

Emerging Autochthonous Transmission of Travel-Associated Vector-Borne Infections in the Continental United States

Steven Duncan, MD and Stephen Eppes, MD

ChristianaCare Health System

Abstract

Over the past 20 years, the continental United States has experienced unprecedented local transmission of infectious diseases which were previously only known to be travel-associated. Confirmed infections have included malaria, dengue, chikungunya, zika, and leishmaniasis. Scientific projection models predict an increasing risk of such infections in the future, particularly in southern states along the Gulf Coast. Outbreaks may reflect changes in climate conditions, infrastructural capacity, and patterns of human behavior.

Introduction

Historically, the U.S. has triumphed when it comes to combatting infectious diseases through public health interventions. Widespread vaccination efforts and mosquito control measures led to the virtual elimination of yellow fever, smallpox, poliomyelitis, and diphtheria.^{1,2} The country was declared malaria-free in 1951 owing to the U.S. National Malaria Eradication Program, which effectively eliminated the need for its own existence and was disbanded.³ Other pathogenic organisms are nearly eliminated in the U.S. such as *Haemophilus influenzae* type b, rubella, tetanus, rabies, and anthrax.^{1,4-7} Cholera and typhoid cases were greatly reduced with the advent of chlorination and other innovations in water and sewage treatment.⁸ The incidence of tuberculosis has decreased ten-fold since systematic national surveillance was implemented in 1953.⁹

As countries at various stages of development collaborate to control infectious diseases on their own soil, U.S. physicians must treat returning international travelers for non-endemic infectious diseases that were acquired abroad. However, within the last 15 years, endemic transmission has been confirmed for certain vector-borne infections which were previously felt to be only travel-associated. These tropical diseases include malaria, dengue, chikungunya, zika, and leishmaniasis.

Malaria

Malaria is a life-threatening bloodborne protozoal infection which primarily afflicts tropical regions of the world. After 20 years without autochthonous spread within the United States, malaria returned between May and October of 2023 with 10 new documented cases. Local transmission of *Plasmodium vivax* was confirmed in Texas, Arkansas, and Florida, and a single case of malaria from *Plasmodium falciparum* was identified in Maryland.¹⁰⁻¹² All patients received medical attention and recovered.¹³

To cause infection, malaria depends on environmental alignment between the parasite, vector, and host. Though the risk of contracting malaria in the United States remains low, its vector, the *Anopheles* mosquito, can be found in most states and territories. *Plasmodium* sporozoites can survive and replicate at temperatures above 59 degrees Fahrenheit (optimally at 80 degrees

Fahrenheit and 80% relative humidity), making southern climates particularly hospitable in the summer months.^{13,14} Impacts of climate change on global temperature, rainfall patterns, and other environmental conditions are predicted to lengthen mosquito survival time and facilitate transmission dynamics.¹⁵

Dengue

Dengue, a Flavivirus infection spread by *Aedes* mosquito vectors, is endemic to tropical and subtropical regions. Dengue infection can cause fever, headache, rash, and body pains.¹⁶ Due in part to efforts from the Pan American Health Organization, mosquito populations were effectively suppressed, and no dengue cases were reported in the U.S. for 35 years. Then in the southernmost reaches of the United States, five sporadic outbreaks of locally transmitted dengue were recorded in the Mexico-US border town of Brownsville, Texas between 1980-2005; dengue was rare and isolated to the south Texas border for decades.^{17,18}

In the past 15 years, autochthonous transmission has been newly confirmed in multiple US states: Texas, California, Arizona, and Florida. In 2023, a total of 173 locally transmitted dengue cases were reported by the Florida Health Department.¹⁹ The geographical range of natural dengue vectors, *Aedes aegypti* and to a lesser extent *Aedes albopictus*, has already expanded to the southern United States and these species have been found as far north as the California Bay Area and Washington D.C.²⁰

The coastal southeastern United States is predicted to be suitable for endemic dengue transmission by 2050. Covariate prediction models of global climate, mosquito range, and population density suggest that environmental suitability will increase such that 2.3 billion more people will become at risk of contracting dengue worldwide by 2080. As urbanization goes forward, it is expected that economically disadvantaged populations at the greatest risk of contracting the disease will grow disproportionately.²⁰

Chikungunya

Chikungunya is an arbovirus in the Togaviridae family, also transmitted by *Aedes* mosquito vectors in tropical areas. While some cases are asymptomatic, affected individuals may develop high fever, rash, and musculoskeletal pain which can be severe and debilitating.²¹ For the first time in the continental United States, 13 cases of locally acquired chikungunya were reported in Texas and Florida from 2014 through 2015. If including all U.S. states and outlying territories, locally acquired chikungunya infections briefly outnumbered travel-associated infections by nearly double (4671 versus 2850) in 2014.²² Since 2016, there have been no new cases reported in the continental U.S.

