



# **Dengue and Chagas and Malaria, oh my!**

## **How CDC is Addressing the Rising Threat of Tropical Disease in the United States**

**Dr. Lyle R. Petersen, Director, Division of Vector-borne Diseases**

**Dr. Monica Parise, Deputy Director for Science and Program,  
Division of Parasitic Diseases and Malaria**

**CAPT David Fitter, Director, Division of Global Migration Health**

July 9, 2024

# CDC's National Center for Emerging and Zoonotic Infectious Diseases

- Advanced molecular detection
- Antimicrobial-resistant infections
- Deadly diseases like Ebola, Nipah, and anthrax
- Foodborne, waterborne, and fungal diseases
- Global migration health
- Healthcare-associated infections
- Investing in state and local capacity
- Parasitic diseases and malaria
- Vector-borne diseases

# Emerging Infections – Driving Factors

- **Increasingly Crowded**
  - 11 billion by 2050
  - 80% has occurred in less developed countries
- **Increasingly Connected**
  - Travel ~2.75B airline passengers globally
  - Global supply chains
- **Increasingly Converging**
  - Human and animal populations converging
  - Humans encroaching on wildlife habitats



# Invasive Mosquito-Borne Viral Diseases in the United States

**Lyle R. Petersen, MD, MPH, FASTMH**  
**Director, Division of Vector-borne Diseases**

July 9, 2024



# Mosquito-Borne Pathogens

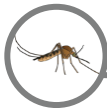
Identified in the United States that cause human disease, 1650–2023



*Aedes* spp.



*Anopheles* spp.



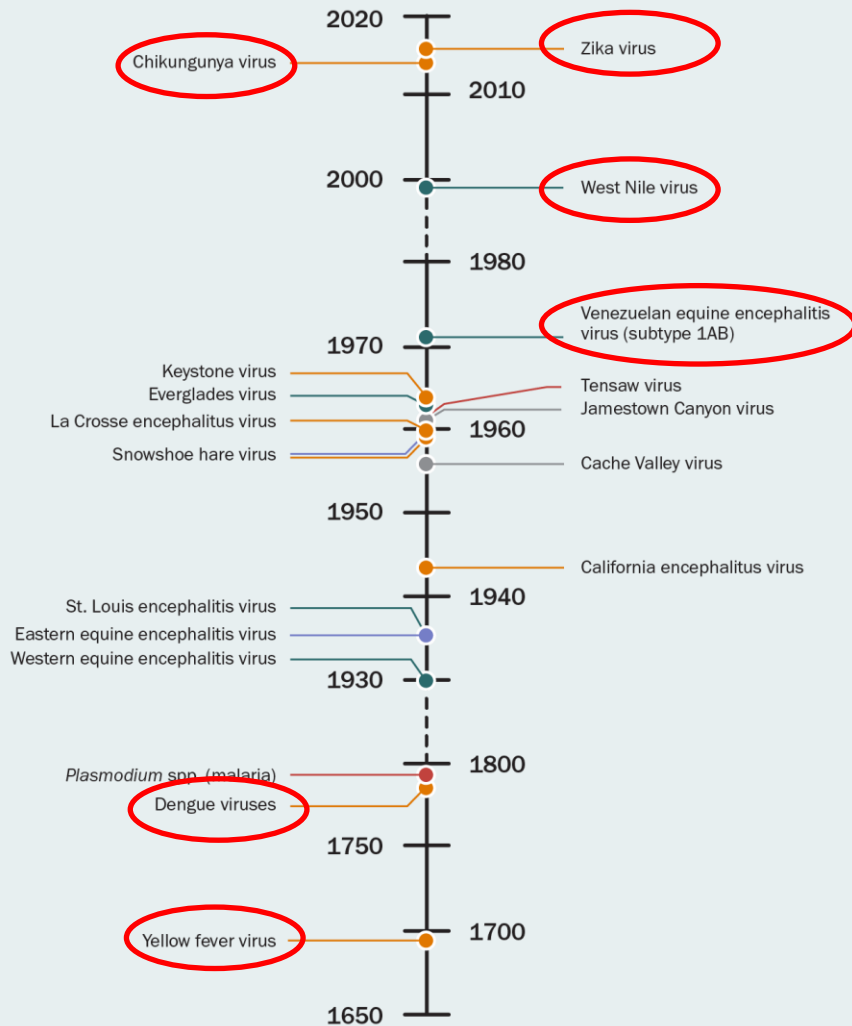
*Culex* spp.



*Culiseta* spp.



Species Not Yet Indicated



# Dengue

- Mosquito-borne, flu-like viral illness, can be fatal, particularly in children
- Human-mosquito-human transmission
- Four viral serotypes
- Lifelong DENV type-specific immunity
- Short-term cross-immunity (~1–2 years)
- Secondary dengue infections increase the risk of severe dengue, likely due to antibody dependent enhancement



