You Can Make a Difference to a Child by Reducing Risk of Lyme Disease

Network to Reduce Lyme Disease in School-Aged Children, Washington, DC

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Lyme Disease Prevention in School-Aged Children

School nurses can make a significant difference in a child's life by preventing Lyme disease in schools. According to the Centers for Disease Control and Prevention (CDC, 2007b), Lyme disease is the most common vector-borne disease in the United States. The number of Lyme disease cases reported to the CDC has significantly increased since 1994 (approximately 12,000 in 1994). State health departments reported 28,921 confirmed cases and 6,277 probable cases of Lyme disease in 2008 (CDC, 2009). From 1992 to 2006, the average annual rates peaked among children 5–9 years of age and adults aged 55–59 years (CDC, 2008). Cases have been reported in all 50 states, although the highest numbers of CDC-reported cases are in the Northeast, North Central, and West Coast of the United States (CDC, 2007a). According to the national Lyme Disease Association (LDA, 2008), Lyme disease is found in 65 countries worldwide.

Adult blacklegged tick (Centers for Disease Control and Prevention, 2009).

The blacklegged (a.k.a. deer) tick is the primary vector of Lyme disease in the U.S. (see photo above). The deer tick and several other types of ticks, including the American dog tick, the lone star tick, and the wood tick also transmit different diseases. Some ticks can be infected with and transmit more than one pathogen, even through a single bite. Babesiosis, ehrlichiosis, bartonellosis, tick-borne relapsing fever, anaplasmosis, Rocky Mountain spotted fever, Powassan encephalitis, STARI (Southern Tick-Associated Rash Illness), and tularemia are some of tick-borne diseases found in various areas of the U.S. The remainder of this article will focus on Lyme disease, due to its prominence in the U.S.

Tick Biology

Deer tick larvae hatch from eggs in the summer and become infected with pathogens that cause disease when they feed on small animals, such as rodents (deer mice, rats, squirrels), birds, etc. After feeding, larvae develop into poppy seed–sized nymphs. The following spring, nymphs

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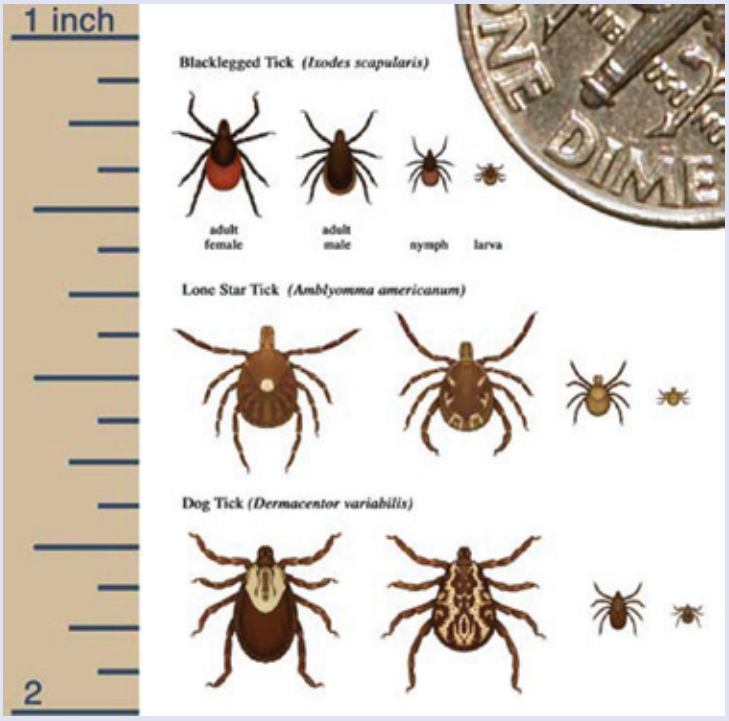


Variability in life stages and size of ticks known to carry tick-borne diseases (Centers for Disease Control and Prevention, 2009).

seek a blood meal (another potential opportunity to become infected), preferring to feed on smaller animals, such as rodents, though they will feed on larger animals, including domestic pets and humans. These ticks wait on low-lying vegetation for a potential "meal" to brush against them. Birds, deer, and other animals transport ticks from place to place.

Nymphs develop into reddish brown sesame seed–sized adults and emerge in the fall, ready to feed again. Adult ticks prefer to feed on deer, but will feed on humans and dogs, as well. Ticks may become active above 35–40° and are now being seen year-round in some reports due to climate change (U.S. Environmental Protection Agency, 2009).

