

malaria vector, First, KBR and PM+KBR impregnated battle-dress allowed better protection against *Ae. aegypti* bites than permethrin impregnated battle-dress. Secondly, results showed evidence of synergism between repellents (DEET or KBR) and pyrimiphos-methyl (PM) on nets in field conditions. PM+DEET and PM+KBR treated nets were as effective as a standard pyrethroid (deltamethrin 25mg/m<sup>2</sup>) against susceptible *An. gambiae* populations and more effective against resistant *An. gambiae* populations. Results also demonstrated that mixtures did select neither *Kdr* allele nor *AcE1<sup>R</sup>* allele. In conclusion, these field trials showed that mixing repellents and organophosphates has the potential to be a good alternative strategy to manage the spread of resistance. However, significant improvements remain to be done to improve residual effect of Insecticide-Repellent Treated fabrics.

## 1218

### DEVELOPMENT OF A NOVEL FORMULATION FOR USE IN INDOOR RESIDUAL SPRAY PROGRAMS

John R. Lucas<sup>1</sup>, Takaaki Itoh<sup>2</sup>, Yoshinori Shono<sup>2</sup>, Luc Djogbénou<sup>3</sup>, Jean-Marc Hougard<sup>3</sup>

<sup>1</sup>Sumitomo Chemical Co. (UK) Plc, London, United Kingdom, <sup>2</sup>Sumitomo Chemical Co., Ltd., Environmental Health Division, Tokyo, Japan, <sup>3</sup>Centre de Recherches Entomologiques de Cotonou (CREC), Cotonou, Benin

Fenitrothion wettable powder (WP) is recommended by the World Health Organization (WHO) for Indoor Residual Spraying (IRS) against malaria vectors. However, with the increase in the use of Long Lasting Insecticidal Nets (LLINs) as a low cost and highly effective intervention, IRS has more recently been used in many parts of Africa as a secondary treatment option, or for use in epidemic zones. In some instances, particularly in highly malarious areas, the use of LLINs and IRS together can give very dramatic reductions in incidence. With the focus now turning towards the elimination or eradication rather than control of malaria, the combination of several vector control interventions combined with the administration of effective anti-malarial drugs will become the norm as countries step up their efforts to eliminate this parasite. There is an increasing concern over the development of resistance to pyrethroids, possibly affecting LLIN performance, which are currently all dependent on this insecticide class. To minimize selection pressure the use of pyrethroid-based IRS products is not recommended with LLIN applications. Alternatives to the widespread use of pyrethroid and DDT-based IRS products are clearly needed (*kdr* resistant insects share a common resistance mechanism to DDT and pyrethroids). To meet this need, a novel Sumithion® IRS formulation is being developed. Laboratory trials to evaluate residual efficacy on a range of representative substrate types against *Anopheles* mosquitoes have been conducted. This data, along with interim results of Phase II hut studies being conducted in Benin are presented.

## 1219

### HUMAN ANTIBODY RESPONSE TO ANOPHELES GAMBIAE SALIVA: A NEW IMMUNO-EPIDEMIOLOGICAL MARKER TO EVALUATE THE EFFECTIVENESS OF INSECTICIDES TREATED NETS (ITNS)?

Papa Makhtar Drame<sup>1</sup>, Anne Poinsignon<sup>2</sup>, Patrick Besnard<sup>3</sup>, Sylvie Cornélie<sup>2</sup>, Vincent Foumane<sup>4</sup>, Cheikh Saya Sow<sup>1</sup>, Jacques Le Mire<sup>5</sup>, Filomena Fortes<sup>6</sup>, Denis Boulanger<sup>2</sup>, Pierre Carnevale<sup>2</sup>, Francois Simondon<sup>2</sup>, Franck Remoue<sup>1</sup>

<sup>1</sup>Institut de Recherche pour le Développement, Dakar, Senegal, <sup>2</sup>Institut de Recherche pour le Développement, Montpellier, France, <sup>3</sup>Service Médical Sonamet, Lobito, Angola, <sup>4</sup>Organisation de Coordination pour la lutte contre les Endémies en Afrique Centrale (OCEAC), Yaoundé, Cameroon, <sup>5</sup>Service Médical Clinique Sonamet, Lobito, Angola, <sup>6</sup>Malaria Control Program, Luanda, Angola

