



# Now is the Summer of our Discontent

*James Edward Katz, M.D.*

"I love everything in the world ... except for ticks."  
- The Dalai Lama

This summer in New England we will have significant increases in tick-borne diseases, most frequently Lyme disease. A combination of warmer winters and a very wet spring have increased the population of white-footed mice, the main host of the Lyme tick, as well as the ticks themselves. We will have LOTS of ticks this year.

## Lyme Disease is an Epidemic

Lyme disease is the most common tick-borne disease in North America and Europe, and one of the fastest-growing infectious diseases in the United States. (CDC MMWR).

The CDC estimates 400,000 cases of Lyme disease per year. The 400,000 number is based on surveys of clinical labs and medical claims. Since 1/3 of patients never have a rash or recall a tick bite, they don't seek care for "summer flu." In addition, we know there are far more patients with asymptomatic exposures (documented by positive blood tests). The true number of infections is much *higher* than the CDC estimate.

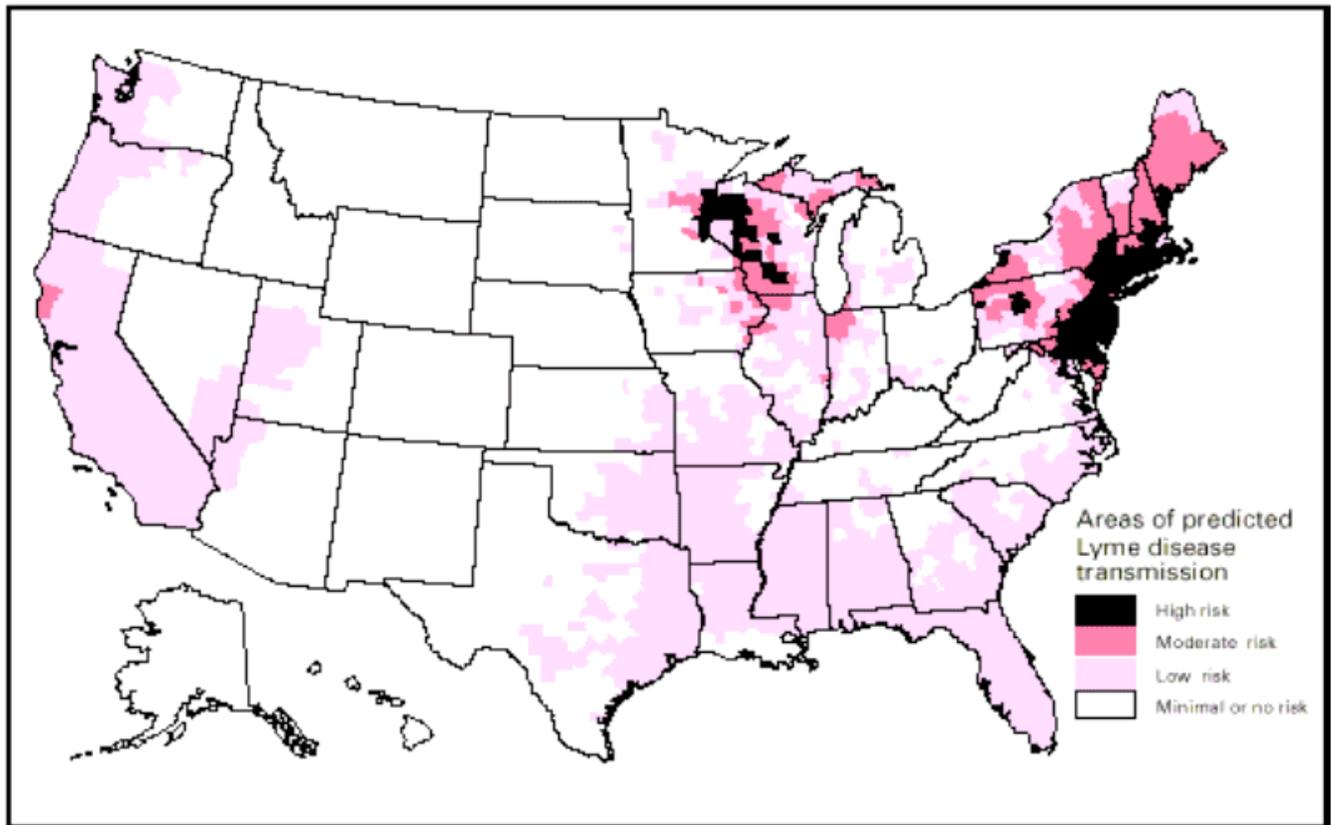
## A Quick Guide to the Tick Lifecycle

As forests were turned into suburban neighborhoods, more nesting areas for the white footed mice were created, while habitats for the mouse's predators - foxes, coyotes, and owls -were destroyed. The population of mice, who breed every three weeks, has risen into the *billions*. Mouse nests serve as incubators for developing Lyme ticks.

