



Kidenga: Community-based Surveillance and Education App

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Aspects of Zika, Dengue, and Chikungunya

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Kidenga

- A mobile participatory syndromic surveillance app to detect individuals with symptoms suggestive of dengue, Zika, and chikungunya and to track activity of the vectors, *Ae. aegypti* and *Ae. albopictus*
 - Pilot launched Sep 2016
 - Pilot areas include Arizona, South Texas, Florida

Partnerships

- University of Arizona is the project lead. They developed the app and own and maintain the app and the data.
- CDC provided seed funding for the development of the app and technical consultation.
- Skoll Global Threats Fund has sponsored marketing and ongoing maintenance costs and provides technical consultation.
- The app was developed with input from state and local health department stakeholders.
- The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Context and Background

Aedes aegypti and *Aedes albopictus* mosquito-borne diseases

- **Yellow fever, dengue, chikungunya, and Zika are growing threats worldwide**
 - No symptoms, or mild/moderate symptoms common (particularly dengue/Zika/chikungunya)
 - Severe disease and long-term consequences possible, including birth defects caused by Zika during pregnancy
- **Small local outbreaks in the continental US**
- ***Ae. aegypti* and *Ae. albopictus***
 - Distributions projected but not confirmed in some areas
 - *Ae. aegypti* may be found up to 8 months of the year in parts of Arizona, Florida, and Texas (where mosquito surveillance is regularly conducted)^{1,2}
 - Highly invasive
 - *Ae. aegypti* and *Ae. albopictus* spread viruses are difficult to control and require significant community engagement

Challenges in *Aedes* mosquito-borne disease control

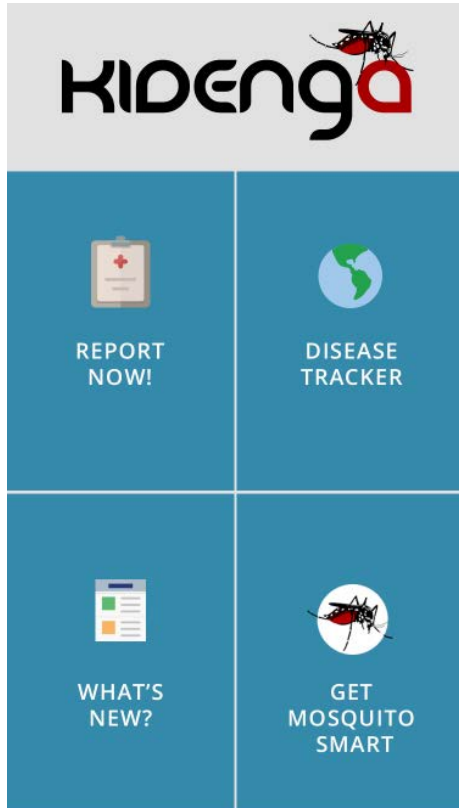
- **Disease detection: traditional laboratory-based surveillance misses many cases**
 - 2 million dengue cases reported to WHO in 2010³; estimated 96 million symptomatic cases⁴
 - For symptomatic Zika and dengue cases, presentation is often mild; sick person may not seek medical care
- **Disease control and prevention requires community action**
 - Specific strategies to prevent mosquito-borne disease should be contextualized with local risk information

Participatory surveillance

- **Participatory surveillance systems**
 - Enable the public to directly report on diseases via internet
 - Aggregate data and provide real-time feedback to users and public health agencies
 - May allow for improved public engagement
- **Growing evidence indicates that participatory surveillance systems may have high level of accuracy, and greater sensitivity and timeliness compared to traditional healthcare-dependent systems⁵**

Kidenga v1.0

Features



- **Health and mosquito activity survey**
- **Map of user reported symptoms and confirmed cases**
- **Newsfeed on the diseases and vectors**
- **Current disease information, prevention strategies, and treatment/testing information**

Registration

- **For persons 13 years of age or older**
- **Participants must provide**
 - Email address
 - Zip code of residence
 - Gender
 - Month/year of birth

Survey: Report Now!

- Weekly push notification to report on themselves and family
- No symptoms? Report mosquito activity – Done in 4 seconds
- Symptoms?
 - Symptoms checklist
 - Highest fever
 - Onset date
 - Travel history
 - Medical care
 - Testing
 - Mosquito activity

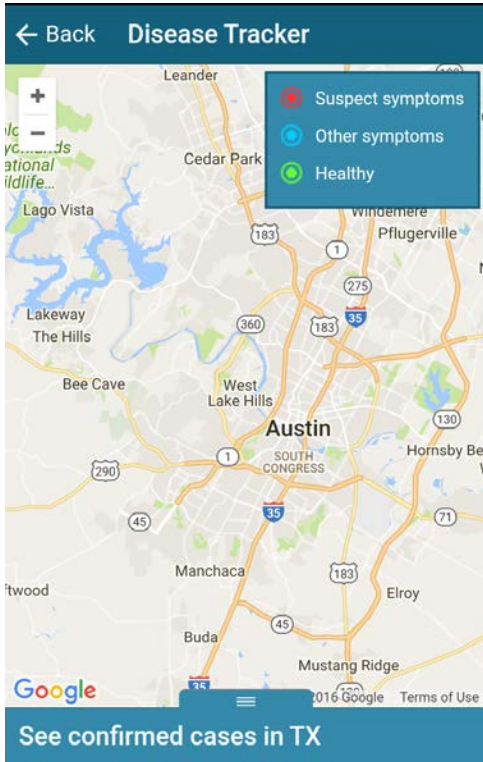
← Back Report Now!

