



VECTOR-BORNE DISEASE NEWS

A SYNOPSIS OF PEER-REVIEWED AND OTHER PUBLICATIONS ON VBDs.

SPRING, 2021



Centers for Disease Control and Prevention A National Public Health Framework for the Prevention and Control of Vector-Borne Diseases in Humans Sep, 2020 States report:

- More than 17 vector-borne diseases were reported to CDC
- The annual number of vector-borne disease cases in reported in the U.S. doubled from 27,388 cases in 2004 to 53,591 cases in 2018
- **In 2018, state and local health departments reported 47,743 cases of tickborne disease to CDC. This is the highest number of tickborne diseases ever reported to CDC**
- **Reported cases significantly underrepresent all vector-borne disease cases**
- Reported cases of Lyme disease and West Nile virus represent less than 1 in 10 of all estimated cases.... More than 100 vector-borne viral, bacterial, and parasitic pathogens are known to cause disease in people
- Since 2004, nine vector borne viruses and bacteria new to the United States have been identified
- The geographic range of ticks, mosquitoes, and fleas that cause disease... has expanded within the U.S.
- The expansion of *Aedes aegypti* mosquitoes and *Ixodes scapularis* ticks are of particular concern.
- In 2017 an invasive vector, *Haemaphysalis longicornis* (the Asian longhorned tick) was identified for the first time in the U.S. This exotic tick causes severe illness or death in people in other parts of the world
https://www.cdc.gov/ncezid/dvbd/pdf/Brochure_National_Framework_VBDs-P.pdf

National Library of Medicine Surveillance for Vector-borne Diseases Among Active and Reserve Component Service Members, U.S. Armed Forces, 2016-2020 Feb 28 2021. ...Lyme disease and malaria were the most common diagnoses among confirmed cases. The next most common diagnoses were Zika virus infection, Rocky Mountain spotted fever, and dengue. Those **5 diseases were responsible for 94% of all confirmed vector-borne diseases reported as RMEs.**
<https://pubmed.ncbi.nlm.nih.gov/33636087/>

Seminars in Neurology Five Emerging Neuroinvasive Arboviral Diseases: Cache Valley, Eastern Equine Encephalitis, Jamestown Canyon, Powassan, and Usutu 2019 ...Five rare emerging or reemerging arboviruses are capable of neuroinvasion.... Cache Valley and Jamestown Canyon viruses likely circulate throughout most of North America, while eastern equine encephalitis and Powassan viruses typically circulate in the eastern half. Usutu ...has the potential to be introduced in the futureTo prevent neuroinvasive arboviral diseases, use of insect repellent and other mosquito and tick bite prevention strategies are key. <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1687839>

TICK-BORNE DISEASES

Ticks and Tick-borne Diseases Control of ixodid ticks and prevention of tick-borne diseases in the United States: The prospect of a new Lyme disease vaccine and the continuing problem with tick exposure on residential properties May, 2021 The main tick vector for Lyme disease spirochetes in the eastern United States, *Ixodes scapularis*, also transmits causative agents of anaplasmosis, babesiosis, and Powassan encephalitis; and this tick species co-occurs with other human-biting vectors such as *Amblyomma americanum* and *Dermacentor variabilis*. It therefore is important that a new Lyme disease vaccine does not result in reduced use of tick-bite prevention measures, such as tick repellents, permethrin-treated clothing, and frequent tick checks.... When considering the full range of options for actions that can be taken to suppress host-seeking ticks on residential properties, it is clear that individual homeowners face a difficult and bewildering task in deciding what to do based on very general guidance from public health agencies (developed without the benefit of a strong evidence base) and often without ready access to local public health professionals experienced in tick control.<https://www.sciencedirect.com/science/article/abs/pii/S1877959X21000029>

Science Direct Prevalence of single and coinfections of human pathogens in *Ixodes* ticks from five geographical regions in the United States, 2013–2019 March 2021. ...Geographic distributions of medically important ticks and tick-borne pathogens continue to expand in the United States.... Coinfection with multiple tick-borne pathogens may amplify severity of disease and complicate diagnosis and treatment. By testing 13,400 *Ixodes* ticks from 17 US states spanning five geographical regions ..., *B. burgdorferi* s.s. was the most prevalent and widespread pathogen. *Borrelia miyamotoi*, *A.*

phagocytophilum, and *B. microti* were widespread but less prevalent than *B. burgdorferi* s.s. Coinfections with *B. burgdorferi* s.s. and *A. phagocytophilum* or *B. microti* were most common in the Northeast and occurred at rates higher than expected based on rates of single infections in that region.

https://www.sciencedirect.com/science/article/abs/pii/S1877959X20305070?dgcid=raven_sd_via_email

Zoonoses and Public Health Human-tick encounters as a measure of tickborne disease risk in Lyme disease endemic areas Feb 20, 2021 Among 2,590 households consisting of 4,210 individuals, experiencing a tick encounter was associated with an increased risk of both self-reported (RR = 3.17, 95% CI: 2.05, 4.91) and verified TBD (RR = 2.60, 95% CI: 1.39, 4.84) at the household level. Household characteristics associated with experiencing any tick encounter were residence in Connecticut (aOR = 1.86, 95% CI: 1.38, 2.51) or New York (aOR = 1.66, 95% CI: 1.25, 2.22), head of household having a graduate level education (aOR = 1.46, 95% CI: 1.04, 2.08), owning a pet (aOR = 1.80, 95% CI: 1.46, 2.23) and a property size of 2 acres or larger (aOR = 2.30, 95% CI: 1.42, 3.70). Results for individual characteristics were similar to those for households. Future prevention studies in LD endemic areas should consider using human-tick encounters as a robust proxy for TBD risk. <https://onlinelibrary.wiley.com/doi/10.1111/zph.12810?campaign=wolsavedsearch>
<https://www.sciencedirect.com/science/article/abs/pii/S1877959X21000029>

Journal of Medical Entomology Established Population of the Gulf Coast Tick, *Amblyomma maculatum* (Acari: Ixodidae), Infected with *Rickettsia parkeri* (Rickettsiales: Rickettsiaceae), in Connecticut Jan 18 2021. We identified an established population of the Gulf Coast tick (*Amblyomma maculatum* Koch) infected with *Rickettsia parkeri* in Connecticut, representing the northernmost range limit of this medically relevant tick species. Our finding highlights the importance of tick surveillance and public health challenges posed by geographic expansion of tick vectors and their pathogens. <https://academic.oup.com/jme/advance-article-abstract/doi/10.1093/jme/tjaa299/6103550>

Ticks and Tick-borne Diseases Tick-borne diseases and co-infection: Current considerations Jan, 2021 The impact of co-infection in humans ... extends into diagnostic challenges arising when multiple pathogens are encountered and we have little current data upon which to make therapeutic recommendations for those with multiple infections. Despite these short-comings, there is now increasing recognition of co-infections

<https://www.sciencedirect.com/science/article/abs/pii/S1877959X20304775>

Wildness and Environmental Medicine Emerging Tickborne Viral Infections: What Wilderness Medicine Providers Need to Know Sept 2 2020 Ticks ... transmit a broad range of pathogens, including bacteria, viruses, and parasites. Ticks harbor pathogens without infection and share pathogens with other ticks while feeding together on a host. The primary objective of this review is to identify tickborne viral pathogens in the United States, focusing on emerging pathogens. Additional objectives include describing the epidemiology of tick-transmitted viruses, identifying the most common tick vectors of viral pathogens in the United States, identifying the most common tick-transmitted viruses worldwide, and recommending effective strategies for the prevention and treatment of tickborne viral infections. Flaviviruses transmitted by ixodid ticks cause most tickborne viral infections that present clinically as either encephalitis or hemorrhagic fever. ... Several new tickborne viruses have emerged in the United States, including Bourbon virus, Heartland virus, Powassan virus, and the severe fever with thrombocytopenia syndrome virus transmitted by a tick recently introduced from China, the Asian long-horned tick (*Haemaphysalis longicornis*). In most cases, there are no specific drug therapies for tickborne viral infections, and treatment is supportive. Vaccination, personal protection, landscape management, and wildlife management are all effective strategies for the primary prevention and control of tickborne viral infectious diseases. <https://pubmed.ncbi.nlm.nih.gov/32891500/>

J Med Microbiology Emerging Tick-Borne Pathogens of Public Health Importance: A Mini-Review June 1, 2020 ... *Ixodes scapularis* and *Amblyomma americanum* ... have expanded their ranges in the USA in recent decades and are responsible for the continuous emergence of Lyme disease and human ehrlichiosis, respectively. This phenomenon is also ... reflected by the increasing number of tick-borne encephalitis and hemorrhagic fever cases in Europe and Asia. ... We provide a concise synopsis of the most medically important tick-borne pathogens worldwide, with a particular emphasis on emerging public health threats. <https://pubmed.ncbi.nlm.nih.gov/32478654/>

Tick-borne Diseases: Diagnosis and Management *American Family Physician* May 1, 2020 Includes key recommendations for best practices; incidence, causative agents, vectors, and geographic distribution of tick-borne diseases in the U.S. Outlines clinical characteristics of tick-borne diseases, treatment protocols, emerging conditions,

tick analysis and prevention. Fully referenced with recommendations and guidance from CDC, IDSA and peer-reviewed literature. <https://www.aafp.org/afp/2020/0501/p530.html>

The Journal of Parasitology Prevalence of Infection and Co-Infection and Presence of Rickettsial Endosymbionts in Ixodes Scapularis (Acari: Ixodidae) in Connecticut, USA Feb, 2020 *Ixodes scapularis* is currently known to transmit pathogens responsible for Lyme disease, anaplasmosis, babesiosis, tick-borne relapsing fever, ehrlichiosis, and Powassan encephalitis. High prevalence of infection and co-infection with multiple pathogens in *I. scapularis* highlights the public health consequences in Connecticut, a state endemic for Lyme and other tick-borne diseases.

<https://pubmed.ncbi.nlm.nih.gov/31971489-prevalence-of-infection-and-co-infection-and-presence-of-rickettsial-endosymbionts-in-ixodes-scapularis-acari-ixodidae-in-connecticut-usa/>

Travel Medicine and Infectious Disease Travel and tick-borne diseases: Lyme disease and beyond.

Nov/Dec. 2019 **On a global scale, ticks are second only to mosquitoes as the most important of vectors of infectious disease agents of humans. Ticks transmit a greater diversity of viral, bacterial and protozoan infections than any other arthropod on earth, and in many temperate regions of the world, including Europe and the U.S., tick-borne diseases (TBD) are the most widespread and medically important of all vector-borne infections.** Lyme borreliosis... afflicts tens and possibly hundreds of thousands of persons in the Northern Hemisphere each year.... The scope and magnitude of other TBD have expanded worldwide both in the U.S. and Europe, 14 newly recognized TBD have been identified in only the last 25 years ...Minimizing the risk of tick bites remains the most important measure to reduce the risk of TBD. This can be accomplished by wearing long pants that are tucked into boots and by applying tick repellents and acaricides. Inspecting for and removing attached ticks with tweezers or forceps as soon as possible following exposures to tick-infested areas is another important consideration. ...Because most bacterial infections transmitted by ticks are susceptible to doxycycline, malaria prophylaxis with doxycycline might also provide protection against many TBD.

<https://hal.archives-ouvertes.fr/hal-01970230/document>

New England Journal of Medicine Bracing for the Worst — Range Expansion of the Lone Star Tick in the Northeastern U.S. Dec 5, 2019 **More than 90% of the nearly 60,000 cases of nationally notifiable vector borne diseases reported in 2017 were linked to ticks...** Abundant reproductive hosts, an increasingly hospitable climate, and genetic plasticity of the lone star tick support the continued invasion and establishment of this tick in the Northeast. Increasing population densities and subsequent range expansion, in conjunction with non-discriminating biting habits and the capacity to transmit diverse pathogens, position the lone star tick as an important emerging health threat to humans, domesticated animals, and wildlife. <https://www.nejm.org/doi/full/10.1056/NEJMp1911661>

UMass Laboratory of Medical Zoology Keep an Eye Out for Ticks this Fall Oct 24, 2019 ...Adult [ticks] have a second peak season in the fall. ...In New England, adult deer ticks re-emerged in force for the fall season around October 15th...