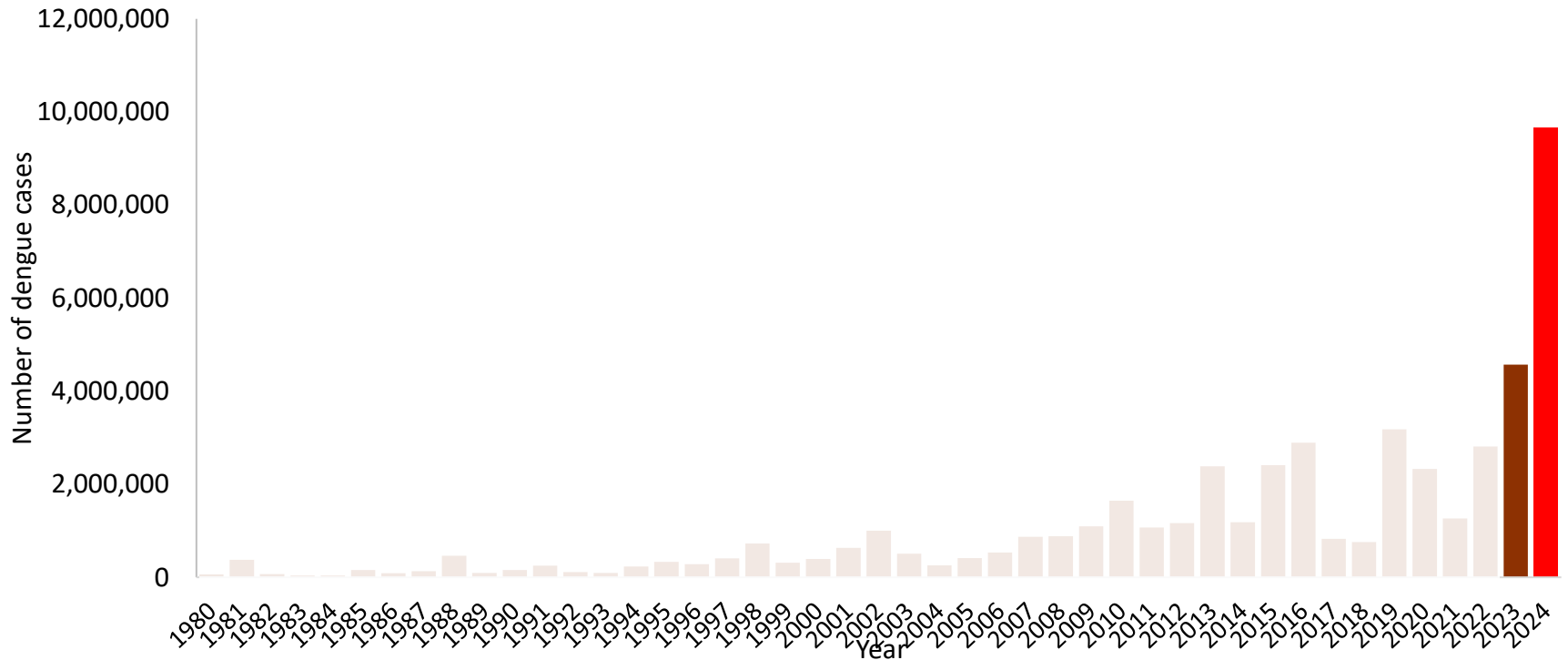
*Aedes aegypti*



*Aedes albopictus*

# Dengue cases in the Americas, 1980–2024\*

More than **9.6 million** cases reported as of June 20 in 2024



\*Data from PAHO PLISA Health Information Platform for the Americas

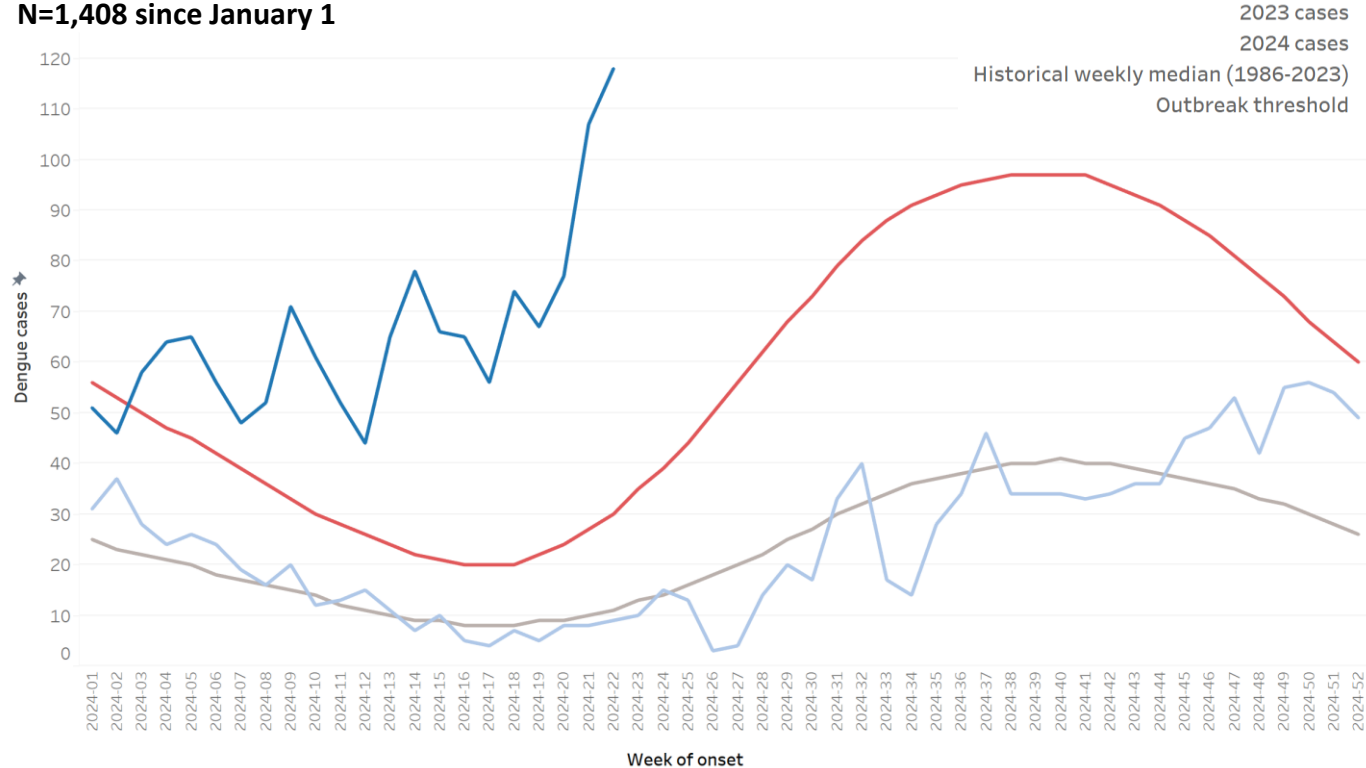
# In Puerto Rico, there are concerning signs of a potential large outbreak with many weeks above the threshold

Dengue cases (PCR or IgM positive) compared to the historical weekly median, and outbreak threshold, *Puerto Rico*, 2024.

*Last updated: June 19, 2024 - Data are preliminary and subject to change.*

*Case counts from the most recent week (Week 22) are still preliminary.*

**N=1,408 since January 1**

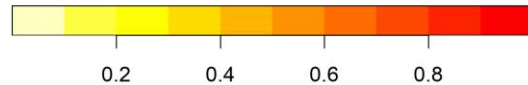
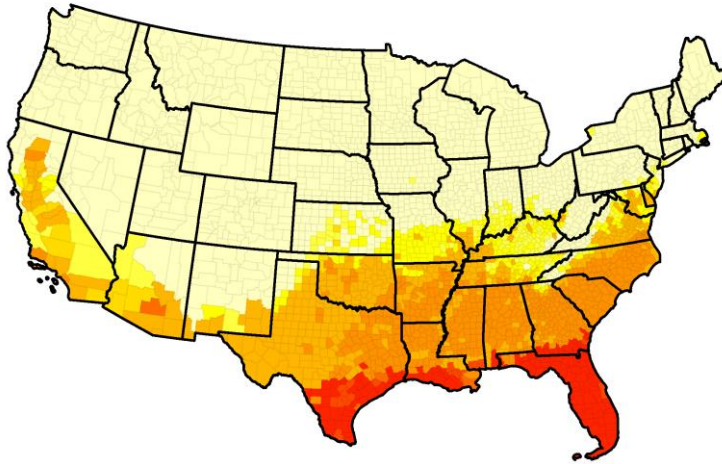


