its hold upon the health authorities of cities and states" (Ravenel 1921:77).

The Practice of Parenting

Infants and young children in the late nineteenth century spent the vast majority of their time under parental supervision inside the

home. The resources that parents brought to child care were critical for the child's chances of survival. The extreme dependence of the child on the mother is best illustrated by what happened when she died in childbirth or shortly thereafter. While we have no evidence about this from the nineteenth century, a study of registered births (about 13,000) in Baltimore during 1915 found that the infant mortality rate among babies whose mothers died within two months of childbirth (N = 32) was 625 per 1000 (Rochester 1923:151). Of the 366 children admitted without their mothers to New York City's Infant Hospital in 1896, 97 percent had died by April 15, 1897 (Henderson 1901:105). The death of a mother was only the extreme instance of parental incapacity, of course, and contemporary accounts described widespread health problems of American women that affected their maternal performance (see Leavitt 1986; ch. 3 for a review).

Mortality was also very high if the mother was forced to work outside the home in the first year of a baby's life. In Baltimore, the infant mortality rate was 59 percent above average among women employed outside the home (Rochester 1923:313). In contrast, it was 5 percent below average for women employed inside the home during their baby's infancy, suggesting that it was not work per se but the mother's separation from the infant that was critical for its survival.

Almost certainly the chief dependency of the infant was on the mother's milk. At the turn of the century, the difference in mortality between breastfed babies and others was enormous. The Children's Bureau study of infant mortality in eight cities between 1911 and 1915, in which the Baltimore study represented about half of the observations, found that death rates among those not breastfed were 3–4 times higher than among the breastfed (Woodbury 1925). While the Children's Bureau study provided the first good statistical documentation of this relation (and is still frequently cited for its precision in measuring it), casual observation had been more than sufficient to establish much earlier the health importance of breastfeeding. Advice about the importance of breastfeeding was common among physicians in the 1840s (Dye and Smith 1986), and health authorities frequently advertised the advantages of breastfeeding in the late nineteenth century. Increasingly, the advantages of breastfeeding and the enormous hazards of impure milk were based upon sound epidemiologic studies (e.g., Park and Holt 1903). A study of the history of infant feeding in the U.S. concludes that physicians at the turn of the century generally advocated that a mother breastfeed her child (Apple 1980:407).

Undoubtedly, an important advantage of breastfeeding was the protection it gave against diarrheal diseases, which struck with particular vengeance in summer (Lentzner 1987). Valuable evidence

from Berlin in 1901 showed that the seasonality of infant mortality was essentially absent among breastfed children: the ratio of July/August deaths to February/March deaths was 2.90 for infants fed on cow's milk and 1.06 for infants who were breastfed (Schwartz 1909:168).

Breast milk had its competitors, however. Cow's milk was sometimes fed to infants despite its lack of cleanliness, and many other substitutes or supplements were introduced at an early age. Apple (1980) describes attempts beginning in the 1890s to use scientific methods to "humanize" cow's milk. The Walker-Gordon Milk Laboratory was established in 1891 in Boston to prepare modified cow's milk formulas according to physicians' prescriptions and to deliver the bottles directly to consumers. By 1903, Walker-Gordon labs could be found in ten other American cities.

There is scant statistical evidence regarding the extent of breastfeeding in the late nineteenth century. The first survey of which we are aware found 65 percent of mothers in New York City in 1908 to be breastfeeding their children at age 9 months, about when the benefits of breastfeeding fade (Schwartz 1909:169). The later Children's Bureau study provided much more detail, though it also pertained exclusively to cities, and mainly eastern cities at that. Table 1.2 is reproduced from Woodbury's (1925) summary of the Children's Bureau's study. It shows that, of an infants' first nine months of life, 57 percent were spent exclusively on breastmilk, 25 percent exclusively on artificial feeding, and 18 percent in a mixed mode. Foreign-born women breastfed somewhat more frequently, with Italians, Poles, and Jews at the top of the list and Portuguese and French-Canadians at the bottom. Polish women in rural areas also appeared to breastfeed longer than German or native American women (Sherbon and Moore 1919:53). Before the Children's Bureau's urban studies, the superior mortality experience of Jews or children in largely Jewish areas had been noted, despite their often poor and crowded circumstances. Several contemporaries attributed it to the fact that Jews had been urbanized for many generations and were better adapted to urban life (Hamilton 1909:78; Devine 1909:103). The extended period of breastfeeding of Jewish mothers is likely an important mechanism through which this "adaptation" worked. Ritual washing before eating and maintenance of sanitary habit in purchasing and preparing food may also have contributed to the better mortality among Jewish children (for extended discussions, see Condran and Kramerow 1990; Schmeltz 1971).