These ticks will be active ... until the ground is covered in snow. <https://aq.umass.edu/landscape/education-events/webinars>

Zoonoses and Public Health Knowledge and prevention of tick-borne diseases among Hispanic and non-Hispanic residents of Maryland and Virginia. Sep 3, 2019 ...Hispanic populations may be at greater risk for occupational exposure to ticks and disseminated Lyme Disease.... Primary language (English vs. Spanish) was a significant predictor of whether an individual had knowledge of symptoms, correctly identified ticks as vectors and performed daily tick checks.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/zph.12627>

Contagion Live Tick, Tick, Tick: Vector-Borne Diseases Ramp Up Jun 4, 2019 Pathogens transmitted by ticks cause the vast majority of vector-borne diseases in temperate North America, Europe, and Asia. In the continental U.S., more than 95% of reported human cases of vector-borne diseases are caused by tick bites. **Lyme disease may exceed 300,000 cases annually, about 10-fold higher than the number of reported cases, ranking it ...second only to sexually transmitted diseases.** <https://www.contagionlive.com/publications/contagion/2019/june/tick-tick-tick-vectorborne-diseases-ramp-up>

Ticks and Tick-borne Diseases Microbiome analysis of Ixodes scapularis ticks from New York and Connecticut April 15, 2019 The black legged tick transmits the greatest diversity of pathogens of any tick within the U.S. Combined, **these pathogens account for >90% of all reported tick-borne diseases.** Lyme disease was detected in 56.3% of ticks. Other pathogens were also found. Powassan was present in 3.6%. 19% of ticks were co-infected with two to three pathogens.

<https://doi.org/10.1016/j.ttbdis.2019.04.011>

International Journal of Environmental Research and Public Health Range expansion of tick disease vectors in North

America: implications for spread of tick-borne disease. Mar 9, 2019 Ticks are the major vectors of most disease-causing agents to humans, companion animals and wildlife. ...[They] **transmit a greater variety of pathogenic agents than any other blood-feeding arthropod.** ...Tick populations in many areas ... have increased in abundance. ...Four representative tick species are ... the American dog tick, the lone star tick, the Gulf Coast Tick, and the black-legged tick. <https://www.mdpi.com/1660-4601/15/3/478>

The New England Journal of Medicine Tick-borne Diseases — Confronting a Growing Threat July 25, 2018 **The public health burden of tick-borne pathogens is considerably underestimated.** ...The CDC reports approximately 30,000 cases of Lyme disease per year but estimates the true incidence is 10 times higher. ...Clinicians should advise patients to use insect repellent and wear long pants when walking in the woods or tending their gardens — and check themselves for ticks when they are done. <https://www.nejm.org/doi/full/10.1056/NEJMp1807870>

Journal of Medical Entomology Prevalence and Diversity of Tick-Borne Pathogens in Nymphal *Ixodes scapularis* (Acari: Ixodidae) in Eastern National Parks (2014-2015) May 2017 [Acadia National Park, Catoclin Mountain Park, Fire Island National Seashore, Gettysburg National Military Park, Manassas National Battlefield Park, Monocacy National Battlefield, Prince William Forest Park, Rock Creek Park, Shenandoah National Park] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5657145/>

- Deer ticks (*I. scapularis*) were found at all sites
- The Lyme disease spirochete *Borrelia burgdorferi* was the most widespread pathogen.
- *Borrelia miyamotoi*, an emerging pathogen, is a relapsing fever spirochete vectored by deer ticks. Infected nymphs were found at 66.7% of sites sampled
- Anaplasmosis (*Anaplasma phagocytophilum*)-infected nymphs were found at 77.8% of sites. Babesiosis (*Babesia microti*) was the least commonly detected pathogen. 28% of nymphs in a specific area were infected
- Multiple pathogens in deer ticks were found at all sites except Monocacy National Battlefield.
- Coinfections with *B. burgdorferi* and *Ba. microti* were the most common (41% of coinfecting nymphs), followed by coinfections with *B. burgdorferi* and *A. phagocytophilum* 35.9% from Virginia to Maine.
- Lone star ticks occurred in high numbers at Fire Island National Seashore and Manassas. They were also found at Prince William Forest Park.

INVASIVE TICK

International Journal of Acarology Multiple pruritic tick bites by Asian Longhorned tick larvae (*Haemaphysalis longicornis*) Aug 13 2020 This study presents the first report of multiple human bites by larvae of *Haemaphysalis longicornis* Neumann in the U.S. An adult male working on a public park in Hackensack City (New Jersey) removed eight attached larvae from the arm, armpit, and back. The worker developed small erythematous pruritic lesions that self-resolved in two weeks. No other symptoms were associated with the bite. The Asian longhorned tick is not considered an anthropophilic tick species. Still, the parthenogenetic population present in the eastern U.S can reach high numbers in small areas increasing the risk of tick bites to non-specific hosts, including humans. Public health practitioners should become familiar with the Asian longhorned tick, and vectorial competence studies should be carried out to determine the risk of tick-borne disease transmission to humans. <https://www.tandfonline.com/doi/abs/10.1080/01647954.2020.1805004>

ABC 6 Asian longhorned tick found in Gallia County Ohio July 31 2020 On Friday, the Ohio Department of Agriculture (ODA) announced that the Asian longhorned tick, has been found in Gallia County. <https://abc6onyourside.com/news/local/asian-longhorned-tick-found-in-gallia-county>

The Mount Airy News Mount Airy NC: Tick swarms kill five cows Jul 9, 2019 ...67 counties in the U.S. have confirmed local Asian Longhorned tick populations. Virginia has the most counties, with 24 confirmed. "It is an aggressive biter and frequently builds intense infestations on animals, causing great stress, reduced growth and production, and blood loss. The tick can reproduce parthenogenetically (without a male), and a single fed female tick can create a localized population." The tick has not been linked to any infections in humans in the U.S. at this point. As of 24 Jun 2019, no harmful germs that can infect people have been found in the ticks collected in the U.S;

Center for Infectious Disease Research and Policy First US human bite from worrying longhorned tick noted June 3, 2019 the first human in the U.S. known to be bitten by an Asian longhorned tick, a rapidly spreading invasive species. Tick sampling found Asian longhorned ticks on the patient's manicured lawn, some of them in direct sun.

<http://www.cidrap.umn.edu/news-perspective/2019/06/first-us-human-bite-worrying-longhorned-tick-noted> <https://academic.oup.com/cid/advance-article-abstract/doi/10.1093/cid/ciz449/5509416?redirectedFrom=fulltext>

Centers for Disease Control and Prevention (CDC) CDC investigating disease threat posed by fast-multiplying exotic tick Nov 29, 2018 Pathogens found in the Asian longhorned tick in other parts of the world include *Borrelia*, *Anaplasma*, *Ehrlichia*, *Rickettsia*, and *Babesia*. **The females can lay eggs and reproduce without mating...Up to thousands of ticks may be found at a time, or on an animal...As of May 22, 2019, Asian longhorned ticks have been found in AK, CT, DE, KY, MD, NC, NJ, NY, PA, TN, VA., and WV.** <https://www.cdc.gov/ticks/pdfs/AsianLonghornedTick-P.pdf>

LYME DISEASE

Centers for Disease Control and Prevention (CDC) Use of Commercial Claims Data for Evaluating Trends in Lyme Disease Diagnoses, United States, 2010–2018 Feb 2021. By using commercial insurance claims data, we estimated that Lyme disease was diagnosed and treated in ≈476,000 patients in the United States annually during 2010–2018. Our results underscore the need for accurate diagnosis and improved prevention. ... Annual incidence ... diagnoses per 100,000 enrollees ranged from 49 to 88, **6–8 times higher than that observed for cases reported through notifiable disease surveillance**. Age and sex distributions among Lyme disease diagnoses in MarketScan were similar to those of cases reported through surveillance, but proportionally **more diagnoses occurred outside of peak summer months**, among female enrollees, and outside high-incidence states. Misdiagnoses, particularly in low-incidence states, may account for some of the observed epidemiologic differences....https://wwwnc.cdc.gov/eid/article/27/2/20-2728_article
Centers for Disease Control and Prevention (CDC) Estimating the Frequency of Lyme Disease Diagnoses, United States, 2010–2018 Feb 2021. https://wwwnc.cdc.gov/eid/article/27/2/20-2731_article

Arthritis & Rheumatology Clinical Practice Guidelines by the Infectious Diseases Society of America (IDSA), American Academy of Neurology (AAN), and American College of Rheumatology (ACR): 2020 Guidelines for the Prevention, Diagnosis, and Treatment of Lyme Disease Nov 29, 2020 This evidence-based clinical practice guideline for the **prevention, diagnosis, and treatment of Lyme disease** was developed by a multidisciplinary panel representing the Infectious Diseases Society of North American (IDSA), the American Academy of Neurology (AAN), and the American College of Rheumatology (ACR). The scope of this guideline includes prevention of Lyme disease, and the diagnosis and treatment of Lyme disease presenting as erythema migrans, Lyme disease complicated by neurologic, cardiac, and rheumatologic manifestations, Eurasian manifestations of Lyme disease, and Lyme disease complicated by coinfection with other tick-borne pathogens. This guideline does not include comprehensive recommendations for babesiosis and tick-borne rickettsial infections, which are published in separate guidelines. The target audience for this guideline includes primary care physicians and specialists caring for this condition such as infectious diseases specialists, emergency physicians, internists, pediatricians, family physicians, neurologists, rheumatologists, cardiologists, and dermatologists in North America. <https://onlinelibrary.wiley.com/doi/10.1002/art.41562>

Scientific Reports Northern and southern blacklegged (deer) ticks are genetically distinct with different histories and Lyme spirochete infection rates June 24, 2020 ... A sparse, stable, and genetically diverse population of ticks in the Southeastern US, that is **rarely infected with the agent of Lyme borreliosis (LB)** is genetically distinct from an abundant, expanding, and comparatively uniform population in the Northeast, where epidemic LB now constitutes the most important vector borne disease in the United States... <https://www.nature.com/articles/s41598-020-67259-0>

Center for Infectious Disease Research and Policy Health insurance claims show increasing Lyme prevalence in US Dec 10, 2019 **A survey of health insurance claims made in the U.S. from 2007 through 2018 shows that claim lines with a diagnosis of Lyme disease increased 117%.** ... Lyme disease was the predominate tick-borne disease on health insurance claims, representing **94% of tick-borne claims**, and, in 2018, 0.058% of all medical claims. <http://www.cidrap.umn.edu/news-perspective/2019/12/news-scan-dec-10-2019>

Annals of Internal Medicine Fatal Lyme Carditis in New England: Two Case Reports Oct 22, 2019 **Lyme disease is the most common vector-borne disease in the U.S., and it is hyperendemic in the Northeast.** Carditis is a rare manifestation that can usually be treated successfully with a short course of antibiotics .However, it can present with many symptoms, and its severity can change rapidly and unpredictably. Death can occur when Lyme carditis is untreated. <https://annals.org/aim/article-abstract/2753436/fatal-lyme-carditis-new-england-two-case-reports>

CDC Emerging Infectious Diseases Relative Risk for Ehrlichiosis and Lyme Disease in an Area Where

Vectors for Both Are Sympatric, New Jersey Jun, 2017

Lyme disease is the most frequently reported vector-borne illness in the Northeast. The much more aggressive Lone Star tick, *Amblyomma americanum*, transmits the agent of human monocytic ehrlichiosis and may serve as the vector for several other emerging tick-borne pathogens....The lower-than-expected number of reported ehrlichiosis cases is attributed to a lack of awareness about ehrlichial disease by the public and by physicians, leading to misdiagnosis and underreporting. Another explanation could be the existence of asymptomatic infections.

https://wwwnc.cdc.gov/eid/article/23/6/16-0528_article

SPOTTED FEVER RICKETTSIOSIS

National Library of Medicine Behavioral characteristics and endosymbionts of two potential tularemia and Rocky Mountain spotted fever tick vectors Dec 2020. *Dermacentor andersoni* and *D. variabilis* ticks are morphologically similar, co-occur throughout the Inland Northwest of Washington State, and both can be infected with pathogenic Rickettsia and Francisella bacteria. ... *D. andersoni* is more resistant to desiccation, but both species share similar questing behaviors such as climbing and attraction to bright light. Both also avoid the odor of eucalyptus and DEET but not permethrin. ...Both tick species are capable of transmitting pathogenic species of Francisella and Rickettsia, which cause tularemia and Rocky Mountain Spotted Fever, respectively.... <https://pubmed.ncbi.nlm.nih.gov/33207056/>

Case Reports in Critical Care Brain Death Secondary to Rocky Mountain Spotted Fever Encephalitis May 2020 We present this case to highlight the importance of considering RMSF and other tick-borne illnesses in a child with prolonged fever and rash in a nonendemic area and also the difficulty of diagnosis in early stages of disease... If a tick-borne illness such as RMSF is suspected, empiric doxycycline therapy should be started immediately, as lab confirmation may take several days, and mortality increases greatly after five days of symptoms.