Most human Lyme disease infections are caused by the bite of the nymphal stage of the blacklegged tick. Nymphs are active during the spring and summer months when human outdoor activity increases and many people do not detect them on their skin.

Lyme Disease Symptoms

Early treatment of Lyme disease symptoms is of critical importance. In early illness, the body may not produce sufficient antibodies to be detected in laboratory testing. For this reason, a clinical diagnosis for Lyme disease early in illness is based on symptoms and history. You can test negative and still have contracted Lyme disease. In later illness, positive antibody tests for the bacteria that cause Lyme (*B. burgdorferi*) by ELISA (Enzyme linked immunosorbent assay) and Western blot can be used by health care providers to support the diagnosis. Lyme disease can have overlapping symptoms with other conditions and should be considered in the differential diagnosis among people in areas where Lyme disease is endemic.

Key symptoms of early Lyme disease may include a circular "bull's eye" rash (called *erythema migrans*), fatigue, chills, fever, headache, muscle and joint aches, and swollen lymph nodes. Notably, not everyone with Lyme disease will develop the bull's eye rash—some develop other types of rashes, some have no rash at all. Symptoms typically start 3–30 days after tick bite, although symptoms may develop months, even years, later (CDC, 2007a).

If untreated or improperly treated, Lyme disease infection may spread to many parts of the body, producing different symptoms at different times. According to the CDC (2007a), these include:

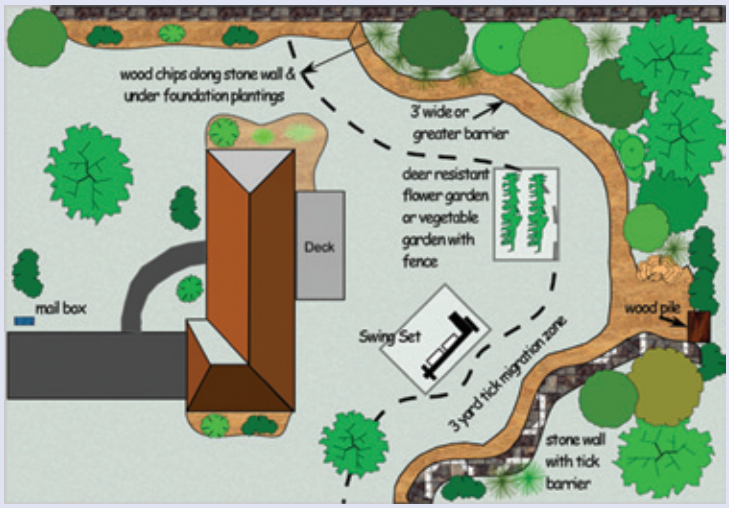
- Arthritis, which is most likely to appear as brief bouts of pain and swelling, usually in one or more large joints, especially the knees.
- Nervous system symptoms, which can include numbness, pain, nerve paralysis (often of the facial muscles, usually on one side), and meningitis (fever, stiff neck, and severe headache).
- Rarely, irregularities of the heart rhythm may occur.
- Problems with memory or cognition, fatigue, headache, and sleep disturbances sometimes persist after treatment.

Rarely, Lyme disease acquired during pregnancy may lead to infection of the placenta and possible stillbirth; however, no negative effects on the fetus have been found when the mother receives appropriate antibiotic treatment (CDC, 2007a).

Individuals being treated for Lyme disease with an antibiotic should not donate blood. Check with blood donor agencies for recommendations on donations after Lyme disease. Transmission of babesiosis, a parasitic disease also transmitted by the deer tick, has occurred via transfusion from an infected blood donation. There are currently no tests that have been licensed for screening blood donations for *Babesia*.

Prevention

Given the seriousness of Lyme disease and increasing number of cases, prevention is an important challenge. Prevention of Lyme disease focuses on personal



Recommended landscape to prevent the spread of Lyme disease (K.C. Stafford, CT Agriculture Experiment Station, 2010).

Mother checking for ticks on child's head (U.S. Environmental Protection Agency, 2010).

and household/community protection. A key step is for all individuals who live in areas with ticks to perform daily tick checks after being outdoors to remove ticks promptly. School nurses should check school district and state policies regarding tick removal. Ticks may attach anywhere on the body, but particularly in creases of elbows, knees, groin, hairline, and behind ears. Other personal protection strategies include avoiding tick-infested areas, especially edges of wooded paths and brushy areas; putting clothes in the dryer on high heat for 60 minutes to kill ticks after being outdoors; wearing light-colored clothing (to notice crawling ticks), and tucking pants into socks when in tick-infested areas. At the household and community levels, there are important environmental management steps, such as clearing away underbrush, leaves, and other debris under which ticks live; keeping lawns mowed and raked; and putting swing sets and patios in sunny areas. School nurses can provide input into development of district policies that will create "tick free zones" around schools and play areas.

