CDPH INFECTIOUS DISEASES BRANCH EPIDEMIOLOGIC SUMMARIES OF SELECTED COMMUNICABLE DISEASES IN CALIFORNIA, 2013–2019

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Background

The California Department of Public Health (CDPH) maintains a mandatory, passive reporting system for a list[1] of communicable disease cases and outbreaks. Health care providers and laboratories are mandated to report all cases, including suspected cases, of these communicable diseases to their local health department (LHD). LHDs are also mandated to report these cases to CDPH.

These *Technical Notes* describe the definitions, methods, and limitations used to summarize the epidemiology of selected communicable diseases reported to CDPH.[2] The diseases selected for the 2013-2019 *Epidemiologic Summaries of Selected Communicable Diseases in California* are general communicable diseases not covered by CDPH's categorical programs for tuberculosis, sexually transmitted diseases, HIV/AIDS, and vaccine-preventable diseases, all of which produce regular summaries of their diseases.

The distribution of information on the health of the community is a core function and essential service of public health. The data in the *Epidemiologic Summaries* provide important health information on the magnitude and burden of these communicable diseases in California. Bearing in mind their limitations, these data can identify high risk groups that may benefit from public health prevention activities and aid in tracking the effectiveness of control and prevention measures.

Materials and methods

Case data sources and inclusion criteria

These *Epidemiologic Summaries* describe incident communicable disease cases that had an estimated illness onset during January 1, 2013 through December 31, 2019. (*Epidemiologic Summaries* for Chikungunya and Zika cover the surveillance period of January 1, 2017 through December 31, 2019, since required reporting of these diseases began on June 1, 2016.) Case data were extracted from California Confidential Morbidity Reports that were submitted to CDPH by May 1, 2020 and entered into the CDPH California Reportable Disease Information Exchange (CalREDIE) system or reported electronically by CalREDIE non-participating LHDs. Cases included met the surveillance case definition per disease (see below).

Data were quality checked, and duplicate case records were removed based on a data-matching probabilistic de-duplication algorithm. For diseases that may occur as acute and chronic conditions—such as coccidioidomycosis and brucellosis—only the first report of the condition in a given patient was included based on an evaluation by the de-duplication algorithm of historical as well as recent surveillance data.

Data on foodborne and waterborne outbreaks with estimated onset dates from 2013 through 2019 were extracted from outbreak report forms submitted to CDPH by May 1, 2020. These reports were the source for the number of outbreak-associated cases per disease, when presented.

Population data source

State of California, Department of Finance population projections and estimations data were used.[3,4]

Definitions

A case was defined as one with laboratory and/or clinical evidence of infection or disease that satisfied the most recent communicable disease surveillance case definition published by the U.S. Centers for Disease Control and Prevention (CDC) or by the Council of State and Territorial Epidemiologists.[5,6] To determine if surveillance case definitions were met, LHDs—and for some diseases, also CDPH—reviewed detailed clinical and laboratory information provided on disease-specific case history forms. Surveillance case definitions of confirmed and/or probable cases included per disease are described in the *Epidemiologic Summaries*.

The estimated date of illness onset for each case was defined as the date closest to the time when symptoms first appeared. For cases for which an illness onset date was not explicitly reported, estimated date of illness onset was selected as the earliest of: date of diagnosis, date the case was reported to or received by CDPH, date of laboratory specimen collection, or date of patient death. For diseases with insidious onset (e.g., coccidioidomycosis), estimated onset was often based on the diagnosis date.

Mutually exclusive race/ethnicity categories were defined as follows: Hispanic/Latino (of any, including unknown, race), and non-Hispanic White, Black, Asian/Pacific Islander, American Indian/Alaska Native, Multiple Race, and Other.

Cases were classified geographically according to the case-patient's county of residence. Cases reported from the City of Berkeley were included in Alameda County, and cases from the cities of Long Beach and Pasadena were included in Los Angeles County. Regions of California were defined by aggregating counties with similar geography, demography, and economic conditions as described by the Public Policy Institute of California.[7] Regions included the Far North (Butte, Colusa, Del Norte, Glenn, Humboldt, Lake, Lassen, Mendocino, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Sutter, Tehama, Trinity, and Yuba counties); Sacramento Metro (El Dorado, Placer, Sacramento, and Yolo counties); Sierra (Alpine, Amador, Calaveras, Inyo, Mariposa, Mono, and Tuolumne counties); Bay Area (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties); San Joaquin Valley (Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare counties); Central Coast (Monterey, San Benito, San Luis Obispo, Santa Barbara, and Santa Cruz counties); Inland Empire (Riverside and San Bernardino counties); South Coast (Los Angeles, Orange, and Ventura counties); and San Diego (Imperial and San Diego counties). Southern California was defined as the counties comprising the Inland Empire, South Coast, and San Diego regions, while all other counties comprised Northern California.

Data analyses

Case totals and, when the data were sufficient, incidence rates per 100,000 population were reported and stratified by estimated year of illness onset, county, region, sex, and age group.

The formulas used to calculate the incidence rate and relative standard error were:

- Incidence rate (IR) = Number of cases/population x 100,000
- Standard error (SE) = IR/√number of cases
- Relative standard error = SE/IR x 100

An incidence rate was considered unstable if the relative standard error was 23 percent or more (a threshold recommended by the National Center for Health Statistics[8]).

To reduce the level of random error when the case number or population was small, the time and geographic range for incidence rates was expanded, and multiple-year average annual incidence rates and region-specific (rather than county-specific) rates were calculated, as needed. Relative standard errors were calculated for all incidence rates.

Because a substantial portion of all case-patients during the surveillance period did not identify their race/ethnicity (28.6%) or identified as non-Hispanic Other race/ethnicity (5.4%), incidence rates by race/ethnicity were not calculated. However, since race/ethnicity can be an important marker for complex social, economic, and political factors that influence health, the racial/ethnic distribution of cases and the statewide population were presented side by side when the data were sufficient. Cases of non-Hispanic Other race/ethnicity were not included in the analysis of race/ethnicity due to lack of population data for this group.

For some rare diseases, the *Epidemiologic Summaries* present a description of the number of cases rather than incidence rates.

Analyses were conducted using SAS software version 9.4, and maps were created using ArcGIS software version 10.7.1.

