

GLOBAL HEALTH SECURITY THREATS IN AMERICA

**Dengue Fever in Yuma County,
Arizona, 2014**

2018



SGNL Solutions, in consultation with the Council of State and Territorial Epidemiologists (CSTE) and the Centers for Disease Control and Prevention (CDC), explored infectious disease outbreaks that threaten the health security of state, tribal, local, and territorial jurisdictions.

Description and Methods

Following a literature review, SGNL Solutions, in consultation with CSTE and CDC, selected and explored nine infectious disease outbreaks that threaten the health security of U.S. jurisdictions. Those selected focused on domestic outbreaks (1) caused by introduction of a pathogen from outside the United States, (2) associated with a declared public health emergency of international concern from the World Health Organization, (3) associated with CDC Bio-Terrorism Agents, and/or (4) associated with pathogens that are well controlled or eradicated in the United States. Impact areas of interest included public health operations and resources, hospital infection control, economic factors, policy and legislation, and others. SGNL Solutions initiated a data collection process, which included identifying, scheduling, and conducting interviews with key informants (e.g., government staff, local businesses); collecting consent forms; obtaining data for impact factors; and scanning for local media coverage of the incident. The collected data was first coded for sector type (e.g., local and state public health, healthcare, supply chain, workforce, education, tourism/hospitality, trade) and for impact type (e.g., economic, psychosocial, compliance with regulations/contracts/public expectations, policy, provision of goods/services).

Additional themes also emerged during the analysis. Each SGNL Solutions coder independently coded at least three interviews, compared results, and discussed discrepancies to improve inter-rater reliability. All interview transcripts and collected news articles, reports, and other data were coded, synthesized, and summarized as part of the documentation process.

The following describes an outbreak of dengue fever in Yuma County, Arizona, in 2014 and the associated health, economic, and social impacts of the outbreak.

Description of those interviewed:

- **Ken Komatsu**, State Epidemiologist/Chief, Office of Infectious Disease Services, Arizona Department of Health Services
- **Robert Guerrero**, Chief, Office of Border Health, Arizona Department of Health Services
- **Mariana Casal**, Border Infectious Disease Surveillance Officer, State of Arizona
- **Christl Tate**, Project Coordinator, Program & Partnership Development, National Environmental Health Association

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Introduction

Dengue virus is the most common and widespread vector-borne arbovirus in the world, with a 30-fold increase in the global disease incidence in the last 50 years.^{i,ii} It is spread primarily by the *Aedes aegypti* mosquito and the strains of dengue virus are endemic throughout the tropics and subtropics around the world.ⁱⁱⁱ

Dengue fever – an acute febrile illness – can be caused by one of four dengue virus types, making vaccine development difficult. There are around 100 imported cases of dengue imported into the United States each year, but increased international travel to endemic areas, and gaps in mosquito control efforts can lead to outbreaks involving the spread of disease from person to person in the same area, where the mosquito acts as a vector.^{iv}

Description of the Outbreak

During September to December 2014, the same timeframe as a large dengue outbreak in Sonora, Mexico, 93 travel-associated dengue cases were reported in Arizona residents, 75% of which were concentrated in Yuma County.^v Of the patients in Yuma county, the most common symptoms were fever and myalgia, and more than half the patients were hospitalized. Meanwhile, in Sonora, Mexico, fever, headache, and arthralgia were the most common symptoms, but only 21% were hospitalized.^{vi} There were no deaths in either location. Because of the established *Aedes aegypti* populations in Yuma County, local officials were concerned about the possibility of local transmission and needed to follow the cases closely.

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The Arizona Office of Border Health was established to maintain open communication with Mexico, specifically the Ministry of Health in the state of Sonora. Mariana Casal, a surveillance officer for the Office of Border Health, noted that one of the primary focus areas for her office is infectious disease. Prior to 2014, the Binational Case Surveillance program expected to see about five cases of dengue per year, usually among residents who traveled to Central America or the Philippines. By the end of August 2014, Casal noticed a disturbing pattern. Ten cases of dengue had been reported to the Arizona, mostly from individuals in Yuma who had traveled to Mexico. She contacted the Ministry of Health in the state of Sonora and learned they were experiencing an outbreak in San Luis Rio Colorado, a community less than a two hour drive from Yuma County.

