

Epidemiologic Summary of Lyme Disease in California, 2013-2019

Key Findings

Lyme disease is an infectious disease caused by bacteria called *Borrelia burgdorferi* that spread from the bite of infected ticks. In California, the ticks that can spread Lyme disease are western blacklegged ticks. These ticks are common in outdoor areas with grass, shrubs, rocks, logs, and fallen leaves. Infected western blacklegged ticks are most commonly found in [northern coastal counties and in the foothills of the Sierra Nevada mountains in northern California](#). Lyme disease can cause flu-like symptoms, such as fever, body aches, and fatigue, and may cause a rash that spreads over time. If Lyme disease is not treated, it can develop into more severe health problems. People who spend time outdoors in areas where ticks are common, including when traveling to northeastern parts of the U.S. where Lyme disease is more common, are at risk for getting Lyme disease from an infected tick.

Lyme Disease in California from 2013 through 2019

Total Cases: There were a total of 904 new Lyme disease cases from 2013 through 2019.

Rate: The average annual rate of new Lyme disease cases during 2013-2019 was less than 1 case per 100,000 people in California.

- **By County:** Of the 10 California counties that reported at least 1 case of Lyme disease each year during 2013-2019, the average rates were highest in Santa Cruz County (4 cases per 100,000 people), Humboldt County (about 3 cases per 100,000 people), and Sonoma County (about 2 cases per 100,000 people). Most cases (about 82%) in California were reported from the Northern California region.
- **By Sex:** The average rates for males and females were each less than 1 case per 100,000 people.
- **By Age Group:** The average rates were highest in adults aged 65 to 74 years, but rates were less than 1 case per 100,000 people.
- **By Race/Ethnicity:** For cases where race and ethnicity information was available, the highest percentage of cases was in people who reported non-Hispanic White race/ethnicity (about 82%).

The best way to prevent Lyme disease is to protect yourself from tick bites. To help prevent tick bites, wear long-sleeved shirts and pants, and apply insect repellent on clothes and exposed skin before going outside in areas where ticks are common. While spending time outdoors, check yourself and pets often for any ticks that might be crawling on you. Remove any ticks that are found right away. After returning indoors from areas with ticks, shower to wash away any ticks on your body. To kill any ticks that may be on your clothes, put them in a hot dryer for 10 minutes. Continue to check for ticks three days after being outside in areas with ticks.

For more information about Lyme disease in California, please visit the [CDPH Lyme Disease webpage](#). For details about key infectious diseases in California, please visit the [CDPH Surveillance and Statistics Section webpage](#).

Background

Lyme disease is caused by *Borrelia burgdorferi*, a spirochete that is transmitted to humans by the bite of an infected blacklegged tick. Lyme disease is the most common tick-borne infection in North America, with approximately 30,000 cases reported to the U.S. Centers for Disease Control and Prevention (CDC) each year; high-incidence regions include the Northeastern and upper mid-Western United States.¹ Some Lyme disease case-patients who reside in low-incidence states, such as California, might have been exposed while traveling in other states where incidence is higher.^{2, 3} In California, the western blacklegged tick (*Ixodes pacificus*) transmits the causative agent of Lyme disease. Infected western blacklegged ticks are most commonly found in northern coastal counties and in the foothills of the Sierra Nevada mountains in northern California⁴; these ticks are common in outdoor areas with grass, shrubs, rocks, logs, and leaf litter. People are most commonly exposed to *B. burgdorferi* by the bite of the immature nymphal tick, which is active typically in the spring and early summer; an average of 5-15% of nymphal western blacklegged ticks in California are infected with *B. burgdorferi*.⁵

The most common initial sign of Lyme disease is a red, usually painless, expanding rash (erythema migrans) that appears within 30 days after the bite of an infected tick. Other early symptoms include flu-like body aches, fatigue, fever, chills, and swollen lymph nodes. If not treated, some patients can develop neurologic conditions or cardiac abnormalities during the next few weeks, or more severe central nervous and musculoskeletal disease up to several months later.⁶