Limitations

Data quality

For many of the diseases covered in the *Epidemiologic Summaries*, CDPH reviewed case history information to determine whether surveillance case definitions were met. However, for campylobacteriosis, coccidioidomycosis, Creutzfeldt-Jakob disease, cryptosporidiosis, cyclosporiasis, giardiasis, listeriosis (through 2015), salmonellosis, shigellosis, typhoid fever (through 2015), vibriosis (through 2015), and yersiniosis, CDPH relied on LHDs to apply surveillance criteria. It is possible that some cases included in this report did not meet surveillance case definitions and counting criteria.

Deaths

For some diseases, the number of case-patients who died of their illness was calculated based on date of death and other death-related information reported on the Confidential Morbidity Report or case history. However, deaths might have occurred after the case report was completed (and thus were not included in the calculated numbers). The numbers of deaths and case-fatality ratios reported should be interpreted with caution.

Completeness and timeliness of reporting

The numbers of cases reported for some diseases in these *Epidemiologic Summaries* are likely to underestimate the true magnitude of disease. Factors that may contribute to under-reporting include delays in notification, limited collection or appropriate testing of specimens, obstacles or impediments to ill persons seeking health care, limited resources and competing priorities in LHDs, and lack of reporting by clinicians and laboratories. Factors that may contribute to enhanced reporting include disease severity, the availability of new or less expensive diagnostic tests, changes in the case definition by CDC or CDPH, recent media attention or public interest, and active surveillance activities.

During the seven-year surveillance period (2013-2019), the CDC and CDPH Infectious Diseases Branch conducted active surveillance of selected diseases in Alameda, Contra Costa, and San Francisco counties through the California Emerging Infections Program (CEIP). CEIP conducted active laboratory-based surveillance of campylobacteriosis, cryptosporidiosis, cyclosporiasis, Shiga toxin-producing *E. coli* (STEC) infection, listeriosis, salmonellosis, shigellosis, *Vibrio* infection, yersiniosis, and pediatric hemolytic uremic syndrome. Therefore, cases of these diseases may be more completely reported in these counties.

Because outbreak-related case reports were not always identified as such on the Confidential Morbidity Report, it was not possible to ascertain the proportion of outbreak-related cases that were also reported as individual cases. Additionally, case definitions used to classify probable outbreak-related cases may not meet the specific surveillance criteria required for individual case reporting. Thus, some outbreak-related cases may not be included in the total number of cases reported for each disease.

Small numbers and rate variability

All rates, even those based on full population counts, are subject to random error. Random error may be substantial when the number of cases is small (e.g., less than 20) and can make it impossible to distinguish random fluctuations from true changes in the underlying risk of disease. Rates and proportions based on small numbers should be interpreted with caution.

Count and Rate comparisons

Incidence rate comparisons between geographic areas and over time should be made with caution. The limitations previously listed (especially the completeness of reporting and random variability of rates) should be considered when interpreting and comparing incidence rates.

Data presented in the *Epidemiologic Summaries* may differ from previously published data due to delays inherent to case reporting, laboratory reporting, and epidemiologic investigation.

Updated by Kirsten Knutson, Yanyi Djamba, and Allyx Nicolici – Infectious Diseases Branch, December 2021

References

[1] Reportable Diseases and Conditions: Reporting to the Local Health Authority, 17 CCR § 2500 (2021). https://govt.westlaw.com/calregs/Document/I01D4328129FA11EDA5B6DDCDF7AC13B6

[2] Epidemiologic Summaries of Selected Communicable Diseases in California. California Department of Public Health website. Accessed December 27, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/EpiSummariesofCDsCA.aspx

[3] State of California, Department of Finance, P-3 State and County Population Projections by Race/Ethnicity and Detailed Age, 2010–2060. Sacramento, California, January 2020.

[4] State of California, Department of Finance, E-4 Population Estimates for Cities, Counties, and the State, 2011–2019, with 2010 Census Benchmark. Sacramento, California, May 2019.

[5] Surveillance Case Definitions for Current and Historical Conditions. National Notifiable Diseases Surveillance System (NNDSS), U.S. Centers for Disease Control and Prevention website. Accessed September 22, 2020. https://ndc.services.cdc.gov/

[6] U.S. Centers for Disease Control and Prevention. Case definitions for infectious conditions under public health surveillance. MMWR 1997;46(No.RR-10):1-55. https://www.cdc.gov/mmwr/pdf/rr/rr4610.pdf

[7] Johnson, H. A state of diversity: Demographic trends in California's regions. *California Counts: Population Trends and Profiles.* 2002 May; 3(1). San Francisco, CA: Public Policy Institute of California, 2002. Accessed September 22, 2020. http://www.ppic.org/content/pubs/cacounts/CC_502HJCC.pdf

[8] Xu JQ, Murphy SL, Kochanek KD, Bastian B, Arias E. Deaths: Final data for 2016. *National Vital Statistics Reports*. 2018; 67(5). Hyattsville, MD: National Center for Health Statistics, 2018. Accessed September 22, 2020. https://www.cdc.gov/nchs/data/nvsr/nvsr67/nvsr67_05.pdf

Key Findings

Foodborne botulism is caused when a person eats or drinks something that is contaminated with the toxin produced by *Clostridium botulinum* (*C. botulinum*) bacteria. These bacteria can grow and produce botulinum toxin in foods or drinks that aren't processed, preserved, or stored properly. The botulinum toxin attacks the nervous system and causes paralysis, beginning with the muscles of the eyes, face, and throat. People who have botulism will have symptoms such as droopy eyelids, blurred or double vision, or slurred speech. Muscle weakness can then spread downwards, making breathing difficult, and can eventually cause total paralysis and death. Foodborne botulism is rare but can be deadly and requires immediate medical care. Treatment with botulinum antitoxin will stop the toxin from causing more harm.

Foodborne Botulism in California from 2013 through 2019

Total Cases: There were a total of 24 new foodborne botulism cases from 2013 through 2019, with 0 to 15 cases reported per year. In 2017, 15 cases of foodborne botulism were reported, 10 of which were due to a large outbreak. During 2013-2019, three deaths from foodborne botulism were reported.

- **By County**: Cases were reported from 14 California counties. By region, more cases were reported in Northern California (20 cases, 10 of which were due to a large outbreak) than in Southern California (4 cases).
- **By Sex**: The same number of foodborne botulism cases were reported in males (12 cases) as in females (12 cases).
- **By Age Group**: More cases of foodborne botulism were reported in people aged 65 to 74 years (6 cases) and 35 to 44 years (5 cases) than in other age groups.
- **By Race/Ethnicity**: More cases of foodborne botulism were in people who reported Hispanic/Latino race/ethnicity (9 cases) and non-Hispanic Asian/Pacific Islander race/ethnicity (8 cases) than in other reported races/ethnicities.

