Introduction to Public Health

FOURTH EDITION

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Preface

In the Preface to the *First Edition*, I wrote about the public's general ignorance of the field of public health and my own uncertainty about what public health was when, in 1986, I first went to work for the newly established School of Public Health, a collaboration between the University at Albany and the New York State Department of Health. After working with public health professionals from the Department of Health to design curricula for the programs at the school, and after teaching an introductory course in public health for more than 10 years in collaboration with many of the same health department faculty, I feel much more confident about what the term means. After the bioterrorism scare of 2001 and the public health disasters of Hurricanes Katrina and Rita in 2005, I believe that the public has a better sense of the field as well.

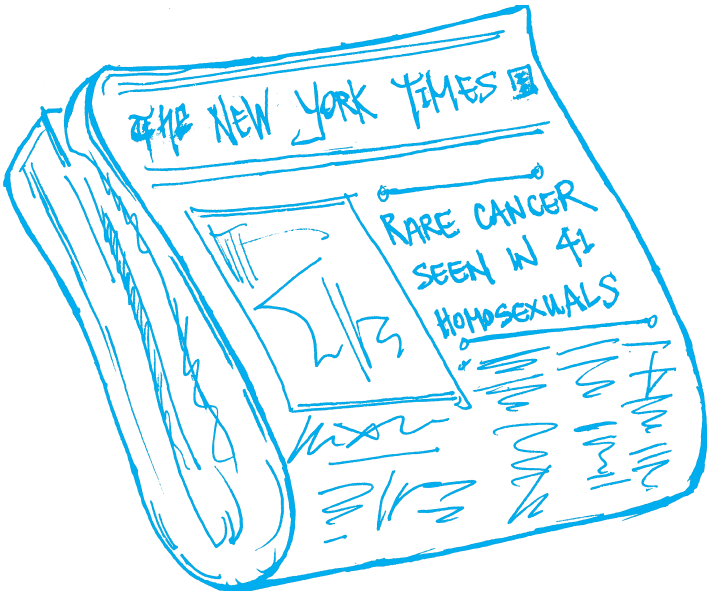
This book was written as a text for an introductory course that could be included in the general education curriculum for college undergraduates. As I wrote in the Preface to the *First Edition*, I believe that every citizen of the United States should know something about public health, just as they should know something about democracy, law, and other functions of government. Public health issues are inherently interesting and important to almost everyone. They are featured almost every day on the front pages of newspapers and in the headlines of television news programs, although often they are not labeled as public health issues. One of my goals is to help people put these news stories into context when they occur.

The *Fourth Edition* of this textbook follows the plan of the first three editions, bringing it up to date and including new developments in infectious diseases, injury control, environmental health controversies, the 2010 Census, the reform of the American healthcare system, and many other issues. I have illustrated public health principles by presenting stories that have been in the news; some of these stories have been ongoing sagas that have been supplemented with each edition. Issues that arose since the publication of the *Third Edition* include the fact that poisoning has become the leading cause of injury death, replacing motor vehicle injuries; the controversy over publication of a scientific paper describing how to synthesize the bird flu

virus, raising concern that terrorists could use the information to cause a deadly epidemic; the discussion of domestic violence as a cause of injury; and the use of smart phones to help people receive health tips, monitor their health-related behaviors, and be informed about emergency alerts. The *Second* and *Third Editions* focused on political interference with science, but as discussed in this *Fourth Edition*, the Obama administration has vowed to restore honest science as a basis of policy decisions. Other changes in the *Fourth Edition* include a new chapter on mental health and a section describing President Obama's medical care reform plan, the Patient Protection and Affordable Care Act.

I have tried to make this book easily comprehensible to the general reader. One of the things that makes public health fascinating to me is the fact that it is often controversial, depending on political decisions as well as scientific evidence. The politics are frustrating to many practitioners, but it is often the politics that put public health in the headlines. I hope that by describing both the science and the politics, I will contribute to making public health as fascinating to the readers as it is to me.

Prologue: Public Health in the News



What is public health? It is an abstract concept, hard to pin down. Reports about public health appear in the news every day, but they are not labeled as public health stories, and most people do not recognize them as such. Here in the Prologue are four major public health stories of the modern era that bring the abstraction to life. The ongoing AIDS epidemic, arguably the greatest challenge that the public health community has faced in the past 50 years, illustrates the multidisciplinary nature of the field and the complex ethical and political issues that are often an inherent component of public health. The outbreak of waterborne disease that sickened more than 400,000 people in Milwaukee, Wisconsin in 1993 was the consequence of a breakdown in a routine public health measure that has protected the populations of developed countries for most of the past century. Lest Americans forget that maintaining the health of the population requires constant vigilance, the dramatic decline in all measures of health in Russia presents a cautionary lesson of what can happen to a society that is unable to protect its people in one regard or another. Finally, the terrorist attacks in

the Fall of 2001 made it clear that the national security of the United States depends not only on the Defense Department, but also on the American public health system.

