

# City Health Information

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## New York City Department of Health and Mental Hygiene

### PREVENTING, DIAGNOSING, AND MANAGING TICK-BORNE DISEASES

- Tick-borne diseases among New Yorkers have been trending upward since 2000 with fluctuations from year to year.
- Most New Yorkers are infected with a tick-borne disease during travel to endemic areas in upstate New York, Long Island, and surrounding states.
- Locally acquired cases of Lyme disease and babesiosis continue to be reported from Staten Island, and smaller numbers have been reported from the Bronx.
- Be aware of the types of ticks and tick-borne diseases present in and around NYC, how to diagnose tick-borne diseases, and where to find guidance on treatment.

Tick-borne diseases among residents of New York City (NYC) have been trending upward since 2000, with fluctuations from year to year.<sup>1,2</sup> The most commonly reported tick-borne disease is Lyme disease, followed by anaplasmosis and babesiosis. Very few cases of ehrlichiosis and Rocky Mountain spotted fever (RMSF) are reported in NYC.<sup>2</sup>

With the exception of RMSF, most cases of tick-borne diseases are associated with travel outside of NYC, commonly to upstate New York, Long Island, Pennsylvania, Connecticut, New Jersey, and Massachusetts.<sup>2</sup> Not all areas of NYC are suitable for all ticks because of their complex life cycle that requires desirable habitat and host animals. However, the blacklegged tick has become established on Staten Island and in the northern Bronx, where cases of Lyme disease and babesiosis without associated travel have been reported for several years (**Box 1<sup>2</sup>**).

The geographic expansion of Lyme disease cases over the past several decades is associated with increases in suburban development and deforestation in the northeastern United States. The changing landscape puts people in close contact with host species, such as small rodents and deer, that enable the spread and growth of tick populations. Furthermore, changing climate patterns can alter the natural environment and long-standing ecological relationships causing expected changes in seasonality and location of tick-borne diseases.<sup>3</sup>

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BLACKLEGGED TICK



LONE STAR TICK



AMERICAN DOG TICK

## TICKS OF CONCERN

Three main ticks of concern in the northeastern United States are the blacklegged tick (*Ixodes scapularis*), lone star tick (*Amblyomma americanum*), and American dog tick (*Dermacentor variabilis*).<sup>4</sup>

The **blacklegged tick** transmits the bacteria that can cause Lyme disease (*Borrelia burgdorferi*) and anaplasmosis (*Anaplasma phagocytophilum*), the intraerythrocytic parasite that causes babesiosis (*Babesia microti*), and Powassan virus, which causes Powassan virus disease.<sup>4</sup> In NYC, the blacklegged tick is prevalent only in Staten Island and areas of the Bronx, including Pelham Bay Park and Hunter Island.<sup>2</sup> The tick is prevalent in Dutchess, Orange, Putnam, Rockland, Sullivan, and Ulster counties in upstate New York.<sup>5,6</sup> *B. miyamotoi*, a spiral-shaped bacteria distantly related to *B. burgdorferi*, has also been found in blacklegged ticks in the northeastern United States. At this time, infection with *B. miyamotoi* is thought to be an uncommon cause of illness, though it is not a reportable condition so national case counts are unknown.<sup>7</sup>

The **lone star tick** transmits the bacteria that can cause ehrlichiosis (*Ehrlichia chaffeensis*, *E. ewingii*).<sup>2</sup> Ehrlichiosis cases in NYC are predominantly travel-associated. The lone star tick is prevalent on

### BOX 1. TICK-BORNE DISEASES IN NEW YORK CITY<sup>2</sup>

- The number of tick-borne disease<sup>a</sup> cases has been increasing over time
  - Cases rose from 610 in 2012 to 922 in 2018—a 51% increase
- Most cases of tick-borne diseases are among residents of Manhattan and Brooklyn, who were infected while traveling to endemic areas surrounding New York City
- Surveillance for local transmission of tick-borne diseases found in Staten Island:
  - Increasing proportion of locally acquired Lyme disease cases from 31% in 2012 to 64% in 2018<sup>b</sup>
  - Increasing number of locally acquired babesiosis cases from 3 in 2016 to 10 in 2018

<sup>a</sup>Anaplasmosis, babesiosis, ehrlichiosis, Lyme disease, Rocky Mountain spotted fever

