Entomological Surveillance and Vector Control

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- Arboviruses are among the most important vector-borne pathogens in the 21st century
- *Aedes*-transmitted viral diseases (ATVD) like chikungunya, dengue, Zika, and yellow fever are growing global threats
- Vector control has been a primary method for preventing ATVD for over 100 yrs
- Control concept is straightforward: Reduce mosquito populations and/or their contact with humans to reduce or prevent disease
- It can be highly effective when comprehensively applied and sustained
- Although impressive progress is being made developing vaccines for chikungunya and other ATVD, vector control is the primary or only intervention currently available
**Aedes Surveillance**

- Effective vector surveillance requires community engagement, social mobilization, and intersectoral integrated actions.

- Coordinated mapping of entomological, epidemiological, and environmental data facilitates planning, implementation, monitoring, and evaluation of vector control activities.

- Entomological surveillance should emphasize routine monitoring of adult female *Aedes* indices; i.e., the life stage that is most directly linked to virus transmission risk.

- Immature mosquito indices can be useful for assessing the entomological impact of an intervention. There is, however, limited and inconsistent evidence associating immature *Aedes* indices to risk of human infection and/or disease.

- Insecticide resistance needs to be routinely monitored, mapped, and managed.
Features of Effective Vector Control Programs

- Programs apply integrated combinations of interventions that are most appropriate to the local situation. There is no single intervention that is most effective across all ecological and epidemiological contexts.
- Programs should simultaneously target immature and adult vectors with multiple interventions.
- Outbreak prevention and interruption requires comprehensive intervention delivery with high coverage that is sustainable. Sustainability requires community involvement and programmatic continuity.
- Effective programs measure, analyze, and integrate entomological and epidemiological data.
- Successful implementation and sustainability of disease prevention programs requires local and national government support and intersectoral collaboration. Ultimately, for long-term sustainability, disease prevention will require a coordinated regional approach.
- Improvement to the built environment (e.g., house designs that exclude mosquitoes, provision of reliable piped water, solid waste removal, and sealed water storage containers) has broad, sustainable benefits for prevention of *Aedes*-transmitted viral diseases and public health, in general.
Current ATVD Vector Control

• Use locally adapted and derived vector control to fight ATVD. A single tool or strategy is not likely to be successful everywhere.

• Know your vector and its local ecology. Interventions targeting *Ae. aegypti* should focus on indoor areas using residual insecticides.

• Know the insecticide susceptibility of the local vector population.

• Most space sprays (both aerial and ground) are relatively ineffective in controlling ATVD, unless they are repeatedly delivered inside homes.

• Targeted indoor residual spray (TIRS) shows promise for reducing ATVD.

• Novel delivery methods have been developed using residual killing agents; e.g., insecticide treated window screens, curtains, and lethal ovitraps show promise.

• Adulticiding should not be done in isolation. It should be part of an integrated vector management plan, in partnership with a larval control program.
Innovation for Aedes-Borne Viral Disease Prevention

• **Future ATVD control programs will benefit from a combination of tools and strategies.** For example, vector interventions (insecticide and non-insecticide) in combination with vaccines. Although the theoretical benefits of combined approaches are appealing, the details for exactly how this should be done in location-specific contexts remains to be determined.

• **New products**
  - Microbial control (*Wolbachia*) of human pathogens in adult vectors
  - Spatial repellents
  - Targeted indoor residual spray (TIRS)

- Mosquito nets treated with chemicals either as single products or combinations
- Vector traps for disease management (ovitraps and auto-dissemination)
- Sterile insect technique (SIT) combined with microbial infection