While Arizona does have *Aedes aegypti* mosquitos, public health officials have fortunately not discovered any that have tested positive for the dengue virus. One way that dengue could become endemic in the region would be if individuals infected with the virus were bitten by *Aedes aegypti* mosquitos who then infected other mosquitos—a transmission that was avoided during this 2014 outbreak. In Yuma, the border between Mexico and the United States is quite active. Every day, over 4,000 Mexican agricultural workers and numerous students cross legally for work and school. Likewise, individuals living in the United States cross to Mexico for work or to care for family members. Economic and social

motivators make it difficult for health officials to include travel restrictions or bans as part of their control strategy.

During this outbreak, Arizona Department of Health Services (ADHS) relied primarily on public health messaging targeted individual strategies, like encouraging the use of repellent and checking homes for standing water. At the beginning of the outbreak, ADHS contacted the CDC's dengue branch in Puerto Rico, which provided communication materials for the public. ADHS found those materials too complex and ultimately ineffective for their jurisdiction and ended up adopting Sonora's simpler public messaging strategies. For example, ADHS implemented Mexico's *Patio Limpio* campaign, which encourages families to eliminate standing water at home. If each family does their part, the community will be protected. Using the same messaging on both sides of the border was viewed as a strength of the binational response.

Impact of the Outbreak

Arizona is a home-rule state, which means that counties have jurisdiction over activities within their boundaries, and the state provides guidance, resources, education, and laboratory support. Yuma’s health director was experienced in running incident command for outbreaks, which is not always the case for local jurisdictions. However, the department only had two environmental technicians, when five were needed to run the field investigation. ADHS pulled staff and called upon partners at the University of Arizona to supplement the workforce.

During the outbreak, the regular work of state and local public health staff was “put on hold” to run incident command, conduct the investigation, and implement control and prevention strategies. In addition to the increased staff time and costs, the response resulted in direct cost increases as well. For example, ADHS’s entire annual travel budget was spent by the end of the investigation, leaving the department strapped for future outbreaks. Ken Komatsu, epidemiologist for the state of Arizona, noted that this particular investigation was quite labor intensive: “We went household to household. We assessed the knowledge of the occupants, and we also looked at mosquito breeding sites in and around their household. We tried to do sampling within the house if there were mosquitos inside the house.... [including] sampling of any larvae that were found.”

As part of the field investigation, Casal and her team developed a tailored epidemiological questionnaire for Arizona cases that captured more detailed information about their travel to Mexico. According to Komatsu, the local health responders in Yuma made an effort to increase cooperation with field investigations through media outreach: “The local health department, to their credit, did alert [the public] first through the media. They knew that they were coming [to do household assessments]. That made a big difference in the acceptance by those they did interview, because many of them did say, ‘Oh, yes. I heard about this on the radio’ or ‘I read about it or saw it on TV.’” Information from the field investigation was shared with officials in Sonora to help them build more detailed exposure maps and was used to develop travel guidance.

Observations from the Field

Typically, nations share data with one another at the highest level (i.e., federal health entity to federal health entity). However, the state of Sonora and ADHS have worked out a secure mechanism for sharing real-time unofficial data to permit health agencies, like Yuma, to better respond to binational threats. Guerrero explained, “If you can imagine an outbreak on the border, and you relied on this federal-to-federal communication, and you had a two-week lag of information, that would be very dangerous.” Likewise, Sonora can easily receive detailed case data from Arizona because they are able to access ADHS’s surveillance system directly.