<sup>b</sup>Residents of outer boroughs diagnosed with erythema migrans (EM) April 1–October 31 were interviewed about travel during the 3- to 30-day incubation period prior to onset. Manhattan residents were excluded as there is no evidence of local transmission of Lyme disease in the borough; a previous study showed 97% of EM cases reported travel, and there are no established blacklegged ticks in the borough

### BOX 2. TICK PREVENTION<sup>10,11</sup>

#### Outdoors

- Avoid going through areas with overgrown bushes, grasses, and lots of dead leaves
- Use insect repellent as directed (**Box 3**)

#### Clothing

- Wear light-colored clothing to see ticks more easily
- Tuck pants into socks and shirts into pants
- If desired, use products containing 0.5% permethrin on clothing or shoes (but not the skin) to repel ticks

#### Returning indoors

- Check for ticks
  - in the navel
  - behind the ears and knees
  - between the legs
  - around the waist
  - in the hairline
  - in other skin folds
- Immediately remove any attached ticks (**Box 4**)
- Shower within 2 hours of coming indoors to wash off and find any crawling ticks
- Wash clothing in hot water to kill ticks (if hot water cannot be used, tumble dry on low heat for 70 minutes or high heat for 40 minutes)
- Place dry clothing in a dryer on high heat for 10 minutes to kill ticks. Wet or damp clothing might need more time in the dryer

#### Pets

- Ask your veterinarian which tick prevention products are best for your pet
- Check for ticks on your pet and immediately remove any that are found
- If you think your pet may have been bitten by a tick and they become sick, speak with your veterinarian

#### Yard

- Trim shrubs and tree branches around your yard to let in more sunlight
- Use gravel or woodchips to define a tick-safe zone around your yard
- Keep playground equipment and outdoor furniture in a sunny location, away from yard edges and trees
- Don't leave out food that attracts deer and other wildlife
- Consider hiring a pest management professional

**See Resources for Patients for tick-prevention materials including tick identification and removal graphics**

Long Island and in upstate NY (particularly the lower Hudson Valley region), New Jersey, Connecticut, Massachusetts, and Pennsylvania. In NYC, the tick is only prevalent in Staten Island and focal areas of the Bronx.<sup>2</sup> The bite of a lone star tick is associated in some people with the development of an alpha-gal allergy, which is an allergy to mammalian meat.<sup>8</sup>

The **American dog tick** is found in all boroughs, though numbers have been decreasing over time.<sup>2</sup> It transmits the bacterium *Rickettsia rickettsii*, which causes RMSF, and the bacterium *Francisella tularensis*, which causes tularemia.

### BOX 3. INSECT REPELLENT<sup>12,13</sup>

#### About repellents

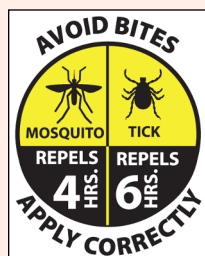
Repellents last for different amounts of time depending on the active ingredient. Generally, the higher the percentage of the active ingredient, the longer the duration of protection. However, products with more than 30% DEET do not offer longer protection. Look for repellents with one of the following active ingredients:

- DEET
- Picaridin
- IR3535
- Oil of lemon eucalyptus (also known as PMD)

**Not all repellents are registered by the Environmental Protection Agency (EPA).** Products with active ingredients deemed to pose minimal risk have not been evaluated for effectiveness. Examples of ingredients used in unregistered repellents include essential oils such as citronella, cedar, geranium, peppermint, and soybean

#### Repellent tips

- Use a repellent that is registered with the EPA (**Resources**). Look for the repellency awareness graphic
- Follow directions on the repellent's label
- Permethrin can be applied to clothing and shoes but not to skin
- Do not spray products directly to your face; instead, spray your hands and then rub them carefully over the face, avoiding the eyes and mouth
- **Children**
  - Apply the repellent to children's skin, avoiding eyes, mouth, and hands, and use sparingly on the ears
  - DEET-based repellents are approved for use on children
  - Apply repellent to children aged 2 months and older
  - Don't apply oil of lemon eucalyptus to children aged younger than 3 years



