

VECTOR BORNE **DISEASES**

CAUSES, PREVENTION,
& TREATMENT





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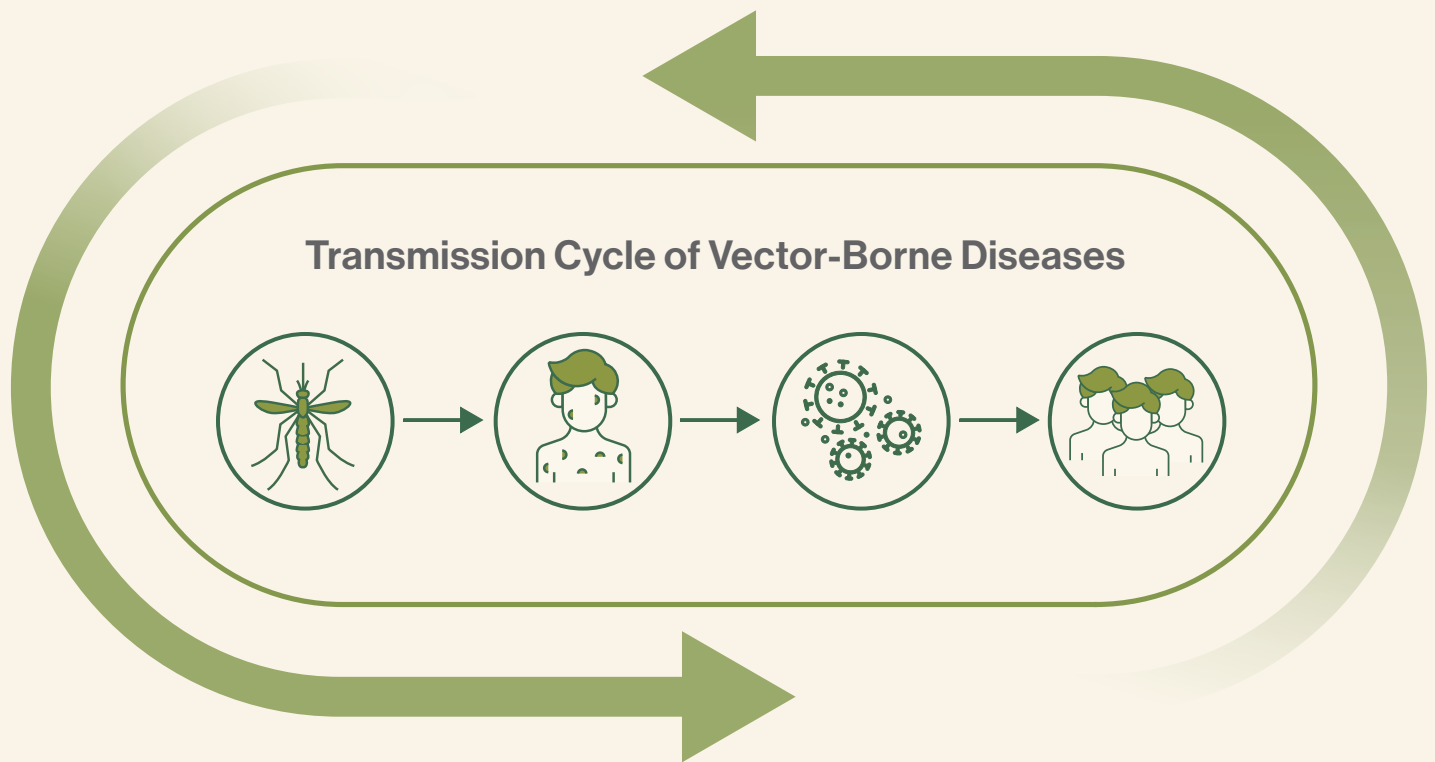
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What is a Vector Borne Disease?

Vector-borne diseases are infections caused by viruses, bacteria, or parasites that are transmitted to humans and other animals by blood-feeding arthropods such as mosquitoes, ticks, fleas, and flies.