To prevent foodborne botulism, foods and drinks should be properly preserved and stored to help keep *C. botulinum* bacteria from growing and making botulinum toxin. Always follow label instructions for refrigerating food, and never eat food that is moldy or smells bad, which can be a sign that the food is contaminated with bacteria that can make you sick. People who do home canning should follow strict instructions to safely can foods and reduce contamination. If someone has symptoms of botulism, immediately seek care at a hospital. Botulinum antitoxin for the treatment of botulism is only available from public health authorities.

For more information about botulism in California, please visit the CDPH Botulism webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Clostridium botulinum is an anaerobic, spore-forming bacterium that is ubiquitous in the environment. Under specific conditions, *C. botulinum* can grow and produce a potent neurotoxin that is a rare but important food intoxicant in the United States. Foodborne botulism follows ingestion of botulinum toxin in contaminated foods. Home-canned foods that have been improperly preserved or fermented have been most likely sources of foodborne botulism, as these provide the optimal conditions for *C. botulinum* to produce spores and toxin.[1, 2] Home-canned vegetables are the most common cause of foodborne botulism in the U.S;[3] far less commonly, commercial foods can also be contaminated with botulinum toxin.[1] *C. botulinum* toxin is listed among the U.S. Centers for Disease Control and Prevention (CDC) category A bioterrorism agents.[4]

Botulism is a rare but severe neuroparalytic illness, and each case should be considered a medical and public health emergency. All patients with suspected botulism must be investigated immediately, and two or more suspected botulism patients that may have shared or consumed the same food or drink are considered to be part of an outbreak. Initial neurologic signs and symptoms result from paralysis of muscles of the eyes, face, and throat, such as droopy eyelids (ptosis), blurred or double vision, or slurred speech, and may appear from 18 to 36 hours after consumption of contaminated food or drink. Illness can progress to a symmetric, descending weakness and, if untreated, can lead to respiratory paralysis and death.[5] Botulinum antitoxin and supportive medical care are the mainstay of treatment. If administered early in the course of illness, botulinum antitoxin can stop the progression of, but cannot reverse, paralysis. Antitoxin is available exclusively from public health authorities.[6, 7]

This report describes the epidemiology of confirmed and probable foodborne botulism cases in California from 2013 through 2019. Case data 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*.[8] The epidemiologic description of foodborne botulism for earlier surveillance periods can be found in the *Epidemiologic Summary of Foodborne Botulism in California, 2001-2008 and 2009-2012*.[9, 10]

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 botulism to their local health department immediately by telephone. In the event that a commercial food product is suspected as the source, special instructions will be given by the California Department of Public Health (CDPH).[11] Per CCR, Title 17, Section 2505, laboratories must immediately communicate by telephone with the CDPH Microbial Diseases Laboratory for instruction whenever a specimen for laboratory diagnosis of suspected botulism is received. Laboratories must report to the local health department when laboratory testing yields evidence suggestive of *C. botulinum*; notification must occur within one hour after the health care provider has been notified.[12]

California regulations require cases of foodborne botulism to be reported to CDPH. CDPH counted cases that satisfied the CDC/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed or probable case. During the 2013-2019 surveillance period, a confirmed case of foodborne botulism was defined as one with clinically compatible illness and either (i) laboratory confirmation including detection of botulinum toxin in serum, stool, or patient's food or isolation of *C. botulinum* from stool, or (ii) a history of consuming the same food as persons with laboratory-confirmed botulism. A probable case was defined as one with clinically compatible illness and an epidemiologic exposure (e.g., ingestion of a home-canned food within the previous 48 hours).[13] Two or more cases of foodborne botulism were defined as an outbreak if a common exposure in food was suspected, implicated, or determined to be the source.[14]

Epidemiology of Foodborne Botulism in California, 2013-2019

CDPH received reports of 24 cases of foodborne botulism with estimated symptom onset dates from 2013 through 2019, with 0 to 15 cases reported per year [Figure 1]. In 2017, 15 cases were reported, 10 of which were due to a large outbreak. During 2013-2019, three case-patients were reported to have died with foodborne botulism.

During the surveillance period, cases were reported from 14 California counties, with more than one case reported from Sacramento (4 cases), San Joaquin (4), Contra Costa (2), Orange (2), Santa Clara (2), and Tulare (2) counties. By region (see *Technical Notes*), more cases of foodborne botulism were reported in Northern California (20 cases, 10 of which were due to a large outbreak) than in Southern California (4).

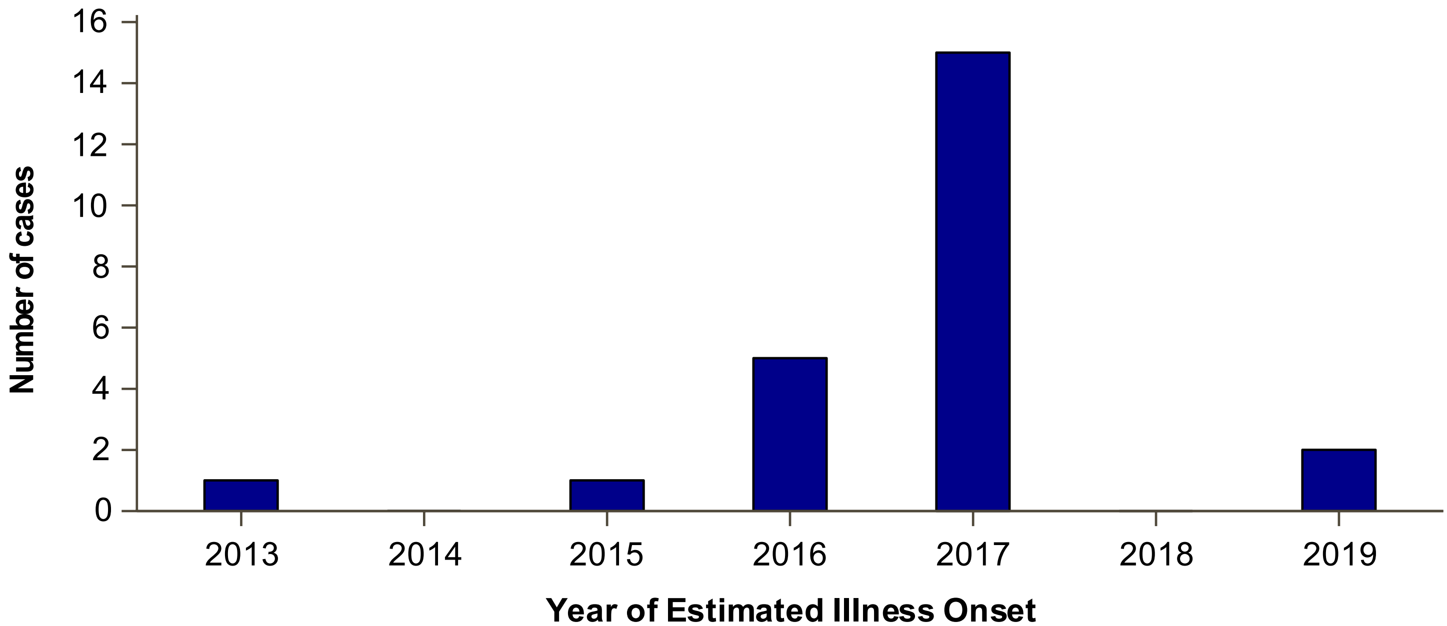
Cases of foodborne botulism were reported equally frequently among males (12 cases) and females (12). By age group, case-patients were aged 15-24 years (3 cases), 25-34 years (2), 35-44 years (5), 55-64 years (4), 65-74 years (6), 75-84 years (2), and 85 years and older (2). No cases were reported among those aged less than 15 years and between the ages of 45 and 54 years. By race/ethnicity, case-patients reported Hispanic/Latino race/ethnicity (9 cases) and non-Hispanic Asian/Pacific Islander race/ethnicity (8) more frequently than other reported racial/ethnic groups.