**DENV infections in Puerto Rico have been above the epidemic threshold for 20 weeks.**

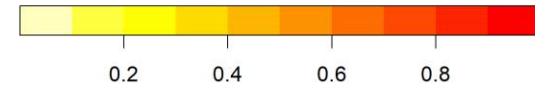
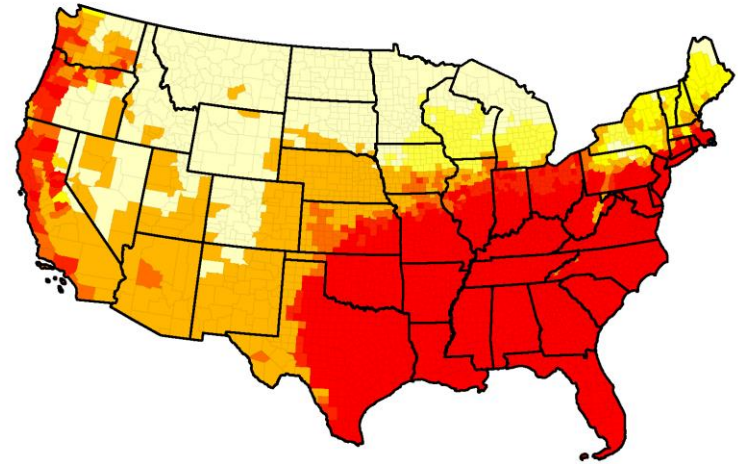


# Dengue vectors are present across much of the U.S

Probability of *Ae. aegypti* presence



Probability of *Ae. albopictus* presence

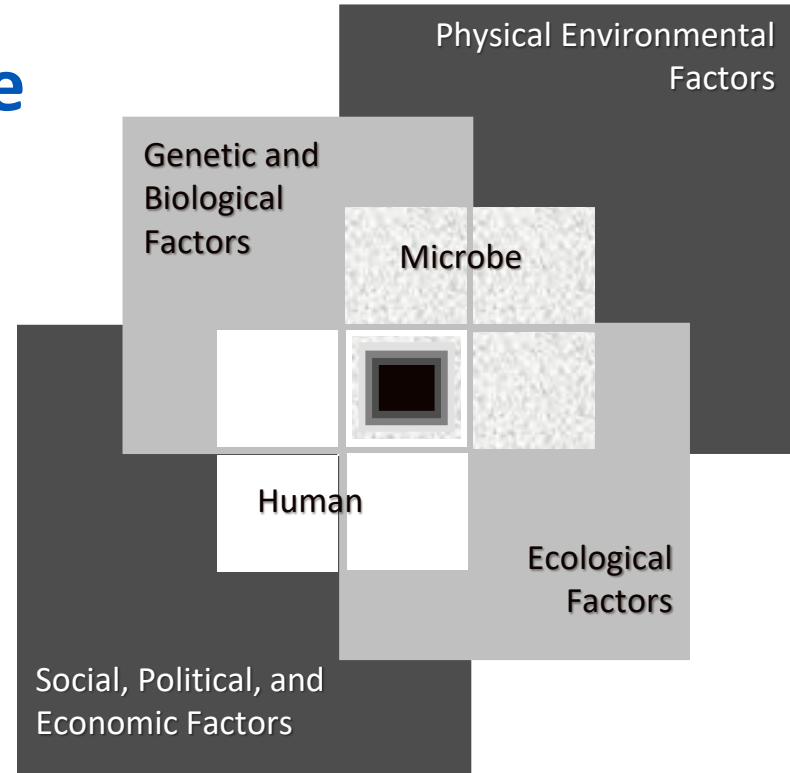


Monaghan AJ, Eisen RJ, Eisen L, McAllister J, Savage HM, et al. (2019) Consensus and uncertainty in the geographic range of *Aedes aegypti* and *Aedes albopictus* in the contiguous United States: Multi-model assessment and synthesis. PLOS Computational Biology 15(10): e1007369. <https://doi.org/10.1371/journal.pcbi.1007369>

<https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1007369>

# Drivers for disease emergence

- Climate and weather
- Changing ecosystems
- Economic development and land use
- Microbial adaptation and change
- Human susceptibility to infection
- Human demographics and behavior
- Technology and industry
- International travel and commerce
- Breakdown of public health measures
- Poverty and social inequality
- War and famine
- Lack of political will
- Intent to harm



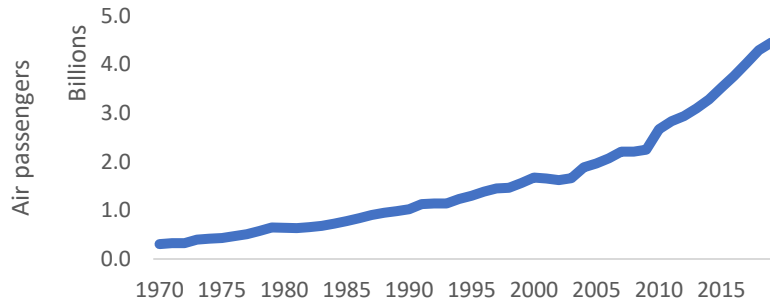
*Convergence Model for Emerging Diseases*

*Note the challenge of attribution!*

**Source:** Institute of Medicine 2003  
report – Microbial Threats to Health

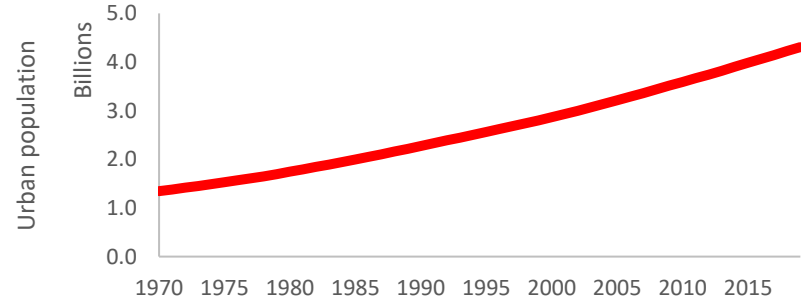
# Travel and population growth contribute to increases in global dengue burden

Global Travel, World Bank, 1970-2019



Rapid increase in human travel

Urban population 1970-2019, World Bank



Rapid and unplanned urbanization

# VBD National Public Health Strategy



## Collaborating Federal Entities

- **Authorized by Kay Hagan Tick Act (2019)**
- **HHS/OASH and CDC co-led**
- **Built upon the VBD National PH Framework**
- **17 collaborating federal entities**
  - Department of Health and Human Services
  - Department of Defense
  - Department of Agriculture
  - Environmental Protection Agency
  - Department of the Interior
  - Department of Commerce
  - National Aeronautics and Space Administration
  - National Invasive Species Council
  - U.S. Global Change Research Program
  - Department of Homeland Security

