Temperature changes make it easier for malaria to climb the Ethiopian highlands

June 15 2017

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The highlands of Ethiopia are home to the majority of the country's

population, the cooler climate serving as a natural buffer against malaria transmission. New data now show that increasing temperatures over the past 35 years are eroding this buffer, allowing conditions more favourable for malaria to begin climbing into highland areas.

That is the conclusion of a new study by researchers from the University of Maine and the International Research Institute for Climate and Society at Columbia University in New York.

Malaria is a climate sensitive disease, and while the biology of malaria transmission is complex, sufficiently low air temperatures inhibit the development of the malaria parasites that cause the disease.

Dr. Bradfield Lyon, a research professor at the University of Maine and lead author on the study, indicates "Air temperatures below approximately 18°C and 15°C, respectively, effectively stop the development of the Plasmodium falciparum and P. vivax parasites responsible for the majority of malaria cases in Ethiopia." Low temperatures also impede the development rates and population density of the Anopheles mosquito, which transmits the disease.

"While locations of sufficiently high elevation have temperatures below these thresholds, our research examined how these "threshold elevations" have been changing with time across the highlands."

The study, published today in the journal *Environmental Research Letters*, utilized a newly developed national temperature dataset for Ethiopia, which combines hundreds of surface station observations with climate model output that incorporates satellite data and other information. The new dataset provides a detailed view of maximum and minimum temperatures across Ethiopia going back to 1981.

The study identified statistically significant increases in elevation for

both the 18°C and 15°C thresholds in highland areas between 1981 and 2014. "The elevation at which the temperature thresholds are met has risen by more than 100 meters since 1981. While a 100 meter increase may appear modest, we estimate that more than six million people currently live in areas with statistically significant increases in threshold temperature."

The researchers point out that exceeding the minimum temperature thresholds necessary for malaria transmission does not in itself point to an increase in the prevalence of malaria.

"While the dynamics of malaria transmission are complicated and control efforts may significantly limit the impact of these temperature changes, our study shows a clear softening of the climate barrier to transmission in the Ethiopian highlands, potentially putting more people at risk," said study co-author Dr. Madeleine Thomson, a senior research scientist at the International Research Institute for Climate and Society.

"Until quite recently, undertaking this type of study was not possible owing to a lack of quality controlled and sufficiently high spatial resolution climate data," said Lyon. "These new data allow us to examine the climate of the highlands in much more detail and confirm some of the anticipated changes of a warming Earth."

More information: Bradfield Lyon et al, Temperature suitability for malaria climbing the Ethiopian Highlands, *Environmental Research Letters* (2017). DOI: 10.1088/1748-9326/aa64e6

Provided by Institute of Physics