Tick larvae are born uninfected. They feed on blood from the white footed mouse and acquire *Borrelia* bacteria, the cause of Lyme (or feed on birds or chipmunks, and remain uninfected). The larvae grow into nymphs, who seek a second blood meal from a larger animal, such as foxes, livestock, dogs, or humans. With this bite, the tick has infected man. For its last meal, the tick, now an adult, latches onto a very large animal, predominantly, but not exclusively, the white-tailed deer. And since no good deed goes unpunished, legislated protections have increased white-tailed deer herds, increasing the reservoir for adult ticks. From the deer, each female produces 3,000 eggs and dies. These will hatch into larvae, who find their way to white tailed mice. Warmer winters, more nesting areas, and fewer predators is a recipe for disaster.

Among patients who sought treatment, medical costs are about 2 billion dollars yearly. However, non-medical costs, such as lost work, disability, pain and suffering, and lost outdoor recreation opportunities due to fear of Lyme, amount to as much as 5 billion dollars (Yale Forestry School). True costs are higher still because the Lyme tick transmits anaplasmosis, babesiosis, ehrlichiosis, and Powassen Fever. Each of these is only a small percentage in comparison to Lyme, but these diseases are more severe, expensive to treat, frequently disabling, and occasionally fatal. The cost of Post-Treatment Lyme Disease Syndrome (once called Chronic Lyme Disease) is not in this estimate. This could be another billion dollars by itself.

## National Lyme disease risk map with four categories of risk



Note: This map demonstrates an approximate distribution of predicted Lyme disease risk in the United States. The true relative risk in any given county compared with other counties might differ from that shown here and might change from year to year. Risk categories are defined in the accompanying text. Information on risk distribution within states and counties is best obtained from state and local public health authorities.

## Avoidance Strategies

*The best tick bite is the one that never happens.*

### Strategy: Part One - Dress Properly

What follows is standard advice from the CDC.

1. Wear long pants, stick them into your socks. Wear long-sleeved shirts. 2. Stay on trails, do not walk near tall grass, and avoid touching branches. 3. Shower or bathe as soon as possible after being outdoors. 4. Conduct a full body tick check. 5. Check your pets, backpacks, etc.



This advice fails because people only follow it sporadically, and because ticks are nearly invisible. Below is a picture of a deer tick. It is the size of the head of a pin. It can climb onto your shoe, up your socks, then under your clothing, up to armpits, back, or scalp. Its bite is painless. Its specialty is stealth. 30% of patients with Lyme disease do not report ever being bitten.

Mr. Tick is hard to spot.

## Strategy: Part Two - Repellents

After how to dress, the CDC recommends 20% DEET, applied directly to skin, as a repellent (on children, avoid the face and hands). Except DEET is primarily a mosquito repellent. Deer ticks will not attach to skin covered in DEET. But they will walk around the DEET area till they find an untreated area. DEET must be reapplied more than once a day to be effective, and people forget to reapply it. One can use picardin, a black pepper derivative, if one wishes to avoid DEET, but picardin has similar limitations. The emphasis is on attire and DEET. All good advice and will decrease tick bites. But read on.

## Strategy: Part Three - Kill the Tick

### Permethrin

Which brings us to Permethrin, *the least used and most effective agent*. I know organic farmers who wear permethrin treated clothing out in their fields. Permethrin's chemical structure is based on natural pyrethrum from the chrysanthemum flower. The pyrethroid insecticides were developed to match the effectiveness of natural pyrethrum, but be more stable in sunlight. Permethrin has many uses, from landscape pest control to head lice shampoos; flea, tick and mosquito control on dogs; and mosquito control on outdoor clothing and camping gear. Permethrin is relatively low toxicity. (From livingwithbugs.com)

It is sprayed on clothing, not skin, and needs to dry (anywhere from ½ hour to overnight depending on humidity). Once applied, it remains effective for up to two years. Permethrin treated clothing **kills ticks and mosquitoes on contact** - i.e. before they bite. It reduces the risk of all tick and mosquito borne diseases. On the East coast, the tick diseases include Lyme, babesiosis, anaplasmosis, ehrlichiosis, and Powassan. The local mosquito diseases include Zika, West Nile Virus, Equine Encephalitis, and dog heartworm.