Common Examples:

Malaria, Lyme Disease, Chickagunya, West Nile Virus, Zika Virus



Pathogen Acquisition

The insect feeds on an infected host (human or animal), acquiring the pathogen (virus, bacteria, or parasite)



Mosquitos

West Nile
Chickugunya

Pathogen Development

The pathogen develops and/or multiplies within the insect.



Ticks

Lyme Disease
Rocky Mountain
Spotted Fever

Pathogen Transmission

When the infected insect bites another host, it transmits the pathogen through its saliva into the host's bloodstream.



Flies

Leishmaniasis
African Sleeping
Sickness



Fleas

Plague
Cat Scratch
Disease



Lice

Relapsing Fever
Trench Fever



Mosquitoes:

The Deadliest Animal in the World

What are Mosquitoes

Mosquitoes are small flying insects from the Culicidae family, known for biting and feeding on the blood of humans and animals. They have slender bodies, long legs, and mouthparts designed to pierce skin and draw blood.

Where do they live

Found throughout the U.S., mosquitoes breed in standing water such as ponds, marshes, bird baths, and even discarded containers like tires.

Types of Mosquitoes

Aedes aegypti (Yellow Fever Mosquito)
Aedes albopictus (Asian Tiger Mosquito)
Culex pipiens (Northern House Mosquito)
Culex quinquefasciatus (Southern House Mosquito)
Anopheles quadrimaculatus

What do they eat

Males feed on nectar and plant juices, while females need blood to produce eggs.

How do they bite

Mosquitoes find hosts by sensing carbon dioxide, heat, and body odor. They pierce the skin with their proboscis to draw blood, injecting saliva that can transmit disease-causing pathogens.

Mosquito Borne Diseases

Malaria

Fever, chills, headache, muscle pain, nausea, vomiting. Severe cases can cause anemia and cerebral malaria.

247m Cases worldwide annually

619k Deaths per year

Dengue Fever

High fever, severe headache, pain behind the eyes, joint and muscle pain, rash, mild bleeding (e.g., nose or gums).

390m Infections annually

36k Deaths per year

Zika Virus

Mild fever, rash, joint and muscle pain, conjunctivitis (red eyes).

1k + Cases reported annually

High Deaths are rare, high birth defects

Chikungunya

Severe joint pain, fever, headache, muscle pain, rash, swelling around the joints.

High Outbreaks recorded

Low Deaths are rare

Eastern Equine Encephalitis (EEE)

High fever, severe headache, vomiting, stiff neck, and confusion. Severe cases can progress rapidly to seizures, brain swelling, and coma.

High Outbreaks recorded

Low 40% fatality rate and permanent brain damage



FEVER



CHILLS



HEADACHE



MUSCLE PAIN
AND FATIGUE



NAUSEA
AND VOMITING



SEVERE
JOINT PAIN

Ticks



What are Ticks

Ticks are often mistaken for insects, but they are actually arachnids, related to spiders, scorpions, and mites. They can be identified by their four pairs of legs and lack of antennae, resembling tiny spiders when viewed closely.

Where do they live

Ticks can be found throughout the United States, with certain regions harboring specific types that carry various diseases. Some areas have a higher prevalence of ticks and tick-borne illnesses than others.

Types of Ticks

American Dog Tick (*Dermacentor variabilis*)
Lone Star Tick (*Amblyomma americanum*)
Blacklegged Tick (Deer Tick, *Ixodes scapularis*)
Brown Dog Tick (*Rhipicephalus sanguineus*)

What do they eat

Ticks require a blood meal to survive. For instance, blacklegged ticks primarily feed on white-tailed deer but will also bite mice, small wild animals, birds, and humans. To transmit an infection, a tick generally needs to be attached for more than 24 hours, making prompt removal crucial in preventing disease transmission.

How do they bite

Ticks cannot jump or fly; instead, they crawl up low brush or grass to find a host. They latch onto their host by claspings with their back legs and reaching out with their front legs, a process known as questing. In some cases, they may drop from their perch onto a passing host.

Tick Borne Diseases

Rocky Mountain Spotted Fever

Fever, headache, rash, nausea, vomiting, abdominal pain, muscle pain, lack of appetite. Severe cases can cause damage to blood vessels, leading to bleeding or clotting.

