It is often assumed that indigenous people like the Native Americans possessed a primordial conservation ethic that they abandoned as they participated in Western systems of commodification. If the global ethnography of hunting and foraging people in modern times is any guide, this assumption is erroneous. Restraint in harvesting wildlife is rare among such people, who instead make choices that maximize efficiency or promise high yields. Moreover, in the case of the North American Indians, the hunt was ruled by culturally defined respect for prey species which, properly approached in thought and deed, gave themselves up for sustenance and use and thereby gained the opportunity to be reborn to be killed another day. For restraint to be practiced, this indigenous belief in reincarnation had to be reconciled with Western-style conservation.

## Conclusion

Neither the antiquity of environmental change nor the enormous scale of transformation in the modern global environment should be in dispute. In some cases, ancient and modern behavior produces similar results: Extinction of a species is forever, whether at the end of the Pleistocene, on a Polynesian island 500 years ago, or in twentieth-century North America. Moreover, some small-scale modern environmental changes at least superficially mimic ancient ones associated with the emergence of densely settled village life based on domestication. The major difference is one of scale, linked to population size and technology: In the past, the changes were local or regional; in the early twenty-first century they have global potential. The tempo of change has also risen markedly. Yet one should be humbled by the fact that the consequences of ancient destructive practices are often visible today—although noting the irony that, in places like Greece, the long history of environmental degradation produced the aestheticized landscapes that many now admire, in ignorance of their origin.

**See also:** *Biogeography; Carrying Capacity; Ecological Perspectives on Population; Hunter-Gatherers; Prehistoric Populations; Sustainable Development.*

### BIBLIOGRAPHY

Diamond, Jared. 1997. *Guns, Germs, and Steel: The Fates of Human Societies.* New York: W. W. Norton.

Goudie, Andrew. 1990. *The Human Impact on the Natural Environment,* 3rd edition. Cambridge, MA: MIT Press.

Hughes, J. Donald. 1994. *Pan's Travail: Environmental Problems of the Ancient Greeks and Romans.* Baltimore, MD: Johns Hopkins University Press.

Kirch, Patrick V. 1997. "Microcosmic Histories: Island Perspectives on 'Global' Change." *American Anthropologist* 99(1): 30–42.

Krech, Shepard, III. 1999. *The Ecological Indian: Myth and History.* New York: W. W. Norton.

Krech, Shepard, III; Carolyn Merchant; and J. R. McNeill, eds. 2003. *Encyclopedia of World Environmental History.* New York: Routledge.

Lowenthal, David. 1990. "Awareness of Human Impacts." In *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 Years,* ed. B. L. Turner II, W. C. Clark, R. W. Kates, J. F. Richards, J. T. Matthews, and W. B. Meyer. Cambridge, Eng.: Cambridge University Press.

McNeill, John R. 2000. *Something New Under the Sun: Environmental History of the Twentieth Century.* New York: W.W. Norton.

Redman, Charles L. 1999. *Human Impact on Ancient Environments.* Tucson: University of Arizona Press.

SHEPARD KRECH III

# EPIDEMICS

Epidemic diseases break out, reach a peak, and subside; endemic diseases cause a relatively constant amount of illness and death over time (see Figure 1). Epidemic diseases can be new or normally endemic to a community. They break out on a local level and remain localized, or spread out in diffusion waves to surrounding communities. Very large-scale epidemics that strike several continents or the entire globe are called pandemics. Although relatively infrequent, pandemics are exceptionally disruptive; the economic, social, and demographic damage they do insures that they receive the lion's share of attention from both contemporaries and historians.

## Defining Epidemics

The most familiar epidemic diseases are propagated by direct contact between infected and uninfected persons, as is the case with tuberculosis, smallpox, measles, polio, syphilis, and AIDS, among others. But some of the most devastating epidemic diseases were and are transmitted to human beings by insect vectors, such as bubonic plague, malaria, typhus, and yellow fever. Among the epidemic diseases spread by water-borne pathogens are cholera, typhoid, and dysentery. Some epidemic outbreaks do not involve microorganisms at all; these common vehicle epidemics can be caused by food-borne or other toxins (e.g., ergotism). Under certain circumstances, even vitamin deficiency diseases like scurvy (Vitamin C) or night blindness (Vitamin A) can break out suddenly in certain populations. Every epidemic disease has its own distinctive etiology, and its own complex relationship with both natural and social environments.

Epidemiologists identify epidemic outbreaks by observing the statistical behavior of a specific disease over time, based on the number of reported cases and/or deaths the disease causes. In theory, if zero cases of a specific disease are expected in a normal year, then even one observed case can signal an epidemic and call for a public health response. This reasoning was used in 1976 to declare a national public health emergency in the United States, based on a single unexpected death from a type of influenza that seemed similar to the 1918 outbreak.

