Infectious Disease Epidemiology

Theory and Practice

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Table 2–10 Death Rates for Common Infectious Diseases in the United States in 1900, 1935, and 1970

Infectious Disease	*Mortality Rate per 100,000 Population*		
	1900	*1935*	*1970*
Influenza and pneumonia	202.2	103.9	30.9
Tuberculosis	194.4	55.1	2.6
Gastroenteritis	142.7	14.1	1.3
Diphtheria	40.3	3.1	0.0
Typhoid fever	31.3	2.7	0.0
Measles	13.3	3.1	0.0
Dysentery	12.0	1.9	0.0
Whooping cough	12.0	3.7	0.0
Scarlet fever (including streptococcal sore throat)	9.6	2.1	0.0
Meningococcal infections	6.8	2.1	0.3

Source: Reprinted from National Office of Vital Statistics, USPHS and Centers for Disease Control and Prevention.

stantially; however, this has been offset by increasing mortality for lung cancer and other diseases. Clearly, the decline in mortality from infectious diseases during the twentieth century stands as a tribute to the advances in public health and safer lifestyles, compared with that in previous centuries.

What caused these remarkable reductions in the mortality from the common infectious diseases? One might surmise that the development of modern microbiology with the understanding the discipline provided about the pathogenesis of specific infections led to the development of vaccines and effective antibiotics to prevent or treat infections. However, for most of these infections, the evidence suggests a more complex scenario. The decline in the annual death rates for tuberculosis in England and Wales antedated the identification of the tuberculosis bacillus; however, the slope of the declining mortality increased after 1948, with the availability of streptomycin, isoniazide, and other chemotherapeutic agents (Figure 2–8). Similarly, death rates from scarlet fever, diphtheria, and whooping cough (pertussis) in children under age 15 in England and Wales began to decline well before these organisms were identified in the laboratory, and the availability of effective antibiotics had a small effect on the overall mortality decline (Figure 2–9).[57] Also, dramatic declines in the death rates from measles and pertussis were seen among children in England and Wales decades prior to the identification of these organisms and the availability of vaccines or antibiotics to treat infected persons. What, then, can account for these declines in mortality? Recent experience with some of these diseases in poor and often malnourished children from developing countries in Africa has shown that some of these diseases still have high mortality in certain populations. For example, measles, which is rarely fatal when it occurs in children in the United States, is still associated with a 15–20% mortality in infants and children in Sub-Saharan Africa. Hypotheses to explain this difference have included poorer nutritional status, earlier ages at exposure, other concomitant infections, higher infectious dose, and greater crowding during epidemic spread among infants in Africa.[58,59] All of these factors may play a role but it is difficult to evaluate their independent contribution. Clearly, the complex changes that have occurred in soci-

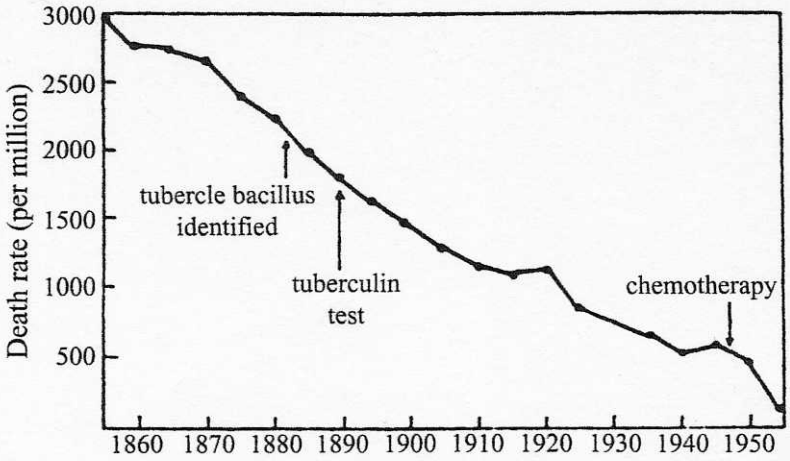

Figure 2–8 Mean annual death rate from respiratory tuberculosis, England and Wales. *Source:* Reprinted from E. Kass, Infectious Diseases and Social Change, *Journal of Infectious Diseases*, Vol. 23, No. 1, p. 111, © 1971, University of Chicago Press.

therapy of neoplasms, aging of the population, increased invasive therapeutic procedures in hospitalized patients, crowding of elderly patients in nursing homes and infants and children in day care centers, widespread use of broad spectrum antibiotics, environmental pollution, and other factors have led to the emergence of infectious diseases. These issues are covered in detail in Chapter 12.

An analysis was done by investigators for the CDC of all deaths in the United States between 1980 and 1992.[56] In this interval, the death rate due to infectious diseases as the underlying cause of death increased 58%, from 41 to 65 deaths per 100,000 population in the United States. Age-adjusted mortality from infectious diseases increased 39% during the same period. Infectious disease mortality increased 25% among those aged 65 years or older, from 271 to 338 per 100,000 population, and 5.5 times among 25- to 44-year-olds, from 6.9 to 38 deaths per 100,000 population. Mortality due to respiratory tract infections increased 20%, the death rate from septicemia increased 83%, and AIDS emerged as a major cause of death. These national data are quite sobering because they clearly demonstrate that an increased infectious disease mortality has occurred recently in the U.S. population, which is not limited to newly emerging diseases, such as AIDS. The 10 leading underlying causes of mortality caused by infectious diseases in the United States in 1980 and 1992 are listed in Table 2–11.