Lyme disease is diagnosed based on symptoms, physical findings (e.g., erythema migrans), the likelihood of exposure to infected blacklegged ticks, and supportive laboratory testing.⁷ Most cases of Lyme disease can be treated successfully with oral or intravenous antibiotics.⁸

This report describes the epidemiology of confirmed and probable Lyme disease cases in California from 2013 through 2019. Incidence rates presented in this report are based on surveillance data and should be considered estimates of true disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes*.⁹ The epidemiologic description of Lyme disease for earlier surveillance periods can be found in the *Epidemiologic Summary of Lyme Disease in California, 2001-2008 and 2009-2012*.^{10, 11}

California Reporting Requirements and Surveillance Case Definition

California Code of Regulations (CCR), Title 17, Section 2500 requires health care providers to report suspected cases of Lyme disease to their local health department within seven calendar days of identification by electronic transmission, fax, or telephone, if an outbreak is suspected.¹² Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of *Borrelia burgdorferi* infection to either the California Reportable Disease Information Exchange (CalREDIE) (via electronic laboratory reporting) or the local health department; reporting must occur within one working day after the health care provider has been notified.¹³

California regulations require cases of Lyme disease to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the CDC/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed or probable case. From

2013 through 2016, a confirmed case of Lyme disease was defined as one with: (i) a physician diagnosed erythema migrans (EM) of at least 5 cm diameter with either a known exposure or laboratory evidence of infection, or (ii) at least one objective late manifestation (i.e., musculoskeletal, cardiovascular, or neurological) and laboratory evidence of infection. A probable case was defined as any other case of physician-diagnosed Lyme disease that had laboratory evidence of infection. Laboratory evidence of infection included: (1) a positive culture of *B. burgdorferi*, or (2) two-tiered testing (a sensitive enzyme immunoassay (EIA) or immunofluorescence antibody assay (IFA) followed by a Western blot) interpreted using established criteria, where a positive IgM test result was sufficient only when the test was performed within 30 days from symptom onset, and a positive IgG test result was sufficient at any point during the patient's illness, or (3) single-tier IgG immunoblot seropositivity interpreted using established criteria, or (4) demonstration of antibody production against *B. burgdorferi* in cerebrospinal fluid (CSF) via EIA or IFA, evidenced by a higher titer of antibody in CSF than in serum. Beginning in 2017, a confirmed case was defined as one with: (i) EM with exposure in a high incidence state¹⁴ (history of tick bite not required), or (ii) EM with known exposure in a low incidence state¹³ and laboratory evidence of infection, or (iii) at least one late manifestation (i.e. musculoskeletal, cardiovascular, or neurological) that has laboratory evidence of infection. Beginning in 2017, laboratory evidence included (1) a positive culture for *B. burgdorferi*, or (2) a positive two-tier test (a sensitive enzyme immunoassay (EIA) or immunofluorescence antibody assay (IFA) followed by a western immunoblot), or (3) a positive single-tier Immunoglobulin G (IgG) western immunoblot test for Lyme disease.¹⁵

Epidemiology of Lyme Disease in California, 2013-2019

CDPH received reports of 904 total cases of Lyme disease with estimated symptom onset dates from 2013 through 2019. The average annual incidence of Lyme disease during 2013-2019 was 0.3 per 100,000 population. Incidence rates fluctuated over time but remained relatively stable from 2013 through 2019 [Figure 1].

Statewide from 2013 through 2019, 10 counties reported at least 1 case of Lyme disease for each year of the surveillance period: Contra Costa, Humboldt, Los Angeles, Riverside, San Luis Obispo, Santa Barbara, Santa Clara, Santa Cruz, Sonoma, and Yolo counties. Cases from these 10 counties made up 50.6% of the total Lyme disease cases reported. Among these 10 counties, the average annual incidence rate of the surveillance period was highest in Santa Cruz County (4.0 per 100,000; 76 cases), Humboldt County (3.4 per 100,000; 32 cases), and Sonoma County (2.4 per 100,000; 86 cases) [Figure 2]. By region (see *Technical Notes*), average annual incidence rates for the surveillance period were 6.6 times higher in Northern California (0.9 per 100,000; 739 cases) than in Southern California (0.1 per 100,000; 165 cases); 81.7% of Lyme disease cases were reported from Northern California. The Far North (1.2 per 100,000, 93 cases) and Central Coast (1.3 per 100,000, 134 cases) regions reported the highest average annual incidence rates during the surveillance period.

