

Environmental Determinants of Infectious Disease

In 2003, the Institute of Medicine (IOM) published “Microbial Threats to Health.” The IOM looked at the “big picture” of public health and how it is constantly changing. New pathogens have been discovered and existing pathogens causing diseases thought to be eradicated have re-emerged, introducing new diseases in the U.S. The report explores thirteen factors that account for new and more serious microbial threats. Many of these thought-provoking factors engage us to think about the environmental determinants of public health. This edition of *Epi Focus* explores a few examples of infectious agents that are impacted by environmental factors and discusses how these pathogens affect human health in both the State of Michigan and Kent County.

Climate and Weather Change

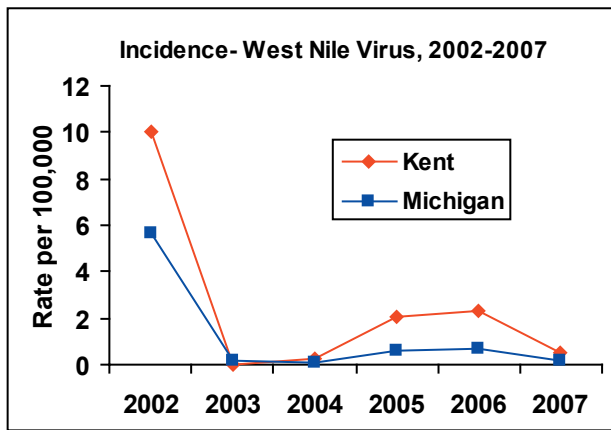
Organisms tend to replicate, move, and evolve during and after changes in the weather. Animals and insects serving as vectors for infectious organisms are impacted by temperature, precipitation, solar radiation, relative humidity, water reservoirs, wind, and duration of daylight. How these vectors adapt to changes in the weather can have a direct effect on disease transmission.



Rodent-borne diseases - Abundant rainfall produces lush vegetation, greater production of grain, and increased food sources for rodents. This weather pattern during the warm months of spring and summer of 1993 was associated with an increase in rodent-borne **hantavirus** infections in the southwest. The type of mouse implicated in Hantavirus infections is the deer mouse, which is found in Michigan. However, weather and climate conditions would likely play a formidable role if we were to see the condition here. Resident cases have been identified in neighboring Indiana.

Mosquito-borne diseases such as malaria, yellow fever, and dengue were once a major public health problem in the United States. Factors mitigating the climate’s effect on individuals in the U.S., as well as other public health strategies have likely led to the decline in these diseases. In Kent County, West Nile Virus is the primary mosquito-borne disease of concern.





West Nile Virus is influenced by climate and weather change. As temperatures increase and stagnant pools of water remain after rains, ideal conditions are created for mosquitoes to breed. West Nile continues to be a public health threat in Kent County.

Rabies - Some scientists have speculated that hot, dry weather earlier in the summer is favorable for the viral replication and transmission of rabies.

Economic Development and Land Use

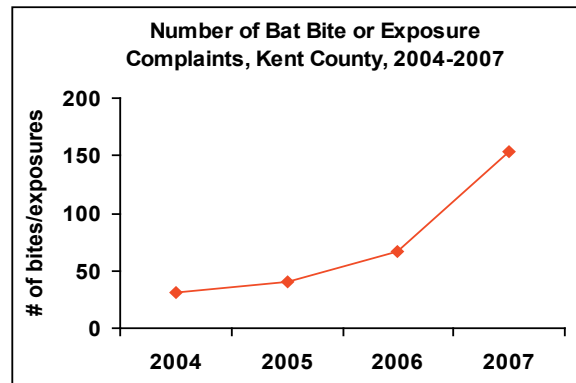
The population is increasing; therefore, there is increased need for food, land, and housing. These factors have led to deforestation (and reforestation) and increased contact between humans and animals. From 1982 to 2003, nonfederal acreage devoted to animal grazing fell from 611 million acres to 576 million acres (6%), according to the USDA. With increased demands for land, animals are sometimes crowded into smaller spaces. Animals in close contact with one another may transmit diseases back and forth. Antibiotics have been used to decrease disease transmission but also to enhance the growth of animals. This use of antibiotics contributes to antibiotic-resistant bacteria that are spread from animals to humans.

Fluoroquinolone-resistant Campylobacter - Campylobacter is the second most frequently reported gastrointestinal illness in Kent County. In 1995, fluoroquinolones were approved for use in poultry flocks to reduce respiratory infections due to crowding. In 2000, 14% of human U.S. Campylobacter infections were due to organisms resistant to Fluoroquinolones. Between 1997 and 2004, the percent of human Campylobacter isolates tested that were resistant to ciprofloxacin increased from 12% to 19%. In 2005, FDA withdrew approval for these agents for use in poultry.