Of the 24 foodborne botulism cases reported during 2013-2019, 12 (50.0%) cases had a food source that was laboratory confirmed for *C. botulinum*: nacho cheese sauce (10 cases), crisp black fungus (1), and a packaged grain product (1). Improper food handling or storage was a contributing factor for the proliferation of *C. botulinum* and toxin production in all confirmed food sources. Of the total cases, 7 (29.2%) did not have a confirmed food source, but reported food items or food processes known to harbor or promote the growth of *C botulinum*; of these, 2 case-patients shared one food/supplement item (prepackaged liquid tea from the same batch), 2 case-patients had several shared meals including fermented food items and dried fish, and 3 patients reported consuming home canned/preserved food items. Of the total cases, 5 (20.8%) case-patients had no food source identified in interview of patient or family, or the patient was lost to follow-up.[a]

Three outbreaks of foodborne botulism were reported during 2013-2019. The implicated food source was known in two 2017 outbreaks: nacho cheese sauce linked to a gas station (10 cases)[15] and prepackaged liquid herbal tea (2)[16]. The food source was unknown in one 2016 outbreak with two cases.

[a] Patients were laboratory confirmed for *Clostridium botulinum* toxin and/or toxin producing organisms and were classified as foodborne due to a lack of evidence of other modes of transmission. This included no wounds, no history of injection drug use, no recent surgeries or fractures, no risk of iatrogenic botulism, and no risk factors for adult intestinal toxemia.

Figure 1. Foodborne Botulism Cases by Year of Estimated Illness Onset, California, 2013-2019



Comments

Although foodborne botulism during 2013-2019 remained a rare occurrence in California, each case represented a medical and public health emergency. Due to the large 2017 outbreak of botulism due to nacho cheese sauce, more cases were reported in that year (15 cases) than in any other individual year during the 2001-2008, 2009-2012, and 2013-2019 surveillance periods.[9, 10] From 2013-2019, more cases were reported in Northern California than in Southern California.

Surveillance and response to foodborne botulism is intensive because the contaminated food item must be identified and removed from distribution (whether it is commercial or homemade) without delay. Rapid diagnosis and treatment, including administration of botulinum antitoxin obtained from public health authorities, provide the best opportunities for minimizing the morbidity and mortality associated with foodborne botulism. Educating about proper food preparation and preservation practices may provide the best opportunities to prevent and control foodborne botulism.

Patients having symptoms of foodborne botulism should immediately seek medical care at a hospital. Foodborne botulism can be prevented by strict adherence to proper food preservation and fermenting guidelines; the U.S. Department of Agriculture has information and guidelines for canning foods at home.[17] Consumers should always follow label instructions for the refrigeration of commercial foods; foods that are moldy or have a bad odor should not be eaten, as these may be signs of contamination.

Prepared by Alyssa Nguyen, Yanyi Djamba, Hilary Rosen, Amanda Kamali, Akiko Kimura, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, January 2022

References

[1] Botulism, Kinds of Botulism. U.S. Centers for Disease Control and Prevention website. Updated June 1, 2021. Accessed October 22, 2021. https://www.cdc.gov/botulism/definition.html

[2] Botulism, About Botulism. U.S. Centers for Disease Control and Prevention website. Updated June 1, 2021. Accessed October 22, 2021. https://www.cdc.gov/botulism/general.html

[3] Botulism, Home-Canned Foods. U.S. Centers for Disease Control and Prevention website. Updated June 6, 2019. Accessed October 22, 2021. https://www.cdc.gov/botulism/consumer.html

[4] Emergency Preparedness and Response, Bioterrorism Agents/Diseases. U.S. Centers for Disease Control and Prevention website. Updated April 4, 2018. Accessed March 1, 2021. https://emergency.cdc.gov/agent/agentlist-category.asp

[5] Botulism, Symptoms. U.S. Centers for Disease Control and Prevention website. Updated February 9, 2021. Accessed October 22, 2021. https://www.cdc.gov/botulism/symptoms.html

[6] Botulism Fact Sheet. California Department of Public Health website. Updated January 2021. Accessed March 3, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/BotulismFactSheet.pdf

[7] Botulism Information for Local Health Departments. California Department of Public Health website. Updated March 16, 2021. Accessed June 30, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/BotulismLHDs.aspx

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

[9] State of California, Department of Public Health. Foodborne botulism. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008.* Sacramento, California, September 2009. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[10] State of California, Department of Public Health. Foodborne botulism. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012*. Sacramento, California, September 2015. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf

[11] Reportable Diseases and Conditions: Reporting to the Local Health Authority, 17 CCR §

2500 (2021).
https://govt.westlaw.com/calregs/Document/I5849DB60A9CD11E0AE80D7A8DD0B623B

