

# Emerging Infectious Diseases

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**Definition:** Emerging infectious diseases in humans include those with increasing incidence or geographic distribution. Recognition of an emerging disease can occur because the disease is present in the population for the first time, because the disease has been detected for the first time, or because links between an infectious agent and a chronic disease or a syndrome have only recently been identified.

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## Summary

**Fifty years ago antibiotics, vaccines, and improved hygiene seemed to have controlled infectious diseases. But health experts now recognize that new infectious diseases have emerged and spread. Many modern demographic and environmental conditions, as well as the ability of microbes to evolve and adapt, favor these emerging diseases. Disparities such as poverty and inadequate access to health care might give groups different risks for certain infectious diseases.**

## Time Trends

Poor sanitary conditions promote infectious diseases: infectious diseases are more likely to occur among individuals with unsafe drinking water, crowded dwellings, or less access to health care. In the first half of the 20<sup>th</sup> century in the United States, better hygiene and water quality improved the health of the general population. Medical care and vaccines lowered the rates of infectious diseases even more. After World War II, antibiotics became available. For the first time, health care providers could treat major infections. New vaccines controlled other severe infections such as polio and measles.

However, infectious diseases did not vanish as had seemed likely. Known diseases persisted while new ones emerged. Many infectious diseases were first recognized only in the last half of the 20<sup>th</sup> century. As early as the 1950s, some infections were resistant to penicillin. In 1957 and 1968, new strains of influenza (flu) spread rapidly around the world. Although less severe than the 1918 flu strain which caused a worldwide outbreak, these strains still resulted in excess deaths. In the 1970s, Legionnaires' disease and Lyme disease were among new

infections identified in the United States. During the 1980s human immunodeficiency virus (the cause of Acquired Immune Deficiency Syndrome or AIDS) appeared. In the same years, tuberculosis (including strains harder to treat with antibiotics) increased in cities in this country. In the 1990s, gonorrhea resistant to treatment and hantavirus emerged. Now U.S. public health agencies are planning for outbreaks of new diseases such as SARS (severe acute respiratory syndrome), pandemic influenza, and West Nile virus.

Emerging infectious diseases may be either familiar diseases becoming more common, diseases appearing in new areas or entirely new diseases. Factors that favor the appearance or spread of new infections include<sup>1,2</sup>:

- Population growth and crowding, especially in urban places
- Disparities in health care access and quality due to poverty or lack of health insurance
- Social disruption, such as people moving or fleeing because of rising sea levels, civil wars, famines, or other disasters
- Personal behavioral choices such as lack of vaccination, poor hand hygiene, food choice and preparation, risky sexual practices, or shared drug injection equipment
- Human susceptibility or altered immune system due to infections, medical treatments, or an increase in aged and chronically ill people
- Breakdown of public health services
- Changes in microbes
- Global travel and commerce including trade in food products and animals
- Economic growth and land use
- Climate and weather including global warming

- Ecosystem change caused by farming, irrigation, or forest clearing or regrowth
- Changes in technology, health care, and industry
- Lack of political will
- Intent to harm.

### **Emerging Diseases and Disparities: International**

Almost all these factors promote emerging infections on a global scale. Regions with fewer economic resources are at greater risk of infectious disease outbreaks and are less able to handle them. People living in such regions might have greater risk of exposure to emerging infections. Crowding often occurs among those living in poverty and might increase the spread of respiratory, skin, and intestinal diseases. Infections spread more easily from animals to humans in places where the ecosystem has been disrupted. In some parts of the world, dam construction has resulted in increases of diseases such as schistosomiasis, which involves a snail reservoir, and Rift Valley fever, a mosquito-borne infection.

Prevention, detection, diagnosis, treatment, supportive care, rehabilitation, and post-outbreak recovery all depend on good social, health care, and public health systems. For example, polio persists in parts of the world. Low vaccination rates, poor sanitation, and crowded living have made it difficult to control this disease. Diarrhea, malaria, pneumonia, and measles are major causes of deaths among children globally and often occur where poverty rates are highest and living conditions poorest.

In 2003, SARS emerged in Asia. The newly identified virus spread to many countries and resulted in 8,098 cases and 774 deaths. Strict infection control measures stopped its spread. Like many emerging infections, SARS comes from wild animals. The first human cases probably had close contact with infected animals sold live for food. Hemorrhagic fever viruses such as Lassa and Ebola also infect humans from wild animal reservoirs.