1k+ Cases in the US

Anaplasmosis

Fever, headache, chills, muscle aches. Severe cases can lead to respiratory failure, bleeding problems, organ failure, or death.

5k Cases in the US

Babesiosis

Fever, chills, sweats, headache, body aches, loss of appetite, nausea, fatigue. Severe cases can cause hemolytic anemia, low platelet count, and organ failure.

2k + Cases in the US

Ehrlichiosis

Fever, headache, fatigue, muscle aches. Severe cases can lead to damage to the respiratory system, kidneys, and central nervous system.

High Outbreaks recorded

Alpha-Gal Syndrome (Red Meat Allergy)

Hives or itchy rash, Swelling of the lips, throat, or tongue, Nausea or vomiting, Heartburn or indigestion, Diarrhea, shortness of breath, or difficulty breathing.

100k Cases from 2010-2022

Powassan Virus

Fever, headaches, vomiting, weakness, confusion and loss of coordination

High Most suffer long-term neurological effects even death

Low Cases reported annually



MUSCLE PAIN
AND FATIGUE



NAUSEA
AND VOMITING



SEVERE
JOINT PAIN



FEVER



CHILLS



HEADACHE



SKIN RASH



U.S. Viruses

Protect Yourself from Tick and Mosquito Viruses

In the U.S., viruses spread by mosquitoes include West Nile, La Crosse encephalitis, and Chikungunya, while ticks transmit Powassan virus and Rocky Mountain spotted fever. These diseases can cause symptoms ranging from fever and rash to severe neurological illness or, in rare cases, death.

Use EPA-registered insect repellent, wear long sleeves and pants, tuck pants into socks, and check for ticks after outdoor activities.

West Nile Virus

West Nile Virus (WNV) is a mosquito-borne disease that has been a public health concern in the U.S. since 1999. Most people infected with the virus experience no symptoms or only mild, flu-like illness, including fever, headache, tiredness, body aches, nausea, and vomiting. Symptoms usually appear 3 to 14 days after infection and often resolve without lasting effects.

However, in severe cases, the virus can cause neurological complications such as encephalitis (inflammation of the brain) or meningitis (inflammation of the membranes around the brain and spinal cord). These cases can result in hospitalization or death, though they are relatively rare.

U.S. Statistics:

In 2021, there were 2,911 reported cases of WNV, with 1,558 classified as neuroinvasive disease. The national incidence was 0.61 per 100,000 people, with higher rates in Colorado and Arizona. In 2023, Colorado faced one of the worst outbreaks, reporting 50 deaths and numerous hospitalizations.

Lyme Disease

Lyme Disease is a tick-borne illness caused by the bacterium *Borrelia burgdorferi* and is the most common vector-borne disease in the United States. It spreads mainly through the bite of an infected black-legged (deer) tick. Early detection and treatment are essential to prevent serious complications.

Typical symptoms appear in the early stages and are often mild and flu-like, including fever, headache, fatigue, and a distinctive “bull’s-eye” rash known as erythema migrans.

If left untreated, Lyme Disease can lead to severe health issues:

Neurological problems such as meningitis, Bell’s palsy, or nerve pain (neuropathy).

Heart complications like Lyme carditis, which causes irregular heart rhythms.

Joint inflammation (arthritis), especially in the knees.

U.S. Statistics:

There are approximately 600,000 new cases of Lyme Disease each year. While deaths are rare, untreated infections can cause long-term and potentially serious effects.

Removing a Tick

Safe Tick Removal: Step-by-Step Guide to Prevent Infection and Disease

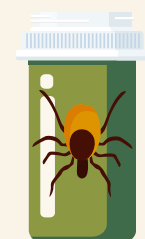
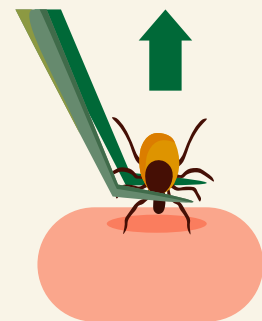
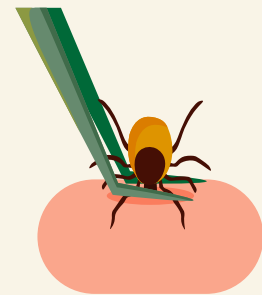
Disinfect the Bite Area: Cleaning the area around the tick bite before removal reduces the chance of infection and ensures that any germs present are minimized. Use an alcohol swab or antiseptic solution to clean the skin.