The average annual incidence rate by sex was 0.3 per 100,000 population for both males and females during the surveillance period. Of the 902 total cases reported with complete sex data, 443 (49.1%) were among females and 459 (50.9%) were among males.

By age group, the average annual Lyme disease incidence rates were highest among adults aged 65-75 years (0.5 per 100,000; 101 cases) and 55-64 years (0.4 per 100,000; 146 cases) [Figure 3].

For Lyme disease cases with complete race/ethnicity data (see *Technical Notes*), the highest percentage of cases was among those who reported their race/ethnicity as non-Hispanic White (82.5%). The percentage of cases who reported their race/ethnicity as non-Hispanic White was disproportionately higher than the percentage of the non-Hispanic White population in California during the same time period (82.5% vs. 38.0%, respectively) [Figure 4].

Of the 904 total Lyme disease cases, 366 (40.1%) case-patients indicated that they participated in an outdoor activity, such as hiking, camping, and picnicking, in wooded, brushy, or grassy areas during the incubation period. Of the 904 total cases of Lyme disease, 206 (22.8%) case-patients indicated that they received a tick bite within 30 days prior to illness onset.

Figure 1. Lyme Disease Cases and Incidence Rates by Year of Estimated Illness Onset, California, 2013-2019

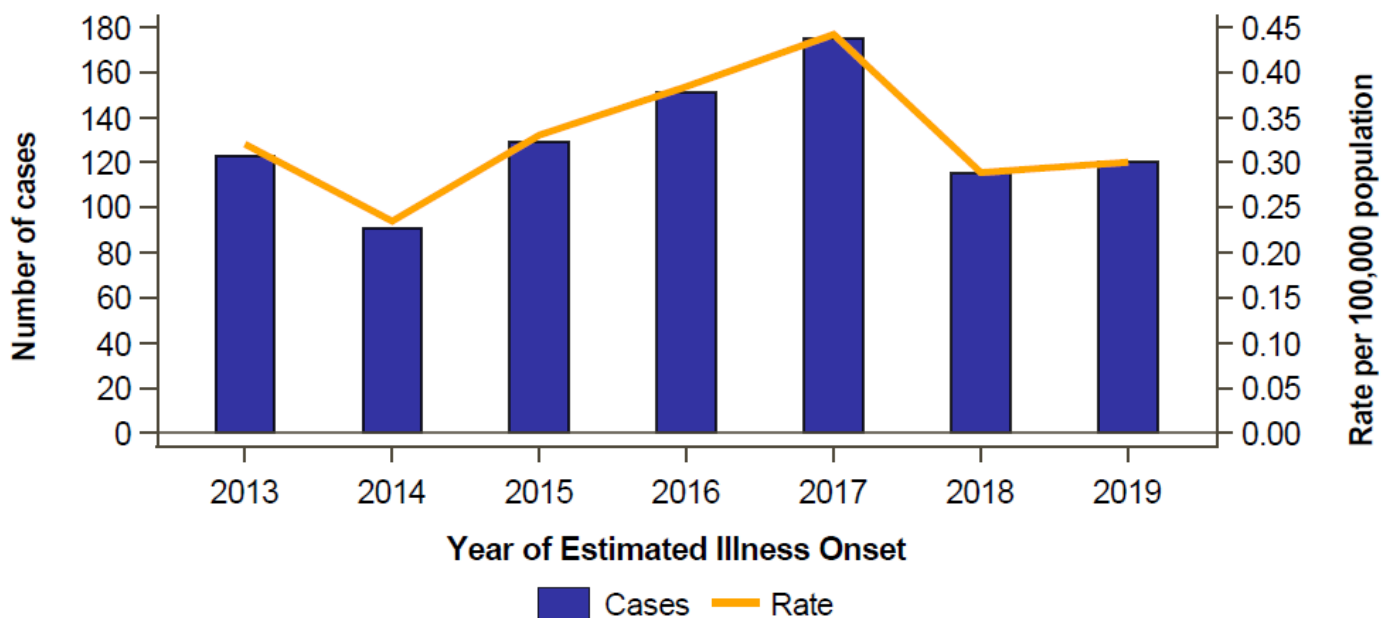


Figure 2. Lyme Disease Average Annual Incidence Rates by County, California, 2013-2019