Rural women were probably breastfeeding children for longer periods than urban women. Here again we must rely on Children's Bu-

TABLE 1.2
Type of Feeding, by Color and Nationality of Mother: Children's Bureau Study, 1911–15

Color and nationality of mother	*Total months lived from birth to end of ninth month*	*Percentage of months of exclusive breast-feeding*	*Percentage of months of partial breast-feeding*	*Percentage of months of artificial feeding*
White	180,397.5	57.6	17.1	25.2
Native	102,285.5	56.2	15.4	28.3
Foreign-born	78,112.0	59.4	19.3	21.1
Italian	11,943.0	68.6	18.3	13.1
Jewish	10,688.0	61.5	27.1	11.3
French-Canadian	8,666.0	42.7	13.3	44.0
German	6,514.0	56.5	22.0	21.5
Polish	10,391.5	65.9	22.7	11.1
Portuguese	5,410.5	48.8	19.3	31.9
Other	24,471.0	60.3	16.5	23.2
Not reported	18.0	27.8	33.3	38.9
Black	11,815.0	54.8	25.5	19.7
Total	192,212.5	57.4	17.6	24.9

Source: Woodbury 1925.
Note: Infants from birth to end of ninth month, in eight cities, from a Children's Bureau study, 1911–15.

reau studies conducted nearly two decades after the date of our sample. Bureau inquiries into infant feeding practices in six rural areas around 1916 showed in every case that rural mothers were breast-feeding for longer periods. Whereas Woodbury (1925:88) found that 35 percent of infants aged 9 months were entirely weaned in the eight cities, the equivalent percentages ranged from 0 percent in a mountainous region of North Carolina (Bradley and Williamson 1918:75) to 23 percent in one Wisconsin county (Sherbon and Moore 1919:53). Rural areas in Kansas (Moore 1917), Montana (Paradise 1919), and Mississippi (Dart 1921) were intermediate. Rural black mothers appeared to differ little from rural white mothers in their breastfeeding practices. While long breastfeeding was probably an aid to the survival of rural children, rural mothers were often charged with introducing solid foods at too early an age and being indiscriminant about the types of foods given infants. Such practices were more common in Mississippi and North Carolina than in Kansas or Montana. Supplementation appeared to begin earlier for babies of black or German mothers.

Children's survival depended on fathers as well as mothers, as in-

dicated in part by the very high mortality of children born out of wedlock. Rochester's study of Baltimore found that the infant mortality rate for illegitimate children was 300.7 per 1000, compared with 103.5 per 1000 for legitimate births (Rochester 1923:170). She believed the former figure to be an underestimate because of the greater difficulty of tracking illegitimate births.

Much of the excess mortality of out-of-wedlock births results from the stresses that illegitimate origin placed on the infant-mother relation. Mothers of illegitimate births were far more likely to work during the child's first year of life, and the child was also more likely to be placed in an institution. In the extreme case, Baltimore children born of unmarried mothers in institutions ($N = 56$) had an infant mortality rate of 625 per 1000 (Rochester 1923:173). Much of the impact of separation of mother and infant, of course, worked through breastfeeding practices. Legitimate children were more likely to be breastfed at every age. At 6 months of age, for example, 53.2 percent of legitimate births in Baltimore were fed exclusively breast milk, compared to 25.4 percent of out-of-wedlock births (ibid.:391).

Health behaviors towards children were part of a larger fabric of emotional and behavioral relations. In the colonial period, the father was the principal parent, and books containing child-rearing advice were directed towards him (Demos 1986:10). Illness and death were apparently accepted in a passive attitude of Christian resignation (Dye and Smith 1986:343). But attitudes began to change in the second half of the eighteenth century. A valuable review and synthesis of the diaries left by middle-class women finds that by the year 1800, mothers had developed a more intense emotional relation with their children than had been true fifty years earlier (Dye and Smith 1986). Nevertheless, nineteenth century mothers appeared to regard serious illness as inevitable. But increased anxiety about child survival throughout the century was evident, perhaps reflecting a growing belief that good mothering could somehow aid a baby's survival. By the first decade of the twentieth century there was general awareness that many infant deaths were preventable, and a growing belief that society at large must assume responsibility for a child's survival and well-being (ibid.). By 1900, women working through women's clubs, municipal reform groups, and social welfare organizations had begun to give public voice to their concerns about child death and to turn it from a private tragedy into a social and political issue (ibid:331). A rallying cry for the assumption of social responsibility was John Dewey's statement in *The School and Society* (1899): "What the best and wisest parent wants for his own child, that must the community want for all of its children." Katz (1986:113) argues that,

by the 1890s, children had captured the energy and attention of social reformers to a greater extent than during any other period of American history. While agitation for the assumption of social responsibility for infant mortality had clearly begun by 1900, the principle was not fully accepted until the first decades of the twentieth century (Dye and Smith 1986:331).

Some contemporary commentators disputed the view that mothers at the turn of the century saw infant death as preventable and were motivated to take steps to avoid it. Writing about her experiences with Irish mothers in New York's Hell's Kitchen in 1902, Josephine Baker comments that they "seemed too lackadaisical to carry their babies to nearby clinics and too lazy or too indifferent to carry out the instructions that you might give them. I do not mean that they were callous when their babies died. Then they cried like mothers, for a change. They were just horribly fatalistic about it when it was going on. Babies always died in summer and there was no point in trying to do anything about it" (Baker 1939:17). Bremner's (1974) volume reprinting articles from the late nineteenth and early twentieth centuries about the state's role in caring for orphaned or abandoned children includes many charges of neglect and abuse on the part of adoptive as well as natural parents.