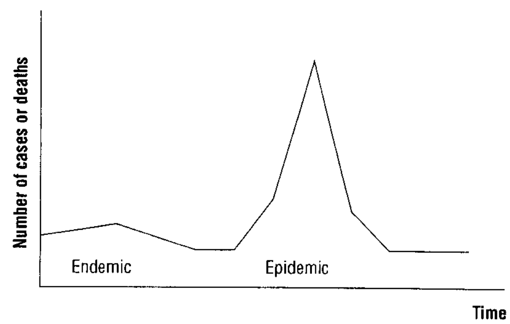
By using statistical criteria alone, more and more diseases have been perceived as taking epidemic form. Around 1950, several chronic diseases were classified as epidemics, including lung and breast cancer and ischemic heart disease. Some slowly-developing "social" diseases—like alcoholism and drug addiction—and a few mental diseases like depression have also been described as epidemics. But instead of erupting and subsiding in a year or less, chronic-, social-, or mental-disease epidemics rise and fall over several decades. As a consequence, they can only be observed by experts with access to high quality morbidity and/or mortality data.

## History of Epidemics

The existence of epidemics has been recorded since the beginning of written history, and in all probability they predate it. Just as epizootics (epidemic animal diseases) have always been part of the demography of animal populations, epidemics were part of the evolution of human populations. It is widely supposed that during the transition from hunting and gathering to agriculture, when human beings began to live in larger groups and at higher densities, the frequency—and possibly the severity—of epidemics increased. Subsequently, the development of cities made epidemic disease an even greater threat to human life.

**FIGURE 1**

**Endemic and Epidemic Disease**




SOURCE: Based on a graph in Gordis, *Epidemiology* (1996).

But knowledge about epidemics and mortality in history is necessarily limited by the relative absence of reliable quantitative data. Although the Black Death is one of history's most famous and well-researched epidemics, data problems have kept everything about the epidemic controversial, except for the fact that it arrived in Southern Europe in 1347 and spread to Northern Europe by 1352. Historians continue to disagree on whether or not the "plague" was one disease or several. (Before the seventeenth century, plague was still a generic concept used in connection with any sudden outbreak of disease.) Accounts from the time often describe the plague as killing the majority of the living. Most historians, however, believe that about one third of Europeans died in the first outbreak, although estimates range from less than a fifth to more than two thirds. Subsequently, major epidemics seem to have erupted with sufficient frequency and intensity in Europe that the continent's population was cut in half. Demographic recovery took two centuries or more.

It was the continuing social and economic disruption caused by recurrent outbreaks of plague that led city officials in Europe, particularly in Renaissance Italy, to develop novel measures of disease management, including the formal surveillance of mortality. By 1500, several cities in Italy were tracking deaths on a week-by-week basis, and trying to distinguish between those that were and were not caused by plague. These data have been used to estimate that, on average, plague outbreaks in the 1400s and 1500s multiplied the normal number of urban deaths by a factor of four to seven (Del Panta and Livi Bacci 1979, p. 72). In Sienna, when the normal death rate was about 35 per 1,000 per year, mortality increased by a factor of five to ten during a plague year (Livi-Bacci 2001, p. 39). In Florence, it has been estimated that epidemic disease caused 38 percent of the total number of deaths among girls under age 15 in the two centuries after the first outbreak of bubonic plague (Morrison, Kirshner and Molho 1985, p. 531).

The ancient Greek concept of *epidemic* was revived in connection with increasingly sophisticated disease surveillance systems, and was used by leading physicians to speculate on the natural causes of any sudden outbreak of disease. (Outbreaks of "influenza" received that name because university-educated physicians once thought they were caused by astral influences). Eventually all the other diseases thought to be causes of death were tracked as well.

London followed the example of cities in Italy, and by the early 1600s its officials had institutionalized the continuous surveillance of death and its causes. Thus, when John Graunt (1620–1674) published demography's founding text in 1662 (*Natural and Political Observations Made Upon the Bills of Mortality*), he could draw on more than a half-century of annual data on about 70 diseases that were thought to be causes of death. The data made it very clear that, while bubonic plague remained the most lethal epidemic disease, smallpox epidemics seemed to be getting worse. In 1665, London, with a population of about 500,000, could still lose some 80,000 lives to plague, while Copenhagen lost 20,000 people out of its total population of 60,000 in 1711.

