Malaria in the debate on climate change and mosquito-borne disease

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I am a specialist in the natural history and biology of mosquitoes, the epidemiology of the diseases they transmit, and strategies for their control. I worked for 22 years for the Centers for Disease Control and Prevention (CDC), including two years as a Research Scholar at Harvard. I am a member of the World Health Organization Expert Advisory Committee on Vector Biology and Control. I have directed many investigations of outbreaks of mosquito-borne disease, and of others such as Ebola Haemorrhagic Fever. I was a Lead Author of the U.S. National Assessment of the Potential Consequences of Climate Variability and Change. I am presently Professor of Medical Entomology at the Institut Pasteur in Paris, France.

In this brief presentation I restrict my comments to malaria, and emphasise four points:

1. Malaria is not an exclusively tropical disease
2. The transmission dynamics of the disease are complex; the interplay of climate, ecology, mosquito biology, mosquito behavior and many other factors defies simplistic analysis.
3. It is facile to attribute current resurgence of the disease to climate change, or to use models based on temperature to "predict" future prevalence.
4. Environmental activists use the 'big talk' of science to create a simple but false paradigm. Malaria specialists who protest this are generally ignored, or labelled as 'sceptics'.

In the early 1990s, malaria topped the list of dangerous impacts of global warming; the disease would move to temperate regions as temperatures increased. This prediction ignored the fact that malaria was once an important cause of morbidity and mortality throughout most of the US and Europe, even in a period that climatologists call the 'Little Ice Age'. In the US, as in western Europe, prevalence declined in the 19th century as a result of multiple changes in agriculture and lifestyle that affected the abundance of mosquitoes, their contact with people, and the availability of anti-malarial drugs. Nevertheless, the most catastrophic epidemic on record anywhere in the world occurred in the Soviet Union in the 1920s, with a peak incidence of 13 million cases per year, and 600,000 deaths. Transmission was high in many parts of Siberia, and there were 30,000 cases and 10,000 deaths in Archangel, close to the Arctic circle. The disease persisted in many parts of Europe until the advent of DDT. Clearly, temperature was not a limiting factor in its distribution or prevalence.

In the mid-1990s, activist emphasis changed to transmission in poorer countries, often referred to as those "least able to protect themselves", particularly in sub-Saharan Africa. Yet in most of the continent, temperatures are far above the minimum required for transmission, and most of sub-Saharan Africa, transmission is termed 'stable" because people are exposed to many infective bites, sometimes more than 300 per year, so annual

incidence is fairly constant. Mortality is highest in "newcomers"—young children and immigrants. Those that survive acquire a partial immunity that reduces the risk of fatal illness. In other regions, transmission is endemic but 'unstable' because annual transmission is variable; the potential for epidemics is great because immunity declines in periods of low transmission. Climatic factors, particularly rainfall, are sometimes—but by no means always—relevant.

In recent years, activist emphasis has shifted to "highland malaria", particularly in East Africa. Despite carefully researched articles by malaria specialists, there has been a flurry of articles by non-specialists who claim a recent increase in the altitude of malaria transmission attributable to warming, and quote models that "predict" further increase in the next 50 years. Tellingly, they rarely quote the specialists who challenge them. Nor do they mention that maximum altitudes for transmission in the period 1880-1945 were 500-1500m *higher* than in the areas that are quoted as examples. Moreover, highland above 2000m constitutes a mere 1.3% of the whole continent, an area about the size of Poland that is totally dwarfed by regions of stable and unstable transmission at lower altitudes.

A galling aspect of the debate is that this spurious 'science' is endorsed in the public forum by influential panels of "experts." I refer particularly to the Intergovernmental Panel on Climate Change (IPCC). Every five years, this UN-based organization publishes a 'consensus of the world's top scientists' on all aspects of climate change. Quite apart from the dubious process by which these scientists are selected, such consensus is the stuff of politics, not of science. Science proceeds by observation, hypothesis and experiment. The complexity of this process, and the uncertainties involved, are a major obstacle to meaningful understanding of scientific issues by non-scientists. In reality, a genuine concern for mankind and the environment demands the inquiry, accuracy and scepticism that are intrinsic to authentic science. A public that is unaware of this is vulnerable to abuse.

The current increase in malaria is alarming, but the principal factors involved are deforestation, new agricultural practices, population increase, urbanization, poverty, civil conflict, war, AIDS, resistance to anti-malarials, and resistance to insecticides, not climate. In my opinion, we should give priority to a creative and organized effort to stem the burgeoning tragedy of uncontrolled malaria, rather than worrying about the weather.

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