In the eyes of many public officials, parents could not always be relied upon either to send their children to school or to avoid exploiting them in the labor market, and regulatory legislation was required. "In any complete system of child saving, compulsory education must occupy a large place. Parents must not be left at liberty to educate their offspring, the future citizens, whose ignorance and evil habits are a menace to order and political institutions" (Henderson 1901:102). By 1900, 32 states had compulsory school attendance laws, with most having penalties for noncompliance. Yet compulsion was unnecessary for the large majority of parents, who were already voluntarily sending their children to school. As a result, the laws had little effect on actual attendance (Katz 1986:130–31).

Child labor outside the home was rising in the late nineteenth century on the heels of new industrial opportunities. The practice was not entirely a product of economic motives but also reflected a belief that children were best kept out of trouble if kept busy. In 1870, one in eight children aged 10–15 was employed. By 1900, the number was one in six. Of boys aged 10–15, 26 percent were employed more than half time, as were 10 percent of girls (Bremner 1971:605). The practice was most common in the South, and by 1900 one-third of workers in southern mills were children (ibid.:601). Goldin and Parsons's (1987) analysis of the Carroll Wright sample, consisting of 6800 industrial

families in 1889–90, suggested that location in an area with a high demand for child labor (e.g., textile producing) sharply reduced the future wealth of children. The children received less schooling and were not compensated in other ways for the sacrifice. In such areas, father's earnings were reduced and current consumption increased. Accounts of abuse of child workers were common and galvanized public sentiment. By 1899, 28 states had passed some legislation regarding child labor. Although 60 percent of the children working in 1900 were in agriculture, the legislation normally applied only to manufacturing and generally set the minimum working age at 12 (Bremner 1971:601–5).

Parental motivation was also suspect when it came to day care. Henderson (1901:99) warned that day nurseries may become agreeable to mothers who are thereby liberated to work, and that fathers, "disposed to shirk duty, may willingly let their wives go out to labor for support while the home is neglected." Only infants of widows, or of women whose husbands are disabled, should be admitted. "For both sanitary and moral reasons, the infants of unmarried mothers cannot ordinarily be accepted" (ibid.:100). The widespread abandonment of children in nineteenth century Paris was cited as an example of what may happen if the state (through foundling hospitals) made it too easy for parents to shirk their duties.

When the state did acquire jurisdiction, either partial or complete, over a child, there was little doubt what its main mission was. According to Letchworth (1897:94), "It is not necessary at this time to emphasize the importance of saving homeless and wayward children. It is now conceded on all sides that, if we would make social progress and strengthen the foundations of good government, into the minds of this unfortunate class must be instilled principles of morality, thrift, industry, and self-reliance." Bremner's (1974) collection of articles about the state's role in child care makes it clear that character development was the central concern, in order that the child not lead a wayward life of crime or idleness as an adult and thereby remain a drain on public resources. In the extreme, male wards of the state who posed serious threats to the public order could be castrated (e.g., Barr 1905; Fisher 1909)—not an uncommon operation. This emphasis on developing a sense of morality and civic responsibility probably reflects the principal public concern with an individual parent's performance as well.

There are undoubtedly both neglectful and careful parents in any era, and it is impossible to characterize the balance at the end of the nineteenth century, or to say how it may have differed from the balance today. Johansson (1987) summarizes arguments for and against

1. Child labor was rising in the late nineteenth century. Shown here is a fully equipped eight-year-old miner from Clarksburg, West Virginia.

2. Urban children were also involved in income-producing activities, as shown in this Jacob Riis photograph of a family group making artificial flowers, ca. 1890.

the proposition that many European parents in the sixteenth to nineteenth centuries did not strive vigorously to keep all of their children alive. She suggests that neglect was used as a form of birth control, especially in Catholic areas where other forms of birth control were strictly proscribed. But there is no evidence on behalf of this claim from the 1870s or later, and none from the United States, where, she suggests, land abundance reduced pressures to avoid dividing the patrimony among offspring.

The view that parental concern for and activity on behalf of child survival increased during the nineteenth century in the United States, as enunciated by Dye and Smith (1986), seems reasonably well supported. The Children's Bureau's studies in the 1910s showed a tremendous parental interest in means to enhance child survival and were remarkably free of any suggestions of parental neglect. A Bureau of Labor study of indigent families in Washington, D.C. noted that virtually all of their children had life-insurance policies, principally to cover the all-too-frequent burial expenses. In view of

the incentives that such policies might be thought to create, it commented that "in this class, parental love would win the victory in any hour of temptation" (U.S. Bureau of Labor 1906:614). That children were sometimes viewed instrumentally, as a source of family income, does not imply any lack of concern for their physical well-being and may even have increased the care they received. Ginsberg (1983), for example, suggests that boys were treated better than girls in nineteenth century Massachusetts (as revealed in their lower mortality) because they had higher earning capacities.

The dominant refrain of writers about health and parenthood in the late nineteenth and early twentieth centuries was not one of neglect but of ignorance. Parents were usually assumed to be motivated to enhance their children's survival chances but to lack essential information or tools to improve them. In the words of Park and Holt (1903:906), "Mothers are often anxious and willing, but ignorant and stupid." These claims grew to a crescendo in the first decade of the twentieth century when, in Irving Fisher's phrase, "the world [was] gradually awakening to the fact of its own improvability" (Fisher 1909:14). In the year that Fisher published his *Report on National Vitality* for the Committee of One Hundred on National Health, the Conference on the Prevention of Infant Mortality was dominated by concern about how to get information to mothers that would enable them to provide better care for their babies. One author affirmed that "the problem of infant mortality is not one of sanitation alone or housing, or indeed of poverty as such, but is mainly a question of motherhood" (Wile 1909:144).