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

[13] Botulism (*Clostridium botulinum*), 2011 Case Definition, Subtype Case Definition: Botulism, foodborne. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed October 21, 2021.
https://ndc.services.cdc.gov/case-definitions/botulism-2011/

[14] National Center for Emerging and Zoonotic Infectious Diseases. National Botulism Surveillance Summary 2016. Atlanta, GA: U.S. Centers for Disease Control and Prevention, Division of Foodborne, Waterborne, and Environmental Diseases; 2017. Accessed January 4, 2022. https://www.cdc.gov/botulism/pdf/Botulism-2016-SUMMARY-508.pdf

[15] Rosen HE, Kimura AC, Crandall J, Poe A, Nash J, Boetzer J, Tecle S, Mukhopadhyay R, Mcauley K, Kasirye O, Garza A, Shahkarami M, Chaturvedi V, Kiang D, Vidanes J, Mccoy K, Barcellos M, Derby T, Jain S, Vugia DJ. Foodborne Botulism Outbreak Associated With Commercial Nacho Cheese Sauce From a Gas Station Market. Clin Infect Dis. 2020 Apr 10;70(8):1695-1700. doi: 10.1093/cid/ciz479. PMID: 31247064.

[16] Kim M, Zahn M, Reporter R, et al. Outbreak of Foodborne Botulism Associated With Prepackaged Pouches of Liquid Herbal Tea. Open Forum Infect Dis. 2019;6(2):ofz014. Published 2019 Feb 9. doi:10.1093/ofid/ofz014

[17] U.S. Department of Agriculture. Complete Guide to Home Canning. Kansas City, MO: U.S. Department of Agriculture, National Institute of Food and Agriculture; 2015. Accessed October 22, 2021. http://nchfp.uga.edu/publications/publications_usda.html

Epidemiologic Summary of Wound Botulism in California, 2013 - 2019

Key Findings

Wound botulism is caused when *Clostridium botulinum* (*C. botulinum*) bacteria get into a wound or opening in the skin and produce the botulinum toxin. The botulinum toxin attacks the nervous system and causes paralysis, beginning with the muscles of the eyes, face, and throat. People who have botulism have symptoms such as droopy eyelids, blurred or double vision, or slurred speech. Muscle weakness can then spread downwards, making breathing difficult, and can eventually cause total paralysis and even death. People who inject illicit drugs (like black tar heroin) are more likely to get wound botulism because the drugs may be contaminated with *C. botulinum*, and the bacteria can get in through the injection site in the skin. Wound botulism is rare but can be deadly and requires immediate medical care. Treatment with botulinum antitoxin will stop the toxin from causing more harm.

Wound Botulism in California from 2013 through 2019

Total Cases: There were a total of 184 wound botulism cases from 2013 through 2019. This is an average of 26 cases each year.

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

- **By County**: About 1 out every 3 cases was reported in Los Angeles County (28 cases) and San Bernardino County (27 cases), but both counties had an average rate of less than 1 case per 100,000 people.
- **By Sex:** Most cases (about 78%) were in males (about 22% were in females), but the average rates in both males and females were less than 1 case per 100,000 people.
- **By Age Group**: The average rates were highest in adults aged 45 to 64 years, but rates were less than 1 case per 100,000 people in this age group.
- **By Race/Ethnicity**: For cases where race and ethnicity information was available, the highest percentages of cases were in people who reported non-Hispanic White (50%) and Hispanic/Latino (48%) race/ethnicity.

To reduce the risk of wound botulism, people who use injection drugs should be aware of the signs and symptoms of botulism so they can seek immediate medical care if they have symptoms. Those seeking medical care should share information about any recent injection drug use so a medical provider can provide the right treatment. It is important to keep wounds from an injury clean so they don't become infected. Even if a wound is not visible, an injection site on the skin can be a source of toxin. If someone has symptoms of botulism, seek medical care at a hospital immediately. Botulinum antitoxin for the treatment of wound botulism is available only from public health authorities.

For more information about wound botulism in California, please visit the CDPH Botulism webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Clostridium botulinum is an anaerobic, spore-forming bacterium that is ubiquitous in the environment. Under specific conditions, *C. botulinum* can grow and produce a potent neurotoxin. Wound botulism is caused when *C. botulinum* colonizes a wound and produces the neurotoxin in situ.[1] Wound botulism occurred primarily in the setting of traumatic injury (when dirt gets into a wound) until the early 1990s, when California began experiencing an epidemic of wound botulism among injection drug users, particularly of black tar heroin.[2, 3] *C. botulinum* toxin is listed among the U.S. Centers for Disease Control and Prevention (CDC) category A bioterrorism agents.[4]

Wound botulism is a rare but severe neuroparalytic illness, and each case should be considered a medical and public health emergency. Initial neurologic signs and symptoms result from paralysis of muscles of the eyes, face, and throat, such as droopy eyelids (ptosis), blurred or double vision, or slurred speech, and may appear from several days to 2 weeks after the wound is infected.[1, 5] Illness can progress to a symmetric, descending weakness and, if untreated, can lead to respiratory paralysis and death. Botulinum antitoxin and supportive medical care are the mainstay of treatment. If administered early in the course of illness, botulinum antitoxin can stop the progression of, but cannot reverse, paralysis. Antitoxin is available exclusively from public health authorities.[6, 7]

This report describes the epidemiology of confirmed and probable wound botulism 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*.[8] The epidemiologic description of wound botulism for earlier surveillance periods can be found in the *Epidemiologic Summary of Wound Botulism in California, 2001-2008 and 2009-2012*.[9, 10]

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 wound botulism to their local health department immediately by telephone.[11] Laboratories must immediately communicate by telephone with the California Department of Public Heath (CDPH) Microbial Diseases Laboratory for instruction whenever a specimen for laboratory diagnosis of suspected botulism is received. Per CCR, Title 17, Section 2505, laboratories also must report to the local health department in the health jurisdiction where the patient resides when laboratory testing yields evidence suggestive of *C. botulinum*; notification must occur by telephone within one hour after the health care provider has been notified.[12]

CDPH counted cases of botulism that satisfied the CDC/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed or probable case. During the 2013-2019 surveillance period, a confirmed case of wound botulism was defined as a clinically compatible illness and either detection of botulinum toxin in serum or isolation of *C. botulinum* from the wound in a patient who has no suspected exposure to contaminated food and who has either a history of a fresh contaminated wound during the 2 weeks before onset of symptoms or a history of injection drug use within the 2 weeks before onset of symptoms. A probable case of wound botulism was defined as a clinically compatible illness in a patient who has no suspected exposure to contaminated food and who has either a history of a fresh, contaminated wound during the 2 weeks before onset of symptoms or a history of injection drug use within the 2 weeks before onset of symptoms.[13]