# VBD National Public Health Strategy

## **Vision:**

A nation where VBD no longer threaten human health & well-being

## **Mission:**

Protect people from illness, suffering, & death due to VBD

### **GOAL 1**

Better understand when, where, and how people are exposed to and become sick or die from VBDs

### **GOAL 2**

Develop, evaluate, and improve tools, methods, and guidance to diagnose VBDs

### **GOAL 3**

Develop, evaluate, and improve tools, methods, and guidance to prevent and control VBDs

### **GOAL 4**

Develop and assess drugs and treatment strategies for VBDs

### **GOAL 5**

Disseminate and implement public health tools, programs, and collaborations to prevent, detect, diagnose, and respond to VBD threats

# Looking Forward

## Protecting people from vector-borne diseases

Successfully implementing the VBD National Strategy depends on continued collaboration, support, leadership, and excellence in innovation and program implementation. Collaboration within and outside of the federal government is necessary to protect the nation and save lives.

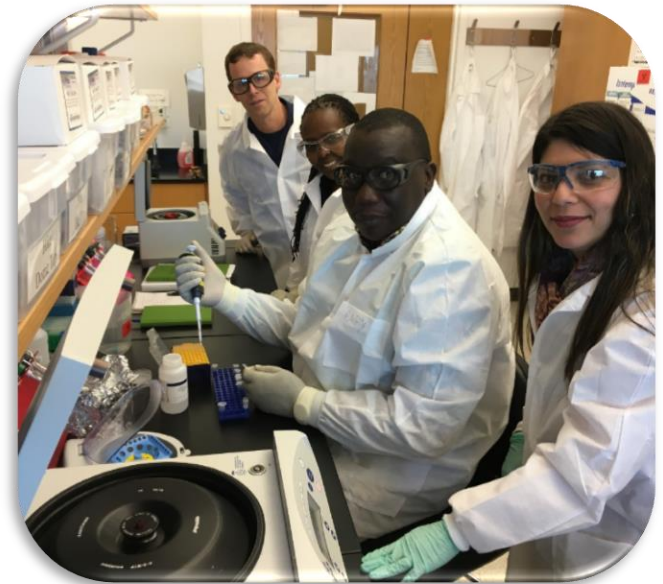


# Ending the Neglect of Neglected Tropical Diseases in the US

**Monica Parise, MD**

**Deputy Director for Science and Program  
Division of Parasitic Diseases and Malaria  
National Center for Emerging and  
Zoonotic Infectious Diseases**

July 9, 2024



# Neglected Tropical Diseases (NTDs)

- **Ancient diseases of poverty**
- **Impose devastating human, social and economic burden on > 1.5 billion people**
  - 200,000 deaths and 19 millions DALYs lost annually
  - Billions in direct health costs, loss of productivity, reduced socioeconomic & educational attainment
- **Role of severe weather**
- **CDC's role: Reduce illness, disability, death caused by NTDs**



Trachoma is the world's leading infectious cause of blindness



Lymphatic filariasis



## 21 WHO Recognized NTDs

- *Buruli ulcer*
- **American trypanosomiasis (Chagas disease)\***
- *Dengue & chikungunya*
- **Dracunculiasis (Guinea worm disease)\***
- *Echinococcosis\**
- Foodborne trematodes infections
- Human African trypanosomiasis (sleeping sickness)\*
- *Leishmaniasis\**
- *Leprosy*
- **Lymphatic filariasis\***
- *Mycetoma/chromoblastomycosis*
- **Onchocerciasis\***
- *Rabies*
- Scabies & other ectoparasites
- **Schistosomiasis\***
- **Soil-transmitted helminthiases\***
- Snakebite envenoming
- Taeniasis/cysticercosis
- **Trachoma\***
- Yaws
- Noma

# Global to Domestic Continuum

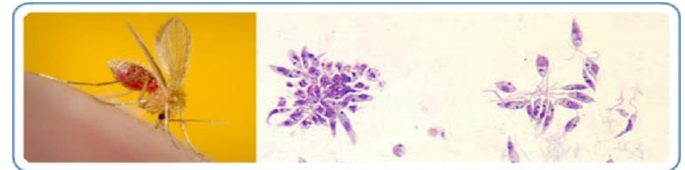
- Chagas disease in the US – preventing congenital transmission and donor-derived infections
- Lymphatic filariasis in America Samoa – interrupting transmission, preventing disability, developing global guidance
- Leishmaniasis in the U.S – improving our understanding of transmission risk in the US and risk for introduction of other species



Triatomine bug, vector of Chagas disease



Health worker demonstrating proper hygiene technique on the leg of a lymphatic filariasis patient

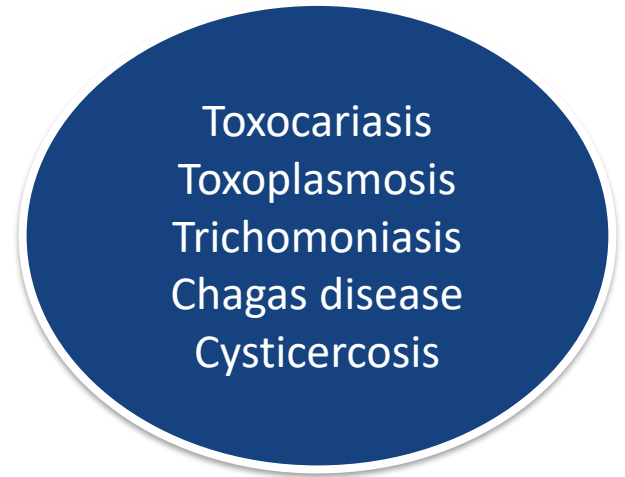


Left: Sand fly, vector of leishmaniasis

Center, right: *Leishmania* sp. promastigotes found in sand fly gut

# Neglected Parasitic Infections in the US

- **Burden of disease is poorly defined**
  - Lack surveillance and tools to define
- **Lack of awareness among healthcare providers**
- **Disproportionately affect minorities and disadvantaged people**



OPEN ACCESS Freely available online

PLoS NEGLECTED TROPICAL DISEASES

Review

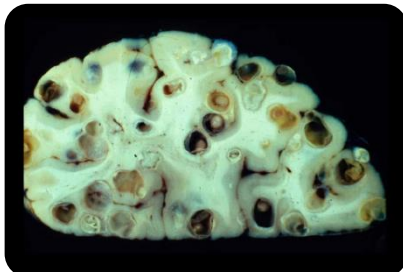
## Neglected Infections of Poverty in the United States of America