A bird influenza (flu) virus could cause a new global flu outbreak. If this were to happen, the impact on countries would likely vary. Death rates ranged 30-fold worldwide during the huge 1918 flu outbreak. The highest rates were in

countries and regions with lower household incomes.<sup>3</sup> Varying death rates might have been due to poorer nutritional status, poorer overall health, higher rates of poverty and crowding, poor living standards, and lack of access to even basic health care.

Death rates might vary even more in a future flu outbreak than in the past. Countries differ in resources such as modern medical care and antiviral medicines. High-income nations have flu response plans that include stockpiling antiviral treatment and expanding health care services. Consequently, the impact of flu outbreaks is likely to be greatest in the regions with fewest economic resources. Emergence of a new flu strain capable of passing from person to person would also be difficult to contain in countries with these characteristics and could lead to a global flu outbreak.

Antibiotic resistance can develop in any group of people. It has repeatedly emerged in places where poverty or poor access to health care results in incomplete antibiotic treatment. Tuberculosis, typhoid fever and malaria are among conditions with increasing resistance to treatment.

### **Emerging Diseases and Disparities: National**

Factors leading to emerging diseases in this country include human behavior, altered immune systems, breakdown of public health services, and changing microbes. Within the United States, some groups have higher risks for acquiring infectious diseases. Infections with respiratory spread, such as pertussis and severe meningococcal disease, have been associated with more crowded living situations. Risks might be higher as well for those with poorer access to health care and lower rates of vaccination. People arriving in the United States might have had disease exposures in other countries with higher risks and therefore higher disease rates.

There are racial disparities in rates of notifiable conditions in this country.<sup>4</sup> In 2002, rates for shigellosis were over four times higher for African Americans, American Indians, and Alaska Natives than for whites. American Indians and Alaska Natives also had higher rates of hepatitis A and salmonellosis. These rates probably reflect different risks of exposure. Crowding in living conditions or in childcare settings contributes to spreading these infections.

Some emerging infections are associated with personal behaviors. Due to a new tampon brand,

toxic shock syndrome was identified as an infection occurring in women using tampons during menstruation.

Global travel and trade have led to disease cases and outbreaks. Imported raspberries were associated with *Cyclospora* infection. Imported foods such as cantaloupe, mangos, and seeds for alfalfa sprouts have been linked to *Salmonella* outbreaks. Exotic or imported pets are another risk factor for emerging infections such as salmonellosis or monkeypox.

Global travel exposes travelers to diseases that may not be common in the United States. Many diseases such as cholera or malaria occur only with exposures outside the United States. Personnel serving in Iraq or Afghanistan have increased rates of diarrhea, respiratory infections, and leishmaniasis. Another challenge identified in military personnel deployed in those regions is highly drug resistant *Acinetobacter* infection of wounds.<sup>5</sup> Travelers and immigrants who are ill or become ill soon after arrival in the United States present special diagnostic and public health challenges.

People with chronic illnesses, with altered immune systems, or needing hospital care can be more prone to infection. They might pick up infections from health care settings and are also more apt to be infected in the community. Blood transfusion or tissue transplant carry rare infections even though donors are routinely screened in this country.

Data about antibiotic resistance and how it may relate to economic disparities are limited. One U.S. study linked lower socioeconomic position and crowding in the home with presence of a new strain of antibiotic resistant *Staphylococcus aureus*. These bacteria cause skin and tissue infections ranging from mild to fatal.<sup>6</sup> Increased use of antibiotics for mild infections can cause antibiotic resistance in common bacteria. International travel can introduce into the United States antibiotic resistant infections such as tuberculosis.

Public health response planners are increasingly aware of disparities. Disasters such as hurricanes and long power failures tend to impact low-income groups most. Those living in or near poverty might be more affected in an emergency or have less ability to take action. Response plans should address their specific needs. All people need access to health care for

events such as worldwide influenza outbreaks or release of a microbe with intent to do harm.

## Emerging Diseases and Disparities: Washington

In Washington, as elsewhere, factors that lead to emerging diseases include human behavior, altered immune systems, breakdown in public health services, and changing microbes. Only limited information specific to Washington is available about possible associations between emerging diseases and economic and other disparities. However, there is some evidence that such disparities play an important role.

