

## Post Outbreak Review: Dengue Preparedness and Response in Key West, Florida

Mary H. Hayden,\* Jamie L. Cavanaugh, Christopher Tittel, Melinda Butterworth, Steven Haenchen, Katherine Dickinson, Andrew J. Monaghan, and Kacey C. Ernst

*National Center for Atmospheric Research, Boulder, Colorado; University of Colorado at Denver, Denver, Colorado; Florida Department of Health in Monroe County, Key West, Florida; University of Arizona, Tucson, Arizona*

**Abstract.** Dengue is the most prevalent mosquito-borne viral infection. Recent outbreaks in the southern United States illustrate the risk of reemergence. The first autochthonous cases since 1934 in Key West, FL, occurred in 2009–2010. We conducted a survey in 2012 with decision makers instrumental to the control of the outbreak to 1) determine their awareness of the multiple strategies used to control the outbreak and 2) assess their perceptions of the relative effectiveness of these strategies. An online survey was delivered to a predefined list of decision makers from multiple sectors to better understand dengue preparedness and response. Thirty-six out of 45 surveys were returned for an 80% response rate. Results indicate the need to focus prevention strategies on educational campaigns designed to increase population awareness of transmission risk. Respondents remain concerned about future dengue transmission risk in Key West and lack of resources to respond.

### INTRODUCTION

The decision-making process for the control of vector-borne diseases requires input from a variety of sources to ensure the success and sustainability of control efforts. Engaging parties involved in the response process, particularly following the emergence of a new disease, is important to developing an understanding of the strengths and weaknesses of prevention policies exercised in the field.

Dengue, one of the most rapidly spreading arboviruses,<sup>1–4</sup> has recently reemerged in Florida. During 2009–2010, the Florida Department of Health reported 93 autochthonous cases of dengue fever in Key West, FL, the first autochthonous dengue fever cases since 1934.<sup>5,6</sup> Since November 2010, no cases of dengue have been reported from Key West; however, autochthonous cases have been reported annually since 2010 in other counties in Florida underscoring risk of continued local transmission in parts of Florida.<sup>7</sup>

In response to the potential threat of further dengue transmission in the Keys and other regions of Florida, during the fall of 2012, we conducted a survey with decision makers, ranging from local to federal levels, who were involved with the response to the outbreak in Key West. The objectives of the survey were to better understand awareness of the preparedness and response measures undertaken during the 2009–2010 outbreak and their perceived efficacy. This project is one of the first efforts to identify and understand multilevel decision-maker response to the threat of dengue in the United States.

### STUDY SITE

Key West is a subtropical port located in Monroe County, FL at the southernmost tip of the Florida Keys in the United States about 160 miles south of Miami, FL. The year-round population is 24,900. This area experiences a relatively mild year-round climate with average Fahrenheit temperatures in the summer reaching the mid-1980s and the low 1970s in the winter. The heaviest rainfall events occur during the summer and early fall.<sup>8</sup>

### SURVEY DESIGN

The Internet-based survey was developed and distributed in collaboration with the Florida Department of Health in Monroe County (FDOH-Monroe County). The survey had two main objectives: 1) determine decision makers' knowledge and implementation of interventions and programs that were conducted in response to the 2009–2010 dengue outbreak in Key West, and 2) assess perceptions of the relative efficacy of current tools designed to reduce vulnerability to dengue. The survey posed 22 questions (21 multiple choice and 1 open ended for comments). The surveys were sent via e-mail to a base list of 45 decision makers provided by FDOH-Monroe County; 36 responded to the survey for a response rate of 80%. Institutional Review Board approval was obtained from the University of Arizona, Tucson, AZ and the National Center for Atmospheric Research.

### PARTICIPANTS

Eighty-three percent ( $N = 30$ ) of participants reported that they held positions directly related to dengue preparedness and response. Respondents were used in the following sectors: county ( $N = 6$ ), state ( $N = 12$ ) and federal government ( $N = 2$ ), nonprofit ( $N = 2$ ), law enforcement ( $N = 1$ ), tourism ( $N = 1$ ), academia ( $N = 4$ ), and medical institutions ( $N = 2$ ) and had been in their current position for an average of 12 years (standard deviation [SD] = 8 years). The majority of respondents worked in public health education and outreach followed by mosquito control, community-based programs, and public assistance. Notably, absent in the response profile were individuals from city government. In addition, we were informed that in at least one organization, a single representative individual responded on behalf of that organization.

### DENGUE ACTIVITY ENGAGEMENT

Specific dengue services that organizations provided included communicating messages to the public (69%), communication with other community-based organizations (66%), dengue surveillance (60%), and community outreach and interventions (57%).