AIDS Epidemic

On July 3, 1981, *The New York Times* ran a story with the headline: "Rare Cancer Seen in 41 Homosexuals."[1] The cancer was Kaposi's sarcoma, a form of skin cancer, rare in the United States but more common in equatorial Africa. The victims were young gay men living in New York City or San Francisco, and 8 of the 41 had died within 24 months of being diagnosed. The report noted that several of the victims had been found to have severe defects in their immune systems, but it was not known whether the immune defects were the underlying problem or had developed later. Most of the victims had had multiple and frequent sexual encounters with different partners, the article said, but there was no evidence that the disease was contagious, since none of the patients knew each other.

On August 29, there was another story: "2 Fatal Diseases Focus of Inquiry."[2] A rare kind of pneumonia called pneumocystis had been striking gay men with a 60 percent fatality rate. According to *The New York Times*, 53 cases of pneumocystis had been diagnosed. Also, the number of cases of Kaposi's sarcoma had grown to 47, and 7 patients had both diseases. No one knew why gay men were affected, but there was speculation that there might be a link to their sexual lifestyle, drug use, or some other environmental cause. The article noted without comment that one woman had also been reported to have pneumocystis pneumonia. A scientific task force had been formed at the Centers for Disease Control and Prevention (CDC) to investigate what was going on. There was no further news in *The New York Times* about what would become known as AIDS until May 1982.[3] In that article, the underlying commonality of the immune defect was recognized, and the condition was called gay-related immune deficiency syndrome (GRID). While immune deficiencies had been known and studied previously, most were genetic conditions that afflicted children from birth or were caused by immunosuppressive drugs used to prevent rejection of transplanted organs. The total suppression of the immune system by whatever means leads to many infections, one of which eventually kills the victim. Speculation as to the cause of GRID generally focused on a sexually transmitted infectious agent, although there was a suspicion that multiple factors might be involved, perhaps including drugs or an immune response to the introduction of sperm into the blood through sexual contact.

As the number of reported cases grew, CDC scientists interviewed people with GRID, questioning them about their sexual behavior and partners. The sexual activities of gay men became the focus of scientists and the news media alike—reports of promiscuous and anonymous sex in public baths and use of drugs to enhance sexual pleasure emerged—which tended to worsen

many people's already negative view of gay men. Linkages were found that began to confirm that a sexually transmitted infectious agent was responsible. But the investigations were hampered by lack of funding. President Ronald Reagan had been inaugurated in January 1981 on a conservative platform. His administration was not interested in a disease that affected people who behaved in ways so unappealing to the general population. Nor was there much concern on the part of the general public. Most people felt no threat to themselves, although people who lived in New York, San Francisco, Los Angeles, and Miami, where most of the cases had been reported, might have felt more cause for concern.

Since early in the epidemic, however, there had been occasional reports of the immune deficiency in women and heterosexual men, many of them intravenous drug users. By the summer of 1982, cases of the syndrome had also been reported in people with hemophilia who were exposed to blood products used to make a clotting factor and in patients who had received blood transfusions. A study of female sexual partners of men with the syndrome suggested that the disease may also be transmitted by heterosexual relations. A number of babies turned up with a syndrome that resembled GRID, possibly transmitted from their mothers before or at birth. It was clear that the condition was not limited to gay men, and its name was changed to Acquired Immune Deficiency Syndrome (AIDS). The public began to take notice.

By mid-1983, the public began to panic. A report by a pediatrician in New Jersey suggested that AIDS had spread within a family by routine household contact. That scared a lot of people: AIDS was a fatal disease, and people did not want to take any chances of catching it. Inmates in a New York State prison refused to eat meals in a mess hall used by a fellow inmate who had died of AIDS. A New York City sanitation worker with no known risk factors contracted AIDS, perhaps from a syringe protruding from a trash bag. In San Francisco, with its large gay population, the police officers demanded special masks and gloves for handling people suspected of being infected with AIDS. Blood banks reported that blood supplies were critically low because people wrongly feared that they could contract AIDS through donating blood. In New York City, tenants of a cooperative apartment building tried to evict a doctor known for treating people with AIDS. In a few well-publicized incidents, schools refused to allow children with AIDS—usually hemophiliacs—into the classroom. A special telephone information number on AIDS, set up by the federal government, was swamped with 8,000 to 10,000 calls per day. Fundamentalist preachers and conservative legislators fulminated that AIDS was God's punishment for abominable behavior and that people with AIDS deserved their fate. Meanwhile, although controversy still restricted federal funding for AIDS research, biomedical scientists were competing to identify the infectious agent, which most scientists believed would turn out to be a virus. Despite the ill repute of many AIDS patients, the disease was of great scientific interest, and the growing public concern promised to reward with acclaim and financial benefits the scientist who isolated the virus. On April 23, 1984, the Secretary

