

Discussion Brief: The Future of Malaria Vector Control and Insecticides

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Anti-vector interventions are proven strategies in preventing transmission of malaria. As such, these efforts remain integral in the global fight against malaria which has, by most counts, made slow but steady progress. But the distribution of insecticide-resistant mosquitoes — recently reported in Nature ([Malaria surge feared, 15 May 2012](#), and [Mosquitoes score in chemical war, 5 July 2011](#)) — puts said gains in jeopardy. In various countries, resistance to DDT, pyrethroid, as well as carbamates and organophosphates, has been discovered and is now threatening the sustainability of vector control programmes. For many working to reduce the burden malaria through vector control, this is not news. Many vector control specialists would like to see more comprehensive, and carefully planned, anti-vector strategies.

Key Points

- Any anti-vector intervention based solely on biocides is by nature, temporary. In most cases the duration of efficacy is inversely proportional to the intensity and coverage. Ironically, the more successfully an insecticide-based intervention is distributed and complied with, the shorter its useful lifespan.
- Switching to another class of insecticide (e.g. pyrethroids to carbamates) will bypass class-specific resistance mechanisms, as long as resistance to the new class is absent.
- Insecticide resistance is an indicator of the pressure exerted on the vector population and should be a warning shot across the bow of malaria control programs. Anti-malaria programs need to shift from the single-minded approach of focusing on ITNs with sporadic IRS with essentially the same insecticides to a more generic mosquito control program that addresses all mosquitoes and their developmental stages.
- The presence of any one mechanism of resistance does not necessarily render an insecticide useless. A compromised insecticide can remain partially efficacious and operationally useful for some time. Increasing application rates or switching to less compromised members of an insecticide family can temporarily compensate for loss of efficacy.
- Once resistance emerges, if insecticidal pressure is maintained or increased, selection will proceed and resistance will inevitably worsen. Only when resistance harms the reproductive competitiveness (fitness) of unexposed vectors does resistance ever fade in the absence of insecticidal pressure.
- ITNs remain useful, even in places where outdoor-feeding is highly prevalent, but not exclusive. They should not be relied upon as the sole means of intervention against vectors, as they adapt to become resistant to insecticides.
- More sustainable solutions that complement insecticides without exacerbating resistance are urgently needed. We need to deploy existing technologies that are culturally appropriate and responsive to the diverse ecology and behavior of local vectors. Such measures include but are not limited to: 1) Housing modification, 2) Habitat modification, 3) Personal protective clothing/repellents.
- Increased entomological capacity is crucial in developing our understanding of the diverse ecological and biological challenges vector control operations face.
- For any vector control program to be successful, the involvement of the community is critical. Programs need to consider the level of education in a community when mapping out strategies of vector control. This determines how receptive communities will be to these strategies.

Key References

- [Hoy MA, 1998. Myths, models and mitigation of resistance to pesticides. Philos Trans R Soc Lond B Biol Sci. 353:1787-1795 \(PDF\)](#)
- [Jones CM, Liyanapathirana M, Agossa FR, Weetman D, Ranson H, Donnelly MJ, Wilding CS, 2012. Footprints of positive selection associated with a mutation \(N1575Y\) in the voltage-gated sodium channel of Anopheles gambiae. Proc Natl Acad Sci U S A. 109: 6614-6619 \(Full text Open Access\)](#)
- [Ranson H, N'guessan R, Lines J, Moiroux N, Nkuni Z, Corbel V, 2011. Pyrethroid resistance in African anopheline mosquitoes: what are the implications for malaria control? Trends Parasitol. 27:91-98. \(PDF\)](#)
- [Spielman A, Kitron U, Pollack RJ, 1993. Time limitation and the role of research in the worldwide attempt to eradicate malaria. J Med Entomol. 30: 6-19 \(PDF\)](#)

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Please consider replying to this discussion with the following information

- Please share your questions, strategy, and interventions for involving the community in malaria vector control
- Do you use or plan on using environmental control measures other than insecticides? If yes, please share.