Grab Tick Close to the Head: Using fine-tipped tweezers, grasp the tick as close to the skin's surface as possible. This ensures that you are pulling the tick from the head or mouthparts, which are embedded in the skin, rather than squeezing its body. Squeezing the tick's body can push infected fluids into the wound.

Pull Out Slowly: Apply steady, even pressure to pull the tick out. Avoid twisting or jerking motions, as these can cause the tick's mouthparts to break off and remain in the skin, increasing the risk of infection. Slow, steady removal minimizes trauma to the skin and reduces the likelihood of the tick regurgitating its stomach contents, which can contain pathogens.

Disinfect Bite Area Again: After the tick is removed, clean the bite area thoroughly with an antiseptic or alcohol swab. This step helps to prevent secondary infections by disinfecting any remaining pathogens on the skin.

Send Tick for Testing: Place the tick in a sealed container or plastic bag and send it for testing if possible. Testing can identify whether the tick was carrying pathogens that cause diseases such as Lyme disease, providing valuable information for medical treatment if symptoms develop.



Why are Insects Attracted to Us

Mosquitoes and ticks use specialized senses to find and feed on humans, detecting specific cues at varying distances.

WHAT THEY SMELL

Female mosquitoes, which are the ones that bite, use several sensory cues to detect humans:

Carbon Dioxide (CO₂): Humans exhale CO₂, which mosquitoes can detect from a distance. Adults exhale more CO₂ than children, making them more likely targets.

Lactic Acid: Produced during physical activity and certain food consumption, lactic acid attracts mosquitoes.

Body Odor: The combination of sweat and skin bacteria creates body odor, which can be highly attractive to mosquitoes.
Blood Type: Mosquitoes show a preference for individuals with Type O blood and are less attracted to those with Type A blood

RANGES

50-10 Meters: At this range, mosquitoes can detect Carbon Dioxide (CO₂)

10-5 Meters: As mosquitoes get closer, they can detect Lactic Acid.

20 Centimeters and Less: At this close range, mosquitoes rely on Body Odor as well as Blood Type





Prevention Tips

Be A.w.a.r.e.

Preventing tick bites is crucial to reduce the risk of tick-borne diseases such as Lyme disease. By following the A.W.A.R.E. guidelines, you can protect yourself and your loved ones from tick bites.

Avoid areas where ticks live: wood piles, leaf litter, long grass, bushy areas, stone walls, and lawn perimeters.

Wear light-colored clothing, long sleeves, long pants tucked into socks, and closed-toe shoes.

Apply EPA-registered insect repellent on skin and clothing.

Remove clothing when entering the home and dry on high heat for 10-15 minutes to kill ticks.

Examine yourself and pets daily, focusing on areas like knees, groin, armpits, behind ears, belly button, and scalp. Shower or bathe promptly to remove unattached ticks. Remove any ticks immediately to prevent disease transmission.

A Avoid



W Wear



A Apply



R Remove



E Examine



Types of Applications

Aerosols: Insect repellent aerosols are convenient and provide even coverage, making them easy to apply over large areas of skin and clothing. However, aerosols can be flammable, posing a risk if used near open flames or high heat sources. Additionally, the propellants used in aerosols can sometimes cause respiratory irritation or be environmentally harmful.

Sprays: Sprays are versatile and can be used on both skin and clothing, offering a convenient way to cover hard-to-reach areas. Some spray formulations may also be flammable, similar to aerosols, depending on the ingredients used. Users should be cautious to avoid inhaling the spray mist and ensure it does not come into contact with eyes or mucous membranes.

Lotions: Lotions are easy to apply and can provide a controlled amount of repellent directly to the skin, which can be especially useful for sensitive areas. However, some lotion formulations can feel greasy or sticky on the skin, which might be uncomfortable for prolonged use. Despite this, lotions tend to have a lower risk of causing respiratory issues compared to aerosols and sprays.