### Is It Safe?

Permethrin is the active ingredient in lice/scabies medicines like Nix and Elimite, which are approved for treatment of children as young as 3 months, as well as for pregnant or nursing mothers. It is FDA Category B in pregnancy, it's highest safety rating. It has minimal absorption from treated clothing; wearing permethrin treated clothing for 28 days straight did not result in significant blood or urine levels. Organizations from The National Academy of Sciences to the US Army endorse its relative safety. In comparison with the other toxins people are exposed to everyday (gasoline fumes, air pollution, etc.) permethrin is close to benign. The EPA "RED" sheet states permethrin "does not represent increased risk."

It is toxic to fish and cats, but not dogs, horses, other animals, or people. There are some internet sites that insist it's safety isn't proven (Beyondpesticides.org). As a physician certified in Occupational and Emergency medicine, I know quite a bit about toxic substances. Most of your household cleansers are more dangerous than permethrin.

Nothing is risk free, so the appropriate question is risk/risk - risk of permethrin versus risk of infection. Patients individual preferences are a crucial part of these decisions - example; for a senior citizen, cost may be the determining factor, while for the parent of a small child, safety may be crucial. But if one looks at the extent of tick and mosquito disease, in numbers, in cost, safety, and in suffering, and one lives in the Northeast US, the equation favors permethrin.

## Is It Effective?

**PERMETHRIN reduces the incidence of tick bites by over 80%** (UNC Study of Forest Rangers in American Journal of Preventive Medicine, 2014). These were experienced outdoor workers all of whom used conventional repellents like DEET and proper clothing. The permethrin treated clothing group had a remarkable reduction in ticks on daily inspections, and a marginally lower rate of new infections. Peak incidence of new cases of Lyme is 5-15 year olds or people over 55. The average forest ranger is skilled at avoiding Lyme, so I would project significant improvement in infection rates for children and adults who do not have experience or special training.

**My recommendation is to give your outdoor shoes, socks, leggings, and pants a permethrin treatment when you buy them.** Also treat outdoor lounge chairs, furniture, and carpets. Let them dry overnight. That one treatment is good for up to two years (depending on how often it rains on the furniture or how often you wash the clothes) or 10 washings. Professionally treated clothing maintains insecticide potency for 70 wash cycles. Put a note on your Google calendar or smart phone to treat again in 2 years. Organic farmers get their permethrin from <https://sawyer.com/products/permethrin-premium-insect-repellent/> or Amazon: <https://www.amazon.com/dp/B001ANQVYU/>,

This military video ([https://www.youtube.com/watch?v=sIRfA1\\_jLoU](https://www.youtube.com/watch?v=sIRfA1_jLoU)) has instructions for field (or home) use. Permethrin treatment is standard for US and British military troops in applicable climates. One can order permethrin treated clothing from Recreational Equipment Inc., Cabela's, L.L. Bean, or Amazon. Consumer Reports has a study showing the clothing works and finds no safety issues with permethrin.

## Strategy: Part Four - Always Look

**However good permethrin treated clothing might be, there is no substitute for a tick inspection after being outdoors in grassy areas.** A friend recently had to get antibiotic treatment when he discovered an engorged tick under his watchband. Your outdoor animals can bring ticks in on their fur, and they're also prone to Lyme disease. Why every garden club, outdoor organization, or home landscaper does not have knowledge of permethrin is a great public health question. (See Tick Removal instructions at end of essay).

To stop the disease, one must spot the tick (that one never felt or saw) and remove the it *before* it has been attached to the skin for 24 hours, after which it injects Lyme bacteria into its host. The tick check is the last line of defense.

## Strategy: Part Five - Kill the Ticks Where They Nest

Ticks breed in the dens of white-footed mice. To kill the ticks before human exposure, one can target mice nests. Get some six-inch lengths of 2" PVC pipe (or toilet paper rolls). Thoroughly spray some big, fluffy cotton balls with permethrin, and let dry overnight. Wearing gloves (they will be sticky), stuff 4-6 cotton balls in each pipe, and place at the base of leaf piles and stone walls. The mice will take the cotton balls to use as bedding in their nests. This can reduce tick populations by 90%. Reload/replace the pipes every at least three months. Below a source for commercially produced tick tubes.