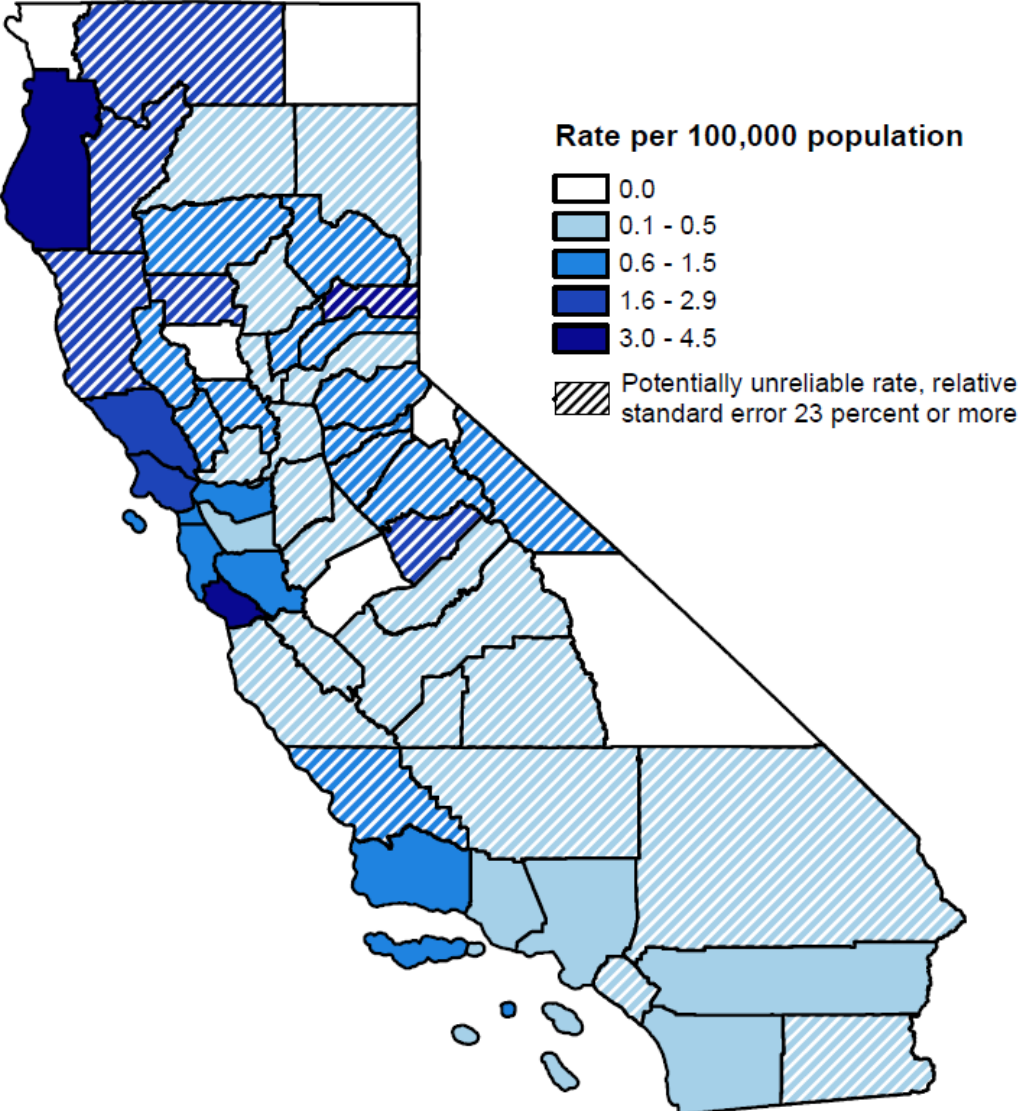
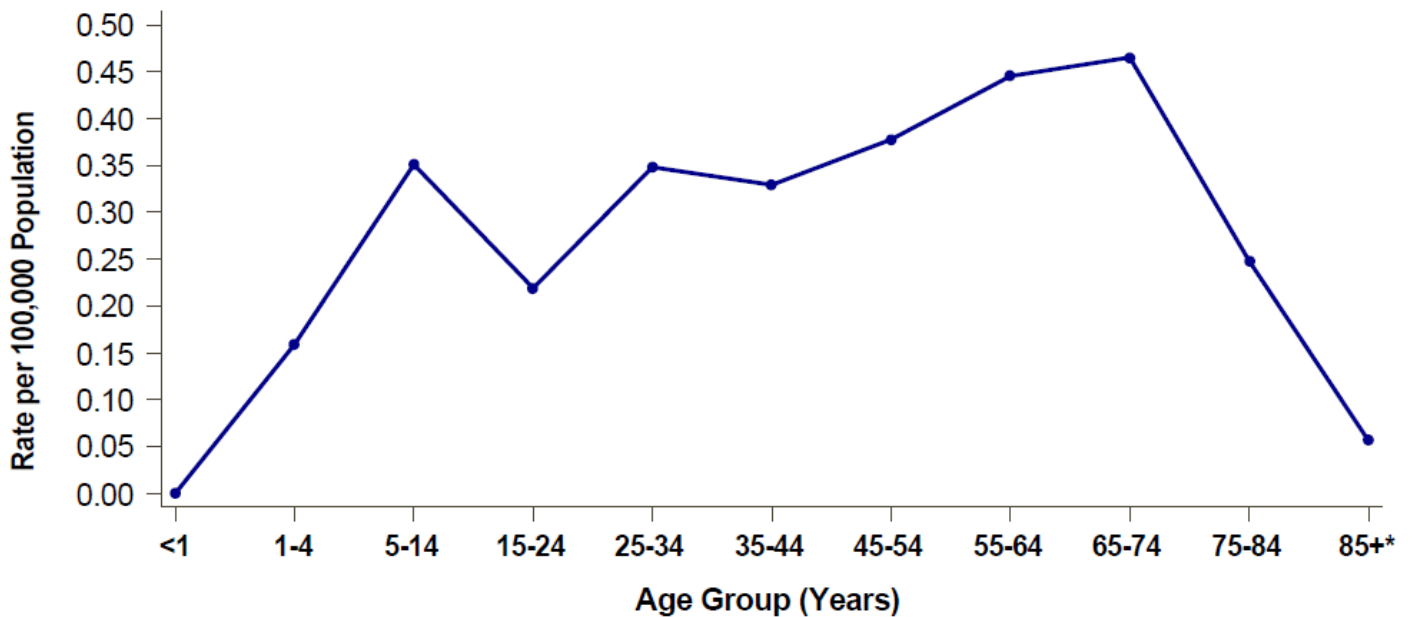