Epidemiology of Wound Botulism in California, 2013-2019

CDPH received reports of 184 cases of wound botulism with estimated symptom onset dates from 2013 through 2019. This corresponds to an average of 26 cases per year and an average annual incidence rate of 0.1 cases per 100,000 population. Wound botulism incidence rates increased gradually during the surveillance period, with the exception of 2018, when the rate increased to 0.13 per 100,000 (50 cases) [Figure 1]. All wound botulism case-patients were hospitalized. Deaths were reported for 5 (2.7%) case-patients at the time of case report. The large majority of wound botulism case-patients reported injection drug use (172 cases; 93.5%); of the total cases, 162 (88.0%) case-patients reported injecting heroin, with 134 (72.8%) case-patients specifying black tar heroin.

From 2013 through 2019, 29.9% of wound botulism cases occurred in two California counties: Los Angeles County (0.04 per 100,000; 28 cases) and San Bernardino County (0.2 per 100,000; 27 cases). The average annual rate in Northern California (1.0 per 100,000; 78 cases) was similar to the average annual rate in Southern California (1.0 per 100,000; 106 cases) (see *Technical Notes*).

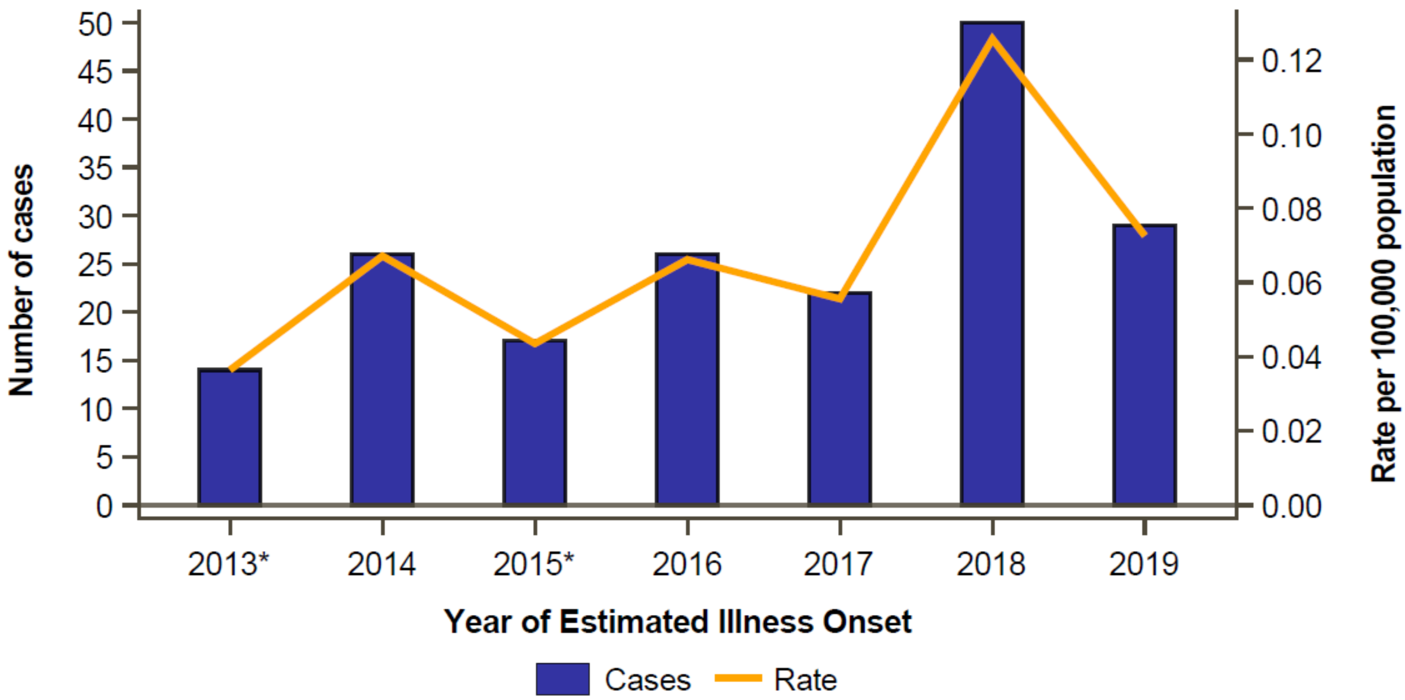
During the surveillance period, 77.7% of cases were among males and 22.3% were among females. The average annual incidence rate was higher among males (0.1 per 100,000; 143 cases) than among females (0.03 per 100,000; 41 cases).

Average annual incidence rates of wound botulism from 2013 through 2019 were highest among adults aged 55 to 64 years (0.2 per 100,000; 53 cases) and 45 to 54 years (0.1 per 100,000; 49 cases). During the surveillance period, 99.5% of case-patients were aged 21 years and older.

For wound botulism cases with complete race/ethnicity information (see *Technical Notes*), non-Hispanic White (50.0%) and Hispanic/Latino (48.0%) were reported more frequently than would be expected compared to the percentage of these groups in California during the same time period (38.0% and 38.5%, respectively) [Figure 2].

