

Climate Change & Infectious Disease

Executive Summary

Climate change is impacting many aspects of our lives, including an increase in the prevalence and diversity of infectious diseases. Environmental conditions in Missouri will increasingly favor the migration and survival of different organisms, including disease-causing agents and species not native to the region. Eating a healthy diet to boost immune systems, maintaining habits that enhance physical and mental wellbeing, and being informed about best practices could be beneficial at the individual level. Educational programs for the general public as well as improvements in public health services and community medicine may also be important to prepare society for climate-associated changes in the near future.

Science Highlights

- Infectious diseases are caused by agents such as viruses, bacteria, fungi, or parasites that live in or on our bodies. Some of these agents are harmless and some are beneficial, while some cause disease.
- With climate change, the geographical ranges of various organisms (including insects, birds, animals, humans, and plants) will shift to environments suitable for their survival.
- Agents that can cause infectious diseases are likely to be transported with these hosts, increasing the number of diseases typically seen in Missouri.
- Missouri's Office of Administration estimates that people over age 65 will increase to about one-fifth of the state's population by 2030. This age sector is more vulnerable to infectious diseases along with those who are very young, immunocompromised, or live in polluted, unhealthy environments.

Limitations

- While scientists in many disciplines are studying different scenarios to predict potential problems and solutions, there is concern that current practices will not change in time to reverse the effects of climate change.
- The multitude and complexity of factors that influence the agents and disease transmission patterns may limit accurate predictions of the ultimate effects of climate change on infectious diseases.

This community science note was prepared in May 2022 by Dr. Prema Arasu, in collaboration with the Missouri Local Science Engagement Network (LSEN). The Missouri LSEN is a partnership between MOST Policy Initiative and the American Association for the Advancement of Science (AAAS) aimed to elevate science in policy conversations in Missouri. For more information, contact info@mostpolicyinitiative.org.

Research Background

Climate Change in Missouri

Hot, humid summers and cold, snowy winters are the norm in Missouri today. However, weather patterns have become more unpredictable in recent years. While the entire planet is getting warmer with global climate change, local and regional changes are more erratic, with larger variations in annual snowfall and temperatures. Current data shows that Missouri's climate is changing and temperatures are creeping upward.¹ This may have negative repercussions for human health.

Infectious Disease Transmission

Infectious diseases are caused by agents external or foreign to our body, unlike diseases such as cancer (abnormal growth of our own cells) or diabetes (malfunction of our physiological system). Agents that live in or on our body are small, micro-organisms that include viruses (such as the coronavirus responsible for the COVID-19 pandemic); bacteria (such as *Staphylococcus* in food poisoning); fungi (such as the ones causing Athlete's foot); and parasites (such as intestinal roundworms or head lice). Several of these infectious agents require other non-human hosts to reproduce and to complete their life-cycles; these other hosts include vectors such as mosquitoes, ticks and flies, as well as animals such as deer, rats and domestic dogs and cats.²

Virtually all forms of life will be affected by climate change.³ As temperatures rise, vectors and hosts of infectious diseases are predicted to move further north in the northern hemisphere and further south in the southern hemisphere in search of environments suitable for survival within their preferred zones or niches.^{3,4} For example, different species of mosquitoes, typically found in tropical and sub-tropical ranges, may spread to new areas and potentially transmit malarial parasites, dengue fever viruses and other infectious agents.