As recognition of the nature of infectious diseases grew, and as evidence was assembled on the role of breastfeeding, of bad milk and water, of diphtheria antitoxin, and of other influences on child health, the frustration of social reformers grew when practices fell short of the ideal. Polish mothers (Hedger 1909:40), Irish mothers (Baker 1939:17, writing about conditions in 1902), rural mothers (Fox 1919:187), and even college-educated mothers (Hollopeter 1906:821) were all charged with ignorance about hygiene and/or proper feeding practices. Obviously, professional self-interest also played a part in these claims, which often laid the basis for professional intervention. By the time the Conference on the Prevention of Infant Mortality was held in 1909, popular education was held to be the key to a successful attack on infant mortality, although some saw the process as taking generations (Phelps 1909:42). Nevertheless, the first decade of the twentieth century was full of optimism about what could be accomplished. In Irving Fisher's words, "The crowning achievement of science in the present century should be, and probably will be, the dis-

covery of practical methods of making life healthier, longer, and happier than before" (Fisher 1909:64).

To fulfill this promise required first of all the diffusion of information about methods that had clearly proven effective in enhancing child survival. The chorus of charges of ignorance that were leveled at mothers must be understood in the light of the new conception of disease processes in the late nineteenth century. These new conceptions displaced some of the emphasis on properties of the general environment—such factors as slaughter houses and sewer gas—and refocused it on properties of human interaction, including the intimate associations found within the home.

Social and Economic Influences on Mortality

It would be misleading to treat America's mortality levels and trends in the late nineteenth century as though they were entirely products of public-health and medical practices. These factors were undoubtedly important in the acceleration of the mortality decline during the late nineteenth century, but many other factors were also at work. Immigrants were arriving at an unprecedented pace; the population was relocating to urban areas; economic growth was fitful and, although it suffered a major setback in the 1890s, was in the longer run providing individuals with the wherewithal to enjoy healthier lives. Clues about the importance of these factors have been provided by many previous studies of other nations or of subnational groups in the United States.

Urbanization

Using a consistent definition of urban population (places larger than 2,500 people), the proportion of the U.S. population living in urban areas grew from 18 percent in 1860 to 40 percent in 1900 (U.S. Bureau of the Census 1975, Series A57–72). This spatial reorganization had two major consequences for mortality. First, the concentration of many people into small areas accelerated the spread of communicable diseases. This effect operates both through greater direct personal contact resulting from crowding, and through increased contamination of water and food. Second, urbanization facilitated the deployment of programs designed to improve health conditions. Like other social services, health services must be "delivered," and their delivery cost was markedly reduced when population concentration reduced the "friction of space." Further, urban populations could form

more effective political pressure groups for securing valued objectives. As noted above, public-health activities were weakest in sparsely populated rural areas.

There is abundant evidence that urbanization initially had an unfavorable effect on longevity both in the United States and in western Europe. It is believed that larger urban areas in western Europe in medieval and early modern times had very high mortality and were sometimes not self-reproducing (Wrigley 1969:95–98; deVries 1984: ch. 9). More extensive information for the nineteenth century shows that urban mortality was typically well above rural (United Nations 1973:132–34). For example, the *department* of Seine, containing Paris, had an average female life expectancy of 31.3 years for the period 1816–45, while the average for France as a whole was 39.2. For 1881–90, expectation of life at birth in Sweden was 43.4 years in urban areas and 51.6 in rural areas, and for 1871–80 the infant mortality rate was 193 per 1000 births in urban areas but 119 in rural. Similarly, in Norway from 1896 to 1900, the infant mortality rate 125.7 per 1000 in urban and 83.0 in rural areas. In England and Wales in 1841, male expectation of life at birth was 40.2 years for the country as a whole but only 35.0 in London, 25.0 in Liverpool, and 24.0 in Manchester. In contrast, the expectation of life at birth was 44 years for the largely rural, agrarian county of Surrey. As late as 1881–90, Manchester still had an expectation of life at birth for males of only 29 years, while selected "healthy districts" had an expectation of 51 years and the country as a whole was at a level of 44 years. In Scotland for the period 1871–80, the male expectation of life at birth was 41.0 for the whole country but 30.9 for the city of Glasgow. (Preston and van de Walle 1978; Glass 1964; Weber 1899:347). An investigation by Williamson (1982a) of living standards in Britain during the industrial revolution suggested that city size, density, and an employment mix favoring mining and manufacturing all significantly raised infant mortality in 1905.

Similar results were reported in 1899 by Adna Ferrin Weber for the United States, Prussia, and France. He also noted the positive relation between city size and mortality levels (Weber 1899:343–67), as did Higgs and Booth (1979) for the United States. Woods et al. (1988) find that 50 percent of the variance in infant mortality rates in the 590 registration districts of England and Wales in the 1880s and 1890s could be explained by population density alone. On urban mortality, Weber wrote: "It is almost everywhere true that people die more rapidly in cities than in rural districts" (1899:343). The causes were not always clear, but: "There is no inherent or eternal reason why men should die faster in large communities than in small hamlets. . . .