<https://pubmed.ncbi.nlm.nih.gov/32426169/>

Morbidity and Mortality Weekly Report Description of Eschar-Associated Rickettsial Diseases Using Passive

Surveillance Data — United States, 2010–2016 Jan 3, 2020 Eschars are a clinical sign used to differentiate less severe rickettsioses from potentially deadly Rocky Mountain spotted fever. Eschars are infrequently reported in tickborne rickettsial disease (TBRD) surveillance data and represent an underutilized resource to aid in distinguishing the various spotted fever group *Rickettsia*. Although 1% of total TBRD case reports during 2010–2016 documented the presence of an eschar, 81% of cases lacked information on eschars altogether....

<https://www.cdc.gov/mmwr/volumes/68/wr/mm685152a2.htm#:~:text=Rickettsial%20eschars%20are%20necrotic%20lesions,group%20Rickettsia%20and%20Orientia%20species.>

Clinical Infectious Diseases Meningoencephalitis due to Spotted Fever Rickettsioses, Including Rocky Mountain

Spotted Fever Aug 15, 2019 Results: Nineteen cases (11 children, 8 adults) met criteria for SFR meningoencephalitis. Rash was significantly more common in children than adults (100% vs. 50%, respectively), but other clinical features were similar between the 2 groups. ...SFR meningoencephalitis is a life-threatening infection. The clinical presentation varies between adults and children based on the presence of rash and brain MRI findings. The starry sky sign was ubiquitous in children and should prompt consideration of empiric treatment for SFR when present.

<https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciz776/5550194?guestAccessKey=8f2bcb54-9b15-4fc1-903e-cfd7dabcf9c4>

BABESIOSIS

Clinical Infectious Diseases Clinical Practice Guidelines by the Infectious Diseases Society of America (IDSA): 2020

Guideline on Diagnosis and Management of Babesiosis Jan 15, 2021 ...Guidance for the most effective strategies for the diagnosis and management of babesiosis. The diagnosis and treatment of co-infection with babesiosis and Lyme disease will be addressed in a separate Infectious Diseases Society of America (IDSA), American Academy of Neurology (AAN), and American College of Rheumatology (ACR) guideline [1]. Recommendations for the diagnosis and treatment of human granulocytic anaplasmosis can be found in the recent rickettsial disease guideline developed by the Centers for Disease Control and Prevention [2]. The target audience for the babesiosis guideline includes primary care physicians and specialists caring for this condition, such as infectious diseases specialists, emergency physicians, intensivists, internists, pediatricians, hematologists, and transfusion medicine specialists.

<https://academic.oup.com/cid/article/72/2/e49/6012666?login=true>

CDC Emerging Infectious Disease Rise in Babesiosis Cases, Pennsylvania, USA, 2005–2018 August 2020 Babesiosis is an emerging infection in the state of Pennsylvania, and clinicians need to be made aware of its clinical manifestations as well as the risk factors associated with severe disease. All 4 cases from 2018 were thought to be acquired in southcentral Pennsylvania counties, whereas prior reports of cases were predominately in the southeast and northeast counties of the state. https://wwwnc.cdc.gov/eid/article/26/8/19-1293_article?deliveryName=USCDC_351-DM33366

PLoS One Zoonotic Babesia: A scoping review of the global evidence. Dec 30, 2019 A review of 1394 articles relevant to human babesiosis and/or zoonotic Babesia species. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0226781>

CDC Morbidity and Mortality Weekly Report Babesiosis Surveillance — U.S., 2011–2015 May 31, 2019 Reported cases occurred most frequently during June–August in the Northeast and upper Midwest. ...[The] foci of transmission might be expanding. Hospitalizations were common, particularly among patients who were asplenic or elderly. Doxycycline, which is *not* recommended for treatment of babesiosis, was specified for 1,320 (48.4%) of the 2,728 patients. https://www.cdc.gov/mmwr/volumes/68/ss/ss6806a1.htm?s_cid=ss6806a1_e

EHRlichiosis

JAMA Network Open Assessment of Risk Factors and Outcomes of Severe Ehrlichiosis Infection Nov 17, 2020 This cross-sectional study including 155 patients identified a delay in doxycycline therapy as a significant factor associated with severe ehrlichiosis. Documentation of tick exposure was independently associated with a decreased need for intensive care unit admission, and a change toward a decreased need for intensive care unit admission among immunosuppressed persons was identified. In this study, delay in initiation of empirical doxycycline therapy appears to be a risk factor for severe ehrlichiosis; education focused on early recognition and treatment may decrease morbidity associated with this infection. <https://jamanetwork.com/journals/jamanetworkopen/article-abstract/2773048>

StatPearls Ehrlichiosis Sep 20, 2020 Continuing Education Activity <https://www.ncbi.nlm.nih.gov/books/NBK441966/>

STARI

Scientific Reports Northern and southern blacklegged (deer) ticks are genetically distinct with different histories and Lyme spirochete infection rates Jun 24, 2020 A sparse, stable, and genetically diverse population of ticks in the Southeastern US, that is rarely infected with the agent of LB is genetically distinct from an abundant, expanding, and comparatively uniform population in the Northeast, where epidemic LB now constitutes the most important vector borne disease in the United States. The contrasting geography and demography of tick populations, interpreted in the context of the geological history of the region, suggests that during the last glacial period such ticks occupied distinct refugia, with only the northern-most site of refuge giving rise to those ticks and pathogens now fueling the epidemic. <https://www.nature.com/articles/s41598-020-67259-0>

POWASSAN VIRUS

J Neuropathol Exp Neurol A Fatal Case of Powassan Virus Encephalitis Oct 5 2020 Powassan virus (POWV) ...causes a rare and potentially life-threatening neuroinvasive disease. Viral transmission occurs ...by the bite of an infected tick in endemic regions of North America. The number of reported POWV cases has recently increased in the United States. We report a fatal case of POWV meningoencephalomyelitis in Northern Wisconsin following a documented tick bite. This report demonstrates in detail regional central nervous system involvement and ultrastructural characteristics of Powassan viral particles by transmission electron microscopy, while highlighting the utility of evaluating fixed autopsy tissues in cases of unexplained meningoencephalomyelitis. <https://pubmed.ncbi.nlm.nih.gov/33020816/>

Clinical Infectious Diseases Powassan virus infection likely acquired through blood transfusion presenting as encephalitis in a kidney transplant recipient June 15, 2020 A kidney transplant patient without known tick exposure developed encephalitis 3 weeks after transplantation. During the transplant hospitalization, the patient had received a blood transfusion from an asymptomatic donor later discovered to have been infected with Powassan virus. <https://academic.oup.com/cid/advance-article-abstract/doi/10.1093/cid/ciaa7>

Clinical Microbiology Reviews Tick-Borne Flaviviruses, with a Focus on Powassan Virus. Dec, 2018 Despite the low disease incidence, the approximately **10% to 15% case fatality rate** of neuroinvasive Powassan virus infection and temporary or prolonged sequelae in >50% of survivors make Powassan virus a medical concern. <https://cmr.asm.org/content/32/1/e00106-17.long>

Zoonosis and Public Health Powassan virus, a scoping review of the global evidence Jun 17, 2019

Powassan virus -POWV... causes sporadic but severe cases of encephalitis in humans. ...To date, POWV has been reported in 147 humans in North America. The virus has also been isolated from five tick species.....

<https://onlinelibrary.wiley.com/doi/full/10.1111/zph.12485>

JAMA Neurology Fatal Powassan encephalitis (deer tick virus, lineage ii) in a patient with fever and orchitis receiving rituximab. *JAMA Neurol.* 2018 Powassan virus is a rare ... cause of severe neurological disease. ...POWV is the causative agent of severe neuroinvasive illness with 50 percent of survivors displaying long-term neurological sequelae. diagnosis. <https://jamanetwork.com/journals/jamaneurology/article-abstract/2675289>

BORRELIA MIYAMOTOI

Bio Med Central (BMC) - Spatial and temporal patterns of the emerging tick-borne pathogen *Borrelia miyamotoi* in blacklegged ticks (*Ixodes scapularis*) in New York Jan 14 2021. ... One of the newer tick-borne pathogens in the United States is *Borrelia miyamotoi*. *Borrelia miyamotoi*, a bacterium that causes relapsing fever, is found in ixodid ticks throughout the northern hemisphere. The first cases of human infection with *B. miyamotoi* were identified in 2011. We surveyed *B. miyamotoi* prevalence in ticks within forested habitats in Dutchess County, New York, and identified possible reservoir hosts. The overall infection prevalence of questing nymphal ticks across all sites was ~ 1%, but prevalence at individual sites was as high as 9.1%. Only 0.4% of questing larval ticks were infected. The locally high prevalence of *B. miyamotoi* in the New York/New England landscape suggests the importance of vigilance by health practitioners and the public. <https://parasitesandvectors.biomedcentral.com/articles/10.1186/s13071-020-04569-2>

Ticks and Tick-borne Diseases Identification of immunoreactive linear epitopes of *Borrelia miyamotoi*. Jan, 2020 *Borrelia miyamotoi* is an emerging tick-borne spirochete transmitted by *Ixodes* ticks.

<https://www.sciencedirect.com/science/article/pii/S1877959X1930353X?via%3Dihub>

ALPHA-GAL ALLERGY

Ticks and Tick-borne Diseases Tick exposures and alpha-gal syndrome: A systematic review of the evidence May, 2021 α -Gal syndrome primarily occurs after consuming meat or other animal-based foods. Reactions are typically delayed 2–6 h, but can range from minutes to 12–24 h. There is inconsistency about α -Gal-specific IgE levels required for diagnosis.

<https://www.sciencedirect.com/science/article/pii/S1877959X21000273>

Expert Review of Clinical Immunology Diagnosis & management of alpha-gal syndrome: lessons from 2,500 patients Jul 8, 2020 Alpha-gal Syndrome (AGS) is a unique allergy to non-primate mammalian meat (and derived-products) that is associated with tick bites and is due to a specific IgE antibody to the oligosaccharide galactose- α -1,3-galactose (alpha-gal). AGS has many novel features that broaden the paradigm of food allergy, including that reactions are delayed 3–6 hours after exposure and patients have frequently tolerated red meat for many years prior to the development of allergic reactions. Due to the ubiquitous inclusion of mammal-derived materials in foods, medications, personal products and stabilizing compounds, full avoidance is difficult to achieve.