The range of chikungunya's *Aedes aegypti* and *Aedes albopictus* mosquito vectors is predicted to expand within North America due to climate change, which poses a threat particularly in southern U.S. states like Texas and Florida where infections were previously reported. In general, the population of the continental United States is immunologically naïve to the virus which leaves inhabitants vulnerable to infection.²³⁻²⁵ In the event of resurgence, American physicians may be unprepared to treat chikungunya and its associated chronic, post-infectious complications which can often be underrecognized and mismanaged.²⁶

Zika

Much like dengue and chikungunya, Zika is an arbovirus transmitted by *Aedes* mosquitos which can cause a self-limited viral syndrome in humans.²⁷ Zika virus is associated with neurologic complications in some patients, and in pregnant women the infection may cause severe congenital malformations such as microcephaly and intracranial calcifications, particularly during the first trimester.²⁸

Zika remains predominantly travel-associated, however 231 cases of local transmission were reported in Texas and Florida between 2016 and 2017.²⁹ The virus also spread to non-travelers through vertical and sexual transmission routes.^{30,31} Similar to dengue and chikungunya, Zika's potential to cause an outbreak within the continental United States likely depends upon the predicted expansion of *Aedes aegypti* and *Aedes albopictus* species in a warming climate.²⁵

Leishmaniasis

Leishmania is an obligate intracellular protozoan that is carried by sandfly vectors and gives rise to parasitic infections in humans. Symptoms can range from localized, ulcerating cutaneous lesions to severe visceral disease with multi-organ involvement and a high mortality rate.³²

Despite its reputation as a travel-associated infection, leishmaniasis has been locally acquired to the United States since 2007 with confirmed cases in Texas and Oklahoma. The World Health Organization officially classified the United States as endemic for leishmaniasis in 2015.^{33,34} The state of Texas requires public health reporting of leishmaniasis, and endemic transmission is more common (~60% of cases) than travel-acquired infections in this region.³³

Endemic leishmaniasis within the United States is caused by *L. mexicana* which exclusively causes cutaneous/mucocutaneous disease.³⁵ Other *Leishmania* species infected horses and dogs within the United States such as *L. infantum* and *L. (Mundinia) species*; although only animal leishmaniasis has been documented, these other species are known to be pathogenic in humans. The United States is also home to several competent sandfly vectors: *Lutzomyia diabolica*, *Lutzomyia anthophora*, and *Lutzomyia shannoni*. While *Lu. diabolica* is considered more anthropophilic, *Lu. shannoni* has widespread distribution in many states and has the potential to spread leishmaniasis broadly under the right conditions.³⁵

Discussion

Several tropical diseases, once thought to be only travel-associated in the continental United States, have recently emerged as locally transmissible or even endemic. Though the local acquisition of tropical vector-borne infections remains limited, this trend is unprecedented in the modern era. Such outbreaks may reflect ongoing changes in global climate conditions, leading to favorable environments for the survival and proliferation of vectors. Scientific prediction models postulate that the potential for future outbreaks driven by insects in the U.S. will progressively increase.²⁰ Arboviral vaccination, currently available to protect against dengue and chikungunya, may eventually become useful for certain regional populations and travellers.^{36,37}

Other vector-borne diseases threaten to increase their footprint or take hold within the continental United States. Domestic accounts of American trypanosomiasis (Chagas disease) have periodically been described in southern states at low rates, due in part to poor surveillance.³⁸ Even still, since the turn of the twenty-first century, autochthonous case counts

have increased 10-fold, and triatomine vectors have been identified in 29 out of 50 states including Delaware.^{39,40} An outbreak of Oropouche virus came to Cuba in May 2024, coming close to the U.S. though mosquito species appear to have limited competence for viral transmission in North America.^{41,42} Spatial expansion of mosquito territories within a warming climate has been influential in shaping recent U.S. outbreaks of Eastern equine encephalitis and West Nile virus.^{43–45}

Human behavior surrounding international travel and support for public health infrastructure continues to play a significant role in how tropical diseases are spread between countries. After eradication, viral outbreaks can signal deteriorating capacity as surveillance wanes, diagnostic tools are less available, and systems are no longer prepared for sizeable outbreaks.⁴⁶ The COVID-19 pandemic laid bare many critical deficiencies in the U.S. public health system's ability to respond to large-scale infectious threats.⁴⁷ U.S.-trained physicians may be unfamiliar with managing tropical infections and existing infrastructure may be insufficient to contain new tropical outbreaks.

Conclusion

Instances of locally transmitted tropical infections, previously considered to be only travel-associated, have started to arise within the continental United States. Cases of endemic malaria, dengue, chikungunya, zika, and leishmaniasis have all been confirmed within the past 20 years. Outbreaks may reflect emerging trends in climatic, infrastructural, and human factors.

Dr. Duncan may be contacted at steven.duncan@christianacare.org.

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