Leaving aside accidental causes, it may be affirmed that the excessive urban mortality is due to lack of pure air, water and sunlight, together with uncleanly habits of life induced thereby. Part cause, part effect, poverty, overcrowding, high rates of mortality, are usually found together in city tenements" (ibid.:348).

According to data from the U.S. Death Registration Area in 1900–1902, the expectation of life at birth was 48.2 years overall for white males, 44.0 years in urban areas, and 54.0 years in rural areas. The national average white female expectation of life at birth was 51.1 years, with 47.9 years in cities and 55.4 years in the countryside (Glover 1921). For seven upstate New York counties for the period roughly 1850–65, urban child mortality rates were substantially above rural rates. The probability of dying before reaching age 5 was .229 in urban places and .192 in rural areas. (Haines 1977: Table 3).[1] Vinovskis (1981: ch. 2 and Table 2.5) found a rough direct relationship between town size and mortality among Massachusetts towns in 1859–61, although he also found that rural/urban mortality differentials were smaller in the first half of the nineteenth century than they had been in the seventeenth and eighteenth centuries. Condran and Crimmins (1980) calculated the ratio of rural to urban death rates for seven states with reasonable registration data in 1890 and 1900.[2] The ratio of average (weighted for population size) urban to rural total death rates was 1.27 in 1890 and 1.18 in 1900. The urban/rural ratio for infant death rates was higher, at 1.63 for 1890 and 1.49 for 1900; the ratios were 2.07 for 1890 and 1.97 for 1900 for early childhood death rates (ages 1–4 years). So the differentials appeared to be shrinking in these states over the last decade of the century and were much greater for infants and young children than for adults. In nineteenth century France, rural and urban mortality levels tended to converge (partly in a cohort fashion) as public health and especially sanitation improvements were introduced (Preston and van de Walle 1978). They were also converging in England and Wales (Woods and Hinde 1987).

The advantage of rural areas was not attributable to superior health programs, as noted above, nor was it likely to have been a result of superior knowledge about disease prevention and treatment. A number of contemporary accounts single out rural residents and farmers as particularly unhygienic. A survey of bathing in Michigan in 1877 found little resort to the practice among farm families, in contrast to customary weekly baths in the upper classes (Leavitt and Numbers 1971:313). Abbott (1900:71) says of farmers that "there are few occupations in which hygiene is more neglected." The ignorance and indifference of farmers and their wives to child health was still being

decried as late as 1919 (Fox 1919:187). The superior mortality of rural residents is most plausibly attributed to their simply being more widely separated from one another's germs.

Of course, rural areas differed profoundly from one another, as later inquiries by the Children's Bureau made abundantly clear. One study of a prosperous rural county in Kansas in 1916 described large farms connected to one another and to towns by excellent roads; highly literate women keenly interested in literature on child survival; wells drilled more than 100 feet into the ground; 95 percent of infants delivered by physicians; and an infant mortality rate of 40 per 1000 (Moore 1917). A study of a mountain region in North Carolina in the period 1911–16 found residents cut off from contact with one another by terrible roads in winter; human waste draining directly into water sources; most births attended by ill-trained midwives; abundant use of patent medicines and home remedies; 64 percent of residents infected with hookworm; and an infant mortality rate of 80 per 1000 (Bradley and Williamson 1918). Even more primitive conditions existed in a county in Montana, but that study's author notes that the infant mortality rate of 71 per 1000 was below that of any of the eight cities studied by the Children's Bureau (Paradise 1919:70).

Industrial and Occupational Structure

Although the hazards of urban living in the nineteenth century seem clearly documented, the effect of industrialization per se on mortality, especially infant and child mortality, is much less clear-cut. In the nineteenth century, rising incomes and technological change led to a proliferation of occupational roles. Some of the new occupations carried with them increased health risks relative to those present on the farm, while others entailed reduced risks. Miners, laborers using heavy machinery, and workers exposed to toxic substances in the workplace are those for whom industrial changes were probably the least advantageous. Most white-collar occupations, on the other hand, entail reduced risks of job-related accidental death, although their sedentary character elevates the risk of cardiovascular disease. The Registrar General of England and Wales, in a survey of occupational mortality differentials for the period 1860–82, found that mortality among farmers was clearly below the national average, but also that mortality among some presumably hazardous occupations such as coal miners and workers in iron and steel manufacturing was also somewhat below the national average. The same was apparently also true for Belgium and Germany (Haines 1979b:29–36). Part of the explanation for low death rates for men in heavy industry may be that

they changed jobs after injury or illness. Based upon poorer data for the United States in the period 1890–1910, Uselding (1976) concludes that mortality was generally (though not consistently) elevated for workers in mining, manufacturing, and mechanical industries, as well as in transport and communications. Yet in a study of the coal mining and heavy industrial areas of northwest Europe in the late nineteenth century, Wrigley found that mining and industrial districts in France and Germany seldom had mortality rates that differed much from those of the surrounding rural areas. First and foremost, high mortality was characteristic of large cities, some of which happened also to be partly industrial, e.g., Paris, Berlin, and Marseilles (Wrigley 1961: ch. 4).

