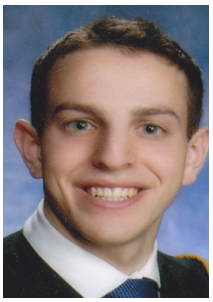
Investigating the Relationship Between Climate Change and Tropical Parasitic Disease



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The International Panel on Climate Change (IPCC) has concluded that Earth's climate has changed considerably in the last century, in part due to human-related activity.[1] Based on the IPCC 2007 Report, the average surface temperature increased approximately 0.74°C ± 0.18 °C over the twentieth century.[1] The increased temperatures are linked to changes in other parameters of Earth's climate system, such as the rising sea-level and increased yearly number of heavy rainfalls, extreme flooding, and droughts.[1,2] Such changes in the Earth's climate system are predicted to continue over the twenty-first century.[1,2] Given that a population's survival is largely dependent on the Earth's climate, increasing attention has been placed on whether climate change has affected parasitic disease patterns. In principle, climate can affect parasitic diseases with respect to changes in reproduction, development, and the population dynamics of the parasite and the parasite host.[3] However, the effects of climate change on parasitic disease over the last century remain controversial. It is important to understand the relationship between climate change and parasitic disease in order for the development of appropriate and effective policies in disease prevention.

The objective of the current study was to investigate the relationship between climate change and various parasitic diseases, including malaria, Chagas disease, leishmaniasis, schistosomiasis, and lymphatic filariasis, considering the potential consequences for the human population as well. Thus, a literature review was performed using OVID as the main search engine to review existing evidence.

A total of 43 observational studies were analyzed (15 malaria, 7 Chagas disease, 11 leishmaniasis, 5 schistosomiasis, and 5 lymphatic filariasis). In reviewing the existing literature, it was observed that the vectors and parasites of the tropical parasite diseases are influenced by local temperatures, rainfall, and other climate indices. While malaria and leishmaniasis were predominantly positively associated with temperature increases,[4,5] Chagas disease was negatively associated with increased temperatures.[6] The effects of temperature on Schistosomiasis and lymphatic filariasis were less consistent, with both positive and negative associations observed. The most common hypothesis to account for the differing associations observed between parasites and temperature change is one of an optimal growth habitat for a given parasite.[3] That is, while temperature positively influences vector and parasite survival, extreme temperatures can be detrimental to currently endemic regions.[3] In examining precipitation patterns, with the exception of lymphatic filariasis, for which a positive association was observed,[7] the effects of precipitation were mixed for other parasitic diseases studied. The effects of precipitation on infectious disease appear to be very specific to the region, as increased rainfall can produce both positive and negative results for the vectors studied.[3]

In conclusion, the current study demonstrates that climate change plays a fundamental role in the survival of vectors and parasites, and the transmission of infectious disease. The results suggest that climate change has altered the geographical distribution of infectious disease, particularly in regions previously unsuitable for vector and parasitic survival. Future studies should seek to define how much of the burden of infectious disease can be attributed to climate change.

Global Health Relevancy

- The Lancet has declared climate change as the greatest global threat of the twenty-first century
- Parasitic disease has expanded to regions previously unsuitable for vector and parasitic survival
- Improving the current understanding on the relationship between climate change and parasitic disease will result in effective policy development for disease prevention