**Other ticks** include the brown dog tick (*Rhipicephalus sanguineus*) and the Asian longhorned tick. The brown dog tick primarily feeds on dogs and can transmit bacteria that cause canine ehrlichiosis. The Asian longhorned tick is found in Staten Island and the Bronx<sup>2</sup>; it has not been shown to transmit human pathogens in the United States to date.<sup>9</sup>

### EDUCATE PATIENTS ABOUT TICK-BORNE DISEASE

Educate patients who visit, live, work, or travel in endemic areas on prevention of tick bites and tick-borne diseases (**Boxes 2<sup>10,11</sup> and 3<sup>12,13</sup>**) and on correct removal of an embedded tick (**Box 4<sup>10</sup>**). Ticks are most active in the warmer months, from March to November. Advise patients to take precautions against ticks during these months and be aware of signs and symptoms of tick-borne diseases in patients. Most infections result from an undetected tick; early detection and prompt removal reduce the chance of disease.<sup>14</sup> Erythema migrans (EM)—a red ring-like or

### BOX 4. HOW TO REMOVE A TICK<sup>10</sup>

- Dispose of a crawling tick or an embedded tick that has been removed by wrapping it tightly in tape and throwing it out or flushing it down the toilet. To save a tick, you can put it in a container with alcohol or in a sealed bag/container
- To remove an embedded tick
  - Using pointed-tip tweezers, grab the tick at the point where it is closest to the skin (this is the head of the tick); do not grab the body of the tick, as that can cause the mouth parts to break off and remain in the skin and increase the risk of an infection
  - Gently pull up on the tick with slow, even pressure to ease out the mouth parts. After removing the tick, wash your hands and skin with soap and water or rubbing alcohol
- Do not
  - Handle the tick with bare hands
  - Squash or squeeze the tick
  - Use petroleum jelly (Vaseline®), nail polish remover, or heat to remove the tick. These methods can increase the risk of infection
- Advise patients to contact a health care provider immediately if they develop fever, aches and pains, or a rash

**See the video "Tick Prevention: Removal" on the Lyme Disease and Other Diseases Carried by Ticks page for a demonstration of correct tick removal**

See [Find the Repellent That Is Right for You](#)



expanding rash (**Figure**)—is diagnostic for Lyme disease and should prompt the patient to seek medical attention. Advise patients to contact you or go immediately to the emergency department if they develop symptoms of fever, headache, confusion, weakness, vomiting, or difficulty breathing in the days following a tick bite.

## DIAGNOSING TICK-BORNE DISEASES

Tick-borne diseases are associated with nonspecific and variable signs and symptoms that mimic viral illness, such as chills, acute fever, headache, and myalgias. Laboratory findings include thrombocytopenia, anemia, and elevated liver values.<sup>14</sup> While not common, coinfection with a second tick-borne disease pathogen can occur from a single tick bite. Rashes occur in 70% to 80% of RMSF patients.<sup>4</sup>