Insect repellent, when used according to directions, offers important personal protection against tick bites. According to the CDC (2007a), use spray insect repellent containing a 20–30% concentration of DEET on clothes and on exposed skin; use 10% DEET on children. Permethrin-based products are intended to be applied on clothing, which can be washed several times without losing protection (Stafford, 2007). Clothing that has been pretreated with permethrin during manufacturing is labeled to provide protection through 70 washes. School officials may need parent permission to apply repellents and parents should be advised to apply them at home prior to coming to school and to examine their children for ticks after school. Check specific manufacturer instructions and cautions on all products and especially for use on children. The U.S. Environmental Protection Agency has developed a Web site (see Resources) providing protection times of various insect repellent products for protection against ticks.

The possibility of transmission of the Lyme disease bacterium increases the longer an infected tick is attached to the skin. Improper tick removal can increase infection risk by causing the tick to inject bacteria-containing saliva into the bite. Do not squeeze, twist, or burn the body of a tick or put any substance like petroleum jelly on it. Grasp it as close to the skin as possible with pointed tweezers and pull straight out. Apply antiseptic to the site (check with your state policies before applying antiseptic ointment; LDA, 2008). Encourage parents to speak with their primary care provider about the bite and feasibility of prophylactic treatment, particularly if living in a high–Lyme disease endemic area. To save the tick to be tested for bacteria that cause Lyme disease, place in a sealed container with a moist cotton ball. Check with a state or local health department to determine if they have a tick-testing laboratory (LDA, 2008), but don't wait for tick-testing results before seeing a health care provider.

Also, to protect students and the district, nurses should play a role in initiating district class trip policies that provide parental notification that children may be traveling to a habitat commonly inhabited by ticks and recommending parents may take proper precautions with their child before and after the trip (e.g., proper clothing, tick checks).

Summary

Early detection is critical since you are on the front lines when educating school staff and students. You, as the school nurse, can make a huge difference in a child's life by providing guidance on Lyme disease prevention, detection, and treatment to your school staff, as well as the parents of the community. ■

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Resources

CDC Division of Vector-Borne Infectious Disease: Learn About Lyme Disease. http://www.cdc.gov/ncidod/dvbid/Lyme/

Lyme Disease Association, Inc. http://www.LymeDiseaseAssociation.org/

EPA—Insect Repellents: Protection Times for Products That Repel Mosquitoes and Tick, by Product Name. http://www.epa.gov/opp00001/health/mosquitoes/mosquito-tick-product.html

References

Centers for Disease Control and Prevention, Department of Health and Human Services. (2007a). *Lyme disease: A public information guide*. Atlanta, GA: Author. Retrieved January 9, 2010, from http://www.cdc.gov/ncidod/dvbid/lyme/lyme_brochure.pdf

Centers for Disease Control and Prevention, Department of Health and Human Services. (2007b). *Lyme disease—United States, 2003-2005*. Atlanta, GA: Author. Retrieved January 9, 2010, from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5623a1.htm

Centers for Disease Control and Prevention, Department of Health and Human Services. (2008). *Surveillance for Lyme disease—United States, 1992-2006*. Atlanta, GA: Author. Retrieved January 15, 2010, from http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5710a1.htm

Centers for Disease Control and Prevention, Department of Health and Human Services. (2009). *Reported cases of Lyme disease by year, United States, 1994-2008*. Atlanta, GA: Author. Retrieved January 9, 2010, from http://www.cdc.gov/ncidod/dvbid/lyme/ld_UpClimbLymeDis.htm

Lyme Disease Association. (2008). *Lyme-r-primer*. Jackson, NJ: Author. Retrieved January 15, 2010, from http://www.lyme-diseaseassocition.org/LymeRPrimer.pdf

Stafford, K., III. (2007). *Tick management handbook*. New Haven: Connecticut Agricultural Experimental Station.

U.S. Environmental Protection Agency. (2009, September). *Biodiversity/landscape change and Lyme disease: Science and application*. Presented at the EPA Regional Science Workshop, Chelmsford, MA.