<https://www.tandfonline.com/doi/full/10.1080/1744666X.2020.1782745?scroll=top&needAccess=true>

HEARTLAND VIRUS

CDC Emerging Infectious Disease Heartland Virus in Lone Star Ticks, Alabama, USA August 2020 We detected Heartland virus (HRTV) in Lone Star nymphs collected in 2018 in northern Alabama. [These] showed high identity with HRTV strains sequenced from Tennessee and Missouri. https://wwwnc.cdc.gov/eid/article/26/8/20-0494_article?deliveryName=USCDC_351-DM33366

MOSQUITO-BORNE DISEASES

Entomology Today - Another Invasive Mosquito Species Arrives in Florida Dec 18 2020. *Aedes scapularis* is a mosquito that can spread yellow fever, Venezuelan equine encephalitis virus, and other human pathogens. It has a wide range, from Texas to parts of South America and throughout much of the Caribbean. In 1945, 3 specimens of larval *Ae. scapularis* were found in ... the Middle Florida Keys, but *Ae. scapularis* has not been seen in Florida since then -- until now. A new study published in November [2020] in the *Journal of Medical Entomology* reports that *Ae. scapularis* is now established in mainland Florida in Broward and Miami-Dade counties. ... *Ae. scapularis* could potentially spread further northward and westward to fill any contiguous areas that are environmentally suitable [and] could vector diseases to people in Florida. *Ae. scapularis* _ in South America and elsewhere has been found to be naturally infected with a range

of pathogens...The species is ecologically well positioned to be a vector ... some populations are well adapted to human-dominated habitats, they feed from a broad range of hosts, and they feed readily from humans. The establishment of *Ae. scapularis* and other invasive species is not only geographic -- it is also ecological. Of Florida's 16 established non-native mosquitoes, 13 were first detected in the state since 1985, and 10 were first detected since 2000. ...Southern Florida has had outbreaks of dengue and Zika viruses transmitted by *Aedes aegypti*. This mosquito has transmitted Zika and dengue in Miami-Dade County and dengue in Key West, FL in past years. This mosquito has been found recently further north in Florida in Gainesville. One hopes that *Ae. scapularis* does not similarly expand its range northward in Florida. <https://entomologytoday.org/2020/12/18/another-invasive-mosquito-species-florida-aedes-scapularis/>

American Journal of Tropical Medicine and Hygiene Artificial Light at Night Increases *Aedes aegypti* Mosquito Biting Behavior with Implications for Arboviral Disease Transmission Oct 15, 2020 ...Biting behavior of normally daytime active *Ae. aegypti* in human hosts is abnormally increased at night following exposure to artificial light at night (ALAN). ...Maximal biting occurred during daytime and lowest level occurred at night. ...Exposure to ALAN increases nocturnal blood-feeding behavior.. <http://www.ajtmh.org/content/journals/10.4269/ajtmh.20-0885>

CDC Travelers' Health Dengue in the Americas Oct 14, 2020 Dengue is a risk in many parts of Central and South America, Mexico, and the Caribbean. Some countries are reporting increased numbers of cases of the disease. Travelers to the Americas can protect themselves by preventing mosquito bites. <https://wwwnc.cdc.gov/travel/notices/watch/dengue-americas>

Pediatric Infectious Disease Journal EVALUATION FOR ARBOVIRAL INFECTION AMONG CHILDREN HOSPITALIZED IN COLORADO WITH ASEPTIC MENINGITIS AND ENCEPHALITIS Aug 5 2020 Among 39 children hospitalized in Colorado with aseptic meningitis or encephalitis, 16 (41%) had an etiology identified, including 2 (5%) with West Nile virus infection. Despite extensive testing, no other arboviral infections were identified. Arboviral infection should be considered in children with neuroinvasive disease during arboviral season with testing directed toward viruses endemic to the region and type of exposure. <https://pubmed.ncbi.nlm.nih.gov/32773665/>

PAHO Epidemiological Update: Dengue and other Arboviruses June 2020 1,600,947 (97.3%) were dengue cases, 37,279 were chikungunya cases, and 7,452 were Zika cases. <https://www.paho.org/en/documents/epidemiological-update-dengue-and-other-arboviruses-10-june-2020>

Journal of Medical Entomology Human Blood Feeding by *Aedes Aegypti* (Diptera: Culicidae) in the Florida Keys and a Review of the Literature May 24, 2020 *Aedes aegypti* females from Key West fed predominantly on humans (79.6%) and did not differ statistically from females collected from the rest of the Florida Keys (69.5%). ... Females of *Cx. quinquefasciatus* fed predominantly (70.7%) on birds and nonhuman mammals in the Florida Keys, ... demonstrating that given the same group of available hosts *Ae. aegypti* selects humans. Our results indicated that *Ae. aegypti* has a high rate of human-biting in a subtropical area within the United States, supporting its role in recent local transmission of dengue and other viruses. <https://academic.oup.com/jme/advance-article-abstract/doi/10.1093/jme/tjaa083/5843580?redirectedFrom=fulltext>

International Journal of Infectious Diseases Seroprevalence of Yellow Fever, Dengue, West Nile and Chikungunya Viruses in Children in Teso South Sub County, Western Kenya Nov 8, 2019 Arboviruses affected over 27% of children younger than 12 years in Teso County, Western Kenya. Chikungunya, yellow fever, dengue and West Nile antibodies were confirmed in children [https://www.ijidonline.com/article/S1201-9712\(19\)30443-6/fulltext?dgcid=raven_jbs_aip_email](https://www.ijidonline.com/article/S1201-9712(19)30443-6/fulltext?dgcid=raven_jbs_aip_email)

Journal of Clinical Virology Neurological manifestations of pediatric arboviral infections in the Americas May 8, 2019 Neurological manifestations of acquired Zika includes hemiparesis, myelitis, Guillain-Barré, cortical infarction and behavioral changes. Neurological manifestations in children with Chikungunya were seizures, encephalitis, meningism and behavioral changes. Among the children with neurological manifestations due to CHIKV, 5.6% died and 8.5% developed neuronal sequelae. <https://www.sciencedirect.com/science/article/pii/S1386653219300940?via%3Dihub>

Review of Integrative Business and Economics Research Current Issue in Tourism: Disease Transmission as a Potential Risk for Travelers, 2019 Chikungunya, Dengue and Zika to be of concern for travelers. http://buscompress.com/uploads/3/4/9/8/34980536/riber_8-s4_07_k19-121_103-114.pdf

International Journal of Environmental Research and Public Health Emerging Mosquito-Borne Threats and the Response from European and Eastern Mediterranean Countries. Dec 7, 2018. ... Mosquito-borne viruses threaten public health in Europe and the eastern Mediterranean. <https://www.mdpi.com/1660-4601/15/12/2775>

WEST NILE VIRUS

Morbidity and Mortality Weekly Report Surveillance for West Nile Virus Disease — United States, 2009–2018 Mar 5, 2021 During 2009–2018, a total of 21,869 confirmed or probable cases of WNV disease, including 12,835 (59%) WNV neuroinvasive disease cases, were reported to CDC from all 50 states, the District of Columbia, and Puerto Rico. A total of 89% of all WNV patients had illness onset during July–September. Neuroinvasive disease incidence and case-fatality increased with increasing age, with the highest incidence (1.22 cases per 100,000 population) occurring among persons aged ≥70 years. Among neuroinvasive cases, hospitalization rates were >85% in all age groups but were highest among patients aged ≥70 years (98%). The national incidence of WNV neuroinvasive disease peaked in 2012 (0.92 cases per 100,000 population). Although national incidence was relatively stable during 2013–2018 (average annual incidence: 0.44; range: 0.40–0.51), state level incidence varied from year to year. During 2009–2018, the highest average annual incidence of neuroinvasive disease occurred in North Dakota (3.16 cases per 100,000 population), South Dakota (3.06), Nebraska (1.95), and Mississippi (1.17), and the largest number of total cases occurred in California (2,819), Texas (2,043), Illinois (728), and Arizona (632). Six counties located within the four states with the highest case counts accounted for 23% of all neuroinvasive disease cases nationally.

https://www.cdc.gov/mmwr/volumes/70/ss/ss7001a1.htm?s_cid=ss7001a1_e&ACSTrackingID=USCDC_921-DM51192&ACSTrackingLabel=This%20Week%20in%20MMWR%20-%20Vol.%2070%2C%20March%205%2C%202021&deliveryName=USCDC_921-DM51192

Cureus Management of West Nile Encephalitis: An Uncommon Complication of West Nile Virus Feb 6, 2021 We did a combined advanced search and Medical Subject Headings (MeSH) search on PubMed. Inclusion criteria included papers written in the English language and human subjects research for the past 25 years. We initially gather 110 papers, and after applying the inclusion/exclusion criteria, we end up with 30 articles for the paper's discussion. This review aims to provide clinicians with an overview of the latest approach in treating and managing hospitalized WNVD patients. It discusses case reports and the outcome of different treatment regimens done in vitro and in vivo. The study discusses all the advancements in treatment and prophylaxis and compares their effectiveness. However, more research is warranted to gain further insight to develop a single guideline for the management of this disease. This review discusses the following treatment modalities: ribavirin, interferon-alpha, intravenous immunoglobulin (IVIG), and other less-used drugs. More studies about ribavirin are needed to know if the drug is useful for WNV encephalitis. Interferon-alpha has been shown to have both protective and disease limiting properties. At the moment, there are no guidelines for the treatment of WNV encephalitis, nor is there a single Food and Drug Administration (FDA)-approved drug. For the time being, IVIG offers the best results in treating WNV encephalitis. <https://www.cureus.com/articles/51980-management-of-west-nile-encephalitis-an-uncommon-complication-of-west-nile-virus>

National Library of Medicine West Nile virus in California, 2003-2018: A persistent threat Nov 18 2020. From 2003 through 2018, 6,909 human cases of WNV disease, inclusive of 326 deaths, were reported to CDPH, as well as 730 asymptomatic WNV infections identified during screening of blood and organ donors. Of these, 4,073 (59.0%) were reported as West Nile neuroinvasive disease. **California's WNV disease burden comprised 15% of all cases that were reported to the U.S. Centers for Disease Control and Prevention during this time, more than any other state.** Peak WNV activity occurred from July through October in the Central Valley and southern California. Less than five percent of WNV activity occurred in other regions of the state or outside of this time. **WNV continues to be a major threat to public and wild avian health in California, particularly in Southern California and the Central Valley during summer and early fall months....** <https://pubmed.ncbi.nlm.nih.gov/33206634/>

Alzheimer's Disease and Associated Disorders West Nile Virus Neuroinvasive Disease Accelerating Probable Dementia With Lewy Bodies Aug 17 2020 We describe a case of dementia with Lewy bodies immediately following encephalitis due to West Nile virus (WNV). The patient ... would have ultimately developed dementia with Lewy bodies even without WNV infection. <https://pubmed.ncbi.nlm.nih.gov/32809984/>

Proceedings Biological Sciences Thermal thresholds heighten sensitivity of West Nile virus transmission to changing temperatures in coastal California Aug 12 2020 Temperatures during the most intense months of WNV transmission (August/September) were more strongly associated with infection probability in *Cx. quinquefasciatus* pools in coastal LA,

...This contributed to a pronounced expansion in the geographical distribution of human cases near the coast during warmer-than-average periods.... <https://pubmed.ncbi.nlm.nih.gov/32752986/>

Journal of Neuroinflammation Neurocognitive impacts of arbovirus infections Aug 10 2020 Arthropod-borne viruses or arbovirus, are most commonly associated with acute infections, resulting in various symptoms ranging from mild fever to more severe disorders such as hemorrhagic fever. Moreover, some arboviral infections can be associated with important neuroinflammation that can trigger neurological disorders including encephalitis, paralysis, ophthalmological impairments, or developmental defects, which in some cases, can lead to long-term defects of the central nervous system (CNS). This is well illustrated in Zika virus-associated congenital brain malformations but also in West Nile virus-induced synaptic dysfunctions that can last well beyond infection and lead to cognitive deficits. Here, we summarize clinical and mechanistic data reporting on cognitive disturbances triggered by arboviral infections, which may highlight growing public health issues spanning the five continents. <https://pubmed.ncbi.nlm.nih.gov/32778106/>

Pediatric Infectious Disease Evaluation for Arboviral Infection Among Children Hospitalized in Colorado with Aseptic Meningitis and Encephalitis Aug 5 2020 Among 39 children hospitalized in Colorado with aseptic meningitis or encephalitis, 16 (41%) had an etiology identified, including 2 (5%) with West Nile virus infection. ...Children with neuroinvasive disease during arboviral season with testing directed toward viruses endemic to the region and type of exposure. <https://pubmed.ncbi.nlm.nih.gov/32773665/>

Case Reports Infectious Disease Guillain-Barré Syndrome Secondary to West Nile Virus in New York City Jul 26 2020 We present a 65-year-old patient with WNV infection who presented with Guillain-Barré syndrome (GBS). She had a rapidly progressing ascending paralysis, a common feature in GBS patients but an uncommon presentation in WNV. <https://pubmed.ncbi.nlm.nih.gov/32774950/>