of Health and Human Services convened a press conference to announce that Dr. Robert Gallo of the National Cancer Institute had discovered the virus—now known as the Human Immunodeficiency Virus (HIV)—and that a vaccine would be available within 5 years.[4] While both of those statements proved to be less than accurate—Gallo's priority was disputed and eventually disproved, and after almost 30 years an effective vaccine has still not been developed—the discovery did promise to allow testing of blood for exposure to the virus. Just a year later, blood banks in the United States began screening donated blood, greatly reducing the risk to transfusion recipients and people with hemophilia.

Now, more than 3 decades after the first reports on AIDS were publicized, most of the hysteria has faded, while many of the direst predictions have been realized. By the end of 2008, more than 1 million people in the United States had been diagnosed with AIDS, and 617,000 had died.[5] An estimated 1.1 million Americans are living with HIV. The proportion of women diagnosed with AIDS increased steadily over the first 2 decades and then stabilized at about 25 percent. A great deal more is known about the disease. New drugs have "miraculously" restored health to some dying patients and offer hope that HIV is becoming a chronic, manageable condition rather than a progressively fatal disease. However, there is still no cure, and long-term prospects for HIV-infected individuals are uncertain at best. The only prevention is the avoidance of risky behaviors. The question of how the government should respond to the AIDS epidemic raised some of the most difficult ethical and political issues imaginable in public health. Every new scientific discovery stimulated new dilemmas. Most of the controversies pitted two opposing principles against each other: the protection of the privacy and freedom of the individual suspected of being ill, and the protection of the health of potential victims at risk of being exposed. This conflict is common to many public health problems. Historically, the protection of the public has taken precedence over the rights of the individual. Thus, the principle of quarantining patients with dangerous infectious diseases such as plague, smallpox, or tuberculosis has been generally accepted and upheld by the courts. However, in the case of AIDS, the issues were more complicated.

Because people with AIDS belonged to stigmatized groups who may have been exposed to the virus because of illegal behavior (intravenous drug use or homosexual acts that were still illegal in many states), they bitterly opposed being publicly identified. Gay men, who had only recently achieved a degree of liberation from public oppression, were very well organized politically; they effectively opposed some measures that would have normally been considered standard public health practice, such as reporting the names of diagnosed patients to the health department. They had well-founded fears of being discriminated against for jobs, housing, access to health insurance, and so on. Major political battles erupted over issues such as whether gay bathhouses should be closed and whether AIDS should be declared a communicable

disease, which would legally require names of patients to be reported to the local health department. As HIV infection has become more controllable, much of the controversy has subsided.

AIDS is particularly difficult for government to deal with because the only effective way to prevent its spread is to change people's behavior. There are precedents for governmental efforts at promoting behavior change—campaigns to promote smoking cessation, use of bicycle helmets, and healthy diet and exercise—but their success has been modest. Generally, the weight of a law adds significantly to the government's success in promoting healthy behavior, as in the case of seat-belt laws and laws against drunk driving. However, behavior that spreads HIV is very difficult to control by law; intravenous drug use is already illegal everywhere in the United States, and homosexual acts were also illegal in many states until the U.S. Supreme Court declared these laws unconstitutional in 2003. From the beginning, public health officials recognized that AIDS could be prevented only by persuading people to reduce their risk by limiting their exposure, which requires convincing them to control powerful biological and social urges.

Beginning with the earliest attempts at AIDS education, conflict arose between the attempt to communicate effectively with people most likely to be at risk and the likelihood of offending the general public by seeming to condone obscene or illegal acts. Conservatives argued—and still argue—that the only appropriate AIDS education message is abstinence from sex and drugs. C. Everett Koop, President Reagan's Surgeon General, was originally known for his right-to-life views. Later he became an unexpected hero to public health advocates by taking a strong stand in favor of frank AIDS education. While stressing the importance of mutually faithful monogamous sexual relationships and avoiding injected drugs, he nevertheless advocated education about the advantages of condoms and clean needles, and he urged schools to teach children about safe sex. In response, Senator Jesse Helms, a powerful conservative from North Carolina, denounced safe sex materials aimed at gay men as "promotion of sodomy" by the government and sponsored an amendment banning the use of federal funds "to provide AIDS education, information, or prevention materials and activities that promote or encourage, directly or indirectly, homosexual activities."[6(p.218)] Today, television advertising of condoms, the most effective barrier to HIV transmission, while not as restricted as it was 2 decades ago, is still controversial.[7] Despite the abundance of sexually explicit programming and widespread advertising of Viagra and similar drugs, stations still fear the ire of political conservatives and moralists.