In a way to improve malaria control, many efforts are conducted under WHO recommendations to develop new tool/indicator for malaria control, such as for evaluating the anti-vector strategies. Previous studies

have shown that the evaluation of human antibody (Ab) response to arthropod salivary proteins represent an epidemiological indicator of exposure to vector bites, and especially our team demonstrated that IgG response to whole saliva of *Anopheles gambiae* in exposed individuals represent a marker of the intensity of *Anopheles* exposure. The objective of the present study was to validate whether this immunological marker based on human anti-saliva IgG Ab levels could be one new indicator to evaluate the effectiveness of ITNs use in malaria control programs. One longitudinal study, concerning individuals (n=108, children and adults) living in malaria endemic area in Angola, was performed from March 2005 to October 2006. The studied cohort was followed for parasitological, clinical, entomological and immunological data, each 6 weeks before and after the well-controlled use of Permanet® mosquito nets (Long Lasting Insecticide Net; installation in Feb. 2006). Seasonal variations of anti-saliva IgG Ab levels to *An. gambiae* saliva were observed before and after the installation of ITNs which appeared to be associated with the exposure to *An. gambiae* (evaluated by the classical entomological methods) and the prevalence/intensity of malaria infection. Moreover, a significant decrease of the anti-saliva IgG response was observed after the ITNs use which was correlated with the decrease of malaria parasitemia, the current and referent criteria showing the effectiveness of these ITNs. In a way to identify new tools for malaria control, we have shown that anti-saliva IgG response in exposed individuals could be not only an immuno-epidemiological marker of exposure to *An. gambiae* bites, but also a potential indicator for evaluating the ITNs effectiveness. Several future studies are needed to confirm this hypothesis in other transmission areas and to identify some immunogenic salivary proteins as higher specific markers. Nevertheless, this study represents a first approach to elaborate such new indicators for evaluating the effectiveness of anti-vector strategies, bases on the evaluation of human Ab response to salivary proteins of arthropod vectors.

## 1220

### EFFICACY OF INSECTICIDE TREATED MATERIALS (ITMS) FOR DENGUE CONTROL IN LATIN AMERICA AND ASIA: CLUSTER RANDOMIZED CONTROLLED TRIALS IN VENEZUELA AND THAILAND

Audrey Lenhart<sup>1</sup>, Elci Villegas<sup>2</sup>, Carmen Elena Castillo<sup>2</sup>, Yuwadee Trongtokit<sup>3</sup>, Chamnarn Apiwathnasorn<sup>3</sup>, Neal Alexander<sup>4</sup>, Philip J. McCall<sup>1</sup>

<sup>1</sup>Liverpool School of Tropical Medicine, Liverpool, United Kingdom, <sup>2</sup>Universidad de los Andes, Trujillo, Venezuela, <sup>3</sup>Mahidol University, Bangkok, Thailand, <sup>4</sup>London School of Hygiene and Tropical Medicine, London, United Kingdom

Dengue fever is the fastest spreading arboviral disease worldwide. In the absence of a vaccine, *Aedes aegypti* vector control remains the most effective strategy to prevent dengue transmission. Our initial studies in Latin America indicated that insecticide treated materials (ITMs) can impact on dengue vector populations and potentially on dengue virus transmission. Cluster randomized trials are underway in Venezuela (6000 households in 75 clusters) and Thailand (2000 households in 26 clusters) to further clarify the efficacy of ITMs in suppressing dengue vector populations. These trials incorporate several advances on the earlier studies: first, different types of ITMs are being tested alone and in combination and householders may choose the manner of deployment; secondly, spill-over effects of the interventions into neighboring control areas are monitored by including external control sites; thirdly, efficacy of ITMs for dengue vector control is measured on a large scale for the first time in SE Asia. Both study sites had high entomological indices at baseline (Venezuela average pupae per person index = 0.52, average Breteau index = 15.3; Thailand average pupae per person index = 0.22, average Breteau index = 22.4), and the ITM interventions were adopted and maintained by the population in both sites to a similar extent, although their manner of deployment varied (Venezuela: window curtains and jar covers; Thailand: indoor and window curtains). Although the trials are set to complete in early 2009, preliminary data and analyses will be presented and important

Lucas J.R., Itoh T., Shono Y., Djogbénou Luc, Hougard Jean-Marc (2008)

Development of a novel formulation for use in indoor residual spary programs

In : 57th American Society of Tropical Medicine and Hygiene annual meeting. American Journal of Tropical Medicine and Hygiene, 79 (6), 358-art. 1218

ASTMH Annual Meeting, 57., La Nouvelle-Orléans (USA), 2008/12/07-11