***E. coli* 0157:H7** - Crowding of animals has influenced the persistence of *E. coli* O15H7. In the U.S, there are fewer feedlots with less than 1,000 heads of cattle and more with a capacity greater than 16,000. The shift from a larger number of cattle in fewer facilities and facilities moving to warmer climates has contributed to the persistence of *E. coli* in slaughterhouses. *E. coli* was implicated in a national foodborne outbreak involving spinach in 2006. DNA fingerprinting allowed investigators to link the strain of bacteria from the bags of spinach to the strain from one field. The field had been contaminated by waste from wild pigs. Additionally there were concerns about the proximity of irrigation wells used to grow produce and surface waterways exposed to feces from cattle and wildlife. We continue to receive reports of *E. coli* 0157:H7 on a regular basis. In 2008, KCHD investigated three cases associated with a statewide outbreak in which shredded packaged lettuce was implicated as the source of infection.

Lyme disease - Blacklegged ticks that transmit Lyme disease thrive in habitats with trees, shade, brushy undergrowth, grassy, leaf-litter and sandy soil. Deer and rodent hosts are normally found in these areas. In some areas, farmland has reverted to small patches of forest, creating ideal habitat for deer. Deer populations have increased, and so have tick populations. Residential development has caused humans to encroach on the tick's habitat resulting in increased exposure of humans to ticks. Cases have been reported in Kent County and surrounding counties including Ottawa, Muskegon, Ionia, Allegan and Barry. It is expected that the number of cases reported will continue to increase due, in part, to expanding tick ranges.

Rabies - In 2007 bats testing positive for rabies in Michigan were at an all-time high. Wisconsin saw a similar increase. Experts have theorized that the increase is due to urban sprawl. In the past, wildlife had plenty of space to get away from humans, but with housing development occurring in more rural areas, people have more contact with wildlife, thereby increasing their risk of exposure to animals with rabies.



Travel and Commerce

Ease of worldwide travel has created the opportunity for humans, animals, and foods to circulate pathogens and their vectors around the globe. Locally, the Kent County Health Department is responsible for screening refugees who come to our country to detect infections (e.g. TB, HIV, etc.) that can be transmitted here.

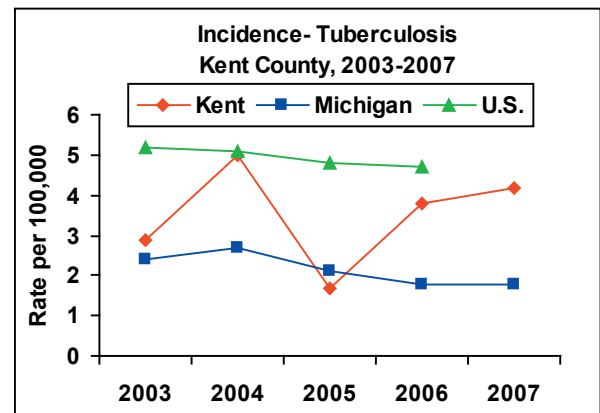
Human Travel

Measles - The Kent County Health Department responded to a measles exposure on an airline flight to Grand Rapids. Upon arrival, communicable disease unit staff located exposed individuals and provided prophylaxis to prevent illness.

Tuberculosis - The rate of reported tuberculosis infection has increased. Nationally, foreign-born persons made up 53% of cases in 2003. This is an increase from 1993 when foreign-born individuals only represented 29% of the national case total.

Bed Bugs - The resurgence of bed bugs is thought to be caused by international travel and laws that ban the use of DDT. In the United States, bed bugs were very common until World War II. With the introduction of such pesticides as DDT, infestations decreased greatly. The use of DDT as a pesticide was banned in the 1970s, leading to increases in bed bug infestations. The recent rise in infestations also may be attributed to the extermination practices of pest control technicians.

Many pest control experts use baiting techniques in infestations of ants, roaches, and spiders. These baiting techniques do not work well for bed bugs because they are blood feeders. Finally, increased world travel has contributed to a resurgence in infestations. Bed bugs move from one country to another through international transport on clothing, luggage, and the human body. Bed bugs are found on airlines and in cargo holds. Bed bugs can also be transferred from lodging and hotel accommodations.



Food Travel

Country-of-Origin Labeling (COOL) - The new COOL law will allow more foods to be labeled with the country of origin. China's chemical-tainted milk and the recent Mexican salmonella-pepper outbreak (which involved Kent County residents) has caused concern over the safety of imported foods. Foods produced in the United States, such as California-grown spinach, have caused numerous outbreaks in recent years. Those worried about safety regulations in certain countries can avoid those imports. This new system should be more comprehensive for tracing food items.



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