Editorials

The challenges of doing more against malaria, particularly in Africa

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The malaria theme section of this issue of the *Bulletin* covers a wide range of topics, from combination therapy (pp. 1378–1388) and insecticide-impregnated mosquito nets (pp. 1389–1400) to the possible use of genetically modified *Anopheles* for vector replacement (pp. 1412–1423), from the use of geographical information systems in the planning, execution and monitoring of interventions (1401–1411; 1438–1444) to the potential role of post-genomics in the development of new antimalarial drugs (1424–1437).

Interestingly, previous issues of the *Bulletin* dedicated to the same subject (e.g. Vol.11, No. 4–5, 1954) were comparatively uniform in content, reflecting the WHO emphasis of the time on malaria eradication by indoor spraying. The wider current view reflects the maturing of malariology as a multidisciplinary science with input from genetics and molecular biology and other cutting-edge disciplines. It also reflects the flexibility of the Roll Back Malaria (RBM) policy, which advocates an open strategy of critical evaluation and malaria control programmes geared to diverse and changing local situations.

The emphasis of this issue of the *Bulletin* (and of this editorial) is on controlling malaria mortality, for which Africa bears the bulk of the world's burden. The evolving biodiversity of the continent includes man, his most pathogenic malaria parasite, *Plasmodium falciparum*, and its most anthropophilic mosquito vector, *Anopheles gambiae*. The breeding of this mosquito is favoured by man-made ecological changes ranging from Neolithic agriculture to current practices of deforestation and irrigation. The outcome is an exceptionally close human–vector association which produces mean parasite inoculation rates exceeding 100 infective bites per year per person in most rural villages of sub-Saharan Africa, whereas less than one infective bite per person is recorded in most residual endemic areas of South-East Asia and South America. The eradication of this extremely stable African population of *P. falciparum* is unattainable in the absence of new tools. This being so, the strengthening of disease control is the only realistic short-term strategy. Despite increasing drug resistance, malaria is still a curable disease, and the commitment to fight it, clearly expressed by African political leaders in the recent Abuja summit, should make it possible to mobilize financial and human resources for drug supply and distribution all the way to the smallest and poorest malaria-endemic rural communities. Guidance for this multisectoral effort is provided by specific operational research such as analysis of the logistic, cultural and economic causes for delayed treatment, which is still a major factor of malaria mortality. Research should also be done to make accurate estimates of the burden of disease imposed by malaria, and to determine the impact of host and parasite genotypes (*1*) and associated pathologies (*2*) on malaria disease severity.

On the other hand, combating the disease must be distinguished from combating the infection and this latter activity should be seen within a long-term strategy aiming at the interruption of trasmission even where *P. falciparum* reaches its highest stability. In these holoendemic and hyperendemic areas, particularly in West African Guinea and the Sudan savanna belts, indoor residual spraying or impregnated mosquito nets are not enough. If successfully applied, they may bring about a temporary reduction in vector capacity but they will not lower it below its critical level. Thus, the possibility of achieving a cost-effective, sustainable equilibrium that is more favourable to the human host is a matter for careful evaluation. It must take fully into account the risk that reduced inoculation rates may result in unstable malaria conditions that may worsen the clinical picture and outcome of the disease. Vector control measures, which are the rule in tropical Asia and South America, are limited in Africa to areas selected according to epidemiological data, historical records and available resources. The focus should be on hypoendemic, or epidemic-prone zones of the continent (such as high altitude areas), where local vector populations of *An. gambiae* and *An. funestus* are so dependent on indoor resting that indoor spraying of residual insecticides has proved crucial for their reduction or even eradication.

Research on new antimalarials could concentrate on vaccines and new drugs. A multi-stage vaccine plus a monodose antimalarial treatment with gametocytocidal effect in addition to the already available impregnated mosquito nets could turn the dream of eradicating *P. falciparum* malaria in sub-Saharan Africa into a reality. Further anti-vector measures could be integrated, among which a full-night-lasting repellent would certainly be worth while. But, since the integration of these tools could prove difficult or insufficient, a more diversified research programme might be needed. Research on biting and oviposition behaviour in view of trapping systems, as well as genetic manipulation of the vector in view of replacement programmes, could lead the way to highly innovative and effective vector control tools.

Finally, it must never be forgotten that social and economic instability has helped to perpetuate the burden of malaria. Where conditions are stable, the prospects for disease control are greatly improved. ■

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2. **Berkley J et al.** Bacteraemia complicating severe malaria in children. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1999, **93**: 283–286.

