Centers for Disease Control and Prevention

MMWR

Morbidity and Mortality Weekly Report

Early Release / Vol. 65

May 10, 2016

Reduced Incidence of Chikungunya Virus Infection in Communities with Ongoing *Aedes Aegypti* Mosquito Trap Intervention Studies — Salinas and Guayama, Puerto Rico, November 2015–February 2016

Olga D. Lorenzi, MS[1]; Chelsea Major, MPH[1,2]; Veronica Acevedo, MS[1]; Janice Perez-Padilla, MPH[1]; Aidsa Rivera, MS[1]; Brad J. Biggerstaff, PhD[1]; Jorge Munoz-Jordan, PhD[1]; Stephen Waterman, MD[1]; Roberto Barrera, PhD[1]; Tyler M. Sharp, PhD[1]

Aedes species mosquitoes transmit chikungunya virus, as well as dengue and Zika viruses, and bite most often during the day.* Infectious mosquito bites frequently occur in and around homes (*1*,*2*). Caribbean countries first reported local transmission of chikungunya virus in December 2013, and soon after, chikungunya virus spread throughout the Americas (*3*). Puerto Rico reported its first laboratory-positive chikungunya case in May 2014 (*4*), and subsequently identified approximately 29,000 suspected cases throughout the island by the end of 2015.† Because conventional vector control approaches often fail to result in effective and sustainable prevention of infection with viruses transmitted by *Aedes* mosquitoes (*5*), and to improve surveillance of mosquito population densities, CDC developed an Autocidal Gravid Ovitrap (AGO) (*6*) to attract and capture the female *Aedes aegypti* mosquitoes responsible for transmission of infectious agents to humans (Figure). The AGO trap is a simple, low-cost device that requires no use of pesticides and no servicing for an extended period of time (*6*).

Since 2012, four communities in two municipalities in southern Puerto Rico, Salinas and Guayama, have participated in an ongoing field trial of AGO traps to control *Ae. aegypti* mosquitoes. Two intervention communities used three AGO traps per home for vector control whereas the other two, nonintervention communities, used only surveillance traps to monitor mosquito population densities. With AGO control traps placed around approximately 85% of homes in intervention communities in addition to randomly distributed surveillance traps, captures of adult *Ae. aegypti* mosquitos in the intervention communities decreased (*6*–*8*). From June 2014 to December 2014, after the identification of the first laboratory-positive chikungunya case, the average densities of *Ae. aegypti* female mosquitoes were 1.1 and 11.6 per surveillance trap per week in communities with and without AGO control traps, respectively (CDC, unpublished data), and this approximately tenfold difference in mosquito densities between the nonintervention and intervention areas remained relatively constant throughout 2015.

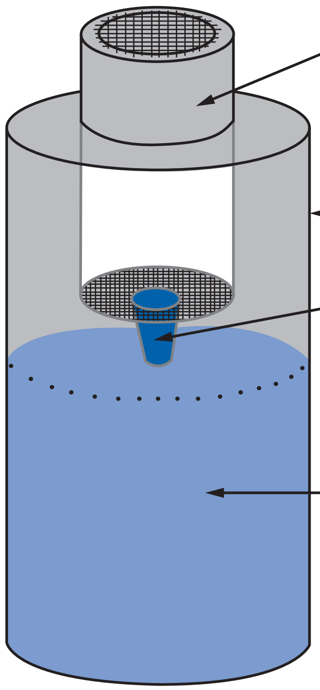
AGO traps have remained in place in the same configuration in the four communities from the start of the field trial to the present. Therefore, the introduction of chikungunya virus into the previously unexposed population of Puerto Rico provided a unique opportunity to assess whether the lower mosquito densities observed in areas with AGO traps were associated with reduced incidence of chikungunya virus infection through a serosurvey in these communities. A CDC Institutional Review Board approved a serosurvey for this purpose.

Stratified random sampling targeted 620 households from intervention and nonintervention communities, representing 28.5% of residents of the communities participating in the AGO field trial. Field personnel visited the selected households up to three times each to recruit household members for participation in the study. All residents of the selected households except children aged <5 years were eligible to participate. Participating household members provided a blood specimen and completed a questionnaire on household characteristics, demographics, history of recent illnesses, and personal mosquito bite prevention practices. Serum specimens were tested by immunoglobulin G (IgG) enzyme-linked immunosorbent assay (*9*) to detect evidence of chikungunya virus infection.

* http://www.cdc.gov/dengue/.
† Puerto Rico Department of Health. Chikungunya Weekly Report, 2014. http://www.salud.gov.pr/Estadisticas-Registros-y-Publicaciones/Pages/Chikungunya.aspx.

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

FIGURE. Diagram of an Autocidal Gravid Ovitrap used to attract and capture female *Aedes aegypti* mosquitoes — Salinas and Guayama, Puerto Rico



The prevalence of chikungunya virus IgG antibody after the introduction of chikungunya virus in a population without previous chikungunya virus exposure provides a valid estimate of chikungunya virus incidence in residents of these communities.