[https://www.smartpakequine.com/pt/damminix-tick-tubes-14905?utm\\_source=cpc&utm\\_medium=google&utm\\_content=shopping&utm\\_campaign=nb\\_shopping\\_catch\\_all&utm\\_term=Shopping%20-%20Catch-All&gclid=CPG-oY2vjtUCFdKfswodhrIAQw](https://www.smartpakequine.com/pt/damminix-tick-tubes-14905?utm_source=cpc&utm_medium=google&utm_content=shopping&utm_campaign=nb_shopping_catch_all&utm_term=Shopping%20-%20Catch-All&gclid=CPG-oY2vjtUCFdKfswodhrIAQw)

Ticks also reside on deer (how they got their name), so limiting deer populations can limit the number of ticks. This was successful on Monhegan Island in Maine. However, what works in a highly-confined space, like an island, has not done as well in open country. Just one highly mobile deer carries enough ticks to reconstitute an entire tick ecosystem.

Spraying yards with insecticide cuts tick populations, but the effect is limited. Mice build nests where sprayers can't reach, and ticks use many different species, like birds and squirrels, in their life cycle, that are highly mobile. Ticks reappear after the spray is washed away by rain or evaporates. Each surviving female tick can lay 3,000 eggs, so they can repopulate.

There is one missing item: a vaccine. There is an effective vaccine (Lymerix), which was withdrawn from the market at the peak of the anti-vaccine frenzy, amid threats of lawsuits for adverse reactions, which were not proven following investigation. You can get a vaccine for your dog in US. You can get a vaccine for slightly different tick in Europe. But there isn't a vaccine in the US.

While spraying for agricultural use under EPA guidelines is appropriate, I have not recommended spraying your yard. It is unlikely to penetrate the mouse nests and will result in increased groundwater presence, placing aquatic organisms at risk, as well as being toxic to honeybees which are already threatened.

### **How Much Can We Save**

Here is where Science meets Politics. Each of the six states with the highest incidence of Lyme disease is facing cuts in their public health departments. These agencies must monitor infectious diseases, rape crisis programs, children with special needs, AIDS treatment, needle exchange programs, and multiple other priorities; not to mention the explosive opioid epidemic. With funding uncertain - possibly a public/private enterprise might be possible - let's look at a hypothetical case.

Consider Connecticut: the state has about 30,000 new cases/year. An education program would need to precede distribution of permethrin. ( 1.3 million households x \$8/spray bottle = 10 million dollars). If permethrin prevents just 30% of cases, then 10,000 cases of Lyme are prevented. The CDC estimates \$3,000/treatment per case; medical savings would be \$30,000,000. \$3 is saved for each \$1 spent. However, reductions in other tick and mosquito borne diseases will save additional dollars, and some lives. 30,000 medical office visits become available for other illnesses. Add the number days of disability, missed school, and economic losses - I will defer to economists for a final tally. For those who say a Lyme prevention program won't move the needle on health care costs, recall former Senator Everett Dirksen, *"A billion here, a billion there, and pretty soon you're talking about real money."*

No essay on Lyme disease would be complete without instructions on removing a tick. Clean the area with alcohol. Tweezers can work for big ticks, but will fail with the nymphs that are most dangerous. One risks crushing them, with the possibility of injecting yourself with bacteria in the process. There are better removal tools. These have a spoon shape with a doubly tapered slot that takes hold of the tick at the surface of the skin. Clean and scrub the area with soap and water when you done, just like you would any other splinter. No burnt matchheads, gasoline, Vaseline, etc., please.

[https://www.amazon.com/Original-Ticked-Off-Remover-family/dp/B00CAQ7C8K/ref=pd\\_bxgy\\_468\\_img\\_2?encoding=UTF8&pd\\_rd\\_i=B00CAQ7C8K&pd\\_rd\\_r=X1K07V77CG2QYAZHHKPO&pd\\_rd\\_w=STUFR&pd\\_rd\\_wg=MguOH&pvc=1&refRID=X1K07V77CG2QYAZHHKPO](https://www.amazon.com/Original-Ticked-Off-Remover-family/dp/B00CAQ7C8K/ref=pd_bxgy_468_img_2?encoding=UTF8&pd_rd_i=B00CAQ7C8K&pd_rd_r=X1K07V77CG2QYAZHHKPO&pd_rd_w=STUFR&pd_rd_wg=MguOH&pvc=1&refRID=X1K07V77CG2QYAZHHKPO)

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We are in the peak of Lyme season. This essay is longer than most, but timely. Future essays will resume the shorter format with which you are familiar. Dr. Katz