Less work has been done on the impact of industrial and occupation structure on infant and child mortality, and the limited results are contradictory. In England and Wales, random samples of 125 registration districts in 1851, 1861, and 1871 revealed that correlations between the infant mortality rate and the proportion of males in mining and metallurgy were insignificant. In contrast, the correlations of those mortality rates with the proportion of the population in urban areas were positive and significant (Haines 1979b:35). Williamson (1982a), however, found that industrial employment had a sizable and significant positive effect on infant mortality, independent of city size, for 72 selected urban areas in England and Wales in 1905.[3]

Just as the functional roles of men diversified in the course of development, so did those of women. In the later stages of industrialization and income growth, less of a woman's time was typically spent in household activities and more in market production outside the home. This change may have had a beneficial influence on child mortality through higher household income but an adverse effect through reductions in time spent on child-rearing. Recently, evidence has begun to emerge suggesting that women's work outside the home is associated with higher risk of child death in developing countries (Caldwell 1981; United Nations 1985).

We have already noted that infants born to working mothers suffered elevated mortality in the Children's Bureau study of 1911–15. Woodbury (1925) attempts to break down this effect into constituent parts. He finds that infant mortality was 2.5 times higher for children of working women. Allowance for breastfeeding differences reduced the ratio to 2.0, for the nationality distribution to 1.7, and for husband's income to 1.6. He attributes the remaining 60 percent excess in infant mortality to a "lack of care." Even before the careful Children's Bureau study, mother's work had been thought to be an important factor in child death. The very high infant death rate of 305

per 1000 in Fall River, Massachusetts, where many women worked in textile mills, was often cited as evidence of the hazards of women working (e.g., Hedger 1909:36). Swedlund (1985) notes that Fall River mothers weaned their children very early. The 1909 Conference on the Prevention of Infant Mortality devoted a good deal of time to the topic of women's work, despite the admission by one participant that the main reason a woman worked was that "she has not money enough to feed and clothe her children" (Hedger 1909:36). The large amount of attention devoted to the subject is also surprising because so few women worked for pay outside the home after giving birth. In the Children's Bureau study, only 4.5 percent of the months lived by infants were spent with the mother working (Woodbury 1925). In terms of "attributable risk" (the total number of excess deaths resulting from mother's work), the hazard was small. And as we show in Chapter 3, the risk appears substantially lower in the nation as a whole in 1900 than in the urban areas later studied by the Children's Bureau. The concentration on women's work as an influence on child health by contemporaries probably says more about social expectations regarding parenthood and the family than it does about major factors in mortality.

Ethnicity and Nativity

The United States in the late nineteenth century was rapidly urbanizing and industrializing, and a large number of immigrants was crossing its borders, principally into its cities, seeking employment and other opportunities. Many of them moved into cramped quarters with poor heating, sanitation, and ventilation. Although crude death rates for the foreign born were often unexpectedly low, reflecting middle-heavy age structures and possibly migrant selectivity, more refined measures do reveal a special toll (Ward 1971:109–17). For example, the 1900–1902 Death Registration Area life tables gave an expectation of life at age 10 of 51.6 years for native white males and 49.1 years for foreign-born white males. Comparable figures for females were 53.3 years and 50.5 years respectively (Glover 1921).

Higgs (1979) used annual registration statistics for 18 large American cities in the period 1871–1900 to relate short-term fluctuations in overall crude death rates to the business cycle via the procyclical demographic variable of immigration. Surges in immigration to the United States in the nineteenth century were more closely related to booms in the American economy than to depressed conditions in Europe (Easterlin 1961), although this view is not universally accepted. An increased influx of immigrants seems to have operated to raise

death rates in American cities in the late nineteenth century. Such a relationship also appears for an earlier period, 1840–80, in Boston (Meckel 1985). One possible explanation is that the transport of individuals from one disease environment to another could result in increased exposure to new pathogens for both migrants and natives. Another is that the foreign born were more likely to have lower incomes and poorer housing and nutrition; to live in less desirable, less healthy, and more crowded urban areas; and to have language barriers that impeded the diffusion of useful health information.

Different customs of child-raising are probably reflected in ethnic differences in child mortality. Woodbury (1925) cites the practice of Portugese mothers in feeding their babies crackers immediately after birth, and of Italian mothers in swaddling their babies, as particularly injurious practices. Aykroyd (1971:485) cites the dangerous turn-of-the-century practice of German mothers of replacing milk with cereal gruels in the diet of a child with diarrhea. Breastfeeding customs also differed, as we have seen, and were likely responsible in good measure for the exceptionally low mortality of babies born to Jewish mothers and the exceptionally high mortality of those born to French-Canadians. Apart from breastfeeding, however, there seems to be little that can be said quantitatively about the different modes of child-rearing as they might influence ethnic variation in child mortality.