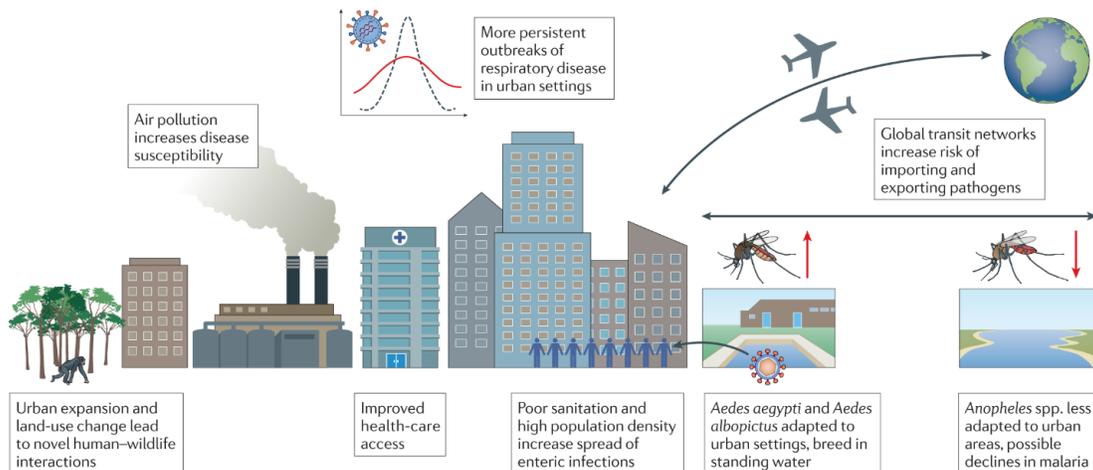


Figure 1. Impacts of urbanization on infectious disease.³ Interactions between urbanized environments and agents can promote the spread of infectious diseases.

To escape the increasing heat and extreme weather events, people and animals will also tend to move to areas that were previously considered cold and harsh, resulting in more densely populated cities and greater likelihood for human-human and human-animal (i.e., zoonotic) interaction and disease transmission.⁵ With movement and greater interaction between people, animals, and disease-causing agents, antibiotic and multidrug resistant organisms (such as tuberculosis) are also likely to increase (Figure 1).⁶ Concurrent migration as well as demographic, socio-economic, and technological changes will all have inter-connected impacts on future scenarios.³

Human Health and Disease Prevention

Human health is in part dependent on the beneficial effects of many microorganisms. Examples include probiotic bacteria in our intestines that help with digestion, and the mites on our skin and eyelashes that feed on and remove our dead cells. These microorganisms on and in our bodies help us thrive and survive.⁴ However, there are also different kinds of microorganisms that are able to infect and enter our body through air, water, food, or physical contact. These microorganisms can sometimes overcome the different defense mechanisms of our immune system and cause various kinds of disease.

Climate change will also affect plants and food animals, resulting in reduced agricultural productivity.⁴ Since good nutrition and clean air and water are all important for good health and a strong immune system, our body's innate ability to fight infection may be diminished and make us more susceptible to infectious agents if food, air, and water systems are disrupted by climate change. Further, immune systems of the elderly are generally less capable of combating and containing infectious agents.⁷ Missouri's Office of Administration estimates that people over age 65 will increase to about one-fifth of the state's population by 2030, and this demographic is generally more vulnerable to disease, as are young and immunocompromised individuals.⁸

Infectious Disease Mitigation

Within the context of climate change, the health and wellbeing of individuals and the local community are inter-connected with complex regional, national, and global factors. Considerable global efforts are already underway to address the impact of climate change, especially as noted by the International Panel on Climate Change Working Group's Sixth assessment reports released in August 2021 (IPCC-WG1) and in February 2022 (IPCC-WG2).⁹ Closer to Missouri, an assessment done in neighboring Illinois considered two scenarios: a deep reduction in the use of fossil fuels versus a continuation of current practices and increasing emission of carbon dioxide. The study concluded that strong, coordinated efforts would be critical to reducing greenhouse gas emissions and maintaining a balance between human and natural systems. The study also concluded that climate change would disproportionately impact low-income communities and people of color, further widening issues of environmental injustice, economic disparities, and vulnerability to health problems.¹⁰

As reported in The Lancet in 2021, “The multitude and complexity of factors that influence [disease] transmission patterns prevent accurate predictions of the effects of climate change on infectious diseases. But the devastating global consequences of the COVID-19 pandemic on health, health systems, and economies should caution governments, policy makers, and the general public to not underestimate the threat of climate-related changes to infectious disease geographical distribution and burden.”⁵ Individual actions that increase resilience include eating a healthy diet, maintaining habits that enhance physical and mental wellbeing, and education regarding approaches in which we can reduce our carbon footprint. Educational and informational programs for the general public, as well as improvements in public health services and community medicine, can also increase resilience. These improvements would include increased funding for preventative measures, better health care standards and access, and vaccinations against infectious diseases as some of the measures needed to prepare society for changes in the near future.

Further information about communicable diseases can be found on the [website](#) of the Missouri Department of Health and Senior Services.¹¹

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