Pediatrics Infectious and Autoimmune Causes of Encephalitis in Children May 1, 2020 We evaluated 231 patients who met the case definition of encephalitis...WNV was the most common infectious cause of encephalitis in our pediatric population despite lower testing frequency for WNV than herpes simplex virus or enterovirus. Increasing testing for anti-NMDAR encephalitis resulted in frequent identification of cases. Increased awareness and testing for WNV and Bartonella would likely result in more identified causes of pediatric encephalitis. Earlier etiologic diagnosis of encephalitides may lead to improve clinical outcomes. <https://pediatrics.aappublications.org/content/early/2020/04/29/peds.2019-2543.long>

American Journal of Ophthalmology Case Reports An Unusual Case of Unilateral Chorioretinitis and Blind Spot Enlargement Associated With Asymptomatic West Nile Virus Infection Apr 23, 2020 ...Ophthalmic manifestations may occur in some patients with asymptomatic WNV infection. ...Acute blind spot enlargement may also be part of the myriad of ophthalmic manifestations present in WNV patients. <https://www.sciencedirect.com/science/article/pii/S2451993620300773?via%3Dihub>

Current Tropical Medicine Reports West Nile Virus-Induced Neurologic Sequelae-Relationship to Neurodegenerative Cascades and Dementias Mar 7 2020 Neuroinvasive viral infections such as WNV may be linked epidemiologically and mechanistically to neurodegeneration. <https://pubmed.ncbi.nlm.nih.gov/32775145/>

The Neurohospitalist Clinical Spectrum of West Nile Virus Neuroinvasive Disease Jan, 2020 West Nile virus (WNV) is the most common arbovirus infection in the U.S.. ...Epidemiology of WNV, risk factors for infection, the neurologic sequelae and long-term outcomes, and the importance of recognizing ocular involvement to prevent ophthalmologic complications. <https://journals.sagepub.com/doi/abs/10.1177/1941874419868636?journalCode=nhoa>

Precision Vaccination West Nile Relocated From Nebraska to the US Southwest During 2019 Dec 26, 2019 As of December 17, 2019, California (213), Arizona (173) and Colorado (120), Nevada (44) and New Mexico have reported a total of 590 West Nile virus (WNV) cases during 2019. **These states represent about 64 percent of all West Nile virus (WNV) cases (910) reported by CDC during 2019.** <https://www.precisionvaccinations.com/preventive-vaccines-west-nile-virus-remain-early-stage-clinical-study>

PLoS Pathogens Twenty years of West Nile virus spread and evolution in the Americas visualized by Nextstrain Oct 31, 2019 It has been 20 years since West Nile virus first emerged in the Americas.... Now the virus has become endemic to

the U.S., where an estimated 7 million human infections have occurred, making it **the leading mosquito-borne virus infection and the most common cause of viral encephalitis in the country.**

<https://journals.plos.org/plospathogens/article?id=10.1371/journal.ppat.1008042>

Journal of Medical Entomology Epidemiology of West Nile Virus in the U.S.: Implications for Arbovirology and Public Health Oct 24, 2019 Since West Nile virus (WNV) emerged in the U.S. in 1999, **22,999 neuroinvasive disease cases** in humans were reported through 2017. These cases have arisen from an estimated seven million human infections. Population incidence is highest in the West and Midwest.

<https://academic.oup.com/jme/article/56/6/1456/5572378?searchresult=1>

Journal of Medical Entomology West Nile Virus Mosquito Vectors in North America Oct 24, 2019 East of the Mississippi River, mostly *Culex pipiens* L. complex mosquitoes drive intense enzootic transmission with relatively small numbers of human cases. Westward, the presence of highly competent *Culex tarsalis* (Coquillett) under arid climate and hot summers defines the regions with the highest human risk. West Nile virus human risk distribution is not uniform geographically or temporally within all regions. Notable geographic 'hotspots' persist with occasional severe outbreaks.

<https://academic.oup.com/jme/article-abstract/56/6/1475/5572131?redirectedFrom=fulltext>

Annals of Neurology West Nile virus neuroinvasive disease Sep 18, 2019 Since 1999, there have been nearly 20,000 cases of confirmed symptomatic West Nile virus (WNV) infection in the U.S., and **it is likely that more than 1 million people have been infected by the virus. WNV is now the most common cause of epidemic viral encephalitis in the U.S.....** Recovery from neurological sequelae of WNV infection including cognitive deficits and weakness may be prolonged and incomplete.

<https://onlinelibrary.wiley.com/doi/abs/10.1002/ana.20959>

Pediatric Neurology Pediatric West Nile Virus-Associated Neuroinvasive Disease: A Review of the Literature Mar, 2019—A summary of the most recent literature regarding... From 1999 to 2016, 2397 cases in individuals under 19 years of age have been reported to the CDC, 34% of which were neuroinvasive... Children with WNV have a better prognosis than older adults, with a fatality rate of 1% compared with 14% in older adults. **West Nile virus-associated neuroinvasive disease, especially in pediatric populations.**

[https://www.pedneur.com/article/S0887-8994\(18\)30062-6/fulltext](https://www.pedneur.com/article/S0887-8994(18)30062-6/fulltext)

Emerging Infectious Diseases Cumulative Incidence of West Nile Virus Infection, Continental United States, 1999–2016 Feb, 2019 Using reported case data from ArboNET and previous seroprevalence data stratified by age and sex, we conservatively estimate that ≈7 million persons in the United States have been infected with West Nile virus since its introduction in 1999...more than double the 2010 estimate of 3 million

infections. https://wwwnc.cdc.gov/eid/article/25/2/18-0765_article

Centers for Disease Control and Prevention (CDC) Jan 8, 2019 WNV is now well established in the lower 48 states of the U.S. ...Avoidance of mosquito bites is the only practical preventive measure available.

<https://www.cdc.gov/westnile/statsmaps/preliminarymapsdata2018/disease-cases-state-2018.html>

ZIKA VIRUS

University of Minnesota Center for Infectious Disease Research and Policy Zika roadmap outlines steps toward diagnostics, treatment, vaccines Feb 26 2021.... Zika can be found on most every continent, affecting a total of 87 countries and territories as of July 2019.... The massive 2015-16 outbreak in the Americas involved more than 700,000 cases. Zika infection, while normally mild, can lead to Zika congenital disease, whose symptoms may include microcephaly in infants. The WHO has also linked it to health problems such as Guillain-Barré syndrome, neuropathy, and spinal cord inflammation. ...A 2018 study by researchers from the US Centers for Disease Control and Prevention looked at 1,450 children in US territories whose mothers had Zika during pregnancy. Of the children, 14% had birth defects associated with the virus and 6% had microcephaly.

<https://www.cidrap.umn.edu/news-perspective/2021/02/zika-roadmap-outlines-steps-toward-diagnostics-treatment-vaccines>

National Library of Medicine Meanings, risk perceptions, and prevention strategies for pregnant women since the emergence of the Zika virus in Brazil Feb 22 2021. This study aimed to understand the meanings, risk perceptions, and strategies to prevent infection with the Zika virus developed by pregnant women with different socioeconomic conditions... as well the contribution by their male partners in dealing with the risk of infection since the emergence of this virus in Brazil. Women interviewed in the public health system felt more vulnerable to the risk of infection than

women interviewed in the private health system, with a major impact on their psychosocial well-being. According to the women, their partners placed huge demands on them to adopt preventive measures, but the male partners themselves failed to take the same precautions, e.g., ignoring the risk of sexual transmission of the Zika virus. It is crucial to strengthen health communications activities to guarantee the availability of information on the disease that responds adequately to the population's needs. <https://pubmed.ncbi.nlm.nih.gov/33624694/>

PLoS Neglected Tropical Diseases Vertical transmission of zika virus in *Aedes albopictus* Oct 15, 2020 ZIKV can be vertically transmitted in *Ae. albopictus* via transovarial transmission.
<https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0008776>

News Wise Scientists Uncover How Zika Virus Can Spread through Sexual Contact Apr 27, 2020 Zika virus is capable of replicating and spreading infectious particles within the outermost cells lining in the vaginal tract, according to new research. <https://www.newswise.com/articles/scientists-uncover-how-zika-virus-can-spread-through-sexual-contact?sc=sphp> <https://www.dropbox.com/s/i29us697rnh3zui/Mungin%20Abstract.pdf?dl=0>

Journal of Neurological Sciences Association between Zika virus and future neurological diseases Feb 15, 2020 Viruses such as human cytomegalovirus, rubella, varicella-zoster and West Nile have been reported to cause birth defects similar to Zika virus (ZIKV), and some of them have also been associated with long-term neurological impacts. Other clinically relevant neurotropic arboviruses include Flaviviruses (e.g., St. Louis encephalitis virus, and Japanese encephalitis virus), Bunyaviruses (e.g., La Crosse virus and California encephalitis virus) and New World Alphaviruses (e.g., Eastern, Western, and Venezuelan equine encephalitis viruses). [https://www.ins-journal.com/article/S0022-510X\(19\)32382-2/fulltext](https://www.ins-journal.com/article/S0022-510X(19)32382-2/fulltext)

CDC Morbidity and Mortality Weekly Report Population-Based Surveillance for Birth Defects Potentially Related to Zika Virus Infection — 22 States and Territories, January 2016–June 2017 Jan 24, 2020 ...Prevalence of birth defects potentially related to Zika virus infection during pregnancy increased 21% during the second half of 2016 compared with that in the first half. In U.S. territories with widespread local Zika virus transmission, the prevalence of birth defects potentially related to Zika virus infection increased fourfold during January–March 2017 compared with January–March 2016. <https://www.cdc.gov/mmwr/volumes/69/wr/mm6903a3.htm>

International Journal of Infectious Diseases Clinical, laboratory and immune aspects of Zika virus-associated encephalitis in children Jan, 2020 Zika virus (ZIKV) infection was detected in an important fraction of pediatric encephalitis cases. ZIKV encephalitis patients displayed a higher frequency of exanthema and shorter duration of hospitalization compared to patients with encephalitis caused by other etiological agents.
[https://www.ijidonline.com/article/S1201-9712\(19\)30424-2/fulltext](https://www.ijidonline.com/article/S1201-9712(19)30424-2/fulltext)

Maternal and Child Health Journal Zika Testing Behaviors and Risk Perceptions Among Pregnant Women in Miami-Dade County, One Year After Local Transmission. Jun 17, 2019 Participants with some high school education were significantly more likely than those with higher education levels to see ZIKV as a “big problem” in the community.
<https://link.springer.com/article/10.1007%2Fs10995-019-02756-x>

Journal of Assisted Reproduction and Genetics ...Aspects of Zika virus infection on the male reproductive system May 30, 2019Data on ZIKV persistence in semen and associated risks to the male reproductive system described in human and animal model studies. <https://link.springer.com/article/10.1007%2Fs10815-019-01493-y>

BCM Public Health A survey of the knowledge, attitudes and practices on Zika virus in New York City Jan 2, 2018 -- Participants reported more actions related to the reduction of potential mosquito breeding sites (94%) and protection against mosquito-borne transmission (63%) than of protection against sexual transmission (23%). ...40% of persons do not think that the risk of Zika applies to them. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5748954/>

Guillain Barre

Journal of the Peripheral Nervous System Diagnosis and Treatment of Guillain-Barré Syndrome During The Zika Virus Epidemic In Brazil: A National Survey Study. Nov 20, 2019 ... Sixty-one percent of neurologists noticed an increase in patients with GBS during the ZIKV epidemic; 30% experienced an increase in problems in managing GBS during this time.
<https://onlinelibrary.wiley.com/doi/abs/10.1111/jns.12358>

Nature Reviews. Neurology. Diagnosis and management of Guillain-Barré syndrome in ten steps. Sept 20, 2019 Guillain-Barré syndrome (GBS) is a rare, but potentially fatal, immune-mediated disease of the peripheral nerves and nerve roots that is usually triggered by infections. The incidence of GBS can... increase during outbreaks of infectious diseases.... <https://www.nature.com/articles/s41582-019-0250-9>

International Journal of Infectious Diseases Guillain–Barré syndrome associated with Zika virus infection in Honduras, 2016–2017 Jul, 2019 In addition to GBS, the neurological consequences of ZIKV include not only CZS and GBS, but also encephalitis, meningoencephalitis, myelitis, sensory neuropathies, optic neuropathy, seizures, and epilepsy, among other reported complications. [https://www.ijidonline.com/article/S1201-9712\(19\)30214-0/fulltext](https://www.ijidonline.com/article/S1201-9712(19)30214-0/fulltext)