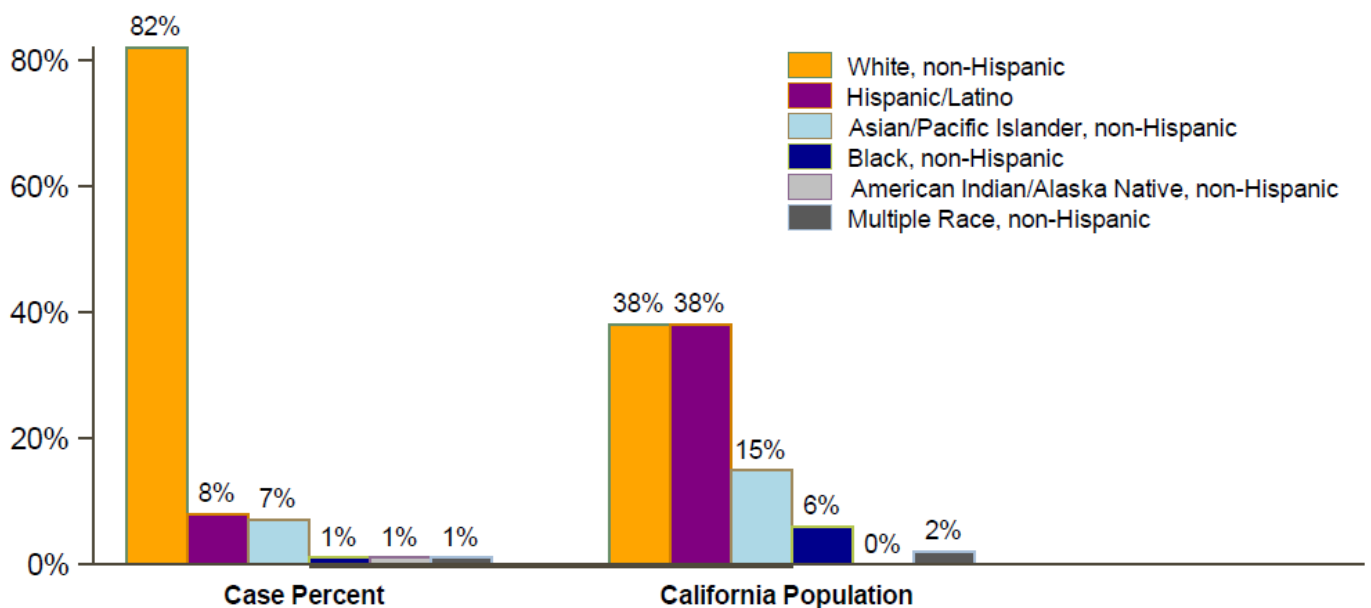