Bands and Patches: Insect repellent bands and patches are convenient and offer a wearable solution that doesn't require direct application to the skin. However, their effectiveness is often limited to the immediate area around the band or patch, making them less effective for comprehensive protection. Additionally, some bands and patches have been restricted or regulated due to concerns over inconsistent efficacy and potential skin irritation.





Types of

Insect Control Products

Effective Insect Control Methods

To manage insect populations and prevent bites, use a combination of approaches:

Candles & Diffusers: Emit repelling scents like lavender or eucalyptus.

Body Repellents: Synthetic actives, biopesticides like IR3535, or plant oils for skin protection.

Clothing Repellents: Use permethrin-treated fabrics or spray clothing and gear.

Traps: Capture mosquitoes using CO₂, heat, or UV light.

Insecticides: Foggers and sprays provide temporary area-wide control.

Biological Controls: Use natural predators like bats, birds, or ladybugs to reduce pests.

Pros & Cons of Actives

Category	Pesticide
Name	Older synthetics
Developed By	In use since the mid-1900s
Function	Repel biting insects by interfering with their ability to detect people
Pros	- Long track record of use - Widely available (sprays, lotions, wipes, roll-ons) - Long-lasting at higher concentrations
Cons	- May cause skin irritation or rashes - Some can damage plastics, synthetic fabrics, and varnishes - Noticeable odor in some formulas

Types of Repellents for Skin

The EPA classifies repellents by their active ingredients

Pesticides: Synthetic actives, EPA-registered for effectiveness when used per label.

Examples: synthetic actives

Biopesticides: EPA-registered actives modeled on natural substances.

Examples: IR3535

Naturals: Plant-based, not EPA-tested, and provide shorter protection (2–4 hrs).

Examples: Citronella, Lavender Oil

Precautionary Statements

Always read and follow the product label. Precautionary statements differ by product: keep repellent out of eyes, and wash hands before eating, drinking, or using the toilet.

Category	Pesticide
Name	Newer synthetics
Developed By	1980s onward; synthetic repellent actives
Function	Repel mosquitoes, ticks, and other biting insects; sold as sprays, lotions, and wipes
Pros	- Long-lasting protection - Mild or no odor - Gentler on plastics, fabrics, and paints - Widely available
Cons	- May cause mild eye irritation - Age limits apply to some products - Less long-term research than older actives

Precautionary Statements

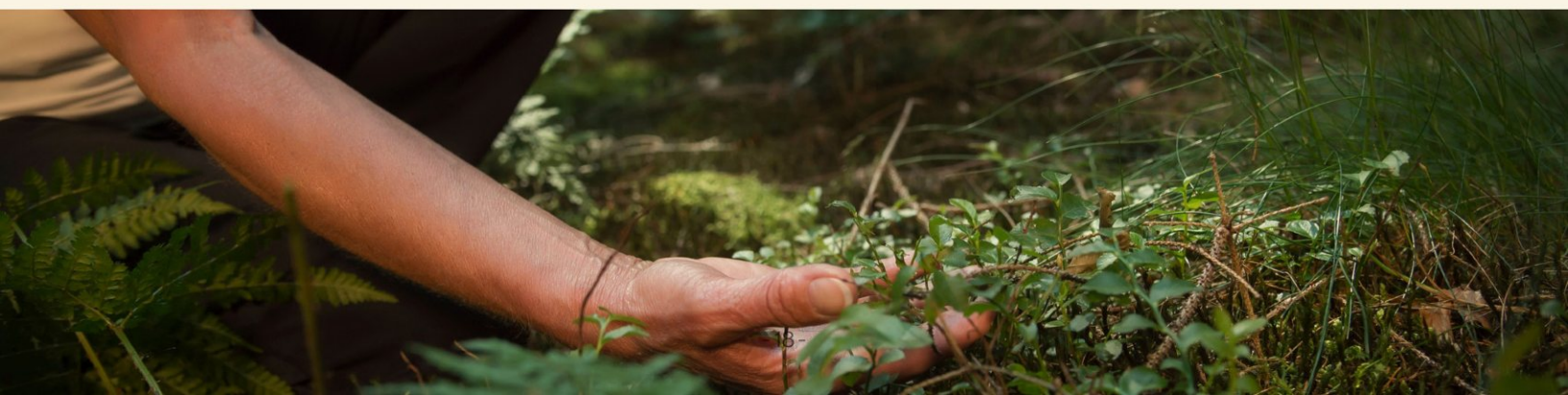
Always read and follow the product label. Precautionary statements differ by product: keep repellent out of eyes, and wash hands before eating, drinking, or using the toilet.