America had another important aspect of ethnic diversity: its black population. Originally involuntary immigrants to the American colonies, most (79.5 percent) were still living in the relatively healthier rural areas in 1900. In the Death Registration Area, however, 82 percent of the black population was urban. Although the Death Registration Area contained only 4.4 percent of the total American black population, its records have formed the basis of present views of black mortality at the turn of the century. The 1900–1902 Death Registration Area life tables give an expectation of life at birth of 32.5 years for black males, in contrast to 48.2 years for white males and 44.0 years for urban white males. The corresponding numbers for females were 35.0 years for blacks, 51.1 years for whites, and 47.9 years for urban whites (Glover 1921). As we show in the next chapter, however, the DRA data almost certainly overstate black/white mortality differences.

Most blacks lived in rural areas of the South in the families of unskilled laborers or sharecroppers. Blacks had received little or no land after the Civil War, and few had been able to acquire it in the next three decades, in part because of discrimination in credit markets. The initial postwar enthusiasm for educating their children had waned among black parents because there was found to be little eco-

nomic payoff to schooling in a society that denied blacks jobs of skill and responsibility (Ransom and Sutch 1977: chs. 2, 9). Daily conditions of life among southern blacks are vividly described in two inquiries by the U.S. Department of Agriculture in the late 1890s. In eastern Virginia, blacks lived in one- or two-room cabins of primitive construction. Few families had lamps or candles; the fireplace was the only source of illumination at night, and posed a constant hazard for unattended young children. Families rented "one-mule farms," about 20 acres, and paid up to half of their annual produce in rent to the landowner, who often exploited their illiteracy by overcharging them for household provisions. Hogs and hominy were the dietary staples (Frissell and Bevier 1899). Turnover was high, and because they were renters there was little incentive to improve the property on which they resided. Conditions were no better in Alabama, where clothing was described as coarse, scanty, and ragged, and where cracks in the flooring of cabins accommodated insects and snakes. The status of a black farmer was determined mainly by the number of bales of cotton he could produce in a year. One family, miserably poor, subsisted for days at a time on nothing but corn pone. Dietary protein was deficient, although caloric consumption was generally adequate (Atwater and Woods 1897).

Literacy and Income

The earliest good evidence on the relation between child mortality and literacy or income in the United States is drawn from the Children's Bureau study. Rochester's study of Baltimore births in 1915 found no systematic relationship between mother's literacy and infant mortality, once the husband's earnings were controlled (Rochester 1923:332). Nor was the mother's ability to speak English important. In fact, among Polish mothers, those who spoke English had higher child death rates than those who didn't. Rochester notes that the mother's ability to speak English was also unrelated to her degree of contact with infant welfare agencies, except among Italian mothers (ibid.:131–32). Perhaps because its effects were so weak, literacy was dropped from consideration in Woodbury's (1925) summary of the Children's Bureau studies.

In contrast, the husband's earnings displayed a powerful effect. The infant mortality rate was 167 per 1000 live births for families in which the father's annual income was less than $450, and only 59 per 1000 for families with father's annual earnings in excess of $1250. The sample average mortality rate was 110 (Woodbury 1926:151–52). Among literate mothers, the infant mortality rate in Baltimore ranged

from 161 per 1000 if the father earned less than $450 per year to only 37 per 1000 if he earned $1850 or more (Rochester 1923:332). Strong earnings effects were evident among both foreign-born and native-born mothers. Breastfeeding duration varied inversely with father's earnings, providing a partial offset to the enormous influence of this variable.

Some of the earnings effects appeared to operate through housing variables. Among infants born to native white women who survived at least two weeks, the death rate was 46 per 1000 if there were fewer than one person per room in the household. It was 86 per 1000 if there were between 1 and 2 persons per room, and 140 per 1000 if there were more than 2 persons per room (Rochester 1923:111).[4] The effect of overcrowding was also evident within families in the same earnings class, with children in overcrowded households typically having double the death rate of other children (ibid.:291). Presence of toilets and bathtubs in the household also improved the infant mortality rate, with diarrheal and intestinal diseases accounting for most of the mortality differential (ibid.:113).

Diet

Beyond the age of 6 months, children became increasingly dependent upon foods other than breast milk. While practically nothing is known about the specific food intake of American children in the late nineteenth century, it is very likely that they shared the favorable conditions that characterized the nation as a whole. Bennett and Pierce (1961) have traced changes in the American diet from 1879 to 1959. They find that the amount of calories per capita available at the retail level was about 3,700 in 1889 and 1899 (ibid.:117). This figure had declined to 3,187 by 1958. At 3,700 calories per capita per day, American food availability compared favorably with that of European countries (Atwater and Woods 1897; Wait 1909a; Fogel 1988). Approximately 27 percent of the calories were derived from wheat, 12 percent from corn, and 35 percent from animal products, of which 11 percent was in the form of milk or butter (Bennett and Pierce 1961:118).

Inquiries by the U.S. Department of Agriculture and the U.S. Bureau of Labor provide information on regional and class variation in food availability, price, and consumption. A 1901 study by the Bureau of Labor into food expenditure among 2,567 families of working men in different regions showed that the average income of the families was $827 and that an average of $237 of this income was spent on food. The percentage spent on food ranged only from 34.6 percent

in the West to 40.5 percent in the North Atlantic region (U.S. Bureau of Labor 1906:187). Beef was more expensive in the North Atlantic region than elsewhere because most was shipped from the Midwest or West. At 15.4 cents per pound, fresh beef was 29 percent more expensive in the North Atlantic region than in the South Central (Holmes 1907:79). Nevertheless, the North Atlantic region consumed more beef per capita than the national average. Hog products showed very little regional price variability. The largest regional variability in the diets of working men's families related to milk products and salt pork. The North Atlantic, North Central, and Western states consumed about 50 percent more milk per family than the South, but less than half as much salt pork (U.S. Bureau of Labor 1906:189). The typical family in the South Atlantic region consumed 222 pounds of salt-hog products in 1901 and 307 pounds of fresh beef; in the South Central region, the figures were 249 and 317 pounds, respectively.