Generally, both tuberculosis and HIV infections are more common among racial minorities, people of Hispanic origin, and immigrants. These groups are also at increased risk for other diseases linked to food preferences or exposures during travel. For example, *Listeria monocytogenes* causes mild diarrhea in most people. Older people, those with altered immune systems, and newborns can have severe disease. Listeriosis has been caused by foods such as hotdogs, deli cold cuts and salads, and unpasteurized (raw) dairy products. In Washington, homemade soft cheese (queso fresco) from raw milk has caused cases among Hispanics. In 2005, two of four newborn cases of listeriosis were babies of Hispanic origin.

Environmental changes also increase risk for some diseases. *Vibrio parahaemolyticus* can contaminate shellfish and cause diarrhea. In the past decade, there were fewer than 20 cases a year in the state but in 2006, Washington had a large outbreak. Eating raw or partly cooked shellfish from the Pacific Northwest caused most cases. Other states and countries also reported cases connected with shellfish from this region. Warmer-than-usual water and air might have caused more *Vibrio* growth in ocean waters and led to the outbreak.

Increasing international travel provides the opportunity for spreading a number of diseases. Reports each year of travel related infections such as malaria and typhoid fever among Washington residents suggest a need for better preventive services before travel. Some infections resulting from travel, like hepatitis A and typhoid, can also put close contacts at risk. In 2005, all 11 cases of typhoid reported in the state were travelers or shared a household with a traveler.

Avoiding mosquito bites during travel can prevent certain diseases. Mosquitoes spread malaria or

dengue fever from one person to another. Taking the right medicine and not getting insect bites during travel can prevent infection. About 25 malaria cases are reported each year in Washington. All cases are among immigrants or returning travelers. Washington public health agencies received reports of one dengue case each in 2003 and 2004 and three cases in 2005. All cases were due to travel.

Other rare infections reported in the state result from international travel. In 2005, there were two cases of African tick bite fever after travel to South Africa. The same year there was a case of hepatitis E after travel to India.

High rates of vaccination control measles in this country. The disease now occurs as a travel-related infection. There were three reports of measles in Washington in 2005 and 2006 combined, all in people who had traveled internationally. A vaccine can also protect against Japanese encephalitis. The one case reported in our state in 2004 was after travel.

Vaccination against disease protects the person. It also protects the rest of the community. Those without vaccination are at risk of infection and can serve as a source of disease spread locally.

**See Related Chapters:** [Hepatitis](#), [Sexually Transmitted Infections](#), [Tuberculosis](#), [HIV/AIDS](#), [Childhood and Adult Immunizations](#), and the [Environmental Health Section](#).

### **Data Sources**

Washington State Department of Health, Annual Communicable Disease Reports, 1998-2005.

### **For More Information**

*Emerging Infections*. Institute of Medicine. National Academy Press, 1992.

Protecting the Nation's Health in an Era of Globalization  
<http://www.cdc.gov/globalidplan/index.htm>

### **Endnotes**

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<sup>1</sup> Institute of Medicine. (1992). *Emerging Infections*. National Academy Press.

<sup>2</sup> Heymann, D. (2005). Social, behavioral and environmental factors and their impact on infectious disease outbreaks. *Journal of Public Health Policy*, 26, 133-139.

<sup>3</sup> Murray, C. J. L., Lopez, A. D., Chin, B., Feehan, D., & Hill, K. H. (2006). Estimation of potential global pandemic influenza mortality on the basis of viral registry data from the 1918-1920 pandemic: a quantitative analysis. *The Lancet*, 368, 2211-2217.

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<sup>4</sup> Centers for Disease Control and Prevention. (2005). Racial Disparities in Nationally Notifiable Conditions – 2002. *Morbidity and Mortality Weekly Report*, 54, 9-11.

<sup>5</sup> Aronson, N. E., Sanders, J. W., & Moran, K. A. (2006). In harm's way: infections in deployed American military forces. *Clinical Infectious Diseases*, 43, 1045-1051.

<sup>6</sup> Bratu, S., Landmand, D., Gupta, J., Trehan, M., Panwar, M., & Quale, J. (2006). A population-based study examining the emergence of community-associated methicillin-resistant *Staphylococcus aureus* USA300 in New York City. *Annals of Clinical Microbiology and Antimicrobials*, 5, 29. published online: <http://www.ann-clinmicrob.com/content/5/1/29>.