Category	Biopesticide
Name	IR3535
Developed By	Used in Europe 30+ years. EPA Reg. No. 70759-2-91651 (lotion), 70759-3-91651 (spray)
Function	Repels mosquitoes and ticks; available in sprays and lotions
Pros	- Repels mosquitoes and ticks up to 8 hours - Virtually odorless - Non-greasy and comfortable on skin - Compatible with plastics, fabrics, and paint - For adults and children, used per label
Cons	- May cause mild eye irritation - Less widely available than older synthetic repellents

Precautionary Statements

For external use only. Causes substantial but temporary eye injury. Do not get in eyes. Discontinue use and consult a doctor if irritation or rash occurs.

Category	Natural
Name	Natural Repellents (Citronella, Lavender, etc.)
Source	Derived from essential oils such as citronella (lemongrass), lavender, and other plants
Type	Plant-based, non-synthetic repellents
Pros	- Plant-based oils; many are not reviewed by EPA for efficacy - Pleasant, aromatic scent
Cons	- Short protection time (2–4 hours) - May cause skin irritation or allergic reactions - Effectiveness varies by concentration and environment - Not EPA-reviewed or officially verified for efficacy



Insect Repellent Recommendations

What to Look for in an Insect Repellent:

When choosing an insect repellent, prioritize products that are EPA-registered, and follow the label directions. Look for repellents with effective active ingredients that are suitable for your needs and preferences.

Recommended Active Ingredient: IR3535

IR3535: Choose repellents containing IR3535, an EPA-registered biopesticide. It is virtually odorless and compatible with lineman gloves and FR clothing.

Application Tips:

For Body: Use sprays for easy and even coverage over large skin areas.

For Face: Apply lotion to your hands first, then gently spread it on your face, avoiding the eyes and mouth to reduce irritation risk.

For Clothing: Use sprays on clothing for additional protection. If using permethrin, ensure it is applied and allowed to dry on the clothing before wearing to avoid skin contact with the wet chemical.

Other Considerations:

PPE Compatibility: Ensure the repellent is compatible with your personal protective equipment (PPE), especially if using FR clothing or linemen's electrical gloves. Verify that the repellent is approved for such use.

Target User: Consider who will be using the repellent. For children, or when distributing to many people, choose a product labeled for that use and follow the label directions.

Job Type and Environment: Consider the nature of the job and location. If working near lakes, rivers, water treatment plants, or reservoirs, follow the label directions for use near water.





I.C Insect Repellent

Features & Benefits

Description

I.C. Insect Repellent Lotion is an EPA-registered IR3535 repellent made for outdoor crews who work in PPE. It repels by making the wearer harder for biting insects to detect, rather than by using a neurotoxin. Its active ingredient, IR3535, is a synthetic biopesticide modeled on a naturally occurring amino acid. It is virtually odorless, lightweight, and non-tacky.

Industries

Outdoor Workers, Municipalities, Utilities, Power Gen, Arborists, Telecommunications, Construction, Military

Features & Benefits

Repels mosquitoes and ticks for up to 8 hours

EPA Reg. No. 70759-2-91651 (lotion) and 70759-3-91651 (spray)

No-odor, gear-safe formula for crews in PPE

Easy to spread and absorbs quickly for comfortable wear

Non-tacky and non greasy

Non-Fragranced and odorless formula

Stay-put formula remains planted onto skin and will not run into eyes

Maintains effectiveness even after sweating or brief exposure to water

Linemen Glove and Fire-Retardant Clothing Safe

Apply with confidence anywhere on exposed skin

Won't damage clothing or equipment with extended use

Bulk Sizes for Crew & Workplace Needs

Available as a lotion or a spray



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