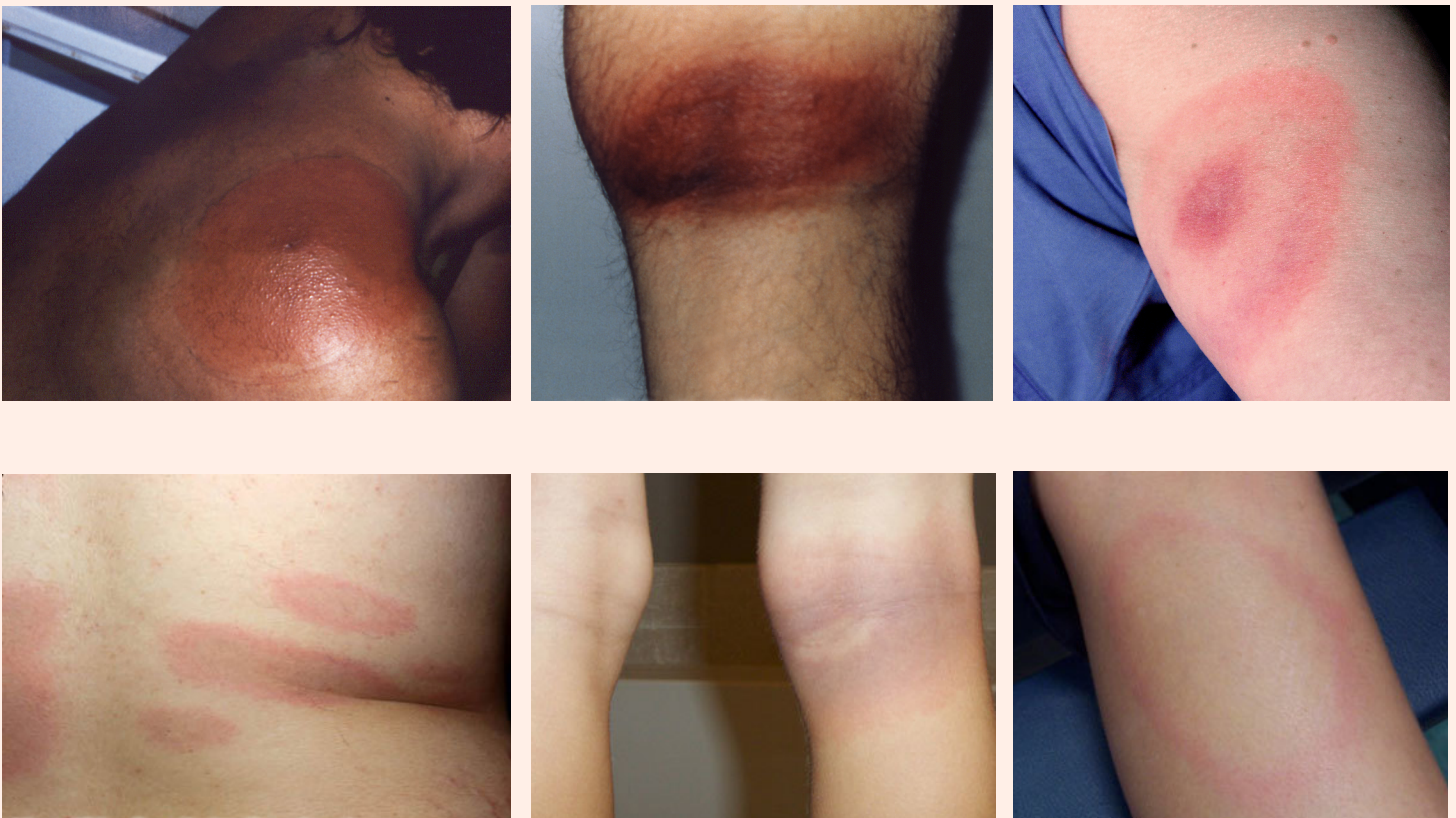
EM (**Figure**) is reported among 60% to 80% of patients with Lyme disease.<sup>4</sup> An EM > 5 cm is sufficient

for diagnosis of Lyme disease without other signs or symptoms.<sup>14</sup> A rash is sometimes seen with ehrlichiosis, particularly among children, but is rare with anaplasmosis (< 10%). No rash is seen with babesiosis or Powassan virus disease.<sup>4</sup> See **Box 5**<sup>15</sup> for information on testing.

A history of a tick bite is not a prerequisite for considering tick-borne diseases for patients with compatible illness, since only a small proportion of patients diagnosed with these diseases recall being bitten by a tick.<sup>16</sup> Recent travel during warmer months to upstate New York, Long Island, and other parts of the Northeast, Mid-Atlantic, and Upper Midwest should prompt consideration of tick-borne diseases.<sup>17</sup>

For more detailed guidance, see *Tickborne Diseases of the United States: A Reference Manual for Healthcare Providers*.

**FIGURE. LYME DISEASE RASH: ERYTHEMA MIGRANS**



Sources: Top row, CDC Public Health Image Library; bottom row (left to right), Bernard Cohen, Robin Stevenson, Taryn Holman



## LYME DISEASE PROPHYLAXIS

Antibiotic prophylaxis may be used for Lyme disease but not for other tick-borne diseases. A single dose of doxycycline (200 mg for adults or 4.4 mg/kg for children of any age weighing less than 45 kg) may be offered to patients to reduce the risk of Lyme disease when all of the following circumstances exist<sup>14</sup>:

- the patient has spent time in a Lyme-endemic region,
- the tick has been attached for  $\geq 36$  hours, based on engorgement or history,
- prophylaxis can be started within 72 hours of tick removal,
- the tick can be reliably identified as *I. scapularis*,
- the patient does not have any contraindications to treatment with doxycycline.

