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

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

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

Rapid increase in human travel

Rapid and unplanned urbanization
VBD National Public Health Strategy

- 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
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

<table>
<thead>
<tr>
<th>NTDs within DPDM’s purview</th>
<th>Diseases in italics housed in other CDC centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Buruli ulcer</td>
<td>- Onchocerciasis*</td>
</tr>
<tr>
<td>- American trypanosomiasis <em>(Chagas disease)</em></td>
<td>- Rabies</td>
</tr>
<tr>
<td>- Dengue &amp; chikungunya</td>
<td>- Scabies &amp; other ectoparasites</td>
</tr>
<tr>
<td>- Dracunculiasis <em>(Guinea worm disease)</em></td>
<td>- Schistosomiasis*</td>
</tr>
<tr>
<td>- Echinococcosis*</td>
<td>- Soil-transmitted helminthiases*</td>
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<tr>
<td>- Foodborne trematodes infections</td>
<td>- Snakebite envenoming</td>
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<tr>
<td>- Human African trypanosomiasis <em>(sleeping sickness)</em></td>
<td>- Taeniasis/cysticercosis</td>
</tr>
<tr>
<td>- Leishmaniasis*</td>
<td>- Trachoma*</td>
</tr>
<tr>
<td>- Leprosy</td>
<td>- Yaws</td>
</tr>
<tr>
<td>- Lymphatic filariasis*</td>
<td>- Noma</td>
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<tr>
<td>- Mycetoma/chromoblastomycosis</td>
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</tbody>
</table>

*NTDs within DPDM’s purview; diseases in italics are housed in other CDC centers
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
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
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

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
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
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.
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

**GLOBAL 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.

**SUrveillance of Molecular epidemiology of Malaria In Travelers – SUMMIT**

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

 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

2024 CDC YELLOW BOOK
Health Information for International Travel

CDC Centers for Disease Control and Prevention
CDC.gov/Travelers, InfectiousTravels

Travelers' Health
Travelers Health > 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.

**Dengue**
- Mosquito bite

**Leishmaniasis**
- Sand fly bite

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

- Avoid Bug Bites
- Chagas disease
- Dengue
- Leishmaniasis
- 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

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 ≥ 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.

Green indicates outbreak areas (see larger map)
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 artesenate for severe malaria
### Presumptive Parasitic Treatment Program for US-bound Refugees (1999–Present)

<table>
<thead>
<tr>
<th>Region</th>
<th>Artemether-lumefantrine (malaria)</th>
<th>Praziquantel (Schistosoma)</th>
<th>Albendazole (soil-transmitted helminths)</th>
<th>Ivermectin* (Strongyloides)</th>
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<tbody>
<tr>
<td>Africa, non-Loa loa areas</td>
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* 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
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.