CHIKUNGUNYA

Centers for Disease Control and Prevention (CDC) - Chikungunya virus disease cases* reported to ArboNET by states and territories – United States, 2020 (as of January 7, 2021) Travel-associated cases/ Locally acquired cases, No. (%): California 4 (19)/0 (0), Idaho 1 (5)/0 (0), Illinois 2 (10)/0 (0), Missouri 1 (5)/0 (0), New Jersey 3 (15)/0 (0), North Carolina 5 (24)/0 (0), South Carolina 1 (5)/0 (0), Tennessee 1 (5)/0 (0), Texas 3 (14)/0 (0), Territories (N=0)/(N=0). Although the number of reported cases of chikungunya virus infection are vastly fewer than reported in recent years, the virus has not disappeared. One wonders if cases during 2020 were underreported, masked by the occurrence of cases of COVID-19 during the pandemic. <https://www.cdc.gov/chikungunya/geo/united-states-2020.html>

Clinical Infectious Disease Fatal outcome of chikungunya virus infection in Brazil Aug 7 2020 ...68 fatal cases had CHIKV infection confirmed Co-detection of CHIKV with DENV were found in 22% of fatal cases, ZIKV in 2.9%, and DENV and ZIKV in 1.5%. A total of 39 CHIKV-deaths presented with neurological signs and symptoms... CHIKV-ECSA strains can cause death in individuals from both risk and non-risk groups, including young adults. <https://pubmed.ncbi.nlm.nih.gov/32766829/>

Clinical Medicine Chikungunya arthritis Sep 1, 2019 The chikungunya virus (CHIKV)... has emerged as a significant public health concern in the last 10–15 years, especially in Asian and South American countries. ... Cases have now been reported in North America and Europe. CHIKV infection predominantly causes musculoskeletal symptoms with a chronic polyarthritis which may resemble autoimmune inflammatory arthritis. CHIKV infection should always be suspected in a returning traveler presenting with fever, skin rash and arthralgia. <http://www.clinmed.rcpjournal.org/content/19/5/381.short>

DENGUE

Journal of Medical Entomology Spatial Risk Distribution of Dengue Based on the Ecological Niche Model of Aedes aegypti (Diptera: Culicidae) in the Central Mexican Highlands May, 2020 Dengue is the most important viral disease transmitted by mosquitoes, predominantly *Aedes (Stegomyia) aegypti* (L.) (Diptera:Culicidae). Forty percent of the world’s population is at risk of contracting the disease ...The present ecological niche model represents an important tool for the monitoring of dengue and the identification of high-risk areas. <https://academic.oup.com/jme/article-abstract/57/3/728/5688527?redirectedFrom=fulltext>

CDC Dengue in the U.S. – 2020

State	Travel Associated	Locally transmitted
Arizona	4	0
Arkansas	1	0
California	59	6
Colorado	4	0
Delaware	1	0
District of Columbia	2	1
Florida	40	70
Georgia	1	0
Hawaii	5	0
Illinois	9	0
Indiana	2	0

State	Travel Associated	Locally transmitted
Nebraska	3	0
Nevada	3	0
New Jersey	2	0
New Mexico	1	0
New York	4	0
North Carolina	5	0
Ohio	2	0
Oregon	9	0
Pennsylvania	4	0
South Carolina	2	0
South Dakota	1	0

Iowa	1	0
Louisiana	3	0
Maryland	3	0
Massachusetts	9	0
Michigan	2	0
Missouri	3	0

Tennessee	1	0
Texas	43	10
Virginia	5	0
Washington	8	0
Wisconsin	7	0
TOTAL	252	80

AP News Health officials: 4 new Dengue fever cases in Florida Keys Aug 3 2020 Four cases of Dengue fever have recently been confirmed in the Florida Keys, bringing the total number of cases reported this year to 26...The Florida Department of Health in Monroe County said ... the mosquito-borne infections were acquired locally.

<https://apnews.com/a582945de8d73f55add0ffb615380d42>

International Journal of Infectious Diseases Prevalence of dengue antibodies in healthy children and adults in different Colombian endemic areas Feb, 2020 Dengue seroprevalence is over 90% in Colombian volunteers from 4 to 95 years old. There is a wide and persistent DENV circulation and a large number of asymptomatic infections in the population. [https://www.ijidonline.com/article/S1201-9712\(19\)30439-4/fulltext](https://www.ijidonline.com/article/S1201-9712(19)30439-4/fulltext)

ProMED-mail Dengue/DHF update (05): Americas 2020

County	Serotype	Total	Confirmed	Severe	Deaths	County	Serotype	Total	Confirmed	Severe	Deaths
North America USA	D?	307	307	0	0	Haiti	D?	17	0	0	0
Belize	D1,2	2,779	324	0	0	Jamaica	D?	824	15	-	1
Costa Rica	D1,2	10,056	426	21	0	Martinique	D1,2,3	32,398	12276	47	17
El Salvador	D2	5,450	-	9	0	Montserrat	D?	1	0	0	0
Guatemala	D1,2,3,4	5,782	786	14	8	St. Barthelemy	D1,2	1,616	889	0	0
Honduras	D1,2	26,006	75	1,787	10	St. Kitts & Nevis	D3	20	2	0	0
Nicaragua	D2	53,953	1,259	70	1	St Martin	D1,2,3	2736	488	1	1
Panama	D1	19,162	4,129	12	6	St Vincent & the Grenadines	D3	1,790	1790	8	8
Cuba	D1,2	1,418	1,418	1	0	Trinidad & Tobago	D?	59	2	0	0
Dominican Republic	D1	3,964	453	245	36	Turks & Caicos	D1	142	23	0	0
Puerto Rico	D?	558	558	24	0	Virgin Islands	D?	44	44	0	0
Anguilla	D1,3	6	2	0	0	Bolivia	D1,2	85,326	14,605	223	33
Antigua & Barbuda	D3	409	3	0	0	Columbia	D1,2,3,4	78,979	17,401	897	55
Aruba	D?	11	4	0	0	Ecuador	D1,2	16,570	-	51	6
Bahamas	D?	3	0	0	0	Peru	D1,2	56,394	35641	122	88
Cayman Islands	D2	35	1	0	0	Argentina	59,358	48,415	48,415	37	19
Dominica	D2,3	88	14	1	0	Chile	D2	9	9	0	0
French Guiana	D1,2,3	5,426	4287	11	4	Paraguay	D1,2,4	223,782	37890	167	75
Guadeloupe	D1,2,3	19,407	282	3	2	TOTALS FOR THE AMERICAS		2,251,689	992,847	5,648	991

MALARIA

Journal of Travel Medicine Malaria in the Pregnant Traveler May 18, 2020 Mosquito repellents, including DEET and permethrin treatment of clothing, are considered safe in pregnancy and important to prevent malaria as well as other arthropod-borne infections such as Zika virus infection. <https://academic.oup.com/jtm/advance-article-abstract/doi/10.1093/jtm/taaa074/5838121?redirectedFrom=fulltext>

EASTERN EQUINE ENCEPHALITIS

CDC As of December 17, 2019, CDC has received reports of 38 confirmed cases of Eastern equine encephalitis virus disease for this year, including 15 deaths. Cases have been reported from ten states: Alabama (1), Connecticut (4), Georgia (1), Indiana (1), Massachusetts (12), Michigan (10), New Jersey (4), North Carolina (1), Rhode Island (3), and Tennessee (1). <https://www.cdc.gov/easternequineencephalitis/index.html>

New England Journal of Medicine Eastern Equine Encephalitis Virus — Another Emergent Arbovirus in the U.S. Nov 21, 2019 <https://www.nejm.org/doi/full/10.1056/NEJMp1914328>

ST LOUIS ENCEPHALITIS

CDC As of December 17, 2019, CDC has received reports of 38 confirmed cases of Eastern equine encephalitis virus disease for this year, including 15 deaths. <https://www.cdc.gov/easternequineencephalitis/index.html>

American Journal of Tropical Medicine and Hygiene St. Louis Encephalitis Virus Disease in the U.S., 2003-2017. Oct. 2018. 198 counties in 33 states and the District of Columbia reported SLEV activity. A total of 193 human cases of SLEV disease were reported, including 148 cases of neuroinvasive disease. AK, AZ, and MS had the highest average annual incidence of neuroinvasive disease cases. <http://www.ajtmh.org/content/journals/10.4269/ajtmh.18-0420>

LA CROSSE ENCEPHALITIS

IndeOnline.com Massillon OH Stark family warns of dangerous mosquito virus after rare diagnosis Oct 7, 2018 <https://www.indeonline.com/news/20181007/stark-family-warns-of-dangerous-mosquito-virus-after-rare-diagnosis> La Crosse encephalitis, a rare and dangerous virus, is on the increase. [See link for story of one family's experience, symptoms, more.] Transmitted by infected eastern treehole mosquitoes, it has a 5-15-day incubation period, with most severe cases often found in children under 16. It can cause seizures and, in some cases, coma and paralysis. It strikes boys 5-9 in particular. Though most patients recover, it can cause cognitive and neuro-behavioral problems that require occupational therapy. There is no cure, however, symptoms are treatable. Severe neurological cases occur, mainly in pre-school age children. They are seldom fatal, but prolonged hospitalization and sequelae including personality changes, may occur. The virus can be transovarially transmitted by the infected female to her eggs, so that emerging adults may already be infected and ready to transmit the virus. See a summary of LACV, its epidemiology, geographic distribution, and clinical characteristics at <https://www.cdc.gov/lac/tech/epi.html>.

KEYSTONE VIRUS

USA Today Brain-swelling sickness carried by mosquitoes can infect humans June 25, 2018--Another mosquito-borne virus, the Keystone virus, might pose a risk to people, specifically those in Florida. A confirmed human case was recently reported in *Clinical Infectious Diseases*. Cases could be "fairly common in North Florida," but patients are rarely tested for the virus. <https://www.usatoday.com/story/news/nation-now/2018/06/25/what-keystone-virus-mosquito-carrying-sickness-found-florida/730055002/>

JAMESTOWN CANYON VIRUS

Concord Monitor (NH) A NH man said to be infected with a rare mosquito-borne disease called Jamestown Canyon virus may be its first recorded fatality. <http://www.concordmonitor.com/jamestown-canyon-virus-death-18342165>

YELLOW FEVER

The Independent Florida Alligator Yellow fever mosquito found in downtown Gainesville May 9, 2020 ...A yellow fever mosquito was found downtown this week. Yellow fever mosquitoes can spread yellow fever, dengue, chikungunya and Zika viruses, according to the post. https://www.alligator.org/news/local/yellow-fever-mosquito-found-in-downtown-gainesville/article_51273a9e-9221-11ea-93da-231b185e49f5.html

Consumer Media

CNN Why tick season could be worse in the summer of Covid-19 July 5, 2020 ...Last year, the Centers for Disease Control and Prevention announced a rise in Lyme and other tick-borne diseases, with seven additional germs identified in the US in the last two decades, while the "lone star tick" expanded its footprint beyond the southeast to northern states and the Midwest.... But ignoring basic steps that reduce the risk of tick and vector-borne illnesses to focus solely on Covid-19 prevention is just one danger. Another is the possibility of confusing the symptoms if you start feeling sick... Dr. Segal-Maurer says "You need to use DEET. It's gotta be 30%. You need to watch where you hike. And then you need to do a body check when you get back inside." <https://www.cnn.com/2020/07/05/us/ticks-lyme-disease-covid-summer-scen-trnd/index.html>

People's Pharmacy Are Tick-Borne Illnesses More of a Problem? Sep 26, 2019 A single tick can carry many pathogens. As a result, a person who is bitten might develop two or more tick-borne illnesses... Many species of ticks have been extending their range into new territory. Because they carry disease-causing pathogens with them, clinicians may not recognize the resulting illnesses at first. <https://www.peoplespharmacy.com/articles/are-tick-borne-illnesses-more-of-a-problem/>

PROTECTION

Experimental and Applied Acarology Natural insensitivity and the effects of concentration on the repellency and survival of American dog ticks (*Dermacentor variabilis*) by DEET Oct 2 2020 DEET's effectiveness against ticks is influenced by a variety of factors (e.g., duration and concentration of application, drying time, route of exposure, tick species and developmental stage....Higher concentrations of DEET were more effective at repelling *D. variabilis*...<https://pubmed.ncbi.nlm.nih.gov/33009647/>