## TREATMENT OF TICK-BORNE DISEASE

Most tick-borne diseases are treatable with antimicrobials. See *Tickborne Diseases of the United States: A Reference Manual for Healthcare Providers* for guidance.

## REPORTING

Lyme disease, babesiosis, anaplasmosis, ehrlichiosis, spotted fever group rickettsioses, tularemia, and Powassan virus disease are reportable in NYC. Report confirmed tick-borne diseases within 24 hours via [NYCMED](#).

For more information, see *Provider Reporting: How to Report Diseases, Events, and Conditions to the NYC Health Department*.

### BOX 5. TESTING FOR TICK-BORNE DISEASES<sup>15</sup>

Optimal diagnostic tests depend on timing relative to symptom onset and disease

- Polymerase chain reaction (PCR) tests for anaplasmosis and ehrlichiosis are most sensitive during the first week of illness
- Serologic assays may lead to false-negative results when performed in the 1 to 2 weeks following illness onset due to a delayed antibody response. Additionally, antibodies may persist for several years, and if detected, may not be indicative of current illness
- With anaplasmosis, ehrlichiosis, and Rocky Mountain spotted fever (RMSF), repeat serologic testing on a convalescent specimen after 2 to 4 weeks; a fourfold or greater rise in antibody titers confirms a diagnosis
- False-positive serologic results may occur with RMSF. Antibodies to spotted fever group rickettsioses (SFGR) other than RMSF may reflect past exposures to a wide variety of SFGR species, including *Rickettsia akari*, and not reflect incident cases of RMSF. *R. akari* is the causative agent of rickettsialpox, testing for which is available at the Centers for Disease Control and Prevention (CDC)
- The CDC recommends a two-step test for Lyme disease. If the first antibody test is negative, no further testing is recommended. If positive or indeterminate (or equivocal), perform the second Western blot test. The overall result is positive only when the first and second tests are positive (or equivocal)

#### Tick testing

Testing ticks for diseases is generally not recommended because

- Results may be unreliable; laboratories that test ticks are not required to meet the same quality standards as clinical laboratories
- A positive test does not mean that the tick was attached long enough to transmit the pathogen
- A negative test might provide a false sense of security as a patient might have unknowingly been bitten by a different tick

## RESOURCES FOR PROVIDERS

### Tick-borne diseases

- *Tickborne Diseases of the United States: A Reference Manual for Healthcare Providers*

### Disease reporting

- *Provider Reporting: How to Report Diseases, Events, and Conditions to the NYC Health Department*

## RESOURCES FOR PATIENTS

### Insect repellent

- Find the repellent that is right for you: <https://www.epa.gov/insect-repellents/find-repellent-right-you>
- Insect repellent safety: <https://www1.nyc.gov/site/doh/health/health-topics/insect-repellent-safety.page>

### NYC Health Department

- Ticks: <https://www1.nyc.gov/site/doh/health/health-topics/ticks.page>
  - New York City tick ID and removal wallet card (with tick identification and removal illustrations)
  - Ticks taking over? Take back your yard
  - All about ticks: a workbook for kids and their parents

### Additional resources

- Centers for Disease Control and Prevention. Ticks: <https://www.cdc.gov/ticks/index.html>
  - Tick bite: what to do
  - What you need to know about Asian longhorned ticks—a new tick in the United States
- Tick Encounter Resource Center: <https://tickencounter.org/>
- The Northeast Regional Center for Excellence in Vector-Borne Diseases: <https://www.neregionalvectorcenter.com>
- New York State Department of Health. Tick prevention: removal (video): <https://www.health.ny.gov/diseases/communicable/lyme>

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## CONTINUING EDUCATION ACTIVITY

This issue of *City Health Information*, including the continuing education activity, can be viewed [here](#).

### Instructions

Read this issue of *City Health Information* for the correct answers to the questions. To receive continuing education credit, you must answer 80% of questions correctly. Visit <https://www.surveymonkey.com/r/38ZF9JZ> to complete this activity online.

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### Financial Disclosure and Conflict of Interest Statement

Participating faculty members and planners have no relevant financial relationships to disclose:

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### Time to Complete

This activity will take approximately 60 minutes to complete.