

Study pins factors behind geography of human disease

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If your home region has a hot, wet climate and a lot of different kinds of birds and mammals living in it, there's a really good chance the region will also contain numerous kinds of pathogens that cause human diseases.

A new study examining the geography of human disease, led by Dr. Rob Dunn at North Carolina State University alongside an international team of biologists and social scientists, shows that that one can predict the number of kinds of disease-causing [pathogens](#) in a region just by knowing its climate or the number of birds and mammals found there. Multiple things, Dunn says, might influence the diversity of pathogens in a region: [human population](#) size and density, the amount of time people have lived there or expenditures on disease control. Each of these undoubtedly has some influence, but the environment is dominant.

"We imagine that we have nature under control, but nobody seems to have told nature," Dunn says. "The environment and, in its broadest sense, nature determines the number of kinds of diseases in different regions of the world in much the way that it has influenced the number of kinds of birds, mammals, ants or bees."

But while the environment determines how many diseases one finds in a region, it does not determine how common they are. The researchers also examined the factors correlated to the prevalence, or commonness, of human pathogens across the globe and discovered that the most important factor is health-care spending, specifically expenditures on

disease control.

"On the one hand, we are not very effective at altering the numbers of kinds of pathogens present, as those numbers are strongly correlated with environmental conditions. The vagaries of climate and life over which we have little control determine which diseases you are at risk of contracting in any given place," Dunn says. "But on the other hand, we can control the prevalence of pathogens by [spending money](#) on disease-control efforts. It is that prevalence that influences human health and well-being."

A paper describing the research appears online in *Proceedings of the Royal Society of London: B*, a leading peer-reviewed biology journal.

The study examined a host of factors thought to be involved in the global distribution of disease-carrying organisms. Climate and geographic variables, population data, disease-control data, pathogen data and human history data were all factored into statistical models that attempted to show which factors had stronger correlations to disease.

Geographic regions with lots of different kinds of birds and mammals are correlated with the presence of lots of pathogens. The most likely explanation for this relationship is simply that the same environmental factors have influenced patterns in diversity of human pathogens that have patterns in the diversity of the rest of life, including the birds and mammals. Reducing bird and mammal diversity will not remove the diseases, Dunn asserts. In fact, making wild birds and mammals more rare seems likely to increase the diversity of human diseases, with diseases on rare mammals and birds all too eager to jump from their sinking ships.

But all is not lost if you live in hotter and wetter climes with lots of birds and mammals around. Dunn points to life in the United States as one

example. Malaria is present but is rare and relatively insignificant because of the country's historic effort at controlling disease. In short, the United States has a large number of different kinds of pathogens, Dunn says, but pathogen prevalence is low because of a strong history of disease-control and health-care spending.

The researchers also suggest ways to optimize future spending. In particular, places where current spending is low and populations are large are likely to be places where the most people will be saved by additional efforts - notably India, Pakistan and East African nations along the equator. "Current health-care spending is quite low, prevalence of pathogens is quite high, and human populations are large in these areas, so it makes sense to target efforts there," Dunn says.

Provided by North Carolina State University

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