What symptoms have you experienced during the past week (Mon, August 29 through Sun, September 4)?

- | | |
|--|--|
| <input type="checkbox"/> fever | <input type="checkbox"/> chills/night sweats |
| <input type="checkbox"/> fatigue | <input type="checkbox"/> headache |
| <input type="checkbox"/> cough | <input type="checkbox"/> bone pain |
| <input type="checkbox"/> nausea/vomiting | <input type="checkbox"/> joint pain |
| <input type="checkbox"/> sore throat | <input type="checkbox"/> rash |
| <input type="checkbox"/> diarrhea | <input type="checkbox"/> eye rash |
| <input type="checkbox"/> shortness of breath | <input type="checkbox"/> pink eye |
| <input type="checkbox"/> body aches | <input type="checkbox"/> leg/joint swelling |

Next

Disease Tracker: Bi-directional information exchange



USER GENERATED



CONFIRMED HEALTH DEPARTMENT DATA



Following report

- Opt-in or opt-out for future follow-up (asked only once)
- If reporting symptoms:
 - Directed to education section and warning signs for severe disease
 - Receive email with educational information
 - Receive email with letter for clinicians

Get Mosquito Smart!

<	GET MOSQUITO SMART
MOSQUITOES	>
DISEASES	>
ZIKA & PREGNANCY	>
PREVENT & PROTECT	>
ABOUT CARE	∨

If you have symptoms, go to the doctor right away if:



GET MOSQUITO SMART

Not all mosquitoes are the same. Two types of mosquitoes can spread Zika, dengue, and chikungunya.



Aedes aegypti

These mosquitoes are called *Aedes aegypti* and *Aedes albopictus*.



Aedes albopictus

They have white stripes on their legs.

Protect yourself!

These mosquitoes live indoors and outdoors.

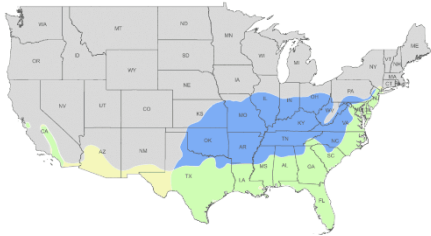
These mosquitoes most often bite during

Get Mosquito Smart!

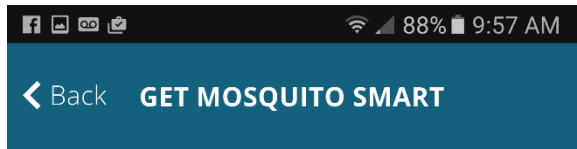


Where are these mosquitoes?

These mosquitoes live in many different countries, including the United States.

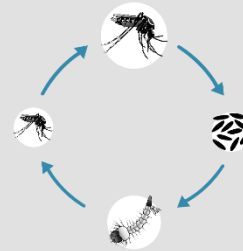


Places in the United States where the mosquitoes that can spread Zika, chikungunya, and dengue might be found.



Mosquito Lifecycle

Mosquitoes look for standing water in buckets, bowls, animal dishes, flower pots, vases, old tires, and even in plants that collect water.

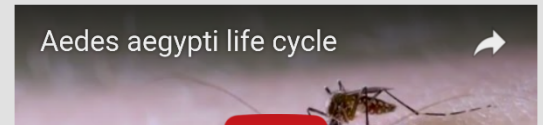


Adult female mosquitoes lay eggs in standing water (they only need a capful!). The eggs look like black dirt.

Mosquito eggs can survive even after the water dries up.

The eggs hatch into mosquitoes when they are submersed in water.

The hotter it is the faster this cycle goes.



Get Mosquito Smart!



Where is Zika?

In the world



Countries in the Americas and Caribbean where Zika is spreading.

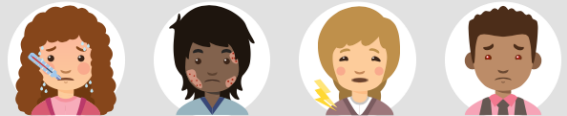
Last updated: *August 30, 2016.*

In the United States



GET MOSQUITO SMART

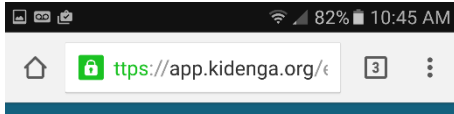
Do you have a **fever, rash, joint pain, or red eyes**? It could be Zika.



What happens to you?

- The illness is usually mild. The symptoms can last several days to a week.
- People usually don't get sick enough to go to the hospital, and they rarely die of Zika.
- Many people might not even realize they are infected with the Zika virus. Four out of five people who have Zika don't have symptoms!

Get Mosquito Smart!