Drug regimens introduced in the mid-1990s that are capable of controlling the damage the virus wreaks on the immune system stimulated new medical, ethical, and economic challenges. The drugs have side effects that may prove fatal for some patients and have long-term adverse effects in others. Complicated regimens for taking many pills per day have been simplified, but new problems of viral strains resistant to the drugs have arisen. These strains may be transmitted to others. Moreover, the drugs are expensive, costing an average of $15,475 for a year's

supply,[8] well beyond the budget of most patients, although government programs pay for the treatment of many patients. The federal government spent $14.1 billion on HIV-related medical care in the United States in 2011.[9]

The history of the AIDS epidemic vividly illustrates that public health involves both science and politics. It took the science of epidemiology, the study of disease in human populations, to determine the basic nature of the disease and how it is transmitted. The biomedical sciences, especially virology and immunology, were crucial in identifying the infectious agent, determining how it causes its dire effects on the human organism, developing methods to identify virus-infected blood, and devising drugs that can hold the virus at bay. Biostatisticians help to design the trials that test the effectiveness of new drugs and, eventually it is hoped, vaccines—believed to be the greatest hope for controlling the virus. In the meantime, behavioral scientists must find ways to convince people to avoid actions that spread the virus.

The politics of the AIDS epidemic shows the tension between individual freedom and the health of the community. There is a strong tradition of the use of police powers to protect the health of the public in all civilized societies. In the United States, there is also a strong tradition of individual liberty and civil rights. Politics determines the path the government will take in balancing these traditions. Public health is not based on scientific facts alone. It depends on politics to choose the values and ethics that determine how science will be applied to preserve people's health while protecting their fundamental rights.

Cryptosporidium in Milwaukee Water

In early April 1993, an outbreak of "intestinal flu" struck Milwaukee, causing widespread absenteeism among hospital employees, students, and schoolteachers. The symptoms included watery diarrhea that lasted for several days. The Milwaukee Department of Health, concerned, contacted the Wisconsin State Health Department and an investigation began.[10]

Stool samples from the most severely ill patients had been sent to clinical laboratories for testing, and these tests yielded the first clues to the cause of the illness. Two laboratories reported to the city health department that they had identified *Cryptosporidium* in samples from seven adults. This organism was not one that most laboratories routinely tested for, but starting April 7, all 14 clinical laboratories began looking for it in all stool samples submitted to them—and they began finding it. Ultimately, 739 stool samples tested between March 1 and May 30 were found positive for *Cryptosporidium*.

Cryptosporidium is an intestinal parasite that is most commonly spread through contaminated water. In people who are basically healthy, the severe symptoms last a week or so. In addition to the watery diarrhea, the symptoms include varying degrees of cramps, nausea, vomiting, and

fever. The infection can be fatal in people with a compromised immune system, such as AIDS patients or people taking immunosuppressive drugs for organ transplants or cancer treatment.

In Milwaukee, public health officials immediately suspected the municipal water supply, which comes from Lake Michigan. They inspected records from the two water treatment plants that supplied the city, and suspicion immediately fell on the southern plant. The inspectors noted that the water's turbidity, or cloudiness, which was monitored once every 8 hours, had increased enormously beginning on March 21, an ominous sign. On April 7, city officials issued a warning, advising customers of the Milwaukee Water Works to boil their water before drinking it. On April 9, they temporarily closed the plant. Looking for evidence that the water was indeed contaminated with *Cryptosporidium*, they discovered that a southern Milwaukee company had produced and stored blocks of ice on March 25 and April 9. Testing confirmed that the organism was present in the ice.

Meanwhile, public health investigators were trying to determine how many people had been made sick by the contaminated water. Reasoning that only the most severely affected patients would go to a doctor and have their stools tested, they began a telephone survey of Milwaukee residents. On April 9, 10, and 12, they called randomly selected phone numbers and asked the first adult who answered whether anyone in the household had been sick since March 1. Of 482 respondents, 42 percent reported having had watery diarrhea, which was considered to be the defining symptom of the illness. In a more extensive telephone survey conducted on 1,663 people in the greater Milwaukee area between April 28 and May 2, 30 percent of the respondents reported having had diarrhea. Half of the respondents whose water came from the southern plant reported the symptoms, while only 15 percent of those whose homes did not get water from the Milwaukee Water Works had been ill. These individuals had probably been exposed at work or from visiting the affected region.[10]

