


# **Adapting Exposure Notifications Systems Developed to Mitigate COVID-19 Infections to West Nile Virus (WNV)**



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# West Nile Virus (WNV)

Definition: it is a leading cause of **mosquito-borne disease** in the continental United States (occurs summer through fall)

Symptoms: **fever**, headache, **body aches**, **vomiting**, **diarrhea**, rash, severe illness affecting the **central nervous system** (neck stiffness, disorientation, **coma**, tremors, **convulsions**, muscle weakness, **vision loss**, numbness and **paralysis**)

Odds of being symptomatic: **1 in 5 people**

Treatments: **no vaccine or specific medicines are available → rest and hydration**

Greater risk for severe illness: **people over 60**, certain **medical conditions** (**cancer**, **diabetes**, **hypertension**, **kidney disease**, and **organ transplants recipients**)

# Impacted Communities

- California's WNV disease burden comprised 15% of all cases that were reported to the U.S. Centers for Disease Control and Prevention from 2003-2018
  - More than any other state
  - Race/ethnicity was not reported for a large percentage of cases (34%/30.8%)
- WNV is most prevalent in Southern and Central California
  - Central California had 39.8% of cases
  - Southern California had 55.3% of cases
  - People ages 20-39, 40-59, & 60+ all have higher rates of incidence
- We chose to focus on the community within Southern California
  - About to be mosquito season (summer)
  - Where we are living right now

# Public Health Problems Within Southern California

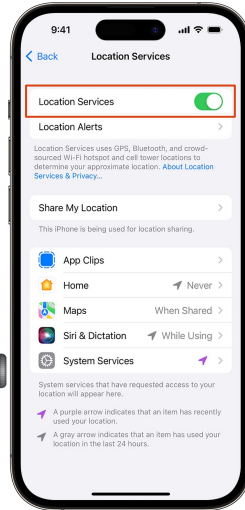
- West Nile Virus first emerged in Southern California in 2003, about four years after the first emergence in New York in 1999. From there WNV spread to other counties within the state.
- California have both human and non-human activity.
- California had the second highest amount of cases (168) of WNV during the 2022 year.
- California also has a WNV incidence rate of 0.327 (per 100,000) during the 2022 year.
- Top four of the most-burdened counties in California are in Southern California. (LA, Orange, Riverside, San Bernardino)

# Proposed Technology

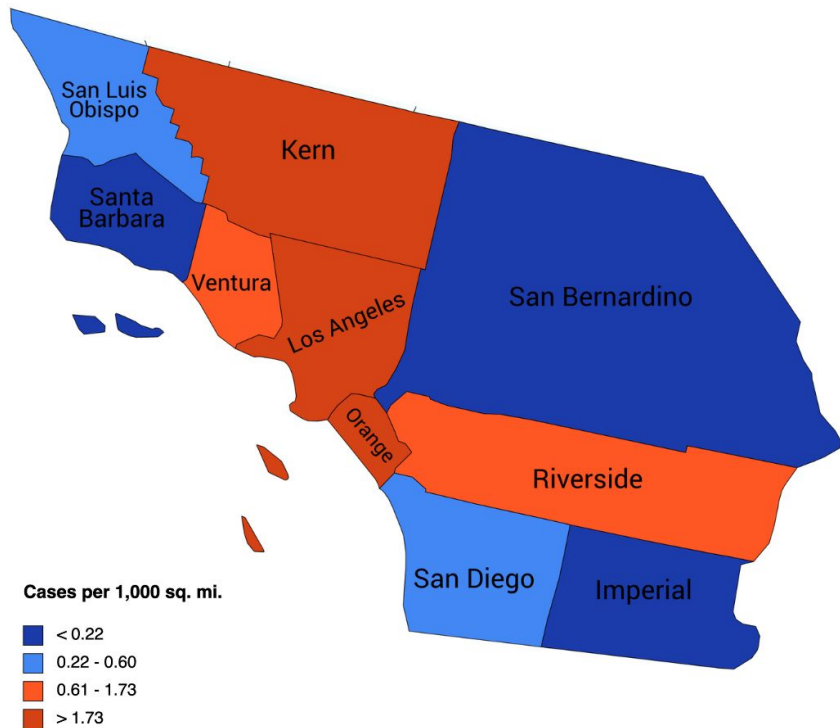
We propose developing a webapp that sets up a geographical barrier over regions that has high prevalence of West Nile Virus carrying mosquitoes. It would notify people whenever they enter the barrier and provide information about how to stay safe from it.