**Peter J. Hotez\***

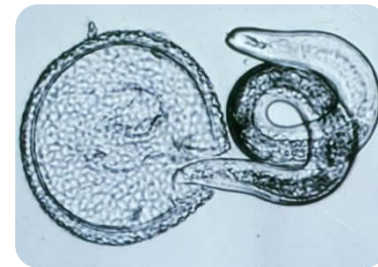
Department of Microbiology, Immunology, and Tropical Medicine, The George Washington University and Sabin Vaccine Institute, Washington, D.C., United States of America

# Burden of Neglected Parasitic Infections in the US

- Chagas disease **300,000** people infected
- Neurocysticercosis **2,000** cases diagnosed yearly
- Toxocariasis **70** people are blinded each year
- Toxoplasmosis **>60 million** people chronically infected
- Trichomoniasis **8 million** people newly infected each year



Brain affected by neurocysticercosis  
Courtesy of [Medscape](#)



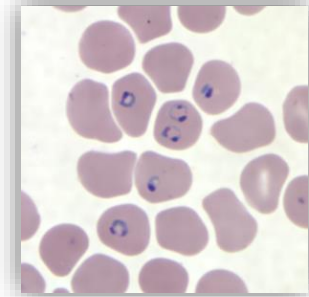
*Toxocara* larva hatching

# Domestic Priorities

- **Outbreak investigations**
  - E.g., cyclosporiasis, malaria
- **National surveillance for parasitic diseases**
  - 4 nationally notifiable diseases in the US
- **Clinical inquiries and Drug Service**
  - Thousands of clinical inquiries/year
  - 100+ drug releases/year of treatments otherwise unavailable in the US



Above: Oocyst of *Cyclospora cayentanensis*  
Below: Rings of *P. falciparum* (malaria parasite) in red blood cells



## Malaria Hotline for Healthcare Providers

Via telephone: 1-770-488-7788 or 1-855-856-4713 (toll free) Via telephone (after hours): 1-770-488-7100 Via e-mail: [malaria@cdc.gov](mailto:malaria@cdc.gov) Hours: 9am–5pm ET / Monday–Friday

## Parasitic Diseases Hotline for Healthcare Providers (for all non-malaria parasitic diseases)

Via telephone: 1-404-718-4745 Via telephone (after hours): 1-770-488-7100 Via e-mail: [parasites@cdc.gov](mailto:parasites@cdc.gov) Hours: 8am–4pm ET / Monday–Friday

## Domestic Priorities (cont.)

- **Chagas disease**
  - Increasing awareness among US healthcare providers, establishing screening
- **Soil-transmitted Helminths**
  - Collaborating with partners in Alabama and Mississippi to determine prevalence
- **Lymphatic filariasis (LF) in American Samoa**
  - Working with partners toward elimination

Right: School children check in to take preventive medicines for LF during a round of mass drug administration.



# Innovating for Impact

- **Multiplex immunoassay**
  - Developed by CDC to detect 30+ disease agents
- **Operational research**
  - Sugar baits, spatial repellents, larval control, housing modifications
- **Vector genetics**
  - Mosquito cryopreservation
- **Detecting resistance**
  - Genomic and transcriptomic approaches to insecticide resistance
  - Development of novel assays to detect drug resistance
- **Leveraging existing technology for new uses**
  - Schistosomiasis testing



Above: Sugar bait  
Below: Spatial repellent

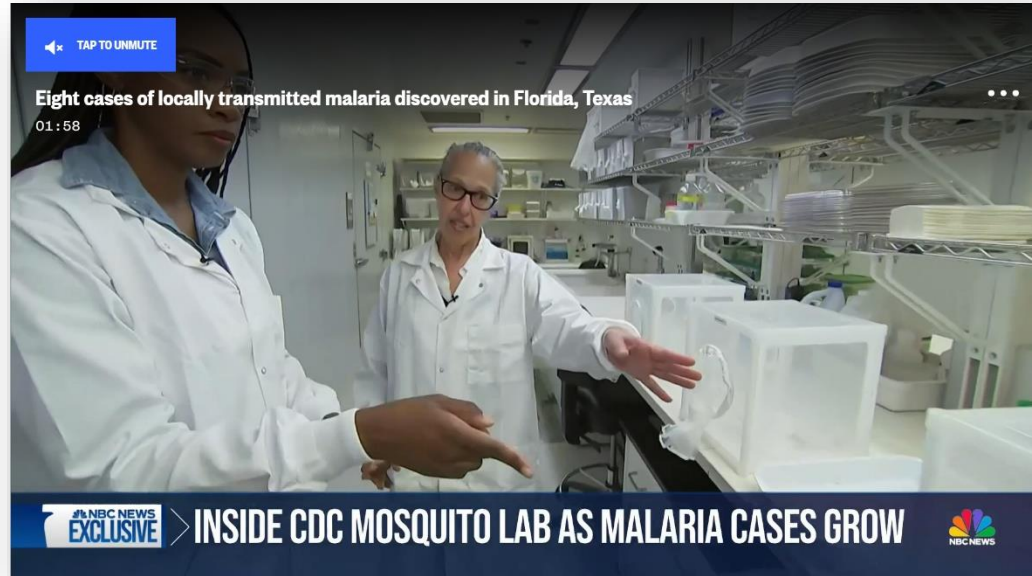


# Malaria Prevention & Control



# 2023 Locally Acquired Malaria in US

- First cases locally acquired in 20 years
- Partnerships with states crucial in limiting local spread
- CDC's role
  - Supported states with diagnosis, lab testing, mosquito control, and more
  - Conducted genomic sequencing to better understand the threat



# Laboratory Readiness for Domestic Malaria

- **Genome sequencing approaches provide critical information to support case/cluster investigations**



- Detect new and/or emerging antimalarial resistance markers

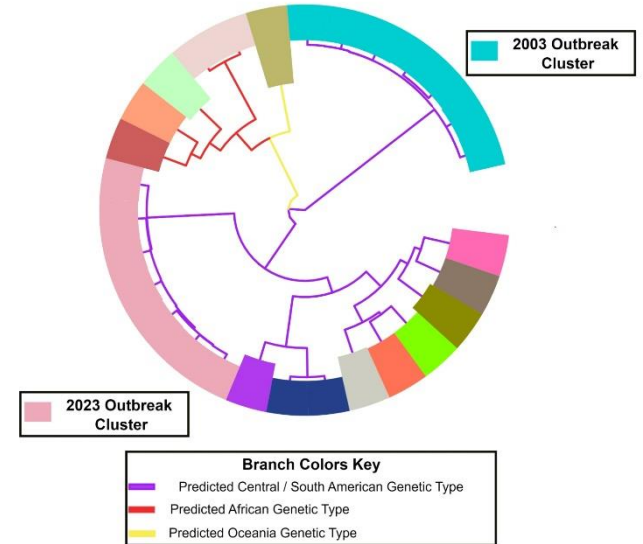


- Determine genetic relatedness of strains

- Did a cluster emerge from a single introduction event?