The investigators, who reported the results of their study in the *New England Journal of Medicine*, estimated that at least 403,000 people were made ill by the *Cryptosporidium* contamination of the Milwaukee water supply.[10] The number of deaths has been estimated to be 54; 85 percent of them were AIDS patients, whose compromised immune systems made them especially vulnerable.[11] In discussing how the contamination had occurred, the investigators speculated that unusually large amounts of the organism may have come from cattle farms, slaughterhouses, or human sewage swept into Lake Michigan by heavy spring rains and snow runoff. Flaws in the water treatment process of the southern plant led to inadequate removal of the parasites. After the problem was diagnosed, the southern water treatment plant was thoroughly cleaned, and a continuous turbidity monitor was installed that automatically sounds an alarm and shuts down the system if the turbidity rises above a certain level.

Cryptosporidium contamination is probably much more common than is recognized. It is difficult to control because the organisms are widespread in the environment and they are resistant

to chlorination and other commonly used water disinfection methods. *Cryptosporidium* was first recognized as a waterborne pathogen during an outbreak in Texas in 1984 that sickened more than 2,000 people.[12] There may be many other pathogens that could surprise us with waterborne outbreaks; according to a report by the Institute of Medicine, only 1 percent of the organisms associated with disease that might be found in water have been identified.[13]

The United States has one of the safest public water supplies in the world. Nonetheless, according to the CDC, an estimated 4 million to 33 million cases of gastrointestinal illness associated with public drinking water systems occur annually.[14] Many communities are still using water treatment technology dating to World War I, while population growth, modern agricultural technology, toxic industrial wastes, and shifts in weather patterns due to climate change are challenging the aging infrastructure. Updating the infrastructure is expensive; but waterborne disease outbreaks are also expensive. An analysis of the cost of the Milwaukee outbreak in medical and productivity costs, done by scientists from the CDC, the City of Milwaukee Department of Health, the Wisconsin State Division of Public Health, and Emory University yielded an estimate of $96.2 million.[15] These authors estimated that, based on the approximately 7.7 million cases of waterborne disease annually, waterborne disease outbreaks cost $21.9 billion each year in the United States. They recommended that the cost of the outbreaks should be considered when costs of maintaining safe water supplies are calculated. Safe drinking water, one of the most fundamental public health measures, is by no means assured in the United States.

Worst Case Scenario: Public Health in Russia

The Soviet Union set a high priority on public health soon after the Russian Revolution, when the population was suffering from the effects of war, including famine, plague, and a general lack of sanitation. The communist government ran educational campaigns to teach people to practice basic hygiene and prevent disease. It promised free medical care to all; it trained physicians and built hospitals and tuberculosis sanitariums. The incidence of typhus, typhoid fever, and dysentery were dramatically cut. By the 1930s, Western visitors were impressed with the nation's progress in raising the health of the population to near European levels. However, the promise was soon eroded by the abuses of the Soviet system. Progress was choked off by Stalin's suppression of science, the policy of secrecy that concealed bad news, and the Soviet industrial planning process that pushed for continuously increased production at all costs.[16]

The extent of the public health disaster was not known until the late 1980s when Gorbachev began the policy of glasnost, or openness. Westerners—and Russians themselves—learned that infant mortality rates had been rising since the 1970s but were not published because they

were embarrassing to the government. The extent of environmental degradation throughout the former Soviet Union, together with increasing rates of cancer, respiratory disease, and birth defects, had become obvious. The corruption and incompetence in the Soviet medical system were also clear: shortages of vaccines, drugs, and medical supplies; unhygienic practices including the reuse of needles for injections and immunizations; poor training of physicians; and shortages of nurses. Alcoholism was rampant.[16]

After the Soviet Union disintegrated in 1991, public health in Russia and other former Soviet states grew dramatically worse. In Russia, death rates increased and birth rates declined so that by the mid-1990s, deaths were almost twice as common as births. While economic and social conditions have improved somewhat since then, the public health has improved only marginally. In 2012, the ratio of deaths to births was approximately 1.5.[17] Life expectancy at birth for Russian men, which was 65.4 years in 1962–1963, fell to 57.3 in 1994 and has recovered only to 60.1 in 2012.[17] Life expectancy for women is longer, at 73.2 years, but women tend to suffer from worse health than men, especially at older ages.[17,18] (In 2012, the life expectancy for American men was 76.0 and 81.0 for American women.[17])