Zika can spread through sex

Zika can be passed through sex from a person who has Zika to sex partners.



A pregnant woman with Zika can pass it to her unborn baby. Zika can cause serious birth defects.

If you are pregnant, and you have a partner who lives in, commutes, or has traveled to a place with Zika, be careful:

- Use condoms every time you have sex or don't have sex while pregnant.
- Zika lasts in semen longer than in blood.

If you are thinking about getting pregnant, see your



Protect yourself and your family




- Wear long-sleeved shirts and long pants.
- Use insect repellent. Always follow instructions on the label.
- Use Environmental Protection Agency (EPA) - registered insect repellents with one of the following active ingredients: DEET, picaridin, IR3535, oil of lemon eucalyptus, or para-menthane-diol.
- EPA-registered repellents work the best and for the longest amount of time.
- EPA-registered repellents are safe and effective, even for women who are

What's New?

- RSS newsfeed
- Searches for any news item with Zika, dengue, and chikungunya
- Shareable
- Users in select pilot areas may receive press releases issued by their state or local public health department related to the diseases and their vectors


Verizon LTE 11:07 PM 95%

< Back What's New



Why The Low Zika Numbers In Haiti Might Be Wrong
NPR

The Dominican Republic has identified nearly 1,000 pregnant women suspected of being infected with the Zika virus. Haiti, which shares the same...



Public backlash delays Zika spraying in Fla. as virus spreads
CBS News

Stakeholders and Marketing

Stakeholders and Marketing

- **Usefulness of surveillance data contingent on**
 - A large and consistent group of diverse community users, especially in low risk areas
 - Strategies to integrate health reports for high-risk populations who may not have smartphones
 - Buy-in from public health departments to use the data and advocate for this novel surveillance tool
 - Local health departments serving as spokespersons for the app
- **Community interest in Zika virus emergence will be leveraged, specifically targeting AZ, TX, and FL**
 - English and Spanish radio public service announcements in select Arizona markets
 - Press releases
 - Social marketing campaign
- **Evaluation planned to assess acceptability and impact of both surveillance tool and educational tool**

Obstacles and Speed bumps

- **Surveillance**
 - Obtaining and maintaining a large user-base
 - Determining appropriate special scale for presentation
 - Ethics and legal issues
 - Evaluation of data for which there is no other sentinel surveillance system for comparison
- **Education**
 - Identification of standard data streams for timely data presentation to user
 - Balancing accuracy with general community understanding
 - Level of risk for a community evolves with time
 - Tailoring messaging by jurisdiction
 - Guidelines for testing
 - Public health contacts
- **Managing diverse stakeholder interests**

Future directions

Reach: Kidenga 1.1

- Spanish version currently under development for Spanish speaking populations in the US



Reach: V2. Community Health Worker (CHW) Real Time Surveillance and Outreach

- **Kidenga v1 relies on individual smartphone ownership**
- **Target: Develop a CHW interface in Kidenga for information exchange**
 - CHW access hard-to-reach communities
 - Allow more rapid detection of outbreaks in these communities
 - Better prepared CHW with near real-time knowledge about the outbreak and prevention pushed out by health departments

Engage: Kidenga V3. The Mosquito Hunt Game




- **Context:** Kidenga V1.0 relies on sustained community interest for reporting
- **Gap:** People may lose interest
- **Target:** Educational mosquito hunt game; points for reporting symptoms & areas where mosquitoes can lay eggs.
- **Rationale:** 70% of teachers reported increasing student engagement with games⁶.
- **Expected outcomes:**
 - Increased individual participation in core Kidenga app.
 - Educational tool for CHW to engage children.
 - Children act as health messengers to family⁷.

Tailored Climate Driven Alerts



- **Context:** Kidenga V 1.0 focuses downstream on disease data
- **Gap:** Early warning about heightened mosquito activity can motivate action and reduce transmission risk.
- **Target:** Develop shareable spatially and temporally targeted messaging about mosquito activity to users to motivate action.
- **Rationale:**
 - Mosquito activity is linked to weather conditions⁷.
 - Personalized health messaging is more effective⁸.
 - Climate change projected to change areas and times for mosquitoes⁹.

THANK YOU!



The Brownsville area has experienced recent rain and based on the combination of heat and rain you should expect increased mosquito activity in your area.




Mosquito activity levels for Brownsville this week are projected to be **HIGH** but slightly down from last week.



TAKE ACTION

- Remove standing water from inside and outside your home.
- Keep your yard clean of containers and anything that can collect water.
- Use mosquito dunks or granules in water sources you can't clean out.

SHARE



Summary

- **A mobile participatory syndromic surveillance app to detect individuals with symptoms suggestive of dengue, Zika, and chikungunya and to track activity of the vectors, *Ae. aegypti* and *Ae. albopictus***
 - Pilot launched Sep 2016
 - Pilot areas include Arizona, South Texas, Florida
- **Also a platform for education and public health messaging, including local alerts**
- **Collaborative effort between University of Arizona and state and local health departments**
- **Spanish version under development**
- **Next steps include efforts to expand user base and geographic reach for high risk populations and areas.**

References

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