- Predict geographical origin of strains



Genotyping results demonstrated that the 2023 *P. vivax* strains in Florida were associated with a single introduction of a strain with South/Central American origin. This cluster was distinct from a 2003 cluster in Florida.



*Anopheles stephensi* mosquito

## Focus on *Anopheles stephensi*

- **Changing the malaria landscape**
  - Thrives in urban areas with little rainfall
  - If established in US, could increase malaria risk
- **What CDC is doing**
  - Identifying geographic areas at greatest risk and spread
  - Improving our understanding of mosquito bionomics to best target interventions
  - Improving our understanding of the contribution to malaria transmission
  - Improving surveillance and control capacity across Africa with appropriate tools and best practices

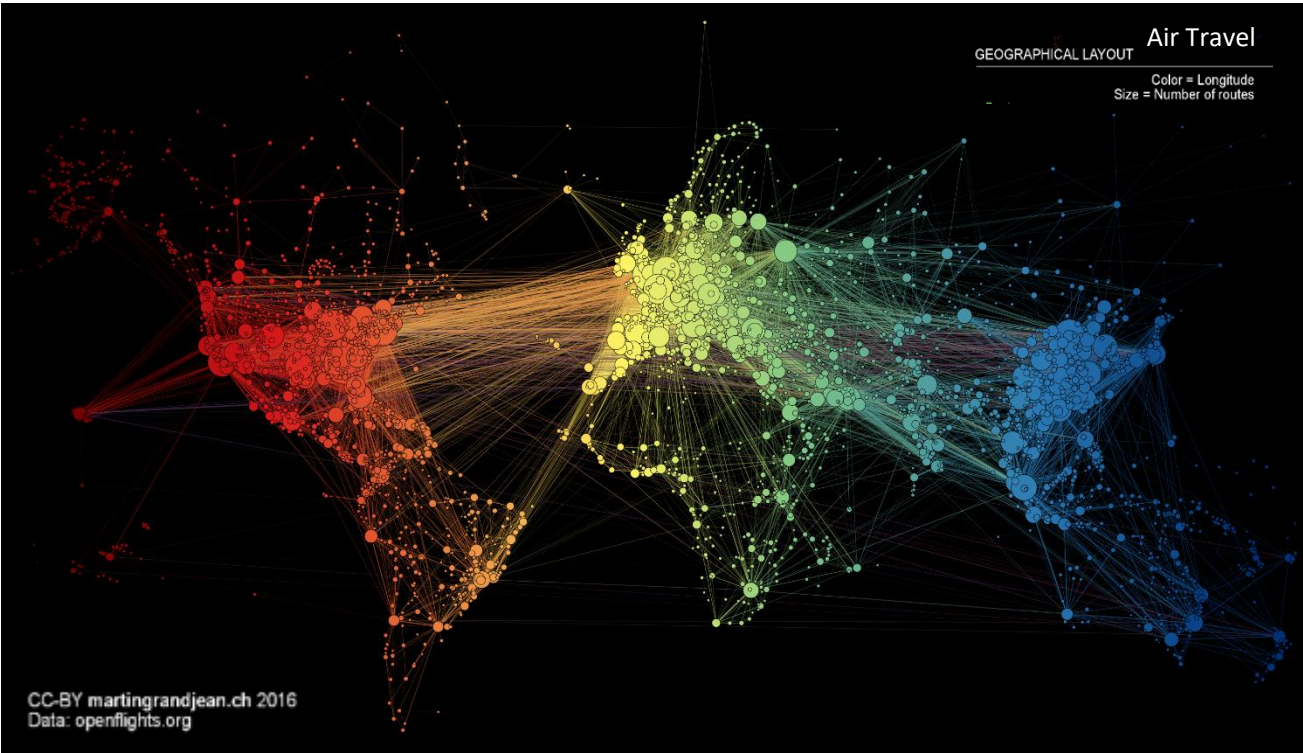
# Global Migration and Neglected Tropical Diseases

**CAPT David Fitter, MD, Director**  
**Division of Global Migration Health**

July 9, 2024

# Global Travel Volume to the United States

*Approximately 1 million travelers arrive in the United States each day at air, land, and sea ports of entry*



# Mitigation Along the Travel Continuum

## Before Travel

- Yellow Book
- CDC Travelers' Health website
  - Travel Health Notices
  - Destination pages
  - Travel advice
- Vaccinations and preventive medicines

## During Travel

- Traveler takes precautions
- Partners detect and report ill travelers

## After Travel

- Airport public health messaging
- Guidance for clinicians when evaluating ill travelers



# Travel Health Surveillance

## GeoSentinel

Worldwide clinical-care-based network for the surveillance and research of travel-related illnesses



### Surveillance of Molecular epidemiology of Malaria In Travelers – SUMMIT

## TravEpiNet

Consortium of health clinics across the United States that studies the role of travelers in the spread of global pathogens and delivers pretravel care.

Enabling clinicians to easily find location-based travel health recommendations—is innovation needed?

R Ryan Lash <sup>1</sup>, Allison Taylor Walker <sup>1</sup>, C Virginia Lee <sup>1</sup>, Regina LaRoque <sup>2 3</sup>, Sowmya R  
Edward T Ryan <sup>2 3</sup>, Gary Brunette <sup>1</sup>, Kelly Holton <sup>1</sup>, Mark J Sotir <sup>1</sup>

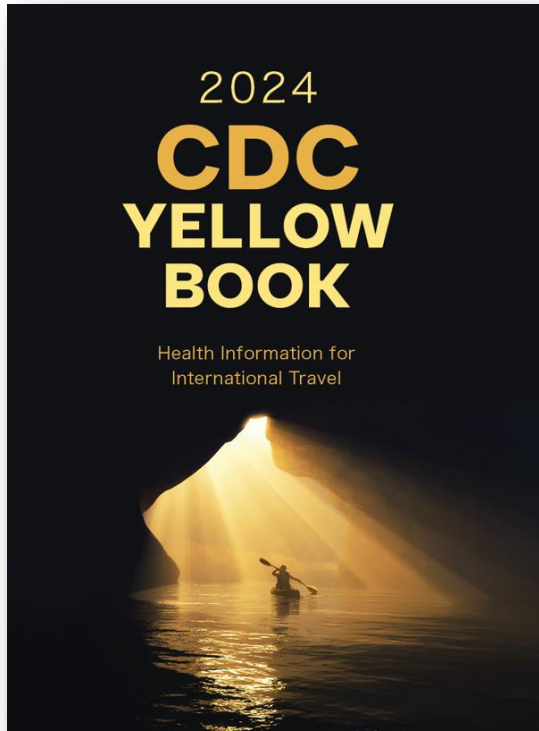
Affiliations + expand  
PMID: 29788401 PMCID: PMC5991802 DOI: 10.1093/jtm/tay035