The infant mortality rate fell during the 1990s and 2000s, but still it was 9.9 per 1,000 live births in 2012, compared to 6.0 in the United States.[17] Abortions, the most common method of birth control, were twice as common as childbirth in the early 1990s; recent government efforts to restrict abortions, together with the increased availability of birth control, reduced their number; still, the abortion rate in Russia is among the highest in the world.[19] These factors have led to a decline in the size of the Russian population, which has fallen by 6 million people since 1992 to about 143 million in 2008 and is expected to continue its decline; it is projected to reach below 100 million in 2050.[18] This has negative implications for Russia's future economics, security, and public health.[20] Although many factors contribute to these alarming statistics, much of the blame appears to fall on the economic stress and social breakdown that accompanied the breakup of the former Soviet Union. Middle-aged men have been the group most severely impacted by the changes in the system. They are dying in large numbers from motor vehicle accidents, suicide, homicide, drowning, alcohol poisoning, and cardiovascular disease. Alcohol contributes to many of these deaths; although the official per capita consumption is only marginally higher than in the United States and Western Europe, 75 percent of the alcohol consumed in Russia is in the form of spirits, while Americans and Europeans are more likely to drink beer and wine. There is also a problem in Russia with drinking of alcoholic substances not intended for consumption, such as perfumes and medicines. One-quarter to one-third of all adult male deaths have been directly attributed to alcohol abuse. Among men, deaths from alcohol poisoning, accidents, violence, and cardiovascular disease occur disproportionately on Saturdays, Sundays, and Mondays after binge drinking on weekends.[21]

Although the effects of alcohol are said to outstrip all other health risks, other unhealthy behaviors contribute to the high death rates among adults, especially men. Some 61 percent of Russian men smoke. The rate is much lower—15 percent—for women, but it is increasing. The Russian diet, high in cholesterol-rich animal fats and eggs and low in fruit and vegetables, contributes to abnormally high rates of cardiovascular disease and some cancers. Russians tend to have a sedentary lifestyle and although obesity is less prevalent among Russian men than American men, it is more common in Russian women than Americans.[21]

Infectious diseases, which had been well controlled during the Soviet era, have reappeared, and the CDC warns travelers about hepatitis A, tickborne encephalitis, measles, and rabies, especially in rural areas.[22] Tuberculosis has been a major problem, fed by poverty and social dislocation in the 1990s and overcrowded conditions in prisons, which spreads the disease to communities when prisoners are released. Improper use of antibiotics has led to drug resistance in many of these cases.[23] Infection with HIV, the virus that causes AIDS, has been spreading out of control, contributing to the prevalence of tuberculosis. The United Nations estimates that about 1 million Russians carry the HIV virus, almost as many as in the United States, which has more than double the population.[24] Intravenous drug use is responsible for the majority of infections, although they are expanding in heterosexual populations and are also being seen more in men who have sex with men.

The Russian medical system is vastly underfunded. Doctors and nurses are poorly paid and many hospitals are poorly equipped, especially in rural areas. Although health care is free in principle, many patients must pay under the table for services.[25] According to World Health Organization figures, the Russian government spends $1,038 per person annually on health, which is more than double what it spent in 2000; but this still compares poorly with annual expenditures of $2,784 in the United Kingdom. The United States spends $7,410 per person annually, which is generally regarded as excessive.[26] A 2008 World Bank report on recommendations for healthcare reform in Russia starts with public health strategies that are already widespread in the United States, strategies that will be discussed later in this book. These are the World Bank's recommendations:

1. Control excessive alcohol consumption by targeting supply (e.g., regulation of production, distribution, prices, access, and advertising) and demand (e.g., information, education, and communication campaigns).
2. Control tobacco consumption (e.g., development of policies for smoke-free worksites and public places; taxation; legislation for banning tobacco advertising and promotion, as well as sale to minors).

3. Promote changes in diet and physical activity (e.g., public health policy incentives to promote dietary guidelines for healthier eating; school programs on the importance of health, nutrition, and physical activity).
4. Improve road safety by promoting the use of seat belts and helmets, enforcing laws to prevent accidents due to drunk driving, and retrofitting current road infrastructure with low-cost safety design features (e.g., medians, separation for pedestrians and cyclists) and systematic maintenance to remediate road hazards.[18]

The report then goes on to discuss methods for improving the medical care system.

