

Methods to Prevent Tick Bites and Lyme Disease



Nick H. Ogden, ^{DPhil}^{a,*}, L. Robbin Lindsay, ^{PhD}^b, Steven W. Schofield, ^{PhD}^c

KEYWORDS

- Personal protection • Lyme disease • Repellent • *Ixodes scapularis*
- *Ixodes pacificus*

KEY POINTS

- There are no licensed vaccines for protection of humans against Lyme disease. Prevention thus relies on the following:
 - Avoiding areas where ticks that transmit *Borrelia burgdorferi* occur, at times that the ticks are active.
 - Personal prevention of tick bites and transmission of *B burgdorferi* through wearing of appropriate clothing, use of insect repellents and clothing treatments, and prompt removal of unattached or attached ticks before they respectively attach to feed or transmit *B burgdorferi* while feeding.
 - Reducing environmental risk by controlling ticks and tick infections with pesticide applications; reservoir-targeted interventions (eg, bait boxes); and landscape management.
 - Prophylactic treatment with antibiotics after a tick bite to prevent transmitted *B burgdorferi* from producing clinical Lyme disease.

INTRODUCTION

Lyme disease occurs in 3 main regions of North America: (i) the US Pacific coast states and southern British Columbia in Canada, where the main vector is the western black-legged tick, *Ixodes pacificus*; (ii) the contiguous US upper Midwest/southern Manitoba/Northwestern Ontario; and (iii) the contiguous US mid-Atlantic and north-eastern states/southeastern Canada. In the latter 2 regions, the blacklegged tick, *Ixodes scapularis*, is the vector.^{1,2} It is this species that is associated with the large

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^a National Microbiology Laboratory, Public Health Agency of Canada, 3200 Sicotte, Saint-Hyacinthe, Quebec J2S 7C6, Canada; ^b National Microbiology Laboratory, Public Health Agency of Canada, 1015 Arlington Street, Winnipeg, Manitoba R3E 3R2, Canada;

^c Communicable Disease Control Program, Force Health Protection, Department of National Defence, 1745 Alta Vista Drive, Ottawa, Ontario K1A 0K6, Canada

* Corresponding author.

E-mail address: nicholas.ogden@phac-aspc.gc.ca

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majority of Lyme disease cases as well the increase in the numbers of cases reported over recent decades.^{3,4} The key role of this species reflects its recent significant geographic range expansion (northward, westward, and southward) out from refuges in the northeastern and upper Midwestern United States, so many more people now live in areas where this species occurs.^{3,4} Also, this vector usually has higher infection prevalence than does *I pacificus*. Accordingly, the risk associated with a bite from this vector is usually higher. This is not to say that infection prevalence is always high for this species: *I scapularis* occurs widely in the southern and southeastern United States, where it is rarely infected with *Borrelia burgdorferi*.⁵

Given the increasing threat of Lyme disease, the need for effective methods to protect against this disease has never been greater.^{6,7} Options in this regard are limited, not least because there are no licensed human vaccines against Lyme disease and area-wide and centrally organized tick control programs are lacking.⁸ Nevertheless, exposure to ticks and *B burgdorferi* can be reduced, usually at the individual person or individual property level, with several relatively simple interventions^{9–13}:

- Avoiding areas where ticks that transmit *B burgdorferi* occur, at times that the ticks are active;
- Applying personal protective measures, such as wearing appropriate clothing, using insect repellents and clothing treatments, and removing ticks before they can attach and transmit *B burgdorferi*;
- Reducing environmental risk by controlling ticks and tick infections with pesticide applications; reservoir-targeted interventions (eg, bait boxes); and landscape management;
- Using prophylactic antibiotics in an appropriate manner after a tick bite to prevent transmitted *B burgdorferi* from producing clinical Lyme disease.

The target audience for this review includes medical professionals who provide advice on Lyme disease and its prevention, and public health professionals who may wish to use and disseminate this information.

Avoiding Risk Areas

A simple rule for Lyme disease is: “if you don’t get a tick, you don’t get sick.” In recent times in the United States, and currently in many parts of Canada, this could be achieved by avoiding the areas where Lyme disease occurs.^{1,14,15} The range expansion of *I scapularis* and Lyme disease has changed this, and these ticks are now found in more regions and have also moved into more densely populated areas, including on or close to private/residential properties.¹⁶ Nonetheless, avoidance can be a viable risk-reduction approach—at least in some locations and situations.¹²

So how can ticks and Lyme disease be avoided? First, ticks are associated with specific habitats, in particular, mixed wooded areas that support the rodent, bird, and deer hosts of the ticks.^{17–19} In these habitats, ticks often are found in leaf litter, at the edges (ecotone) of forested habitats, as well as along hiking or animal trails.¹⁹ Tick populations can exist in quite small patches of woodland, including those found in backyards, but are less frequently encountered on lawns, especially those that are kept short.^{20–22} Thus, if woodland leaf litter and ecotone habitats can be avoided, the risk of tick bites is generally very low.²³ Conversely, visiting such habitats increases exposure and should prompt consideration of use of additional interventions.

Second, the risk of bites and Lyme disease is higher in areas where ticks are established (ie, are self-sustaining).^{24,25} This is not to say that exposure cannot occur in other areas. Small numbers of adventitious ticks can occur outside areas where tick populations have become established due to dispersal by mammal and bird

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