There were no more major outbreaks of bubonic plague in Europe after the 1720s. Historians still disagree about the relative importance of human agency (particularly in the form of public health measures) versus exogenous natural causes in its disappearance. The evidence is inconclusive for Europe, but it is worth noting that outside Western Europe, in countries such as Russia, Turkey, Egypt, China, and India, bubonic plague continued to erupt on a large scale long after 1720. It ceased to do so only after European-style public health measures were adopted and enforced.

When T. R. Malthus published the first edition of his essay on population in 1798, there was enough mortality data—both urban and rural—to hypothesize about the role played by more ordinary epidemics in the regulation of population growth. To Malthus, sudden outbreaks of disease were just one of a set of four mortality-related positive checks on growth, the others being poverty, war, and famine (which he regarded as the last and most deadly positive check). Subsequent historical research suggests that before the twentieth century most deaths that occurred during wars and famines were caused by epidemic disease, not by battle casualties or starvation. Since the poor are often (but not always) hardest hit by epidemic disease, there seems limited value in distinguishing between poverty, war, famine, and epidemic disease as separate checks on population growth, at least before 1900.

## Modern Study of Epidemics

Modern demographic historians tend to study epidemic disease as part of "crisis mortality," those sudden increases in deaths or death rates that were a general feature of pre-modern mortality patterns. In theory, mortality crises can be caused by natural disasters as well as by wars, persecution, genocide, and famine; but in practice most crises were caused by epidemics, at least before the early twentieth century. Using historical data, demographers have attempted to gauge how much death rates must rise above some "normal" or background level of mortality in order to constitute a mortality crisis. No agreement has been reached on how to measure either "normal" or "crisis" mortality—especially in cities, where death rates were exceptionally volatile. Thus the relative importance of crisis mortality, and by implication, epidemic disease, in keeping life expectancy levels low (below 40 years) before the modern era remains a matter of controversy.

In theory, the extent to which epidemics as mortality crises can regulate population growth depends on their frequency, amplitude, and duration. But with respect to amplitude, using a high threshold to identify a mortality crisis (for example, requiring that the crisis death rate must be at least five times the "normal" level) would mean that mortality crises (and, by implication, major epidemics) were too infrequent to check population growth in most places and times. In contrast, if death rates must only exceed normal levels by 10 percent, then frequent mortality crises (caused mostly by epidemics) would clearly have been the major brake on population growth in the past. In general, the importance of mortality crises, or epidemics, cannot be assessed independently of the demographic criteria used to identify them.

The uncertainties connected with crisis mortality stimulated demographic research on all short-term fluctuations in pre-modern populations, including marriages and births as well as deaths. In some localities, harvest failures could cause grain shortages, rising prices, and (with a lag) rising death rates, mostly in connection with epidemic disease. But in other cases, a steep rise of grain prices has been observed to lag behind the sharp rise in death rates associated with an outbreak of epidemic disease. Historical research suggests that up to half of all epidemics in early modern Europe broke out and caused mortality crises for reasons unconnected to harvest failures, high prices, or food shortages. The implication is that some epidemics were Malthusian—meaning that they were related to increasing poverty and malnutrition—while others were not.

From a biological standpoint, this conclusion is not surprising, since those diseases that take epidemic form are differentially, not equally, sensitive to the nutritional status of the individuals exposed. This observation is relevant to the study of economic development, where it is still widely but mistakenly assumed that whenever per capita incomes rise, nutrition will improve and death rates will fall automatically without public health reforms. This overlooks the extent to which economic development stimulated urbanization, and thus the frequency with which density-dependent, air- and water-borne diseases broke out. The empirical evidence is that death rates rose during Europe's development, despite rising income levels, until effective measures were taken to control infectious diseases that often took epidemic form.

During the twentieth century, the same story can be told on a global scale: it is primarily the decline of the infectious and parasitic diseases as leading causes of death that produced the global rise of life expectancy. These diseases were first targeted for control through public health measures because of their close connection to epidemic outbreaks of disease and death. Wherever common epidemics were prevented by effective measures of disease control, death rates declined and remained relatively flat from year to year.

The last traditional mortality crisis in the developed countries occurred in 1918 as part of a worldwide pandemic of influenza. This one outbreak was estimated to have caused more deaths in one year than World War I did in several years. (Estimates range from 20 to 40 million deaths caused by influenza, versus 15 million for war-related losses). Nevertheless, in America and Europe influenza was not particularly lethal; many more people were infected than died. In the United States, although one-third of the population is estimated to have developed the symptoms of influenza, at most less than 3 percent of the infected died (Davies 1999, p. 219). Even so, the influenza epidemic produced at least 500,000 excess deaths; as many as 650,000 if pneumonia cases are included. Had death rates prevailing during the epidemic continued, life expectancy levels in the United States would have dropped by 12 years (Noymer and Garenne 2000, p. 568). Instead, death rates quickly returned to normal levels, and subsequently resumed their decline.

