Malaria
A changed climate in Africa?

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The rise of malaria in Africa is a subject of much debate. A new analysis emphasizes the influence of rainfall, but there appear to be few areas where climate has been a major driver of this change.

After decades of decline, malaria has been on the rise in many parts of Africa — an estimate[1] by the World Health Organization is that, in some parts of the continent, malaria mortality in young children almost doubled from the 1980s to the 1990s. The disease causes some 3,000 deaths each day and imposes huge losses in economic productivity[2].

Is this resurgence a sign of increased transmission caused by climate change? Probably not, according to results presented by Small, Goetz and Hay[3]. Writing in the Proceedings of the National Academy of Sciences, they describe their analyses of trends in climate suitable for the regular transmission of malaria in Africa between 1911 and 1995. Their conclusion does not imply that future climate change will not affect transmission, but it does focus attention on other contemporary trends.

Several studies have projected that global climate change will increase future malaria transmission in Africa[4–6]. However, the link between contemporary changes in malaria and climate is hotly disputed. Alternative explanations such as an increase in parasite resistance to the front-line drugs since the 1960s, poverty and a decline in many African health services are cited as more likely causes[7–9]. Undoubtedly, a mix of such reasons is behind the rise in malaria. But identifying the prime factors will help greatly in planning control measures.

One problem dogging the interpretation of changes in local disease patterns in relation to climate is that meteorological recording stations are sparsely distributed in many parts of the continent, so that long-term records from the same locality are rare. As an alternative, researchers have used so-called ‘climate surfaces’ — maps interpolated from these sparse data. But these surfaces often provide only a coarse representation of climate, and their usefulness in relation to the scale of the malaria data has been open to question[10–12]. To eliminate this mismatch, Small et al.[3] used a malaria transmission index calculated directly from the interpolated climate data. Refreshingly, for an area of science beset by untestable models, they then produced an 85-year ‘hindcast’ against which observed trends in malaria could be compared. The malaria transmission index used by Small et al.was formulated in an earlier study to map zones of malaria transmission across Africa[13]. This index is based on the temperature and precipitation constraints within which the mosquito vector and malaria parasite can develop, and is pretty simple. It has nonetheless proved remarkably effective for estimating the distribution of stable malaria (as opposed to epidemics at unstable fringes) at coarse scales and is in operational use throughout the continent.

Using this index, Small et al. calculated the annual transmission suitability for each half-degree latitude–longitude grid cell (about 55 km X 55 km) across Africa from 1911 to 1995. Time-series analysis revealed that both positive and negative trends were restricted to a few limited zones, with only one (southern Mozambique) showing a consistent increase in climatic suitability for transmission. Obviously, a model at this spatial resolution will miss finer-scale patterns, for instance in climatically varied mountain areas, and will produce transmission suitability maps specific to the index used. Nonetheless, it might be expected that more widespread positive changes would have been found if climate has been a major driver of change in transmission in this period.

A notable finding, however, was that in those areas showing positive significant trends,precipitation,not temperature,drove most changes. Mathematical models of malaria transmission, often used to project events under changed climate conditions, are based mainly on temperature-dependent processes and incorporate precipitation only as a simple global threshold sufficient for mosquito breeding5. Clearly this needs to be improved, but we have very little empirical understanding of how rainfall,humidity and their interactions with temperature influence vector populations.Moreover,owing to natural variability, it is difficult to identify robust signals in precipitation patterns from climate models. This is particularly so in Africa[14] — a landmass that is strongly influenced by El Niño, the episodic disruption of the ocean–atmosphere system in the tropical Pacific which has a large-scale influence on weather and climate.

As far as climate change is concerned, then, the main message from Small et al.[3] is that malaria transmission needs to be understood in terms of precipitation as well as temperature. No doubt climate models will continue to improve and we can look forward to refinement in the projection of these parameters. Regrettably, however, knowledge of the basic ecology of malaria transmission lags behind — for instance, we cannot yet relate absolute mosquito abundance to climate[6].The urgent need is for progress on the entomological front to guide future modelling work on transmission. ■

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