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As California warms, cases of dengue fever are expected to grow

Breakbone fever. The nickname alone attests to the pain that dengue fever can cause. About half the people who get the virus are asymptomatic. But for the rest, an infection can be excruciating, even life-threatening, and there is no treatment.

Historically, dengue fever has been rare in California. But according to [new research](#) published in The Lancet Regional Health Americas, a warming climate is making parts of the state more hospitable to the illness — and the mosquitoes that carry it.

“Given that California only experienced its first cases of locally-acquired dengue in 2023, we were surprised at the extent of current risk that our model predicted,” said senior author [Andy MacDonald](#), an assistant professor at UC Santa Barbara’s Bren School of Environmental Science & Management.

A growing global threat, dengue thrives in more than 125 countries. It’s mainly spread by the mosquito *Aedes aegypti*, an urban bloodsucker that preferentially feeds on humans. The dengue virus has four strains, and a second infection with a different strain can be much more dangerous than the first.

“It’s just a horrible disease,” said Lisa I. Couper, a postdoctoral scholar in environmental health sciences at UC Berkeley and the primary author on the new study. “Even mild cases are described as having a really high fever, joint pain, muscle pain and intense fatigue. More severe cases can involve vomiting, bleeding

and being out of commission for weeks, and can be fatal.”

California health officials first documented *Aedes aegypti* in the state in 2013. Within about a decade, the insect had been found in more than half of California’s counties. Then, in 2023, a person in Pasadena was hospitalized with dengue; in a sweep of neighborhoods near that person’s home, public health officials found one other person who tested positive for dengue but was asymptomatic. Neither had traveled recently, leading the officials to conclude for the first time that the disease had been contracted locally.

So far, dengue is not endemic, or consistently present, in California. It has rarely been detected in the state, with only about 20 cases of local transmission to date. Instead, it overwhelmingly originates in people who have recently returned from places where the virus is endemic.

Couper said this suggests that dengue is repeatedly reintroduced by travelers, but isn’t sustained locally — in part because the climate has been too cool for the virus to persist in much of the state. However, that may be changing in many of California’s human-dominated landscapes.

“California is on the edge of temperature suitability for dengue,” Couper said. “The optimal temperature for the virus to reproduce is around 29 degrees Celsius (or 84 degrees Fahrenheit). For a lot of the year, and for most places, California is below that optimum temperature. But as the climate warms in California, we’re getting closer to it.”

Warming temperatures mean potentially more illness

In the new study, researchers at UC Berkeley, UC Santa Barbara, Stanford University, Arizona State University, and from Santa Clara and Los Angeles Counties, modeled the current and future habitat suitability in California for dengue based on predicted warming.

They looked for places with three overlapping qualities: likely presence of host mosquitoes, likely human travel from places where dengue is endemic, and

temperatures warm enough for the virus to spread. They confirmed that parts of the Central Valley and Southern California already are well-suited for the virus to circulate locally.

“We found that 18.2 million people currently live in an area where they have those necessary conditions for local dengue transmission,” Couper said. Collectively, that represents 46% of Californians, according to 2020 U.S. census data. That number may increase by more than 4 million in the future.

“And the transmission risk will expand geographically and extend for longer periods seasonally as the climate and land use changes,” MacDonald added.

Right now, there is a dengue “bottleneck” in cooler parts of the state, including the north and coastal regions, because of how the virus replicates. Once inside a mosquito, the dengue virus needs time to reproduce before that mosquito’s bite can then infect the next person.

“It’s not as if an *Aedes aegypti* could bite one infected person and then immediately go bite and transmit dengue to another person,” Couper said. “The mosquito takes in the virus, but that virus takes a while to develop inside of the mosquito and become infectious to another person.” In cooler temperatures, the virus replicates more slowly, extending how long its buzzing pest host must survive for the virus to be passed on. But as California warms, those bottlenecks may lessen.

Questions remain about dengue’s future in California

There are a few caveats to the model. One is that the model may underestimate how many people move to the mosquito-suitable areas it identifies, possibly leading to an underestimate of future dengue cases.

“We may be underestimating risk, because the Central Valley is the fastest growing region in California,” Couper said.

Additionally, the model assumes that some regions — those with more people who self-reported ethnicities from places where dengue is already endemic — would see more local cases, because community members would be more likely to visit and

bring infections back home.

“Of course, that’s a pretty big assumption,” Couper said.

There’s also a potential connection between wealth and travel that the study was not able to tease out, such as the likelihood of wealthier Californians traveling to Southeast Asia or other dengue-endemic vacation hotspots and bringing the virus back. And it’s hard to say at this point how the seasonality of dengue may be changing around the world along with climate, or how people’s travel patterns may shift in the future. Nonetheless, suitable habitat for *Aedes aegypti* is increasing in the state.

Though this study focused on dengue risk, Couper said that local transmission of other mosquito-borne tropical diseases also may increase in California in the future, as is happening around the world.

“Climate warming is increasing the transmission of these environmentally-mediated diseases in temperate regions that are at the margins of suitability, like in California,” she said. “We could also see increasing risks for things like chikungunya and zika, which are vectored by the same mosquito.”

For now, Couper encourages Californians to educate themselves on the symptoms of dengue, especially if they live in the Central Valley or southern cities. There are ways to control mosquito exposure, such as by removing the standing water they need to breed, wearing long sleeves and pants during mosquito season, and using products containing the insect repellent DEET. The California Department of Public Health recommends that upon returning to California, people who travel to areas where dengue is common should keep using mosquito repellent and protecting themselves from bites for three weeks even if they don’t have dengue symptoms, to avoid spreading the disease locally.

Couper also encourages people not to panic. “At present, people in California are, by and large, more likely to get dengue from traveling to a dengue-endemic region than they are locally,” she said. “But the risk here does seem to be increasing.”

Maya L. Kapoor at UC Berkeley contributed to this story.

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