This report contains preliminary results from data collected during November 2015–February 2016. In the sampling frame, 377 of 620 houses were occupied with a household member responding to field personnel visits. Of the 377 responding households from the two intervention and two nonintervention communities, 233 households (62%) participated in the study, and 327 (64%) of 511 eligible household members agreed to participate. The proportion of female participants (63%) and mean age of participants (53 years) were somewhat greater than those measures for all eligible household members (55%; 49 years). The female/male distribution and mean age of participants from intervention communities were not significantly different from those of participants from nonintervention communities. After adjustment for sample design, the proportion of chikungunya virus IgG antibody among participants from the two intervention communities was one half that of participants from intervention communities (risk ratio = 0.52, 95% confidence interval = 0.38–0.71) (Table).

TABLE. Crude prevalence of chikungunya virus IgG antibody among residents of four communities participating in vector control studies, community type — Salinas and Guayama, Puerto Rico, November 2015–February 2016

Community type	Participants	Anti-CHIKV IgG positive participants (%)
Nonintervention communities (no AGO traps)	152	69 (45.4)
Community A	103	42 (40.8)
Community B	49	27 (55.1)
Intervention communities (AGO traps present)	175	40 (22.9)
Community C	101	19 (18.8)
Community D	74	21 (28.4)

Abbreviations: AGO = Autocidal Gravid Ovitrap; CHIKV = chikungunya virus; IgG = immunoglobulin G.

Lower incidence of chikungunya virus infection in the intervention compared with nonintervention communities occurred in the context of tenfold lower mosquito densities in the intervention areas with AGO traps. These preliminary findings suggest AGO traps might reduce virus transmission by reducing mosquito density. Additional data and statistical analyses are ongoing to account for nonresponse, adjust for age of participants and community characteristics, and evaluate associations between behaviors and chikungunya virus incidence. CDC produces AGO traps in limited numbers. To increase the availability of AGO traps for surveillance and for further studies of their use in control of *Ae. aegypti* mosquitoes in other settings and on a larger scale, efforts are under way for private sector companies to mass produce AGO traps of similar quality with comparable adult female *Ae. aegypti* mosquito capture rates.

[1]Division of Vector-Borne Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [2]Office of the Director, Office for State, Tribal, Local and Territorial Support, CDC.

Corresponding author: Tyler Sharp, Tsharp@cdc.gov, 787-706-2245.

References

1. Stoddard ST, Forshey BM, Morrison AC, et al. House-to-house human movement drives dengue virus transmission. Pro Natl Acad Sci USA;2013:994–999.
2. De Benedictis J, Chow-Shaffer E, Costero A, Clark GG, Edman JD, Scott TW. Identification of the people from whom engorged *Aedes aegypti* took blood meals in Florida, Puerto Rico, using polymerase chain reaction-based DNA profiling. Am J Trop Med Hyg 2003;68:437–46.
3. Fischer M, Staples JE. Notes from the field: chikungunya virus spreads in the Americas—Caribbean and South America, 2013–2014. MMWR Morb Mortal Wkly Rep 2014;63:500–1.
4. Sharp TM, Roth NM, Torres J, et al. Chikungunya cases identified through passive surveillance and household investigations—Puerto Rico, May 5–August 12, 2014. MMWR Morb Mortal Wkly Rep 2014;63:1121–8.

5. Achee NL, Gould F, Perkins TA, et al. A critical assessment of vector control for dengue prevention. PLoS Negl Trop Dis 2015;9:e0003655. http://dx.doi.org/10.1371/journal.pntd.0003655
6. Mackay AJ, Amador M, Barrera R. An improved autocidal gravid ovitrap for the control and surveillance of *Aedes aegypti*. Parasit Vectors 2013;6:225. http://dx.doi.org/10.1186/1756-3305-6-225
7. Barrera R, Amador M, Acevedo V, Caban B, Felix G, Mackay AJ. Use of the CDC autocidal gravid ovitrap to control and prevent outbreaks of *Aedes aegypti* (Diptera: Culicidae). J Med Entomol 2014;51:145–54. http://dx.doi.org/10.1603/ME13096
8. Barrera R, Amador M, Acevedo V, Hemme RR, Félix G. Sustained, area-wide control of *Aedes aegypti* using CDC autocidal gravid ovitraps. Am J Trop Med Hyg 2014;91:1269–76. http://dx.doi.org/10.4269/ajtmh.14-0426
9. Johnson AJ, Martin DA, Karabatsos N, Roehrig JT. Detection of anti-arboviral immunoglobulin G by using a monoclonal antibody-based capture enzyme-linked immunosorbent assay. J Clin Microbiol 2000;38:1827–31.

Readers who have difficulty accessing this PDF file may access the HTML file at http://www.cdc.gov/mmwr/volumes/65/wr/mm6518e3.htm?s_cid=mm6518e3_w. Address all inquiries about the *MMWR* Series, including material to be considered for publication, to Editor, *MMWR* Series, Mailstop E-90, CDC, 1600 Clifton Rd., N.E., Atlanta, GA 30329-4027 or to mmwrq@cdc.gov.