\*Address correspondence to Mary H. Hayden, National Center for Atmospheric Research, P.O. Box 3000, Boulder, CO 80307. E-mail: mhayden@ucar.edu

## EFFECTIVENESS OF ACTIVITIES

Participants were asked to rate the effectiveness of activities that had been used to manage health risks from dengue during the 2009–2010 outbreak. Responses were rated on a Likert scale of 1–5 with 1 being not at all effective and 5 being extremely effective. The majority of respondents (68%) felt that mosquito-control inspections were the most effective activities for minimizing health risks (<http://keysmosquito.org/about-us-2/about-the-keys-mosquito-control/>).<sup>1</sup>

Activities also considered effective in reducing health risks from dengue were communication of health messages to the public via radio or newspaper (68%) and dengue virus surveillance (57%). The two strategies viewed as least effective were the Action to Break the Cycle of Dengue (ABCD) (39%), a partnership in which decision makers are encouraged to promote mosquito-prevention activities, and the mosquito-control television (TV) program (18%) (Table 1).

## HEALTH MESSAGING INTENDED TO REDUCE DENGUE RISK

Participants were asked what health messages and actions their organizations recommended to clients and colleagues during the dengue season; highest ranked messages included removing standing water (90%), using repellent (87%), wearing protective clothing (74%), and seeking medical care if symptomatic (74%) (Figure 1).

## BARRIERS TO ACTION

When asked what might prevent their clients and colleagues from taking recommended action during the dengue season, responses included “People think it won’t happen to them, so

they don’t heed the warnings, and no one wants to wear long sleeves in the summer.” In addition, one participant replied:

*... generally speaking some people are reluctant to use repellent routinely; if people don't notice mosquitoes biting they may not use repellent... not being aware [that] all containers can act as mosquito breeding sites... not having a person assigned to routinely dump water... language and economic barriers related to outreach... challenges reaching out to the homeless.*

Furthermore, another respondent stated that, “The public, at least in Key West, has a suspicion that there is not a problem that is important enough for them to take any precaution, a large failure in effectively communicating a message they are ready to listen to and act upon.”

This lack of perceived severity of risk was echoed by another respondent,

*... the community as a whole still does not accept the potential for a truly devastating outbreak of another serotype with more cases and more severe disease that would not only cause suffering to disease, but also severe economic effects on their tourism industry that could result in large numbers of failing businesses in Key West. A catastrophe in the making that has not at all received the attention it deserves.*

## CURRENT AND FUTURE IMPACTS OF DENGUE

Survey participants were asked how serious an impact the dengue outbreak in 2009–2010 had on the “health and economy” of Key West. Fifty-eight percent indicated that the health

TABLE 1

Overview of services provided by respondents’ organizations by class of control strategy and perceived effectiveness of specific dengue control activities

Class of control strategy	Dengue services provided during outbreak	Proportion indicating they provided service (%)	Specific dengue control activity	Rated effectiveness (% very effective/extremely effective)
Mosquito source reduction activities	Mosquito control	20	Mosquito control inspections	68
	Coordinating community cleanup	26	Community cleanup activities	35
	Checking abandoned, seasonal, or foreclosed homes	34	–	–
Partnering logistics	Notifying partners and colleagues about dengue control activities	51	ABCD newsletter	39
	Coordinating activities among community organizations	42	Keys ABCD partnership	44
	Communication with other community organizations	66	Development of Action to Break the Cycle of Dengue (ABCD) campaign	45
Outbreak detection and monitoring	Dengue surveillance	60	Dengue surveillance	58
	Dengue diagnosis and reporting	42	–	–
	Mobilizing service providers during outbreak	29	–	–
	Determining the economic impact of dengue	13	–	–
Community engagement	Education sessions and workshops	42	Education sessions and workshops	50
	Public health messaging	69	Mosquito control “report cards”	35
			Mosquito control TV show	21
			Communication of messages to the public (radio/ newspaper)	68
	Community outreach and interventions	58	Community outreach and interventions (e.g., door hangers)	58

ABCD = Action to Break the Cycle of Dengue; TV = television. Dengue control activity effectiveness rated on a scale of 1–5, 1, not at all effective and 5, extremely effective.

