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