USA TODAY Fact check: Limes spiked with cloves are not effective in repelling mosquitoes June 24, 2020 The research found that DEET-based products provide complete protection against mosquitoes for the longest amount of time compared to botanical repellents. ...Non-DEET repellents cannot be relied on for protection in environments where the threat of mosquitoes are prevalent... ..Studies show that the risks of DEET... are very low when used as directed <https://www.usatoday.com/story/news/factcheck/2020/06/24/fact-check-clove-spiked-limes-deter-mosquitoes/3241517001/>

Today.com How to choose the best bug repellent, according to experts June 10, 2020 "Use Environmental Protection Agency-recommended repellents. Ingredients like DEET, Picaridin, IR3535 and oil of lemon eucalyptus work well," said Laura C. Harrington, a professor in Cornell University's entomology department. <https://www.today.com/shop/best-mosquito-repellents-t183341>

Fatherly Mosquito Repellents Keep the Bugs At Bay. June 4, 2020 ...First of all, DEET works. As a first order of protection, experts recommend applying DEET or picaridin to your body. These are the two most effective chemical repellents against the species that ravage humans and carry disease. ... DEET ... works and is actually incredibly safe. <https://www.fatherly.com/play/best-natural-mosquito-repellant-strategies/>

kgun9.com Consumer Reports: Top-performing insect repellents June 3, 2020 Many of the highest-rated products contain DEET at concentrations of 15-30%. CR's two top rated repellents contain DEET. Ben's Tick and Insect Repellent Wipes and Total Home Woodland Scent Insect Repellent... If you don't want to use DEET, a better option than essential oil repellents are products containing 20% picaridin or 30% oil of lemon eucalyptus. <https://www.kgun9.com/money/consumer/consumer-reports-top-performing-insect-repellents>

Men's Health Is DEET Actually Bad for You? Here's What to Know. May 27, 2020 ...In 2014, EPA conducted another review and concluded that insect repellents containing DEET do not present a health concern when products are used as stated on the label. Products containing DEET range from 4 to 100% DEET. A higher percentage of the active ingredient doesn't mean it's better at fending off pests. It means it lasts longer. So you can use a product with a low percentage of DEET as long as you reapply it as often as the label states. <https://www.menshealth.com/health/a32688498/what-is-deet-spray/>

KOMO.com Seattle, WA Consumer Reports tests 43 insect repellents to find what works May 20, 2020 *Consumer Reports* tested 43 insect repellents for this year's evaluation – and once again, the top-performing products contained the active ingredient DEET. "It's consistently high performing and we really think it provides reliable protection," said Catherine Roberts, *Consumer Reports* associate health editor. In fact, 15 of the 20 recommended insect repellents this year contain DEET. The others had picaridin or oil of lemon eucalyptus – which sounds like it comes from a plant, but it's chemically synthesized.

Good Housekeeping 13 Bug Sprays for Kids and Babies to Help Protect During Your Next Family Outing Apr 29, 2020 EPA registration of skin-applied repellent products, including DEET, indicates that they have been evaluated and approved for human safety and effectiveness when applied according to instructions on the label. Their evaluation includes ensuring that the registered product does not harm vulnerable populations, including children and pregnant women...DEET... is considered safe for anyone older than 2 months—the American Academy of Pediatrics recommends products that contain between 10% and 30% DEET. <https://www.goodhousekeeping.com/childrens-products/g32269687/best-bug-sprays-for-babies-kids/>

SYN TV National Dec 31, 2019 That's safe for all. Pregnant and breast-feeding women. You want to make sure it contains the active ingredient, DEET... And people should know, look for 30% DEET, oil of lemon, eucalyptus. These are safe.

Przegląd Epidemiologiczny Susceptibility of *Dermacentor reticulatus* tick to repellents containing different active ingredients 2019 DEET is considered by many to be the 'gold standard' of insect repellents, and we have also confirmed

this in our studies. DEET expressed the higher repellency after 7 hours of application (90%) comparing to other formulations. Other repellents Picaridin 20% and IR3535 12% were effective only up to four hours after application (the efficacy was 85% and 40%, respectively). <https://www.ncbi.nlm.nih.gov/pubmed/31134780>

***Journal of Medical Entomology* Assessing Effectiveness of Recommended Residential Yard Management Measures Against Ticks** May 23, 2019 We examined the relationship between larval tick abundance and eight property features related to recommendations from public health agencies: presence or absence of outdoor cats, wood piles, trash, stone walls, wood chip barriers separating lawn from adjacent forest, bird feeders, fencing, and prevalence of Japanese barberry. More questing larvae were found in yards where trash or stone walls were present. These effects were less pronounced as forest area increased within the yard. Counts of larvae per mouse were lower in properties with >75% of the yard fenced than in properties with less fencing. We find partial support for recommendations regarding trash, stone walls, and fencing. We did not detect effects of outdoor cats, bird feeders, barriers, wood piles, or Japanese barberry. There was low statistical power to detect effects of ground barriers (gravel, mulch, or woodchip), which were present in only two properties. <https://academic.oup.com/jme/article/56/5/1420/5497764>

***Current Biology* Commonly Used Insect Repellents Hide Human Odors from Anopheles Mosquitoes** November 4 2019 DEET, IR3535, and picaridin decrease the response of Orco-expressing ORNs when these repellents are physically mixed with activating human-derived odorants. https://www.sciencedirect.com/science/article/abs/pii/S0960982219311674?dgcid=raven_sd_recommender_email

***Time* DEET Is the Most Effective Bug Spray. But Is It Safe?** Jul 25, 2019 ...A *New England Journal of Medicine* study concluded that ... DEET is among the most effective ways to prevent bites. "I use DEET all the time when I'm working in the field," says Jonathan Day, a professor of medical entomology at the University of Florida....Existing research suggests that applying DEET is a safe, effective way to protect yourself and your family from potentially disease-carrying bugs. <https://time.com/5347546/is-deet-safe/>

Environmental Working Group's Top Three Bug Repellent Recommendations For Kids Jul 10, 2019 Our top picks are DEET, Picaridin and IR3535..... If you're using DEET to protect kids in an area known for ticks' carrying Lyme disease bacteria or for Zika outbreaks, a concentration of 20 percent to 30 percent may be appropriate...contrary to popular belief, bug repellents with higher concentrations – such as old-school 100 percent DEET – are not necessarily more effective.... ... DEET is a reasonable choice when used as directed, even for children. ... EWG researchers concluded that it is ...generally safer than is commonly assumed. Picaridin is a great alternative to DEET. <https://www.ewg.org/childrenshealth/22764/ewg-s-top-three-bug-repellent-recommendations-kids>

CBS News June 10, 2019 Some ways you can avoid tick-borne disease when spending time outdoors is to wear DEET, tuck your pants into your socks, avoid tall grass, shower immediately after being outside and have someone check your body. ...Time is of the essence, Dr. David Agus warned. "Take a straight tweezers, pull straight out and put the tick into alcohol. The quicker you remove it the better, because it takes time before it can inject its saliva into you. The saliva is what contains the bacteria and the virus." While most diseases like Lyme are treatable, there have been two cases of the Powassan virus reported in New Jersey. It is not treatable. "It's got a 10 percent mortality rate and 50 percent of people who get this virus have permanent neurologic injury. So have someone search you for ticks and pull them off right afterward. Avoid it. Wear Deet." <https://www.cbsnews.com/news/tickborne-diseases-are-one-the-rise-heres-what-you-need-to-know/>

***Scouting Magazine* The colorful history of fighting off pesky pests** May/June, 2019 The CDC and EPA agree that repellents DEET and picaridin are effective at fending off insects... The promise of a bug repellent that really works finally began to be realized with the development of the chemical DEET... While there are pros and cons to all repellents, concerns about the side effects of DEET have been largely put to rest, especially in light of DEET's value in protecting against insect-borne diseases. <https://scoutingmagazine.org/2019/04/the-colorful-history-of-fighting-off-pesky-pests/>

***Prevention* Why Essential Oils Probably Won't Protect You From Ticks This Summer** May 1, 2019 The most preventative insect repellents are ones with active ingredients like DEET, picaridin, IR3535, oil of lemon eucalyptus (OLE), para-menthane-diol (PMD), or 2-undecanone. <https://www.prevention.com/health/a27333432/essential-oils-for-ticks/>

Environmental Working Group EWG's 2018 Guide to Bug Repellents Can Help Fend off Disease- Carrying

Ticks, Mosquitoes July 17, 2018 ...Many people are concerned about the possible drawbacks of common active ingredients like DEET. EWG researchers have analyzed the science in depth and found that, with proper application and precaution, our recommended active ingredients effectively reduce risk from life-altering diseases and have very low toxicity concerns. <https://www.ewg.org/release/ewg-s-2018-guide-bug-repellents-can-help-fend-disease-carrying-ticks-mosquitoes#.W094INVkiUK>

STATE REPORTS

CALIFORNIA

PLOS.org West Nile virus in California, 2003–2018: A persistent threat Nov 18 2020. This manuscript summarizes WNV surveillance data in California since WNV was first detected in 2003 in southern California. From 2003 through 2018, 6,909 human cases of WNV disease, inclusive of 326 deaths, were reported to CDPH, as well as 730 asymptomatic WNV infections identified during screening of blood and organ donors. Of these, 4,073 (59.0%) were reported as West Nile neuroinvasive disease. California's WNV disease burden comprised 15% of all cases that were reported to the U.S. Centers for Disease Control and Prevention during this time, more than any other state. Peak WNV activity occurred from July through October in the Central Valley and southern California. Less than five percent of WNV activity occurred in other regions of the state or outside of this time. WNV continues to be a major threat to public ... health in California, particularly in southern California and the Central Valley during summer and early fall months. <https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0008841>

CBS8.com San Diego, CA California County reports first human case of uncommon mosquito-borne virus in nearly 40 years Oct 22, 2020 San Joaquin County Public Health Services (SJCPH) said it has received the first reported human case of ... St. Louis encephalitis virus (SLEV) in the county in nearly 40 years... When outdoors, apply insect repellent that contains EPA registered active ingredients including DEET, Picaridin, oil of lemon eucalyptus, or IR3535. <https://www.cbs8.com/article/news/local/rare-virus-human-case-stockton/103-b2b86b1d-f08d-487e-9ed0-3865b108a520>

CONNECTICUT

NBCConnecticut.com Warmer Winters Means Ticks Are Thriving Jan 11, 2021 Our warming Connecticut winters means ticks can survive year round. "There's a really good correlation with our increase in temperatures in the winter months and the increase in survival," explained Kirby Stafford, chief scientist at the Connecticut Agricultural Experiment Station and state entomologist. With ticks in their adult stage during the winter months, there's a roughly 50/50 chance any tick that bites you can transmit Lyme Disease. The good news is it takes at least 24, but closer to 36 hours for a tick to infect humans and pets. So as soon as you get done spending time outdoors it's important to do a tick check. <https://www.nbcconnecticut.com/news/local/warmer-winters-means-ticks-are-thriving/2401328/>

FLORIDA

TCPalm.com - Martin County resident tests positive for West Nile virus, the first case in 20 years Nov 30 2020. The Florida Department of Health confirmed a positive human case of West Nile virus in Martin County on Monday — the first in two decades.... St. Lucie and Indian River counties also haven't seen a human case since at least 2003. <https://www.tcpalm.com/story/news/local/martin-county/2020/11/30/west-nile-virus-martin-county-resident-tests-positive-treasure-coast/6468435002/>

Oxford Academy Journal of Medical Entomology Establishment of Aedes (Ochlerotatus) scapularis (Diptera: Culicidae) in Mainland Florida, With Notes on the Ochlerotatus Group in the United States Nov 23 2020. Collections of both larvae and adults across several years indicate that *Ae. scapularis* is now established in Broward and Miami-Dade Counties. These contemporary records of this species in Florida may represent novel dispersal and subsequent establishment events from populations outside the United States or a recent reemergence of undetected endemic populations.<https://academic.oup.com/jme/advance-article/doi/10.1093/jme/tjaa250/5998585>

Center for Infectious Disease Research and Policy Florida reports more dengue cases in Miami-Dade and Monroe counties Sep 23, 2020 The Florida Department of Health (Florida Health) this week announced that a second local dengue case has been reported from Miami-Dade County, and last week it confirmed another local dengue case in Monroe County, raising the total in the county, which includes the Florida Keys, to 56... take precautions such as draining standing water, covering skin and clothing with repellent, and covering doors and windows with screens to keep mosquitoes out. <https://www.cidrap.umn.edu/news-perspective/2020/09/news-scan-sep-23-2020>

GEORGIA

Valdosta Daily Times Valdosta, GA Bitter Cold Temperatures Will Send Pests Scurrying to Your Home this Fall and Winter Sep 24, 2020 Be sure to properly apply an EPA-registered insect repellent containing at least 20 percent DEET before heading outdoors and consider wearing long sleeves and pants to protect against these biting pests.