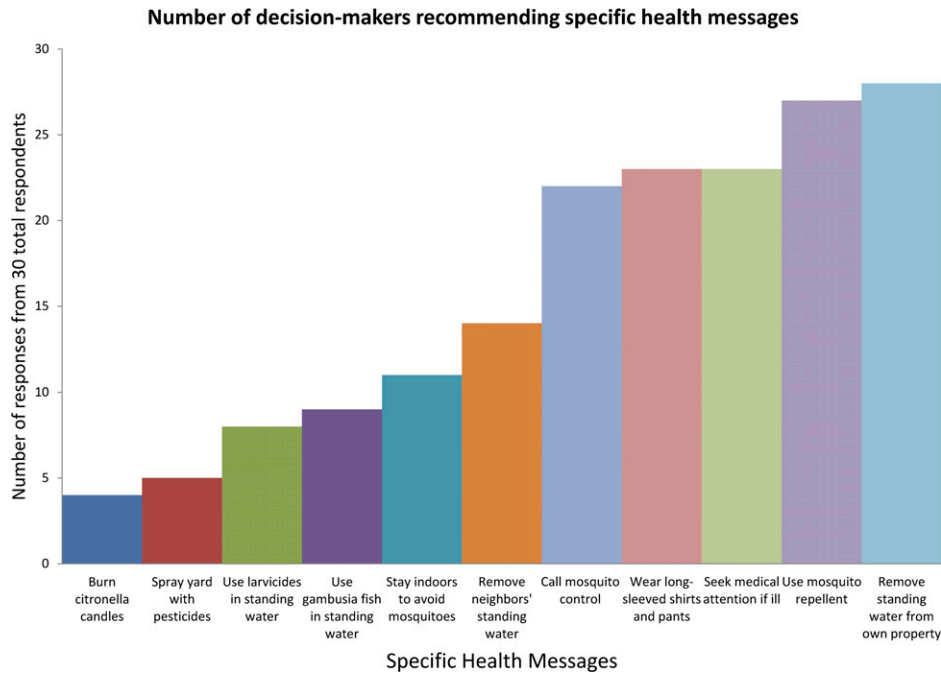


FIGURE 1. Health messaging to public. Number of decision makers recommending particular strategies to the public to reduce dengue transmission.

impact had been somewhat to very serious, whereas 50% felt the economic impact was somewhat to very serious. Concern about future outbreaks was higher with 68% indicating the health impacts of future outbreaks would be serious and 80% indicating the economic impact could be somewhat or very serious. Participants were asked about the possibility of a dengue outbreak in the next 5 years; 68% felt that an outbreak was somewhat to extremely likely with only 10% stating that it was not at all likely.

**FACTORS LEADING TO INCREASED RISK OF DENGUE**

Vulnerability to future outbreaks was thought to increase due to increased travel to dengue-endemic areas (30% thought it extremely likely to increase risk), decreased household-level control activities (35%), and reduced financial investment in prevention and control (30%). Only about 10% of respondents indicated that changes in extreme weather conditions would be extremely likely to increase risk of future dengue outbreaks and very few (3%) thought reduced access to medi-

cal care in the future would have an influence on risk of dengue outbreaks in the future.

**REDUCTION OF RISKS**

When asked what could be done to help better protect their clients against dengue, more than 80% of the respondents cited the need for increased public awareness of the risk of dengue while also citing a need for more funding (71%) and more staff (50%) to help protect the population of Key West against dengue (Figure 2).

Perceptions of the effectiveness of intervention strategies used during an outbreak will influence the strategies used during the next event. The domestic mosquito inspection program was rated the most effective prevention strategy.<sup>9</sup> However, this is a resource intensive program; one of the challenges facing small communities is the lack of funding and staffing for dengue outreach and response. Our survey indicates that participants overwhelmingly felt that improvements in community awareness and expansion of dengue prevention would decrease future risk.

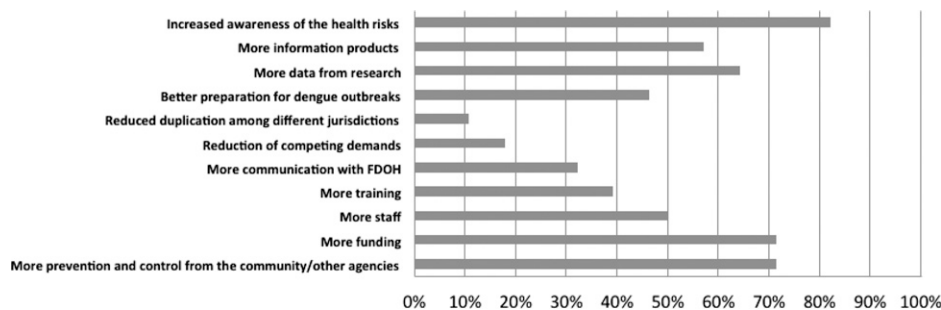


FIGURE 2. “What would help your organization better protect your clients and colleagues from dengue? Please check all that apply.”

Future outbreaks of dengue were perceived as being more serious to the health and economy than the 2009–2010 dengue outbreak. Is the unknown always perceived as riskier than what has already been experienced? This suggests an opportunity to build on current prevention strategies to reduce risk of future outbreaks. Because travel is another important risk factor for dengue introduction,<sup>10</sup> it is important to provide the public with information about dengue risk while traveling and the need for follow-up if symptomatic on return. Early detection and reporting of dengue cases will increase the chances that a coordinated response will be effective.

Understanding decision makers' knowledge and assessment of the efficacy of prevention and response activities is critical to developing successful strategies and timely responses in the future. Additional qualitative research is needed to evaluate the community reach of these activities over the short and long term, to better understand barriers to action, and to advance more effective prevention strategies.

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Authors' addresses: Mary H. Hayden, Katherine Dickinson, and Andrew J. Monaghan, National Center for Atmospheric Research, Boulder, CO, E-mails: mhayden@ucar.edu, katied@ucar.edu, and monaghan@ucar.edu. Jamie L. Cavanaugh, University of Colorado, Denver, CO, E-mail: jamie.cavanaugh@ucdenver.edu. Christopher Tittel, Florida Department of Health in Monroe County, Key West, FL, E-mail: ctittel@aol.com. Melinda Butterworth, Steven Haenchen, and Kacey C. Ernst, University of Arizona, Tucson, AZ, E-mails: mkbutter@email.arizona.edu, shaenchen@email.arizona.edu, and kernst@email.arizona.edu.

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