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Malaria control in Africa: progress but still much to do

During the past two decades, the international community has invested heavily in malaria control, especially in sub-Saharan Africa, with support increasing from around US$100 million in 2000 to nearly $2 billion in 2013.[1] How effective has this investment been? Measurement of the effect of enhanced efforts to control malaria has proved challenging. The main approaches used—measurement of changes in deaths from malaria or clinical episodes of the infection—each have major methodological challenges.[2] Estimates of the number of deaths due to malaria rely to a large extent on verbal autopsy, an imprecise method. Many infections can cause illness resembling malaria; thus, estimates of numbers of cases of malaria can be unreliable unless supported by laboratory diagnoses. Strenuous efforts are being made to improve these approaches; for example, ensuring that all reported clinical cases have been confirmed by a diagnostic test. However, continuing imprecision is shown by the major differences in the number of deaths attributed to malaria in 2010 by WHO and the Institute of Health Metrics: 655 000 and 1 238 000, respectively.[3,4]

An alternative is measurement of changes in the prevalence of malaria infection detected by microscopy or by a rapid diagnostic test. This approach could be more precise because these methods are more specific than verbal autopsy or clinical diagnosis of malaria. This approach was adopted by Abdisalan Noor and colleagues[5] in an important new study in *The Lancet*. The association between prevalence of malaria infection and incidence of clinical malaria or malaria mortality is not linear,[6] so a reduction in parasite prevalence cannot be assumed to be associated with a reduction in the number of deaths from malaria or cases of severe malaria. However, measurement of changes in parasite prevalence can provide a valuable way of assessing changes in the incidence of malaria infection over time.

Noor and colleagues collected data from 26 746 malaria parasite prevalence surveys covering 3 575 418 person-observations done across Africa since 1980—a remarkable achievement. These data, together with spatially matched covariates, were used in a Bayesian hierarchical space–time model to derive estimates of the proportion of the population aged 2–10 years with different levels of malaria parasitaemia ($PfPR_{2-10}$) across Africa in 2000 and 2010. The results presented are both encouraging and sobering.

The encouraging news is that there has been a substantial reduction in the prevalence of malaria infection in children across most of sub-Saharan Africa in the decade 2000–10. Comparison of the $PfPR_{2-10}$ in 2010 with that in 2000 shows a fall in parasite prevalence in 40 of 44 countries in sub-Saharan Africa (Malawi, surprisingly, showed a slight increase), but that the extent of this fall varied greatly across the continent, with it being only modest in most highly

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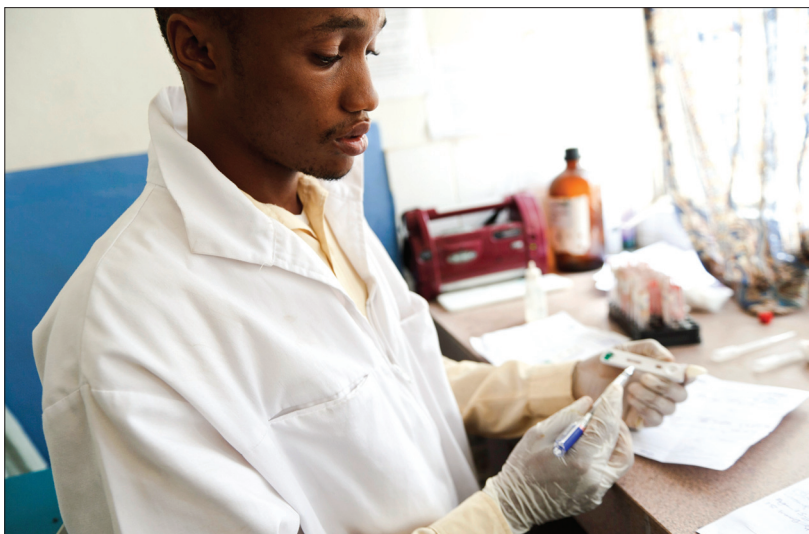
endemic countries. Although the number of people living in areas of hyperendemic or holoendemic malaria ($PfPR_{2-10}$ >50%) has fallen during the decade from 218·6 million to 183·5 million (a 16% drop), the population living in areas of mesoendemic malaria ($PfPR_{2-10}$ >10% to 50%) increased from 178·6 million to 280·1 million (a 57% increase). The population living in areas with a $PfPR_{2-10}$ less than 1% or with unstable malaria increased from 78·2 million to 128·2 million (a 64% increase) and four countries (Cape Verde, Eritrea, South Africa, and Ethiopia) have joined Swaziland, Djibouti, and Mayotte in the group with a $PfPR_{2-10}$ less than 1% or unstable malaria, making elimination a feasible near-term goal in these countries. The reasons for this decline are not the focus of Noor and colleagues' study, but they probably include socioeconomic changes,[7] urbanisation,[8] and the effect of direct malaria control measures. By contrast with this positive news, in 2010, 57% of the population of Africa still lived in areas where the $PfPR_{2-10}$ was 10% or higher,[5] an absence of progress that is shown in the 2000 and 2010 endemicity maps presented in the manuscript.

The valuable analysis undertaken by Noor and colleagues[5] has only been possible because of the work of many others in undertaking classical malaria prevalence surveys. If malaria prevalence is to be used as a key method to measure the effect of control measures, such surveys must be continued, preferably with a standardised methodology and, in low transmission areas, with the inclusion of molecular diagnostic techniques that can detect the many infections that would otherwise be missed.[9]

During the past few years, there has been an increasing focus on malaria elimination,[10] which is commendable because the ultimate goal of all malaria control programmes must be interruption of malaria transmission. However, Noor and colleagues[5] have shown that, during the past decade, the reductions in malaria transmission that have been achieved in much of sub-Saharan Africa, although encouraging, have been only modest. Also, these gains are threatened by emerging resistance to the pyrethroid group of insecticides[11] and by the potential appearance of artemisinin-resistant malaria parasites in Africa. More could be done to improve malaria control in high-risk countries by increasing coverage with proven interventions such as insecticide-treated nets and chemoprevention.[12] However, a focus on elimination must not result in a reduction in support for development of new methods (drugs, insecticides, vaccines, and new approaches to vector control), and improved delivery methods, which will be needed in large areas of sub-Saharan Africa before malaria transmission can be reduced to the level at which elimination becomes a credible prospect.

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