HEADING  
HOME  
HEALTHY

Heading Home Healthy

A program to help travelers stay healthy when they are returning home to visit friends and relatives

# Yellow Book and CDC Travelers' Health Website



**CDC** Centers for Disease Control and Prevention  
CDC 24/7: Saving Lives, Protecting People™

## Travelers' Health

Travelers Health > Brazil

### Brazil

On This Page

[Travel Health Notices](#)

#### Avoid bug bites

##### [Chagas disease \(American Trypanosomiasis\)](#)

- Accidentally rub feces (poop) of the triatomine bug into the bug bite, other breaks in the skin, your eyes, or mouth
- From pregnant woman to her baby, contaminated blood products (transfusions), or contaminated food or drink.

• [Avoid Bug Bites](#)

[Chagas disease](#)

##### [Dengue](#)

- Mosquito bite

• [Avoid Bug Bites](#)

[Dengue](#)

##### [Leishmaniasis](#)

- Sand fly bite

• [Avoid Bug Bites](#)

[Leishmaniasis](#)

##### [Zika](#)

- Mosquito bite
- An infected pregnant woman can spread it to her unborn baby

• [Avoid Bug Bites](#)

[Zika](#)



# Travel Health Notices

## Inform US travelers about global health risks and precautions during:

- A disease outbreak in a country or region
- Sporadic cases of a disease in an unusual or new geographic location
- Natural and human-made disasters with severe environmental health risks, or infrastructure damage that would limit healthcare services availability
- Mass gathering events that can lead to disease outbreaks

### Chikungunya in Maldives

Level 4 - Avoid All Travel

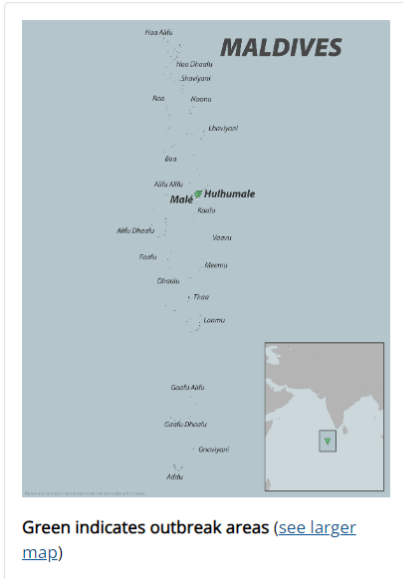
Level 3 - Reconsider Nonessential Travel

Level 2 - Practice Enhanced Precautions

Level 1 - Practice Usual Precautions

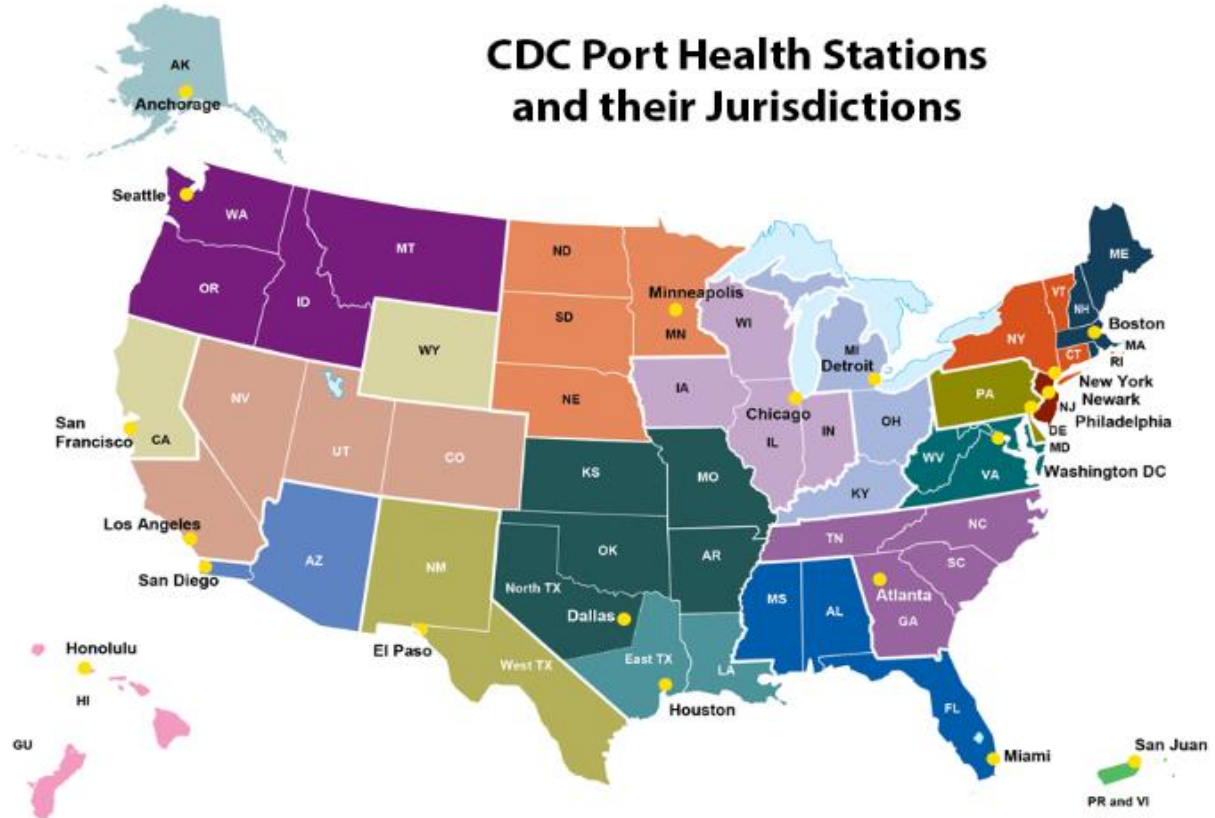
#### Key points

- There is an outbreak of chikungunya in Malé and Hulhumalé regions of Maldives (see map).
- Mosquitoes spread the virus that causes chikungunya.
- You can protect yourself by [preventing mosquito bites](#), which includes using insect repellent; wearing long-sleeved shirts and pants; and staying in places with air conditioning or that use window and door screens.
- [Vaccination for chikungunya](#) is recommended for people aged  $\geq 18$  years who are traveling to a destination with a current chikungunya outbreak.
- If you are pregnant, reconsider travel to Maldives, particularly if you are close to delivering your baby. Mothers infected around the time of delivery can pass the virus to their baby before or during delivery. Newborns infected in this way or by a mosquito bite are at risk for severe illness, including poor long-term outcomes.
- You should seek medical care if you develop [fever, joint pain, headache, muscle pain, joint swelling, or rash](#), during or after travel.