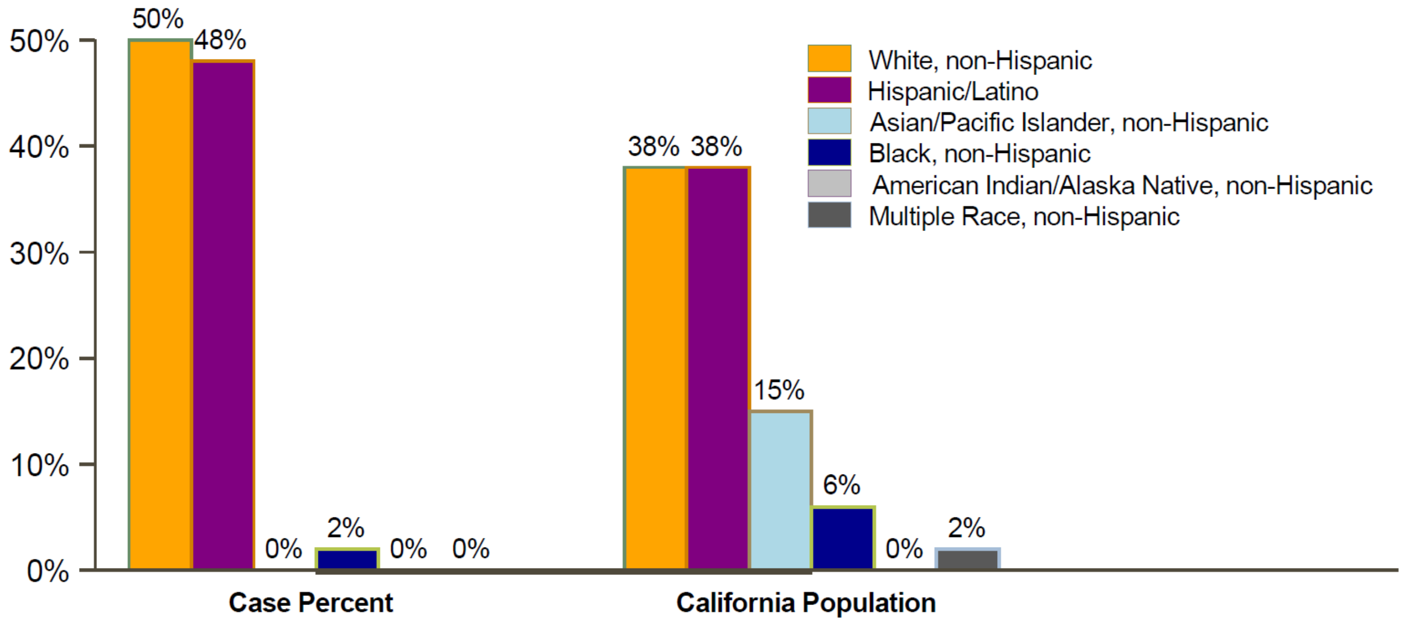
From 2013 through 2019, rare geographic and temporal clusters of wound botulism were identified, necessitating public health response measures, including alerting healthcare providers of the signs and symptoms of botulism and emphasizing educational outreach to at-risk persons. During September 2017 through April 2018, 9 cases of wound botulism were reported in San Diego County. All case-patients reported a history of injecting heroin; 7 (78%) specifically reported black tar heroin use. All patients required hospitalization in intensive care units. A common source of drugs was not identified.[14]

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



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

Figure 2. Wound Botulism Cases and Population by Race/Ethnicity, California, 2013-2019



19% (n=35) of reported incidents of Botulism, Wound did not identify race/ethnicity and 1.1% (n=2) 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

Although wound botulism during 2013-2019 was a rare occurrence in California, each case represented a medical and public health emergency. A slight increase in numbers and incidence rates of wound botulism was observed during the surveillance period. Cases occurred almost exclusively among injection drug users. More than half of all case-patients were adults aged 45 to 64 years, and cases were more likely to be male than female.

Rapid diagnosis and treatment, including administration of botulinum antitoxin obtained from public health authorities, provide the best opportunities for minimizing the morbidity and mortality associated with wound botulism. Additionally, educating injection drug users to seek immediate medical care at a hospital if typical symptoms of botulism develop and to be honest about recent drug use may enable more timely diagnosis and administration of antitoxin.[5] Counseling drug users about safer injection practices may further reduce risk; persons can prevent wound botulism by not injecting illicit drugs. Wound botulism can also be prevented by keeping wounds from an injury clean; persons with wounds (such as from traumatic injuries and surgeries) should seek immediate medical care if experiencing symptoms of wound botulism.

Prepared by Kirsten Knutson, Yanyi Djamba, Hilary Rosen, Amanda Kamali, Akiko Kimura, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, October 2021

References

[1] Botulism, What You Need to Know. California Department of Public Health website. Updated February 19, 2021. Accessed March 3, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Botulism.aspx

[2] Werner SB, Passaro D, McGee J, Schechter R, Vugia DJ. Wound botulism in California, 1951-98: Recent Epidemic in Heroin Injectors. Clin Infect Diseases 2000;31:1018-24.

[3] Yuan J, Inami G, Mohle-Boetani J, Vugia DJ: Recurrent wound botulism among injection drug users in California. Clin Infect Dis. 2011 Apr 1;52(7):862-6.

[4] Emergency Preparedness and Response, Bioterrorism Agents/Diseases. U.S. Centers for Disease Control and Prevention website. Updated April 4, 2018. Accessed March 1, 2021. https://emergency.cdc.gov/agent/agentlist-category.asp

[5] Botulism, Injection Drug Use and Wound Botulism. U.S. Centers for Disease Control and Prevention website. Updated October 4, 2018. Accessed March 3, 2021. https://www.cdc.gov/botulism/wound-botulism.html

[6] Botulism Fact Sheet. California Department of Public Health website. Updated January 2021. Accessed March 3, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/BotulismFactSheet.pdf

[7] Botulism Information for Local Health Departments. California Department of Public Health website. Updated March 16, 2021. Accessed June 30, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/BotulismLHDs.aspx

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

[9] State of California, Department of Public Health. Wound botulism. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008.* Sacramento, California, September 2009. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[10] State of California, Department of Public Health. Wound botulism. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012.* Sacramento, California, September 2015. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf

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

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

[13] Botulism (*Clostridium botulinum*), 2011 Case Definition, Subtype Case Definition: Botulism, wound. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed June 30, 2021.
https://ndc.services.cdc.gov/case-definitions/botulism-2011/

[14] Peak CM, Rosen H, Kamali A, et al. Wound Botulism Outbreak Among Persons Who Use Black Tar Heroin — San Diego County, California, 2017–2018. MMWR Morb Mortal Wkly Rep 2019;67:1415–1418.

Key Findings

Brucellosis is an infectious disease caused by *Brucella* bacteria, which are often found in animals used to produce food for humans, including cows, sheep, goats, and pigs. Dogs and other animals can also be infected with *Brucella*. People can get brucellosis if they have contact with infected animals or eat or drink raw (unpasteurized) milk and cheese. Brucellosis is typically a flu-like illness but can cause infections in bone and other organs if not treated.

Brucellosis in California from 2013 through 2019

Total Cases: There were a total of 197 brucellosis cases from 2013 through 2019.

