

Vector-Borne and Water-Borne Diseases

Climate change is acknowledged by scientists around the world to be a reality and to be caused primarily by human activity, especially the burning of fossil fuels. As the earth warms, the delicate balance of climate, weather events and life is disrupted. Consequences emerge that threaten human health and, ultimately, survival.

This is one of several fact sheets produced by Physicians for Social Responsibility that examine recent scientific evidence of global warming's impact on health.

Vector-borne diseases:

Vectors carry and transmit disease

- Vectors are insects (mosquitoes, ticks, fleas, black flies and sandflies) that carry infectious agents such as protozoa, bacteria and viruses.
- They carry and transmit numerous diseases to humans: parasitic vector-borne diseases such as malaria, leishmaniasis, and Chagas disease; arboviral diseases such as dengue fever, yellow fever, West Nile Virus, Rift Valley fever, and tickborne encephalitis; and bacterial and rickettsial diseases such as Lyme borreliosis, tularemia and plague.

Climate change impacts vector-borne diseases

- Vector organisms and the infectious agents they carry are cold-blooded, so changes in temperature will affect their development, reproduction, behavior and survival rates.
- Changing temperature and precipitation may shift the geographic range in which they can live and the seasonal period of disease risk, resulting in expansion both pole-ward and in higher elevation.
- Higher temperatures can speed up pathogen development within vectors, precipitation can influence the availability of breeding sites, and climatic variables can affect the rate and spread of disease.^{1,2}

Climate change and mosquitoes:

Higher temperatures:

- Boost their reproductive rate, lengthen their breeding season, make them bite more frequently, and shorten the time it takes for the pathogens they carry to mature to an infectious state;
- Can expand the mosquitoes' range to higher elevations and more pole-ward, potentially putting previously unexposed populations at risk.

Increased precipitation:

- Storms, hurricanes and floods can contribute to the spread of malaria, as they leave behind vector breeding sites.

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The threat to health: Mosquitoes can carry malaria and dengue fever, among other diseases.

Malaria:

- In 2010, it was estimated that there were 219 million cases of malaria worldwide, resulting in the deaths of approximately 660,000 people, most of whom were young, African children.³
- Each year in the U.S., there is an average of 1,500 reported cases of malaria, usually brought in from people who contracted the disease in a foreign country.⁴
- Worldwide, malaria has the largest disease burden (illnesses, deaths, financial costs and other indicators) of any vector-borne disease.⁵

Dengue fever:

- Can be transmitted by the Asian tiger mosquito, which can be found in 36 states.⁶
- It is estimated that there are over 100 million cases of dengue worldwide each year. The case-fatality rate of its more serious form, dengue haemorrhagic fever (DHF), is about 5%, mostly among children and young adults.⁷
- The disease is now endemic in many countries of the Americas; there is a small risk for dengue outbreaks in the continental United States.⁷

West Nile Virus:

- Between 1999 and 2012, about 37,000 cases of West Nile Virus were reported in the U.S., and over 1,500 people died as a result.⁸
- Approximately 80% of the people who contract WNV do not show any symptoms.⁹

Climate change and ticks

- Ticks maintain multiple and diverse disease agents (including bacteria, viruses, and parasites) and serve as bridging vectors between animal reservoirs of the disease and humans.
- Changing weather patterns associated with climate change have induced shifts in the distribution of vector ticks carrying Lyme disease. Modeling indicates that in the future, the tick that carries Lyme disease will migrate into Canada.¹⁰
- By expanding development into forested areas, the chances that humans could contract Lyme disease may increase.⁶

Climate change and fleas

- Fleas are best known as vectors of the causative agent of plague. Plague has caused millions of human deaths, especially during the Black Death of the Middle Ages.
- Plague is still with us, notably in New Mexico, where its prevalence seems to correlate with the timing and amount of precipitation.^{11,12}
- Recently, studies of plague transmission in the U.S. found that the pattern of human plague cases has shifted northward as temperatures have warmed. It is predicted that some northward expansion of the disease could occur from New Mexico into Wyoming and Idaho.¹³
- A study showed that an increase in springtime temperatures by 1.8F could increase the number of rodents infected with the plague by 50%.⁶

Water-borne diseases:

Water-borne infectious diseases worsen with climate change

- Infectious diarrhea is one of the most prevalent of the world's water-borne diseases. It is usually a symptom of gastrointestinal infection, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person to person as a result of poor hygiene.
- Severe diarrhea leads to fluid loss and may be life-threatening, particularly in young children and people who are malnourished or have impaired immunity. Globally, it is the second-leading cause of mortality in young children.¹⁴
- This is only expected to worsen with climate change, driven by factors including increased temperatures, flooding, and other changes in the water cycle.¹⁵
- Cholera is a diarrheal disease caused by bacteria that occur naturally in rivers, estuaries, and coastal waters. Scientists have observed a relationship between the increase in sea-surface temperature and the onset of cholera epidemics. Strong El Nino cycles and other climate variables provide a predictive capacity for cholera epidemics.¹⁶

Increased risk of water-borne diseases in the U.S.

- In countries with reliable sources of potable water, contamination of recreational waters from extreme weather events remains a significant means of disease transmission. Ear, nose, and throat, respiratory, and gastrointestinal illnesses are commonly associated with recreational swimming in fresh and oceanic waters.
- Warmer global average surface temperatures are increasing lake, river, and hot spring temperatures which are favorable conditions for the *Naegleria fowleri*-the brain-eating ameba. As a result, *naegleria fowleri* is being found in fresh waters farther north than before.¹⁷
- Other, potentially more severe waterborne diseases are also transmitted in recreational waters, although with less frequency, such as hepatitis, giardiasis, and cryptosporidiosis.¹⁸
- A study of water contamination of the Great Lakes projected that as extremely heavy precipitation events become stronger, there will be a resulting greater potential for flooding and sewer overflow, with a corresponding greater potential for waterborne diseases.¹⁸

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