Contemporary observers believed that urban residents enjoyed a more varied diet than rural residents because markets offered a wider selection of products (Bryant 1898; Hills 1909) and because urban residents had more appliances for food preservation and preparation (Wait 1909b). Diets in poor rural areas in the South were particularly monotonous. In one study of eastern Tennessee in 1901–5, three-fourths of the diet consisted of corn meal, wheat flour, and cured pork (Wait 1909a:108). The difficulty of preserving food in the warmer South was said to be a major reason for its heavy reliance on these basics. The diet of blacks in Alabama was even more rudimentary, consisting of little but salt pork, corn meal, and molasses (Atwater and Woods 1897). This diet was recognized at the time as being deficient in protein. What was not recognized was its even more severe deficiencies in vitamins and minerals, which contributed greatly to the high morbidity from pellagra, for example (Rose 1989). The first indication of the importance of vitamins in the diet did not occur until 1906, when one "growth-enhancing" substance was hypothesized (North 1921). Blacks on the shores of the Chesapeake achieved much better diets through fishing (Frissell and Bevier 1899).

Although on average urban diets may have been better than rural, the poorest classes in cities struggled to put food on the table. A 1905 Bureau of Labor inquiry into the budgets of 19 impoverished working-class families in Washington, D.C. "carrie[d] the investigation down the scale of adversity as far as it is practicable to go" (Forman 1906:593). These families spent greater proportions of their incomes on food, ranging up to 69 percent, and were unable to accumulate any savings. Their diets showed substantially less meat than those of other working men's families (Holmes 1907), and a high percentage

of their incomes was spent on bread and breadstuffs (Forman 1906:601).

Although the diets of the Washington, D.C. families were not converted into calories, another study of 25 families in the poorest part of Philadelphia showed an average daily consumption (per adult male equivalent) of 3,235 calories per person per day. Twenty-six families in the poorest part of Chicago consumed 3,425 calories per person per day. Alabama blacks consumed 3,270 calories daily (Atwater and Woods 1897:65). These figures far exceed the consumption of poorer classes in Europe, which fell below 2,300 calories in Saxony and Naples (ibid.:66). For only 10 cents, Americans could purchase 1,800 calories in the form of sweet potatoes, 5,000 calories in the form of wheat flour, 7,700 in peanuts, or 8,300 in corn meal (Holmes 1907:87). At those prices, even the poor could buy enough food to keep body and soul together.

Undoubtedly, the composition of the diet was inadequate among many groups. But this inadequacy was in part attributable to the

3. By 1900, Americans were well fed by international standards of the time or even of today. Two girls from the slums of 1890 display a giant bread loaf and pretzel.

primitive state of the nutritional sciences, which paralleled the inadequacies of medical knowledge, public-health technology, and social organization that we documented earlier in this chapter. It was not a deficiency of resources but ignorance about their most efficient deployment that was the greatest threat to child survival in the late nineteenth century.

Summary

This chapter has described a variety of social incapacities in the area of child health at the turn of the century. Theories about the etiology of infectious diseases, which were responsible for the bulk of infant and child deaths, were unsettled. The new germ theory was resisted by many physicians and health professionals, and even among adherents it had led to few innovations of practical significance for child survival. The principle of public responsibility for enhancing individual health had been accepted, but implementation of this principle was at the early stages, especially in rural areas where the majority of the population lived. Parents seemed, in general, to be highly motivated to improve their children's health, but they had relatively few means at their disposal to do so. Material resources were not the binding constraint. Even by present international standards, the United States in 1900 was a rich country (see Chapter 5), and it had an abundance of food. But it was not able to translate these material advantages into a high standard of child survival.

These are incapacities as viewed from the present. Undoubtedly, analysts a century hence will find the present level of health knowledge and technique deficient in important respects. Were we to view the situation in 1900 from the vantage point of 1850, on the other hand, it would appear very favorable. Great progress had been made in understanding the mechanisms of the transmission of infectious disease. Antiseptic surgery had become widespread, and diphtheria was being brought under control by a successful therapeutic. Many cities had mounted major efforts to improve their water supplies, and increasingly the standard of success was bacteria counts rather than odor and appearance. Although little progress had been made in improving the purity of retail milk supplies, consumers were beginning to reduce contamination in milk by heating it in the home. Standards of medical practice were improving, and the more enlightened physicians were dispensing useful advice about food purity and the need to isolate infectious family members. Most of the innovations were

adopted first in cities, and as a result mortality in cities appeared to be falling faster than in rural areas.

This record of successes and failures is vital background for understanding the levels, trends, and differentials in child mortality that we describe in the next three chapters. After displaying the facts of child survival in greater precision and detail than was previously possible, we return to these broader themes in the final two chapters.