Figure 3. Lyme Disease Average Annual Incidence Rates by Age Group, California, 2013-2019



*Potentially unreliable rate: relative standard error 23 percent or more.

Figure 4. Lyme Disease Cases and Population by Race/Ethnicity, California, 2013-2019



45.5% (n=411) of reported incidents of Lyme Disease did not identify race/ethnicity and 2.2% (n=20) of incidents identified as 'Other' race/ethnicity and are not included in the Case Percent calculation. Information presented with a large percentage of missing data should be interpreted with caution.

Comments

The average annual incidence of Lyme disease in California during the 2013-2019 surveillance period (0.33 per 100,000; 904 total cases) was slightly higher than that of the 2009-2012 surveillance period (0.25 per 100,000; 374 total cases).¹¹

Average annual Lyme disease incidence rates were similar in geographic distribution to the 2009-2012 surveillance period; rates were higher in Northern California than Southern California, as well as highest in the Far North and Central Coast regions for the 2013-2019 surveillance period. Average annual Lyme disease incidence rates were also similar in trend between the two surveillance periods for age group and race/ethnicity.¹¹

To prevent Lyme disease, persons should prevent tick bites by wearing long-sleeved shirts and pants and applying insect repellent on clothes and exposed skin before going outside in areas where ticks are common. While spending time outdoors, persons should check for ticks often, including on pets. Any ticks that are found should be promptly removed. After returning indoors from areas with ticks, persons should shower to wash away any unattached ticks. To kill ticks that may be on clothes, clothes should be placed in a hot dryer for 10 minutes. Persons should continue to check for ticks three days after being in outdoor environments where ticks are common.