Despite the relative absence of mortality crises in the last half of the twentieth century, new pathogenic diseases (newly discovered, newly reportable, or newly resurgent) have continued to turn up at the rate of six to seven per decade (Karlen 1996, p. 6). Most of these new epidemics caused few cases and fewer deaths. Indeed, in most modern epidemics, even those producing hundreds of thousands of cases, so few die that life expectancy levels are not affected. For example, an epidemic of dengue fever broke out in Brazil in 2002. In the Rio de Janeiro area alone, over 400,000 cases were reported. There were fewer than 20 deaths.

While the twentieth century saw undeniable progress in disease control, the twenty-first century began in the shadow of an unusually deadly epidemic disease. HIV-AIDS was discovered in the United States; based on 31 suspicious deaths, it was declared a new epidemic in 1981. Subsequently hundreds, then thousands, of Americans began to die from the disease. But unlike a classic epidemic disease, AIDS fatalities in the United States took more than a decade to reach their peak. By 1995 AIDS was causing

50,000 deaths a year, but even this carnage was insufficient to appreciably increase the death rate at the national level. With respect to the developed countries (and many developing ones), AIDS has not been sufficiently deadly to prevent the continued rise in life expectancy at birth.

In Sub-Saharan Africa, however, the scale of HIV-AIDS deaths has been compared to that of the bubonic plague. Because the data are often defective or incomplete, it is hard to estimate the impact. Nevertheless demographers have made valuable contributions to the estimation of the impact of AIDS on Africa's future population growth, age-structure, and fertility, as well as on mortality. United Nations estimates for 1995 through 2000 indicate that in 35 highly-affected African countries, life expectancy at birth is about 6.5 years lower than it would have been in the absence of AIDS. In the 11 worst-affected countries, life expectancy at birth may drop to 44 years by 2005–2010, instead of reaching 61 years.

As the tragic social and economic implications of the HIV-AIDS epidemic unfold in the twenty-first century, demographers reflect that epidemic disease has long been a major force in human demographic history. It is possible that research on earlier epidemics may offer valuable insights into the continuing threat posed by both epidemic disease and mortality crises to human welfare.

## Further Reading

Epidemics in Europe have received the most historical attention. L. Del Panta (1980) has reconstructed major epidemics in various Italian cities over five centuries. J. Biraben (1975) studied epidemics in early modern France. English epidemics are the subject of C. A. Creighton's classic, mostly descriptive, two volume history (1891). E. A Wrigley and R. Schofield's *Population History of England* (1981: Part 2, Sections 8 and 9) takes a more quantitative approach, and focuses on smaller-scale outbreaks in England, as do S. Scott and C. Duncan (1998). Recently, more research has been done on epidemics outside Europe: China (C. Benedict, 1996); Japan (A. Janetta, 1987), India and the Near East (S. Watts, 1997). For China, traditional sources have been used to compile a list of hundreds of major epidemics occurring between 243 B.C.E. and 1911 C.E. (W. McNeil, 1976). But the data available are not sufficiently accurate or detailed to permit detailed comparative work until the late nineteenth and early twentieth centuries (P. Cliff, P. Haggett, and M. Smallman-Raynor, 1998).

**See also:** *AIDS; Black Death; Disease and History; Epidemiological Transition; Famine, Concepts and Causes of; Health Transition; Influenza; Mortality Decline.*

### BIBLIOGRAPHY

Benedict, C. 1996. *Bubonic Plague in Nineteenth Century China.* Stanford, CA: Stanford University Press.

Biraben, J. 1975. *Les hommes et la peste.* The Hague: Mouton.

Charbonneau, H., and A. Larose, eds. 1979. *The Great Mortalities: Methodological Studies of Demographic Crises in the Past.* Liège: Ordina Editions.

Cliff, P., P. Haggett, and M. Smallman-Raynor. 1998. *Deciphering Global Epidemics.* Cambridge, Eng.: Cambridge University Press.

Creighton, C. 1891. *A History of Epidemics in Britain from AD 664 to the Extinction of the Plague,* 2 vols. Cambridge, Eng.: Cambridge University Press.

Del Panta, L. 1980. *Le epidemie nella storia demografica Italiana (secoli XIV-XIX)* Turin.

Easterlin, R. 1999. "How Beneficent is the Market? A Look at the Modern History of Mortality." *European Review of Economic History* 3: 257–294.