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Guerrero stated that the high level of trust among Arizona counties, between U.S. county and state level, and across the border between Sonora and Arizona is due in part to funding Arizona received in the 2000s from the Office of the Assistant Secretary for Preparedness and Response, for the Early Warning Infectious Disease Surveillance (EWIDS) program. The funding enabled ADHS to shift from a communication structure based on personal relationships to one based on positions. Rather than an official in Arizona calling up a physician they happened to know in Sonora, staff members knew they were expected to call upon their counterparts regardless of former knowledge of them. Notably, these communications protocols were developed jointly. Guerrero explained, “It wasn’t Arizona telling Sonora, ‘Hey, you need to do this for us,’ but it was us coming together, and them telling us who would be the key person, and then us letting them know as well... that’s part of us developing that trust.”

ADHS also stressed the importance of honoring the edict that all disasters (or outbreaks) are local. ADHS prefers that every patient be laboratory tested for confirmation, while Sonora performs laboratory testing on a small percentage of cases. Guerrero explained, “Part of [the Office of Border Health’s] role within ADHS is to explain to our own agency that not every country runs everything exactly the same.” Sonora has a more limited budget and reasoned that the public health message would be the same whether 100% or 10% of the cases were laboratory confirmed. Likewise, rather than descending upon Yuma and taking charge of

the investigation, ADHS takes the approach of asking local leaders how the state can help them in their response effort.

Politics and trust cannot be underestimated for border health. Several years ago, visitors to Sonora’s popular beaches experienced an uptick in salmonella after consuming ceviche. Guerrero recounted the difficult decision-making surrounding the event. “I remember one time we had an epidemiologist up in Phoenix who said, ‘We should shut down the beaches and issue a public health advisory.’” Luckily, our director at that time said, ‘There’s no way that the state of Arizona is going to issue a public health advisory, and tell Mexico to shut down their beach.’” Guerrero noted that if the Sonora Secretary of Health had issued advisories and closed the beach, he might have faced political retribution. ADHS ended up adopting the same messaging as Mexico: Don’t eat raw seafood, drink bottled water, and have a great time.

In trying to better understand the breeding habits and human factors associated with *Aedes aegypti* in southwestern Arizona, researchers found that small flower pots and saucers were key larval habitats, with almost half of those inspected found to have larvae or pupae.^{vii} They also found a negative association between income level and *Aedes aegypti* presence, which could help inform future surveillance and mosquito control efforts to best control the vector, allowing authorities to target their approaches to where the burden is greatest.

Implications for the Future

The type of mosquito that carries dengue virus – *Aedes aegypti* – also carries yellow fever and the Zika virus, two additional concerning diseases that can be brought back to the United States via international travelers. Though they are not currently endemic in the United States, the threat exists of spreading the disease to other mosquitos and then to other humans within a community or region. For example, Brazil worked to eradicate the *Aedes aegypti* mosquito throughout much of the 20th century and did so a few times. But because the mosquito population is spread throughout all of the Americas, there is a need for a concerted regional effort. Absent this, their success became short-lived, and in 2002 Brazil experienced the worst dengue fever outbreak in history.^{viii}

