

Aedes aegypti control in the Americas: what has worked and not

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Aedes aegypti was eliminated from most of the Americas

1. Elimination of water-holding containers or source reduction
2. Application of the residual insecticide DDT into and around water-holding containers and nearby surface areas
3. These measures were implemented in a vertically-structured vector control operation.

Why did it work?

1. DDT killed both larvae and adult *Ae. aegypti* for months at and around containers
2. In places like Puerto Rico where *Ae. aegypti* was resistant to DDT, it could not be eliminated
 - Malathion, a non residual insecticide, was used instead of DDT
 - Even with repeated applications at shorter intervals, it did not work as well

Comparative time scales

Eggs	—————	Several months
Starved larvae	—————	3 Weeks
Adults	—————	3 Weeks
ULV	—————	Days
Most larvicides	—————	1 Month
DDT	—————	Several months

Current limitations

1. Fast turnover of eliminated containers
2. Many prevalent containers cannot be eliminated (water-storage containers)
3. Larvicides do NOT have long lasting impact
4. Adulticides are usually sprayed outdoors
5. No tools available or applied to kill *Ae. aegypti* adults inside houses (e.g., residual indoor spraying)



Unrealized limitations

1. Cryptic aquatic habitats (e.g., septic tanks, roof gutters, storm drains, etc.)
2. Insufficient deliverance (control measures do not reach the mosquitoes)
 1. Immature control
 2. Spatial ULV spraying
 3. Focal control
3. Lack of tools to evaluate the impact of vector control operations (entomological surveillance)

Issues of deliverance: immature control

1. Immature control of *Ae. aegypti* in a community
2. 10% of houses closed, resident absent, refusal (1.00 x 0.90 coverage) = only 90% reduction is possible
3. Source reduction or larvicides were only 90% effective (resistance, people dump the larvicide as with Abate, etc.) (0.90 x 0.90) = 81% maximum reduction
4. 10% lack of compliance (reported treatment never done, overlooked or ignored containers, data entry errors, etc.) (0.81 x 0.90) = 72% reduction, and so on.
5. Very high efficiency would be required to have a significant impact on *Ae. aegypti*.

Issues of deliverance: Adult control

1. Spatial spraying from truck or aircraft-mounted equipment does not reach indoor resting places and adult *Ae. aegypti*.
2. Focal control around dengue cases
 - a. Only a fraction of all infections are reported (asymptomatic, mild symptoms)
 - b. Delay of > 2 weeks between infection and case reporting
 - c. Control would impact a very small fraction of infected mosquitoes

Conclusions

- Current *Ae. aegypti* control measures eliminate small, uncertain fractions of the population; apparently not sufficient to suppress dengue virus transmission
- The concept of area-wide control of *Ae. aegypti* is not well understood or practiced
- Interventions are not being adequately evaluated or not evaluated at all
- Most insecticides and other control measures do not act long enough to grant sustained mosquito population reductions

Conclusions

- Contention of Chikungunya virus is unlikely if traditional dengue control methods are used
- Integrated, simultaneous area-wide control of adult and immature mosquitoes need to be implemented
- New control tools need to be developed: ovicides, long-acting larvicides
- New, inexpensive entomological surveillance tools need to be developed