Eritrea: evaluating the additive effects of indoor residual spraying (IRS) in a low-transmission setting looking to eliminate malaria

Background
Despite significant progress in malaria control on a global scale, Sub-Saharan Africa still bears the brunt of the disease, with over 90% of clinical cases occurring in this region. Against this backdrop, Eritrea has long been considered a success story. The country has made considerable progress in reducing malaria prevalence through a combination of case management, larval habitat management (LHM), wide-scale distribution of free insecticide-treated nets (ITNs), and indoor residual spraying (IRS) in high-prevalence areas. And yet, elimination appears ever an elusive goal, and malaria remains the leading cause of death in children under five. Given these facts, it is vital to enhance existing malaria control programs in order to move towards effective elimination.

Impact evaluation
Abundant evidence exists to support individual malaria prevention methods, such as IRS or LHM. When it comes to establishing how effective these interventions are when combined, however, data is scarce. This is despite the fact that combining prevention strategies has long been advocated as the way forward in eliminating malaria. The aim of the impact evaluation in Eritrea is to help bridge this information gap.

As countries scale up prevention efforts to eliminate malaria, there is renewed interest in IRS techniques. The study is thus designed to estimate the benefits of introducing IRS over and above the existing intervention package (ITNs, LHM and case management) in Gash Barka, Eritrea. Gash Barka, with near universal ITN coverage under the National Malaria Control Program (NMCP) and relatively low infection rates, still records higher malaria transmission compared to other malarious areas of the country.

A two-arm cluster-randomized community-controlled trial was performed in the area to establish the additive effects of IRS. A total of 115 villages were randomly assigned to either treatment or control groups (57 treatment and 58 control villages), with a minimum five-kilometer distance separating treatment and control villages to avoid contamination. Both groups were already benefiting from standard malaria prevention activities in the region. Between June and July of 2009 households in the treatment group were additionally sprayed with DDT in accordance with relevant WHO guidelines. Data was collected during the period October 6–15, 2009, which corresponds to the peak of the malaria transmission season. A questionnaire was administered to one resident adult in a sample of 1,617 randomly selected households in both treatment and control groups (a total of 7,895 individuals surveyed). Additionally, blood samples were taken from all present household members who gave their informed consent.

Results
The prevalence of malaria parasite infection in the study area was as low as 0.5% at the end of the peak transmission season in 2009, and the study had no power to detect any differences in prevalence rates between treatment and control villages or between males and females. A marginally significant positive relationship – consistent over all
models – was, however, detected between age and infection; children under the age of 15 were over twice more likely to be infected compared to those 15 and older.

The observed low malaria prevalence in the sample can be attributed to a number of factors. Most importantly, mosquito vectors may have been already suppressed as a result of ongoing malaria control activities. In other words, it can be assumed that the control group may have benefitted from an overall suppression of transmission in this area due to near universal ITN coverage and comprehensive control schemes in the past. Additionally, since the IRS intervention achieved household coverage above 85%, protection may have been unintentionally conferred on the control group despite the five-kilometer geographical buffer. Thus, comprehensive prevention efforts undertaken in Gash Barka in addition to IRS, combined with a limited sample size, may render any additive effects of this method difficult to detect.

Policy recommendations

Eritrea has engaged in a long-term and comprehensive malaria control program. Thanks to near universal ITN coverage, continued efforts to manage larval habitats, provision of access to prompt and effective treatment, and applying IRS in response to epidemic spells, the country may now be poised for elimination.

The results of the impact evaluation show that even in this highly conducive environment, age remains an important risk factor. Given that the prevalence of malaria parasitaemia in the study area was twice as high among younger individuals, despite overall low infection rates in the general population, children and young adults may be a good target for further interventions to reduce parasite infection as Eritrea moves towards malaria elimination.

Sources:
Keating, Joseph; Locatelli, Andrea; Gebremichael, Andemariam; Gebremeskel, Tewolde; Mufunda, Jacob; Mihreteab, Selam; Berhane, Daniel; Carneiro, Pedro. 2011. “An evaluation of an indoor residual spray campaign for reducing malaria infection prevalence in an intervention suppressed low-transmission setting in Eritrea: results from a household survey.” Acta Tropica 119: 107-113.


IRS v. ITNs – decision-making with imperfect information

It is believed that public health investments are effective to the extent that they crowd out private health initiatives. IRS has frequently been discussed in this context with regard to the negative implications it may have for individual bed net use.

Interestingly enough, no such effect was observed within the treatment group in the Eritrea IRS impact evaluation. If anything, individuals were more likely to own and use ITNs, most probably due to the fact that the spraying campaign made the disease more salient within the community.

Neither did the IRS intervention have any adverse impact on other individual preventive efforts. Quite to the contrary, for example, individuals in the treatment group were found to be more likely to keep livestock further away from their dwellings.

These insights may corroborate the hypothesis that, with imperfect information, the implications of the standard ‘crowd-out’ model are reversed. Public health interventions in this case need not necessarily crowd out private health initiatives, but actually reinforce them, as awareness of the problem increases. This finding carries powerful implications for malaria elimination, as it has long been acknowledged that combinations of individual interventions are most effective in achieving this objective.