ILLINOIS

News.WTTW.com 6 Chicagoans Infected with West Nile Virus Mark City's 1st Cases This Year Sep 23, 2020 Six Chicagoans infected with West Nile virus mark the first cases of the illness in the city this years... State health officials advise following the three R's to prevent West Nile virus: reduce, repel and report. Reduce the number of mosquitos by getting rid of outside containers that hold water; repel mosquitos by using insect repellent; and report areas where you see stagnant water for more than a week, such as roadside ditches and flooded yards, to local government agencies or health departments. <https://news.wttw.com/2020/09/23/6-chicagoans-infected-west-nile-virus-mark-city-s-1st-cases-year>

MAINE

Journal of Medical Entomology Decoupling of Blacklegged Tick Abundance and Lyme Disease Incidence in Southern Maine, USA May, 2020 ...Maine is a high Lyme disease incidence state, with rising incidence of Lyme disease and other tick-borne illnesses associated with increasing *I. scapularis* abundance and northward range expansion. Lyme disease incidence and *I. scapularis* submission rate were temporally correlated in the northern but not southern tier. This suggested a decoupling of reported disease incidence and entomological risk. <https://academic.oup.com/jme/article-abstract/57/3/755/5663535?redirectedFrom=fulltext>

CDC Emerging Infectious Diseases Surge in Anaplasmosis Cases in Maine, USA, 2013–2017 Feb, 2020 Incidence of human granulocytic anaplasmosis is rising in Maine. This increase may be explained in part by adoption of tick panels as a frequent diagnostic test in persons with febrile illness and in part by range expansion of *Ixodes scapularis* ticks and zoonotic amplification of *Anaplasma phagocytophilum*. <https://wwwnc.cdc.gov/eid/article/26/2/pdfs/19-0529.pdf>

MASSACHUSETTS

The Harvard Crimson Boston, MA West Nile Virus Emerges as a 'High Risk' in Cambridge, Newton, Somerville, and Watertown Sep 15, 2020 The Massachusetts Department of Public Health announced Thursday four new human cases of West Nile virus in the state this year, bringing the state's total case count in 2020 to seven.... <https://www.thecrimson.com/article/2020/9/15/cambridge-west-nile-high-risk/>

MICHIGAN

WXMI-FOX Grand Rapids-Kalamazoo-Battle Creek, MI Oct 14 2020 ...Two humans have also tested positive for EEE, including one person who died from the virus in Montcalm county. To protect yourself from the mosquito- borne illness... use bug spray containing DEET.

NEBRASKA

Journal of Medical Entomology First Records of Established Populations of *Ixodes scapularis* (Acari: Ixodidae) Collected From Three Nebraska Counties May, 2020 ...This is the first documentation of established populations of *I. scapularis* in Nebraska. <https://academic.oup.com/jme/article-abstract/57/3/939/5644602?redirectedFrom=fulltext>

NEW HAMPSHIRE

NBC News Center MAINE - NH reports 5th Jamestown Canyon virus case this year November 20, 2020 The New Hampshire Department of Health and Human Services (DHHS) reported ... an adult from Newport, NH tested positive for Jamestown Canyon virus (JCV). This is the 5th person in New Hampshire to test positive for the virus this year. "Although JCV is still a rare disease, we are seeing more infections in NH, which is concerning," Dr Benjamin Chan, NH state epidemiologist, said. "... JCV can cause a severe neurologic disease. The risk for mosquito-transmitted infections is present from when snow melts in the spring until there is a mosquito killing frost in the fall." ... Reports of JCV in humans have been increasing over the last several years.... This is New Hampshire's 14th case of JCV since the first report of the disease in the state in 2013. Many illnesses caused by JCV are mild, but moderate-to-severe central nervous system involvement requiring hospitalization have been reported, including fatal infections. In NH, human cases of JCV have been recorded as early as mid-May and as late as early November. <https://www.newscentermaine.com/article/news/health/nh-reports-5th-jamestown-canyon-virus-case-this-year/97-993b0731-71cd-4a8b-bfb0-aac4aa9bd617>

NEW MEXICO

Deming Headlight Deming, NM Health department announces West Nile virus on the rise in New Mexico Aug 31, 2019

The New Mexico Department of Health (NMDOH) has identified five additional cases of West Nile virus infection in residents of Bernalillo, Doña Ana, San Juan and Valencia

<https://www.demingheadlight.com/story/news/2019/08/31/health-department-announces-west-nile-virus-rise-new-mexico/2167074001/>

NEW YORK

Mid-Hudson News Westchester confirms West-Nile responsible for Yonkers death Sep 17, 2020 Adults can use insect repellents with up to 30 percent DEET on infants over two months of age by applying the product to their own hands and then rubbing it onto their children, avoiding their hands, eyes, and mouth..

<https://midhudsonnews.com/2020/09/17/westchester-confirms-west-nile-responsible-for-yonkers-death/>

Syracuse.com 'Aggressive' lone star tick invades CNY, raising fears of new diseases May 14, 2020 The lone star tick, more common to the Southwest, is slowly pushing its way north and into New York state. They are already abundant on Long Island. Of the 84 ticks sent A Suffolk County lab, more than half were lone star ticks... Lone star ticks can also carry several viruses that cause disease, including Southern tick-associated rash illness, which looks and feels like Lyme...the ticks can carry heartland virus... The tick can also transmit a sugar molecule called alpha-gal that can cause an allergic reaction if the infected person eats mammal flesh. <https://www.syracuse.com/news/2020/05/aggressive-lone-star-tick-invades-cny-raising-fears-of-new-diseases.html>

NORTH CAROLINA

Greensboro News and Record Bourbon virus? New tick-borne disease may be in North Carolina June 14, 2020 Blood samples taken from deer in New Hanover and Stanly counties in 2014 show antibodies to the virus, indicating ticks here are carrying the disease, according to a letter published recently in the North Carolina Medical Journal. (Dr. Carl Williams, the state's Public Health veterinarian) recommends using insect repellents containing DEET on exposed skin and checking for ticks when you come inside. https://www.greensboro.com/news/local_news/bourbon-virus-new-tick-borne-disease-may-be-in-north-carolina/article_6924c276-60fe-5993-ad12-61b8a2dc1b19.html

North Carolina Medical Journal Indirect evidence of Bourbon virus (Thogotovirus, Orthomyxoviridae) infection in North Carolina. May 2020 ...Neutralizing antibodies against Bourbon virus were detected in white-tailed deer in North Carolina, suggesting that the virus is present in the state. This report signals the need for additional studies and surveillance to determine whether the virus is found throughout the range of the lone star tick, whether deer are shown to be infected in other states, and whether additional human cases of infection by this virus are occurring. The role of the lone star tick as a Bourbon virus vector would be further solidified by experiments to determine its relative susceptibility to the virus and its transmission efficiency. <https://doi.org/10.18043/ncm.81.3.214>

OKLAHOMA

CDC Emerging Infectious Diseases Rickettsia parkeri and Candidatus Rickettsia andeanae in Amblyomma maculatum Group Ticks Feb, 2020 ...Prevalence of *Rickettsia spp.* in 172 ticks of the *Amblyomma maculatum* group collected from 16 urban sites in Oklahoma City... during 2017 and 2018. Most ticks (59.3%) were collected from 1 site; 4 (2.3%) were infected with *Rickettsia parkeri* and 118 (68.6%) with *Candidatus Rickettsia andeanae*. https://wwwnc.cdc.gov/eid/article/26/2/19-0664_article?deliveryName=DM17868

PENNSYLVANIA

Observer Reporter Experts warn of ticks in Western Pa. throughout winter months Dec 2 2020. State experts and local veterinarians are warning the prevalence of ticks and the Lyme disease they can transfer to humans won't go away during the cold weather months. Warmer temperatures happening later in the year ... are allowing the tick populations to survive.... State Department of Environmental Protection spokesman Neil Shader said the region will need "prolonged periods" of below freezing temperatures to reduce the number of encounters people may have with ticks in the woods. https://observer-reporter.com/news/localnews/experts-warn-of-ticks-in-western-pa-throughout-winter-months/article_1d19092a-34de-11eb-a1f2-8f46e713f10e.html

RHODE ISLAND

NewportRI.com Newport, RI DEET vs. natural mosquito repellent: What works? What's safe? Aug 30, 2019 And yes, those include DEET, which is considered safe by state and federal health officials...Although DEET is toxic if swallowed,

the U.S. Centers for Disease Control and Prevention says repellents with DEET should not cause health problems. DPH says DEET should not be used on infants under two months old. On older children, concentrations of 30% or less are acceptable. Products that contain more than 30-50% DEET do not provide better protection, but they do last longer, according to state and federal sources. A 20% concentration provides about four hours of protection. DEET should be applied to clothes and exposed skin.... <https://www.newportri.com/news/20190830/deet-vs-natural-mosquito-repellent-what-works-whats-safe>

SOUTH CAROLINA

WPDE-ABC TV Florence-Myrtle Beach, SC (97) Jul 14 2020 Let's look at some of the recommendations from DHEC. They say to use DEET. You can find that in brands such as OFF and other brands are also effective. [5:21:02 PM] Wear repellents like DEET. Experts say to wear light colors and apply sunscreen before you apply repellent.

SOUTH DAKOTA

Journal of Medical Entomology Epidemic West Nile Virus Infection Rates and Endemic Population Dynamics Among South Dakota Mosquitoes: A 15-yr Study from the United States Northern Great Plains May, 2020 ...The nuisance mosquito, *Aedes vexans* (Meigen) was the most abundant species in the state (39.9.... The WNV vector, *Culex tarsalis* Coquillett (Diptera: Culicidae), was the second most abundant species (20.5%), and 26 times more abundant than the other *Culex* species that also transmit WNV. The abundance of *Ae. vexans* decreased from east to west in South Dakota, resulting in an increase in the relative abundance of *Cx. tarsalis*. WNV infection rates of mosquitoes showed that *Cx. tarsalis* had the most positive sampling pools and the highest vector index of all the species tested. <https://academic.oup.com/jme/article-abstract/57/3/862/5651347?redirectedFrom=fulltext>

TEXAS

Community Impact Newspaper - New mosquito trap tests positive for West Nile virus in Cedar Park Nov 24 2020. Three human cases have been reported in the county in 2020. <https://communityimpact.com/austin/cedar-park-leander/public-safety/2020/11/24/new-mosquito-trap-tests-positive-for-west-nile-virus-in-cedar-park/>

NBCdfw.com Dallas/Ft. Worth, TX Denton County Confirms 6th Human Case of West Nile Virus Oct 22, 2020 DEET: Make sure this ingredient is in your insect repellent. <https://www.nbcdfw.com/news/health/denton-county-confirms-6th-human-case-of-west-nile-virus/2465198/>

VIRGINIA

National Library of Medicine Host interactions of *Aedes albopictus*, an invasive vector of arboviruses, in Virginia, USA Feb 18 2021. *Aedes albopictus* is a potential vector of arboviruses including dengue, chikungunya, and Zika, and may also be involved in occasional transmission of other arboviruses such as West Nile, Saint Louis encephalitis, eastern equine encephalitis, and La Crosse viruses. Results of our study in conjunction with abundance in urban/suburban settings, virus isolation from field-collected mosquitoes, and vector competence of *Ae. albopictus*, highlight the potential involvement of this species in the transmission of a number of arboviruses such as dengue, chikungunya, and Zika to humans. <https://pubmed.ncbi.nlm.nih.gov/33600413/>

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