# Port Health Protection System

- Support state and local health departments and other CDC offices in confirming if an infectious disease case could be travel-associated
- Life-saving drug release and distribution program
  - Botulism and diphtheria antitoxins
  - Previously artesunate for severe malaria

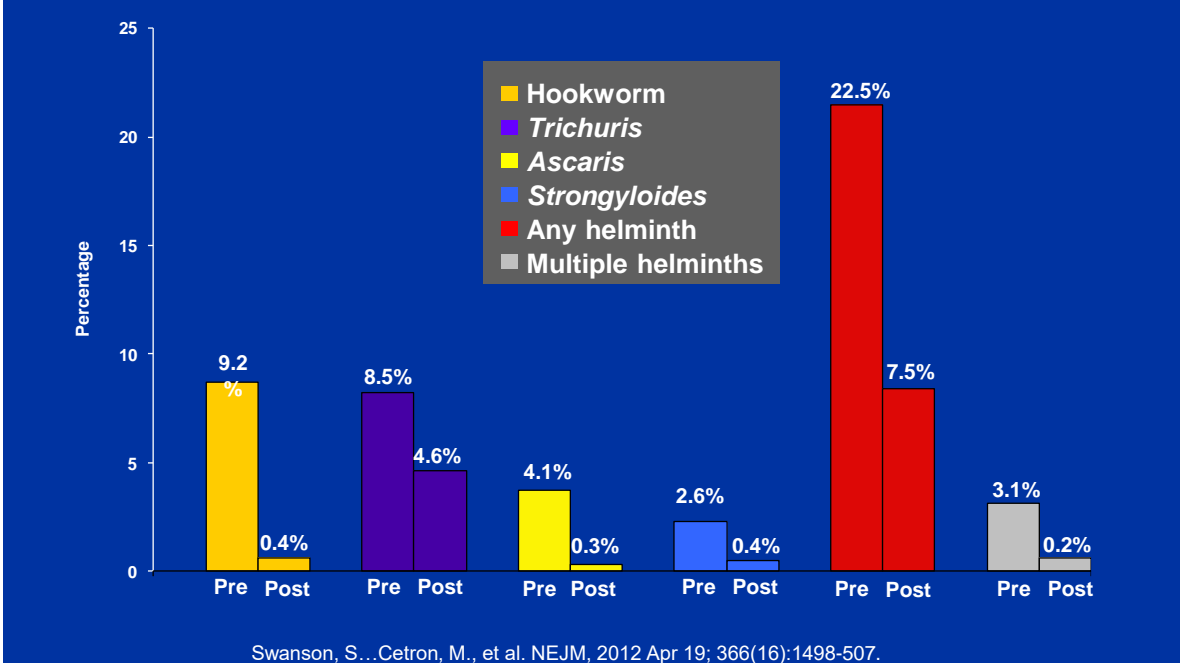


# Presumptive Parasitic Treatment Program for US-bound Refugees (1999–Present)

Region	Artemether-lumefantrine (malaria)	Praziquantel (Schistosoma)	Albendazole (soil-transmitted helminths)	Ivermectin* (Strongyloides)
Africa, non-Loaloa areas	Recommended	Recommended	Recommended	Recommended
Africa, Loa loa areas	Recommended	Recommended	Recommended	Not Recommended
Asia	Not Recommended	Not Recommended	Recommended	Recommended
Middle East	Not Recommended	Not Recommended	Recommended	Recommended
Latin America	Not Recommended	Not Recommended	Recommended	Recommended

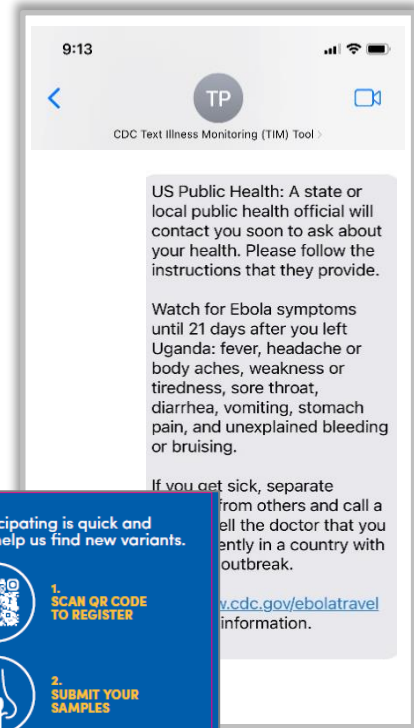
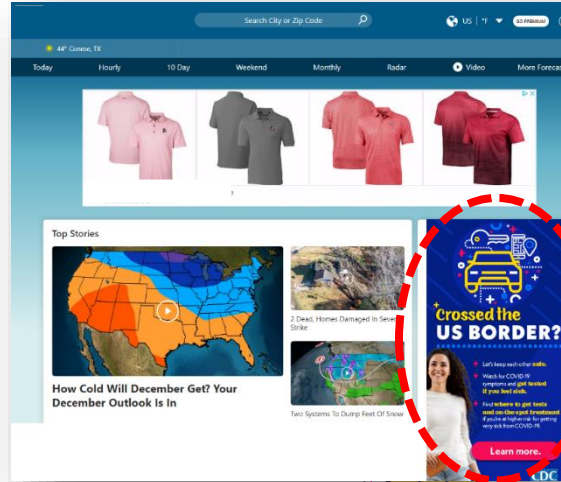
\* If available in country

# Prevalence of Intestinal Parasites Among Refugees Arriving in Minnesota, before/after Overseas Treatment— May 1999 (N = 26,928)



# Innovating Traveler Engagement

- Geotargeting technologies to send public health messages to travelers
- Text Illness Monitoring (TIM) tool
- Traveler-based Genomic Surveillance (TGS) program for early detection



# Thank you!

For more information, contact CDC

1-800-CDC-INFO (232-4636)

TTY: 1-888-232-6348 [cdc.gov](https://www.cdc.gov)

Follow us on X (Twitter) @CDCgov & @CDCEnvironment

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the U. S. Centers for Disease Control and Prevention.