In addition to all of these issues, environmental pollution contributes to the public health crisis. The Soviet emphasis on industrialization and competitiveness in waging the cold war led to a neglect of environmental protection and civilian public works. A 2007 report, *The World's Worst Polluted Places* by the Blacksmith Institute, an international nonprofit organization, focused on the health effects of industrial pollution in the developing world, found that 10 of the 30 worst places, the "Dirty Thirty," were in the former Soviet Union. At the top of the list was Dzherzhinsk, a city of 300,000 that is still a center of Russian chemical manufacturing and is listed in the *Guinness Book of World Records* as the most chemically polluted city in the world.[27] In cities across the nation, Soviet factories of 1930s vintage still spew black smoke and toxic chemicals into the air, causing asthma, chronic bronchitis, cardiovascular disease, and lung cancer. An analysis by the Environmental Defense Fund, published in 2008, concluded that 10 percent of all deaths in Russian cities could be attributed to air pollution. In the remainder of Russia the data are not as reliable, but the authors estimated that, overall, air pollution caused about the same number of deaths as suicide and homicide combined and double the number from transportation accidents.[28]

Raw sewage and industrial wastes pour into rivers used for drinking water and almost three-quarters of the nation's surface water is polluted. Less than half of Russia's population has access to safe drinking water.[29] Rivers used for irrigation have run dry, leaving contaminated dust to blow in the wind. Soil and water are heavily contaminated by the excessive use of pesticides, many of them banned in the United States because of their toxicity. The accident at the Chernobyl nuclear power station in 1986 poured quantities of radioactive material into the atmosphere that contaminated water and soil over 50,000 square miles of the Ukraine, Belarus, and western Russia. Other less publicized nuclear accidents, as well as atomic tests and deliberate dumping of nuclear materials, have exposed thousands of citizens to dangerous levels of radiation. Genetic damage, caused by exposure to radiation and toxic chemicals, is one hypothesis put forward to explain the dramatic increases in birth defects and other health problems that are taking their toll on the Russian people.[16,27]

There does not seem to be much hope for improvement in the environment in the foreseeable future. The Russian government tends to focus its efforts more on economic development than environmental concerns. Even when local authorities wish to take measures to protect the health of their communities, they tend to be overridden by federal bureaucracies driven by economic concerns.[30] The public health disaster in Russia serves to remind Americans how lucky they are and how wise they have been to—through local, state, and federal governments—take measures to protect the environment and their health. Americans take most public health protections for granted—safe water, clean air, freedom from exposure to dangerous radiation, sterile medical instruments, the availability of effective antibiotics to treat infections, and access to immunizations against formerly common diseases. Most Americans expect to live a long and healthy life. However, the benefits of effective public health measures require continued vigilance. The Russian experience illustrates what can happen if these protections are not maintained. In fact, one expert on Russian public health warns that the United States may be in danger of a similar fate. In Russia, he writes, there was a "massive transfer of resources from its social sector to the military–industrial complex." In the long term, the façade of economic and military success fell away. "Could this be a lesson for the current leaders of the world's remaining superpower, a country that can project its military power globally but still fails to provide health care for all its people?"[31]

Public Health and Terrorism

On September 11, 2001, the United States was struck by foreign terrorists, and Americans entered a new phase of civic life. Four passenger airliners were simultaneously hijacked; three were crashed into buildings filled with people going about their work, and one crashed in an empty field in Pennsylvania, apparently headed for another target but was retaken by passengers.

The immediate public reaction to these disasters was the activation of emergency response plans in the regions where the crashes occurred. Police, firefighters, and ambulances rushed to the scenes; hospital emergency rooms were alerted; extra doctors and nurses were called in. In the New York City area, healthcare facilities in the whole region readied themselves to receive the expected large numbers of people wounded at the World Trade Center. Unfortunately, much of this preparation was not utilized because there were so few injured people who survived.

Although the disaster of September 11 was unprecedented in its magnitude, it was similar in kind to other emergencies and disasters for which communities plan: plane and train crashes, factory explosions, earthquakes, hurricanes, and so on. In New York, public health agencies were concerned not only with coordinating emergency medical care, but also with ensuring the

safety of cleanup workers and area residents. Problems with polluted water, contaminated air, spoiled food, infestation of vermin, and so on, had to be dealt with in lower Manhattan just as they must be dealt with after any natural disaster. The longer-term response to September 11 has focused on law enforcement and national defense, with the goal of preventing future hostile acts by terrorists. The federal government has tightened security at airports and borders; it has attacked or warned foreign countries thought to harbor terrorists; and national intelligence agencies have increased their surveillance of persons and groups suspected of being a threat to the United States, to the extent that there are concerns that civil liberties are being eroded. In contrast to the dramatic events of September 11, the second terrorist attack occurring in Autumn 2001 became apparent only gradually. On October 2, Robert Stevens, an editor for a supermarket tabloid, was admitted to a Florida hospital emergency room suffering from a high fever and disorientation. An infectious disease specialist made a diagnosis of anthrax, in part because of heightened suspicions of bioterrorism provoked by the September 11 attacks. The doctor notified the county health department, which notified the state and the CDC. After further tests, the health agencies announced on October 4 that a case of inhalational anthrax had been confirmed. An intensive investigation into the source of exposure began at once. Mr. Stevens died on October 5.[32,33]

On that same day, another case was diagnosed in a worker at the same tabloid office as Robert Stevens. Tests done throughout the building detected a few anthrax spores on Mr. Stevens' computer keyboard and more in the mailroom. The building was closed, and all employees were offered antibiotics to protect them against the development of disease.