supports: **smartphones and smartwatches**

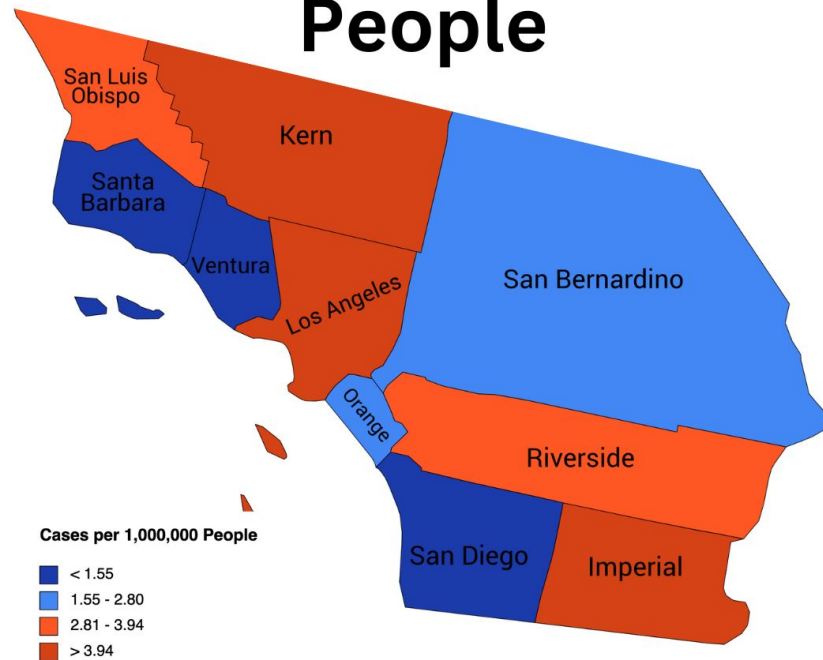
requires: **location services turned ON**



# Cases per 1,000 sq. mi.



# Cases per 1,000,000 People



AT&T



11:19  
Sun, Aug 9



**WNV Notify**

**Possible West Nile Virus (WNV) Exposure**

You have likely entered a region with a high prevalence of WNV carrying mosquitoes. Tap to learn more about how to protect yourself from contracting WNV.

Sun 10:20 PM



# Protect yourself from the West Nile Virus



You recently received a notification indicating that you have entered a region that is prone to West Nile Virus carrying mosquitoes. Keep scrolling to find out more.



## Prevention

### USE INSECT REPELLENT

- DEET
- PICARIDIN (KNOWN AS KBR 3023 AND ICARIDIN OUTSIDE THE US)
- IR3535
- OIL OF LEMON EUCALYPTUS (OLE)
- PARA-MENTHANE-DIOL (PMD)
- 2-UNDECANONE

### WEAR LOOSE-FITTING, LONG-SLEEVED SHIRTS AND PANTS

### TAKE STEPS TO CONTROL MOSQUITOES INDOORS AND OUTDOORS

- USE SCREENS ON WINDOWS AND DOORS. REPAIR HOLES IN SCREENS TO KEEP MOSQUITOES OUTDOORS.
- USE AIR CONDITIONING, IF AVAILABLE.
- STOP MOSQUITOES FROM LAYING EGGS IN OR NEAR WATER.
  - ONCE A WEEK, EMPTY AND SCRUB, TURN OVER, COVER, OR THROW OUT ITEMS THAT HOLD WATER, SUCH AS TIRES, BUCKETS, PLANTERS, TOYS, POOLS, BIRDBATHS, FLOWERPOTS, OR TRASH CONTAINERS.
  - CHECK FOR WATER-HOLDING CONTAINERS BOTH INDOORS AND OUTDOORS.



## Symptoms

NO SYMPTOMS IN MOST PEOPLE (8 OUT OF 10 PEOPLE).

FEBRILE ILLNESS IN SOME PEOPLE (1 IN 5 PEOPLE).

- FEVER
- HEADACHE
- BODY ACHES
- JOINT PAINS
- VOMITING
- DIARRHEA
- RASH

SERIOUS SYMPTOMS IN A FEW PEOPLE (1 IN 150 PEOPLE) (AFFECTS THE CENTRAL NERVOUS SYSTEM)\*.

- HIGH FEVER
- HEADACHE
- NECK STIFFNESS
- STUPOR
- DISORIENTATION
- COMA
- TREMORS
- CONVULSIONS
- MUSCLE WEAKNESS
- VISION LOSS
- NUMBNESS
- PARALYSIS



## Suspected Illness?

IF YOU OR SOMEONE YOU KNOW HAVE SYMPTOMS ALIGNING WITH WEST NILE VIRUS, CALL YOUR DOCTOR OR OUR HELP HOTLINE.