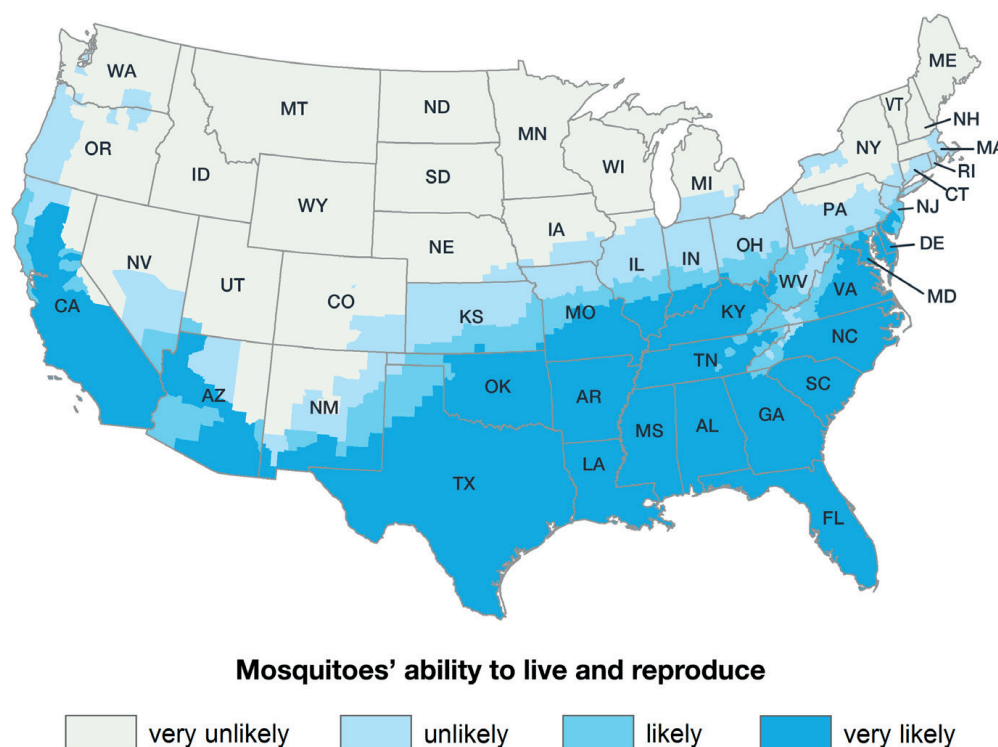


Figure 1
Estimated potential range of *Aedes aegypti* in the United States, 2017; SOURCE: CDC^x

Experts believe that dengue has the potential for severe health and economic consequences in the United States, with many unaware of the risk of the disease.^x Local health authorities need to engage with the public about the possibility of dengue in the population, and invest in mosquito control efforts. Clinicians should also be more aware of the disease and how symptoms present, especially in summer and autumn when mosquitoes are most commonly active. A survey of Arizona health providers following the 2014 dengue outbreak found that 58% of providers lacked confidence to treat mild dengue, and 73% lacked confidence to treat severe dengue,^{xi} emphasizing the need for awareness among health care staff in areas where the disease could be present. Additionally, given the changing climate, this threat is not limited to just places like Arizona and Texas and other border states. Many more states are becoming home to *Aedes aegypti*, where they are likely to live and reproduce, which in turn brings the threat of disease (see Figure 1).

Guerrero emphasized the importance of continued support for binational planning and surveillance programs like EWIDS. “If you can push surveillance further south, then that keeps the United States safer, and by that I mean, if my colleagues in Sonora can better detect infectious disease, and I have strong communication with them, then I’m going to know sooner, and then I’m safer.” Guerrero noted that “if we truly want the border to be safer, then in my eyes, we need to work that much closer with our colleagues on the Mexican side. The important thing here is, there’s got to be something in this for Mexico, or else they’re going to see this as, ‘It’s just U.S.-driven.’” Komatsu emphasized the important role of federal partners in distinguishing the signal from the noise: “How do you do your own work and watch your own state and counties and also watch other countries, which is difficult to do?”

The infectious diseases that threaten the health, welfare, and security of communities throughout the United States are in large part determined by interrelated global factors. No single nation can be protected if other nations remain unprepared to counter threats. Strong and sustainable public health surveillance, prevention, and control efforts across the globe are the first line of defense against infectious disease, often stabilized by ongoing international diplomacy. Yet, these protections are often the first to be neglected, both in terms of resourcing and political will, resulting in the degradation or absence of necessary infrastructure and capacities. Given the speed at which diseases travel in the 21st century, continued investment in building capacity at the source of an outbreak, as well as sustainable workforce and infrastructure capabilities in the United States will be essential to protect U.S. communities. As demonstrated in this report, cross-border collaboration, including coordinated planning, real-time information sharing, leveraging the assets of each partner, and respecting differences in approach, is essential to halting the spread of infectious disease across borders.

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