RECENT WORLDWIDE TRENDS IN INFECTIOUS DISEASE MORBIDITY AND MORTALITY

Infectious diseases play a leading role in mortality and morbidity globally, due in large part to the continued importance of infectious diseases in Sub-Saharan Africa, Asia, and Latin America. Data were published recently from the Global Burden of Disease Study, which was initiated in 1992, in collaboration with the World Bank and the WHO. The goals of this study were to make reasonable estimates from the available data of the impact of various diseases as causes of disability, to develop unbiased assessments for ma-

jor disorders, and to quantify the burden of disease with a measure that could be used for cost-effectiveness analysis. This study found that 98% of all deaths in children younger than 15 years of age are in the developing world and that 50% of deaths between ages 15 and 59 years of age were in the developing world.[60] The probability of death between birth and 15 years of age ranges from 22% in Sub-Saharan Africa to 1.1% in the established market economics. Probabilities of death between 15 and 50 years of age range from 7.2% for women in established market economics to 39.1% in Sub-Saharan Africa. Worldwide in 1990, communicable, maternal, perinatal, and nutritional disorders accounted for 17.2 million deaths, noncommunicable diseases for 28.1 million deaths, and injuries for 5.1 million deaths. The leading causes of death in 1990 were ischemic heart disease (6.3 million deaths), cerebrovascular accidents (4.4 million deaths), lower

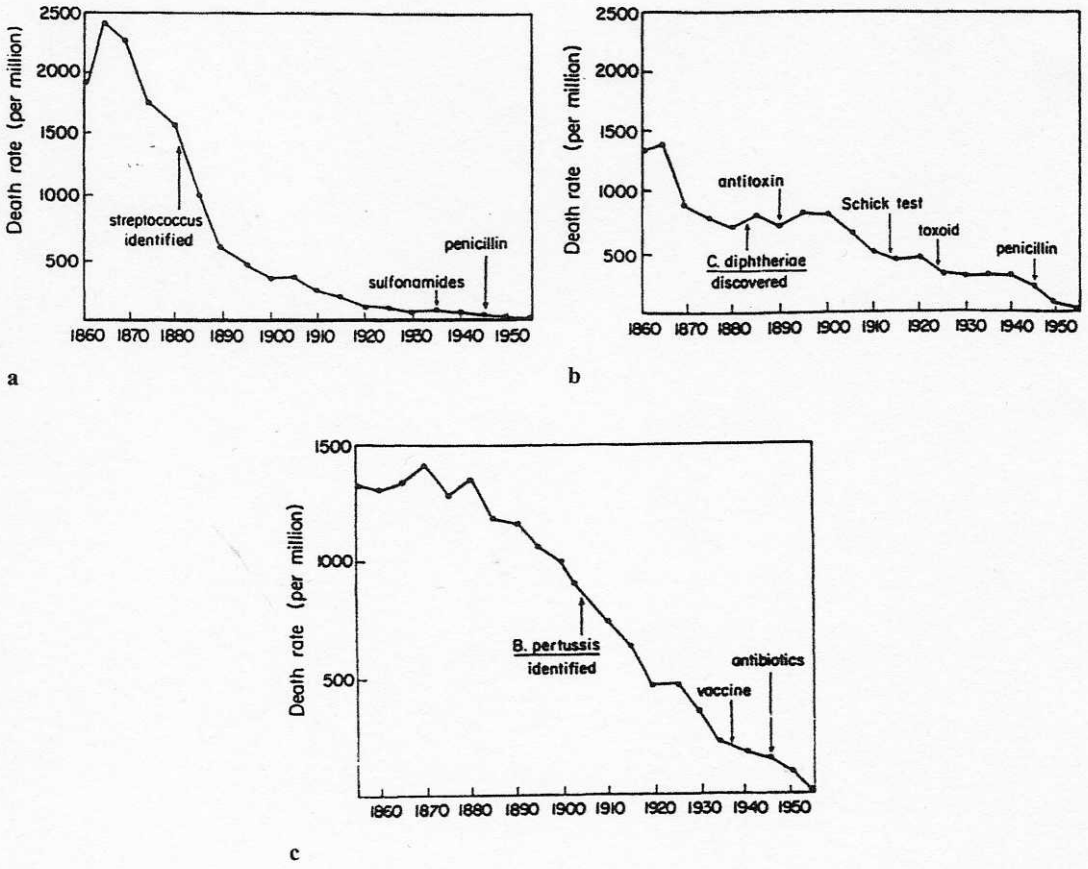

Figure 2–9 **(a)** Mean annual death rate from scarlet fever in children under 15 years of age, England and Wales; **(b)** Mean annual death rate from diphtheria in children under 15 years of age, England and Wales; and **(c)** Mean annual death rate from whooping cough in children under 15 years of age, England and Wales. *Source:* Reprinted with permission from E. Kass, Infectious Diseases and Social Change, *The Journal of Infectious Diseases*, Vol. 23, No. 1, pp. 110–114, © 1971, University of Chicago Press.