Flinn, M. 1981. *The European Demographic System 1500–1820.* Baltimore: Johns Hopkins University Press.

Haggett, P. 2000. *The Geographical Structure of Epidemics.* Oxford, Eng.: Oxford University Press.

Jannetta, A. 1987. *Epidemics and Mortality in Early Modern Japan.* Princeton, NJ: Princeton University Press.

Johansson, S., and C. Mosk. 1987. "Exposure Resistance and Life Expectancy: Disease and Death during the Economic Development of Japan, 1900–1960." *Population Studies* 41: 207–235.

Karlen, A. 1996. *Plague's Progress: A Social History of Disease.* London: Indigo Edition.

Kiple, K. 1993. "The Ecology of Disease." In *Companion Encyclopedia of the History of Medicine,* Vol. 1. London: Routledge.

Lee, J., and Wang Feng. 1999. *One Quarter of Humanity: Malthusian Mythology and Chinese Realities, 1700–2000.* Cambridge, Eng.: Harvard University Press.

Livi Bacci, M. 2001. *The Population of Europe: A History,* 3rd edition. Oxford, Eng.: Blackwell Publishers.

McNeil, W. 1976. *Plagues and Peoples.* Garden City, NY: Anchor Press.

Mosk, C., and S. Johansson. 1986. "Income and Mortality: Evidence from Modern Japan." *Population and Development Review* 12: 415–440.

Noymer, A., and M. Garenne. 2000. "The 1918 Infuenza Epidemic's Effects on Sex Differentials in Mortality in the United States." *Population and Development Review* 26: 565–581.

Omran, A. 1971. "The Epidemiologic Transition: A Theory of the Epidemiology of Population Change." *Milbank Memorial Fund Quarterly* 49: 509–538.

Palloni, A. 1988. "On the Role of Crises in Historical Perspective: An Exchange." *Population and Development Review* 14: 145–158.

Preston, S. 1976. *Mortality Patterns in National Populations.* New York: Academic Press.

Preston, S., N. Keyfitz, and R. Schoen. 1972. *Causes of Death: Life Tables for National Populations.* New York: Seminar Press.

Riley, J. 2001. *Rising Life Expectancy: A Global History.* Cambridge, Eng.: University of Cambridge Press.

Scott, S., and C. Duncan. 1998. *Human Demography and Disease.* Cambridge, Eng.: Cambridge University Press.

Spielman, A., and M. D'Antonio. 2000. *A Natural History of Our Most Persistent and Deadly Foe.* London: Hyperion.

Timæus, I. 1997. "Mortality in Sub-Saharan Africa." In *United Nations Symposium on Health and Mortality.* Brussels: United Nations.

United Nations (UNAIDS and WHO). 1998. *Report on the Global HIV/AIDS Epidemic.* Geneva: United Nations.

Watts, S. 1997. *Epidemics and History: Disease, Power, and Imperialism.* New Haven, CT: Yale University Press.

Wrigley, E. A., and R. Schofield. 1981. *The Population History of England 1541–1871: A Reconstruction.* Cambridge, MA: Harvard University Press.

S. RYAN JOHANSSON

## EPIDEMIOLOGICAL TRANSITION

The term *epidemiological transition* refers to the shift in cause-of-death patterns that comes with the overall decline of death rates. In European countries the fall in death rates, which began after the middle of the eighteenth century, came about because of a decline in infectious disease mortality (chiefly from cholera and tuberculosis). The victory over infectious diseases allowed people to live longer and hence to develop the chronic degenerative diseases that became the main causes of death during the twentieth century: heart disease, cardiovascular disease, and malignant tumors.

Before the eighteenth century the epidemiological pattern was far from stable but the shifts that occurred had no significant effect on the level of mortality: Some infectious diseases diminished in lethality, but other diseases replaced them. In the 1960s it was thought that increases in life expectancy in the most advanced countries were nearing completion, but from the 1970s a major decline in cardiovascular disease allowed new progress. (The fall of cardiovascular mortality began earlier in a number of countries—dating back to at least 1925 in France.) Under the double effect of the continuation of the decline in infectious disease mortality, now largely eliminated, and the decline in cardiovascular mortality, it is the weight of mortality due to cancers that has been increasing.

The epidemiological transition is one component of a series of concurrent changes in population health. Running parallel to it is a functional component, referring to change in functional health status of the population (that is, abilities and disabilities), and a gerontological component, referring to the increasing proportion of the old and very old age groups in the population, with their distinctive health problems. The term *health transition* is used to describe these various components in combination.