[IF YOU ARE EXPERIENCING SEVERE SYMPTOMS, PLEASE FOLLOW THIS LINK TO FIND THE NEAREST DOCTORS OFFICES, URGENT CARES, OR HOSPITALS CLOSE TO YOU.](#)

## Treatments

NO VACCINE OR SPECIFIC MEDICINES ARE AVAILABLE FOR WEST NILE VIRUS INFECTION.

REST, FLUIDS, AND OVER-THE-COUNTER PAIN MEDICATIONS MAY RELIEVE SOME SYMPTOMS.

IN SEVERE CASES, PATIENTS OFTEN NEED TO BE HOSPITALIZED TO RECEIVE SUPPORTIVE TREATMENT, SUCH AS INTRAVENOUS FLUIDS, PAIN MEDICATION, AND NURSING CARE.



# Technology Design Negatively Impacting People

- Notifications may cause people to overlook other notifications
  - Important messages, emails, missed calls
- Can be distracting and bothersome if notifications go off multiple times
  - People traveling in and out of the region may get the notifications multiple times
- False notifications
  - People may waste their time/resources
- Increase of unnecessary panic/worry
  - Entering areas containing WNV could cause stress, especially if notification is not going away
  - People may not develop symptoms

# Technology Generated Data Negatively Impacting People

- Data privacy breaches
  - Exposure notifications collect and process personal data (device identifiers, proximity information, and location data)
  - Can lead to identity theft, targeted advertising, or other forms of exploitation of the individuals
- Lack of proper safeguard
  - Data could be mishandled, accessed by unauthorized parties
  - Used for purposes beyond contact tracing
- Misinterpretation/misinformation
  - Exposure notification data can be complex and subject to misinterpretation
  - Individuals may not fully understand how to interpret data -> incorrect conclusions
  - Spread of misinformation, unnecessary panic, false sense of security
- Government may use data for surveillance, monitoring, or tracking purposes
  - Infringe on civil liberties and raise concerns about mass surveillance and misuse of personal data
  - Can deepen existing disparities and contribute to unequal health outcomes

# Potential Harms

- Alienating non-users, such as people who do not have smartphones or people who do not know how to download or use the app.
  - These users could unknowingly enter an infectious area without being prepared.
  - Then it could lead to them getting exposed and transmitting it to people outside of the infectious area spreading.
- If an area becomes greatly infected then the app might cause the area to be isolated.
  - People might not want to come into the area which could cause the local economy and infrastructure that relies on tourism/outside to crash.
- The app might create a sense of false safety if data is not accurate or up to date.
  - The user might think that as long as they have the app that they are safe from WNV.
  - They could be in an infectious area that is not on the app due to several reasons (invalid data, missing data, bad service, etc...)

# **Exposure Notifications in Previous Applications**

## COVID-19 Response

**Exposure Notification Systems:** Alternative to Manual Contact Tracing

CA Notify, WA Notify, NHS COVID-19 (UK), SwissCovid

Everytime you come into contact with someone who tested positive for COVID-19 and decided to share their positive diagnosis, you would **receive a notification that you might have been exposed to COVID-19** if you were within range of exposure.

### CA Notify \*

approx. **11 million activations** from December 10, 2020, to July 1, 2021

for every person who was told that they tested positive for COVID-19, **15% of them chose to notify others about their positive diagnosis**

around 110,497 people were notified that they were exposed to someone who tested positive for COVID-19

\* (Aronoff-Spencer et al., 2022)

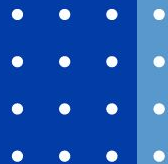
Slow the Spread  
of COVID-19.

# Activate CA Notify

to get an alert if  
you've been exposed  
to COVID-19.



**CA NOTIFY**



[canotify.ca.gov](https://canotify.ca.gov)



# **Ideal Application of Exposure Notifications**

- Strong security to protect and assure the safety of users' data.
- In-app features that allows users to contact medical professionals for advice or immediate care
- Up-to-date information regarding the location of newly infected West Nile patients in the county
- Incorporate different languages into the app
- Frequently updating users of the mosquito's movements during high mosquito seasons
- People are willing to opt-in to location tracking services

# Avoiding Problematic Digital Consumer Technologies

Survey residents in the areas that are affected

- Looking for ways to better support residents and their needs

Researching different tracking technologies to achieve more accurate information of the mosquito's movements

Study how other communities and countries deal with this issue

Ask people about privacy and how they want it protected/establish a strong privacy preserving system

Do research and apply the technology to experimental groups before deployment in order to confirm that it works and can help

# Shortcomings of Proposed Technology

Not usable in areas of no service/weak cell services

Would be annoying for people who travel between boundaries commonly (i.e. for work)

Does not account for people who live within these boundaries

Some people who do not have access to these devices (smartwatches and smartphones)

No real treatment for those who are infected

People who use VPN's could miss out/get false notifications because of their location change



**Thank You**

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