On October 9, the New York City Department of Health announced that a newsroom worker at NBC in New York City had developed cutaneous anthrax. She had handled a suspicious letter containing a powder, later identified as anthrax spores. Shortly after, a 7-month-old infant, who had visited his mother's workplace at ABC-TV 2 weeks earlier, was diagnosed with cutaneous anthrax. The child had developed a severe, intractable skin lesion that progressed to severe anemia and kidney failure, but anthrax had not been suspected as a cause of these symptoms.[34] By this time, it was clear that the outbreak was intentionally caused and that a bioterror attack was under way.

On October 15, a staff member working in Senator Tom Daschle's office in Washington, DC opened a letter and noticed a small burst of powder from it. Alert to the threat of anthrax, the aide notified the police and the FBI, and the area was vacated. The letter tested positive for anthrax. Staff and visitors who were potentially exposed were offered antibiotics, as were workers in the Capitol's mail rooms.[35]

The bad news continued. At about the same time that workers in the media and in Congress were being exposed, the disease was breaking out in postal workers in New Jersey, Maryland, and Virginia, although it took days or weeks to recognize what was happening. While it was

known by mid-October that anthrax spores were being sent through the mail, they were not believed to escape from sealed envelopes. As it turned out, postal workers were among the most affected by the outbreak. The Brentwood Mail Processing and Distribution Center in the District of Columbia was closed on October 21 after four postal workers were hospitalized with inhalational anthrax; two of these workers died.[36]

All told, a total of 22 cases of anthrax were diagnosed over a 2-month period, of which 11 were the inhalational form. Five of the latter group died, one of whom was a 94-year-old woman in Connecticut whose source of exposure was never verified. It was surmised that a piece of mail received at her home had been cross-contaminated by another piece of mail at a postal facility.[37] The CDC estimated that 32,000 potentially exposed people received prophylactic antibiotic therapy, which may have prevented many more cases.[38] Contaminated buildings, including five U.S. Postal Service facilities, had to be closed and laboriously decontaminated; some of these building could not be reopened for more than a year.[39,40]

Investigation of postal service records determined that letters to the media were mailed in Trenton, New Jersey in mid-September. The letter to Senator Daschle and one to Senator Patrick Lahey, which was not opened until it was irradiated to kill the bacteria, were mailed in Trenton on October 9. A number of hoax letters, similar to the anthrax letters, some containing innocuous white powder, were also mailed to media and government offices from St. Petersburg, Florida. Since they were sent before the news broke about the anthrax letters, they were presumably sent by the same person. The perpetrator of the anthrax mailings was finally identified in 2008 as a scientist working on drugs and vaccines against anthrax at the U.S. Army Medical Research Institute of Infectious Diseases. As the FBI began to close in on him as a suspect, Bruce Ivins committed suicide. Many of his colleagues doubt that he was responsible, and the case will never be proven in court. The Department of Justice released its evidence against him and requested the National Academy of Sciences to conduct a review of the evidence.[41] The Academy's report concluded that the evidence was consistent with Dr. Ivins's lab being the source of the anthrax spores but did not prove it.[42] That is likely to be the last word on the subject.

The anthrax attacks terrorized the population far beyond the actual damage done. They also disrupted the public health and emergency response systems out of proportion to the actual threat. Any encounter with white powder evoked panic, causing people to send samples to public health laboratories for testing. At New York State's Wadsworth Center in Albany, scientists worked around the clock throughout the fall, testing more than 900 samples. Some of the unlikely specimens sent for testing were a pair of jeans, a box of grape tomatoes, a box of Tic Tac® breath freshener, and several packets of cash from automatic teller machines. The largest amount of cash submitted at one time was $8,000, carefully guarded and picked up

by police immediately after the anthrax tests proved to be negative (L. Sturman, personal communication).

The events that occurred in the Autumn of 2001 disturbed Americans' sense of security within their borders. The terrorists' hijacking of four airplanes prompted major efforts to strengthen homeland security through more rigorous screening of airline passengers and of international travelers at the borders, precautions that are now routine and are expected to be maintained. The anthrax attacks called attention to the fact that the public health system is America's best protection from bioterrorism. Increased funding for disease surveillance, public health laboratories, and emergency response systems has strengthened the ability of the public health system to respond to bioterrorist attacks as well as to natural disasters and epidemics. These precautions are just as important as other homeland security measures for Americans to be safe in their homeland.

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