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References

- ¹ [Lyme Disease, Data and Statistics. U.S. Centers for Disease Control and Prevention website.](https://www.cdc.gov/lyme/datasurveillance/index.html) Updated April 29, 2021. Accessed May 24, 2021. <https://www.cdc.gov/lyme/datasurveillance/index.html>
- ² Saunders, M and Kjemtrup, A. Chapter 3: Tick-borne diseases. In: [Vector-Borne Disease Section Annual Report, 2019](#). California Department of Public Health, Sacramento, California, 2020. pp 7-12. Accessed May 24, 2021. <https://westnile.ca.gov/pdfs/VBDSAnnualReport19.pdf>
- ³ Forrester JD, Brett M, Matthias J et al. Epidemiology of Lyme disease in low-incidence states. *Ticks Tick Borne Dis.* 2015 Sep;6(6):721-3.
- ⁴ Lyme Disease in California StoryMap. California Department of Public Health website. Accessed July 27, 2021. <https://storymaps.arcgis.com/stories/f64d0c19a3ab42cf90e8ce38397e96e0>
- ⁵ [Lyme Disease in California Brochure. California Department of Public Health website.](#) Updated August 2017. Accessed May 24, 2021. <https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/2017LymeDiseaseinCABrochure.pdf>
- ⁶ [Lyme Disease, Signs and Symptoms of Untreated Lyme Disease. U.S. Centers for Disease](#)

[Control and Prevention website](https://www.cdc.gov/lyme/signs_symptoms/index.html). Updated January 15, 2021. Accessed May 24, 2021.
https://www.cdc.gov/lyme/signs_symptoms/index.html

⁷ [Lyme Disease, Diagnosis and Testing. U.S. Centers for Disease Control and Prevention website](https://www.cdc.gov/lyme/diagnostesting/index.html). Updated May 21, 2021. Accessed May 24, 2021.
<https://www.cdc.gov/lyme/diagnostesting/index.html>

⁸ [Lyme Disease, Treatment for erythema migrans. U.S. Centers for Disease Control and Prevention website](https://www.cdc.gov/lyme/treatment/index.html). Updated November 3, 2020. Accessed May 24, 2021.
<https://www.cdc.gov/lyme/treatment/index.html>

⁹ State of California, Department of Public Health. [Technical notes. In: *Epidemiologic Summaries of Selected Communicable Diseases in California, 2013-2019*](https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesTechnicalNotes2013-2019.pdf). Sacramento, CA; 2021. Accessed December 30, 2021.
<https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesTechnicalNotes2013-2019.pdf>

¹⁰ State of California, Department of Public Health. Lyme disease. In: [Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008](https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf). Sacramento, CA; 2009. Accessed May 17, 2021.
<https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf>

¹¹ State of California, Department of Public Health. Lyme disease. In: [Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012](https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf). Sacramento, CA; 2015. Accessed May 17, 2021.
<https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf>

¹² [Reportable Diseases and Conditions: Reporting to the Local Health Authority, 17 CCR § 2500 \(2021\)](https://govt.westlaw.com/calregs/Document/I5849DB60A9CD11E0AE80D7A8DD0B623B).
<https://govt.westlaw.com/calregs/Document/I5849DB60A9CD11E0AE80D7A8DD0B623B>

¹³ [Reportable Diseases and Conditions: Notification by Laboratories, 17 CCR § 2505 \(2021\)](https://govt.westlaw.com/calregs/Document/I1947D280662411E384928538D6692020).
<https://govt.westlaw.com/calregs/Document/I1947D280662411E384928538D6692020>

¹⁴ [Lyme Disease, Lyme Disease Maps: Most Recent Year. U.S. Centers for Disease Control and Prevention website](https://www.cdc.gov/lyme/datasurveillance/maps-recent.html). Updated April 29, 2021. Accessed May 17, 2021.
<https://www.cdc.gov/lyme/datasurveillance/maps-recent.html>

¹⁵ [Lyme Disease \(*Borrelia burgdorferi*\) Case Definitions, 2011 & 2017](https://ndc.services.cdc.gov/case-definitions/lyme-disease-2011/). National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed July 27, 2021.
<https://ndc.services.cdc.gov/case-definitions/lyme-disease-2011/>;
<https://ndc.services.cdc.gov/case-definitions/lyme-disease-2017/>