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Initial Assessment of the Acceptability of a Push-Pull *Aedes aegypti* Control Strategy in Iquitos, Peru and Kanchanaburi, Thailand

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Abstract. As part of a larger research program evaluating chemical threshold levels for a Push-Pull intervention to reduce man-vector (*Aedes aegypti*) contact, this qualitative study explored local perceptions and strategies associated with mosquito control within dengue-endemic communities in Peru and Thailand. Focus groups were used to provide preliminary information that would identify possible public acceptance issues to the Push-Pull strategy in each site. Nine focus group discussions (total of 102 individuals) conducted between September 2008 and March 2009 examined several themes: 1) current mosquito control practices; 2) perceptions of spatial repellency and contact irritancy versus killing mosquitoes; and 3) initial perceptions toward mosquito host-seeking traps. Results indicate participants use household-level strategies for insect control that reveal familiarity with the concept of spatial repellent and contact irritant actions of chemicals and that placing traps in the peridomestic environment to remove repelled mosquitoes was acceptable. Preliminary evidence suggests a Push-Pull strategy should be well accepted in these locations. These results will be beneficial for developing future large scale push-pull interventions and are currently being used to guide insecticide application strategies in (entomological) proof-of-concept studies using experimental huts.

INTRODUCTION

Dengue viruses cause more human morbidity and mortality worldwide than any other arthropod-borne virus, and represent the most rapidly advancing vector-borne disease in the world.[1–3] Infections produce a spectrum of clinical illness ranging from a nonspecific viral syndrome to severe and fatal hemorrhagic disease. Annually, there are an estimated 50–100 million cases of dengue fever (DF) worldwide, up to 500,000 cases of dengue hemorrhagic fever (DHF), and over 24,000 deaths (mainly among children) attributed to dengue viruses.[1,4]

The four different dengue serotypes are maintained in a cycle that involves humans and *Aedes* mosquitoes (principally *Aedes aegypti*). The most common strategies for dengue vector control worldwide focus on reducing vector populations through larviciding and/or container removal. However, the needs to seek out, identify, and treat or remove all larval development sites make the implementation of these strategies challenging. Indoor residual or space spray techniques, such as thermal fogging and ultra-low volume (ULV) spraying, are also used for controlling adult *Ae. aegypti*.[5–7] These measures are implemented at the time or shortly after an epidemic has been identified to serve as emergency control but, although these may have a dramatic effect in reducing the numbers of reported dengue cases for a transient time following application, are not used for disease prevention.[8] In addition to the logistical complexities local vector control authorities have in implementing these strategies (i.e., financial and labor constraints, infrastructure limitations, and public willingness to allow access to enter homes), insecticide resistance within the vector population can warrant a once effective killing agent ineffective thereby decreasing the available chemical tools recommended for vector control. However, evidence exists that resistant populations exhibit repellent and irritant behavioral responses to insecticides independent of their toxic effects.[9] Combined, these indications warrant the evaluation and development of novel vector control strategies. These new approaches should ideally include the integration of currently available insecticides, based on other chemical actions they possess, into appealing consumer-based products for increased cost-benefit. This includes the use of insecticide-treated materials that can be applied at the household level.[2,10,11]

This study represents one component of a larger proof-of-principle research program designed to evaluate the effectiveness of reducing indoor densities of *Ae. aegypti* using minimal treatment coverage and dose of spatial repellents and contact irritant chemicals currently recommended for vector control—specifically, chemical tools registered for public health either through indoor residual spray (IRS) or insecticide-treated bed net (ITN) interventions, such as alphacypermethrin, deltamethrin, lambda-cyhalothrin, permethrin, and DDT (reference compound).[12,13] These chemicals are being evaluated at doses and coverage levels that exploit spatial repellent (SR) and contact irritant (CI) actions with minimal toxicity to reduce insecticide resistance selection pressure—such an approach deviates from current adult control strategies, which focus on a direct chemical kill. Applied at the house level, an SR action will prevent mosquitoes from entering a home, and a CI will promote mosquito escape from indoors. Both behaviors will reduce indoor *Ae. aegypti,* reducing human-vector contact, and thereby potentially prevent dengue transmission. As this approach will allow the adult mosquito to move freely within the outdoor environment, we are exploring the use of an outdoor trap to augment an SR or CI strategy by subsequently removing repelled/irritated vectors from the peridomestic environment (i.e., the development of a "Push-Pull" system). We have chosen to evaluate the BG-Sentinel trap (BGS; Biogents AG, Regensburg, Germany), as the "Pull" component, because of previously reported efficacy in capturing *Ae. aegypti* under

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