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

- **By County**: Only two counties in California (Los Angeles and San Diego) reported at least one case of brucellosis each year during 2013-2019.
- **By Sex**: The average rates for males and females were each less than 1 case per 100,000 people.
- **By Age Group**: Average rates were higher in adults aged 65 to 84 years compared to other age groups, but still 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 (about 78%) was in people who reported Hispanic/Latino race/ethnicity.

To help prevent brucellosis, people should avoid eating or drinking dairy products, including milk, cheese, and ice cream, that have not been pasteurized. People should be especially cautious of dairy products that are produced outside the United States. People who work with animals or handle animal tissues, including veterinarians, meat-processing employees, and hunters, should protect themselves by wearing gloves, goggles, and aprons to help prevent bacteria from infected animals from getting into their eyes or a break in their skin.

For more information about brucellosis in California, please visit the CDPH Brucellosis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Brucella spp. are uncommon but important bacterial zoonotic pathogens in the United States, causing an estimated 100 to 200 cases of human illness each year. Since 1954, the U.S. Department of Agriculture (USDA) National Brucellosis Eradication Program has significantly reduced the prevalence of *Brucella* in domestic livestock through routine testing, culling, and vaccination. In 2008, USDA declared all 50 states free of bovine brucellosis.[1] However, brucellosis remains endemic and an economically important disease in much of Africa, the Middle East, Central and South America, and Mexico. In these countries, contact through broken skin with infected animal reproductive tissues and fluids, or inhalation of bio-aerosols, can lead to transmission of *Brucella* bacteria, most notably in occupational settings such as livestock ranches, laboratories, slaughterhouses, meat-processing facilities, and veterinary settings. In California, consuming dairy products that are not pasteurized, particularly milk and cheese produced outside the U.S., is the most common route of exposure. Persons who harvest and dress certain wild animals (e.g., feral swine) may also be exposed to *Brucella* spp.[2] Person-to-person transmission is extremely rare.[3] *Brucella* spp. are listed among the U.S. Centers for Disease Control and Prevention (CDC) category B bioterrorism agents.[4]

Brucellosis has a variable and sometimes prolonged incubation period (5 days to 6 months) and often presents as a nonspecific febrile syndrome (acute or insidious onset of fever, night sweats, fatigue, headache, and arthralgia). If treatment is delayed, patients may experience recurrent or "undulant" fevers and possible focal infections in bones, joints, and other tissues.[5, 6]

Animal brucellosis control programs (vaccination and/or test-and-slaughter of infected animals) help to ensure that commercial foods of animal origin remain free of *Brucella* contamination. Avoiding consumption of unpasteurized dairy products (e.g., raw milk or cheese), particularly those products that are produced and imported from outside the United States, is central toward prevention of brucellosis among Californians.[1, 2]

This report describes the epidemiology of confirmed and probable brucellosis 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*.[7]

California Reporting Requirements and Surveillance Case Definition

California Code of Regulations (CCR), Title 17, Section 2500 requires health care providers to immediately report known or suspected human cases of brucellosis to their local health jurisdiction.[8] Laboratories must immediately contact the California Department of Public Health (CDPH) Microbial Diseases Laboratory for instructions whenever a clinical specimen for laboratory diagnosis of suspected human brucellosis is received. Per CCR, Title 17, Section 2505, laboratories must report to the local health jurisdiction where the patient resides when laboratory testing yields evidence suggestive of *Brucella* sp.;[9] all clinical specimens provisionally identified as *Brucella* spp. must be confirmed by a public health reference laboratory.[10]

California regulations require cases of brucellosis to be reported to CDPH. During the surveillance period, CDPH defined a confirmed brucellosis case per the CDC/Council of State and Territorial Epidemiologists 2010 case definition as a clinically compatible illness characterized by acute or insidious onset of fever, and one or more of the following: night sweats, arthralgia, headache, fatigue, anorexia, myalgia, weight loss, arthritis/spondylitis, meningitis, or focal organ involvement (endocarditis, orchitis/epididymitis, hepatomegaly, splenomegaly), along with definitive laboratory evidence of *Brucella* infection. Definitive laboratory evidence of *Brucella* infection included either culture and identification of *Brucella* sp. from clinical specimens, or evidence of a fourfold or greater rise in *Brucella* antibody titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart. A probable case was defined as clinically compatible illness and either an epidemiologic link to a confirmed case or presumptive laboratory evidence (supportive serology using the agglutination method or detection of *Brucella* DNA by PCR).[11]

Epidemiology of Brucellosis in California, 2013-2019

CDPH received a total of 197 reported cases of brucellosis with estimated symptom onset dates from 2013 through 2019. The average annual incidence of brucellosis for the surveillance period was 0.1 case per 100,000 population. The greatest number of cases were reported in 2018 (38 cases), and the fewest in 2016 (20 cases) [Figure 1].

Statewide from 2013 through 2019, only Los Angeles (57 cases) and San Diego (13 cases) counties reported at least one case during each year of the surveillance period at an equivalent rate of 1.0 case per year per 100,000 population. Cases from these two counties comprised 35.5% of the total brucellosis cases reported.

The average annual incidence among males and females was 0.1 per 100,000 population for each group. Of the 197 total cases, 104 (52.8%) were among males and 93 (47.2%) were among females.

Annual incidences were highest among adults aged 75 to 84 years (0.2 per 100,000; 18 cases) and adults aged 65 to 74 years (0.1 per 100,000; 30 cases) compared to other age groups. No cases were reported in children aged less than 1 year [Figure 2].

For the 178 brucellosis cases with complete race/ethnicity data, the highest percentage of cases was among those who reported Hispanic/Latino race/ethnicity (77.5%) [Figure 3].

Of the 197 total brucellosis cases reported during the surveillance period, 158 (80.2%) reported consuming any type of dairy product, including milk and/or cheese, during the incubation period. Of these 158 cases, 90 (57.0%) case-patients reported consuming both milk and other dairy products during their incubation periods. Of these 90 cases, 63 (70.0%) case-patients reported consuming pasteurized milk, 18 (20.0%) reported consuming unpasteurized milk, and 9 (10.0%) reported consuming milk of unknown pasteurization. Of the same group of 90 cases, 47 (52.2%) case-patients reported consuming queso fresco and 14 (15.6%) reported consuming soft cheese; dairy products were acquired from outside the U.S. for 45 (50.0%) cases, within California for 36 (40.0%) cases, and from an unknown location for 9 (10.0%) cases. Of the 45 cases that reported acquiring dairy products from outside the U.S., 29 (64.4%) acquired the dairy product from Mexico.

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

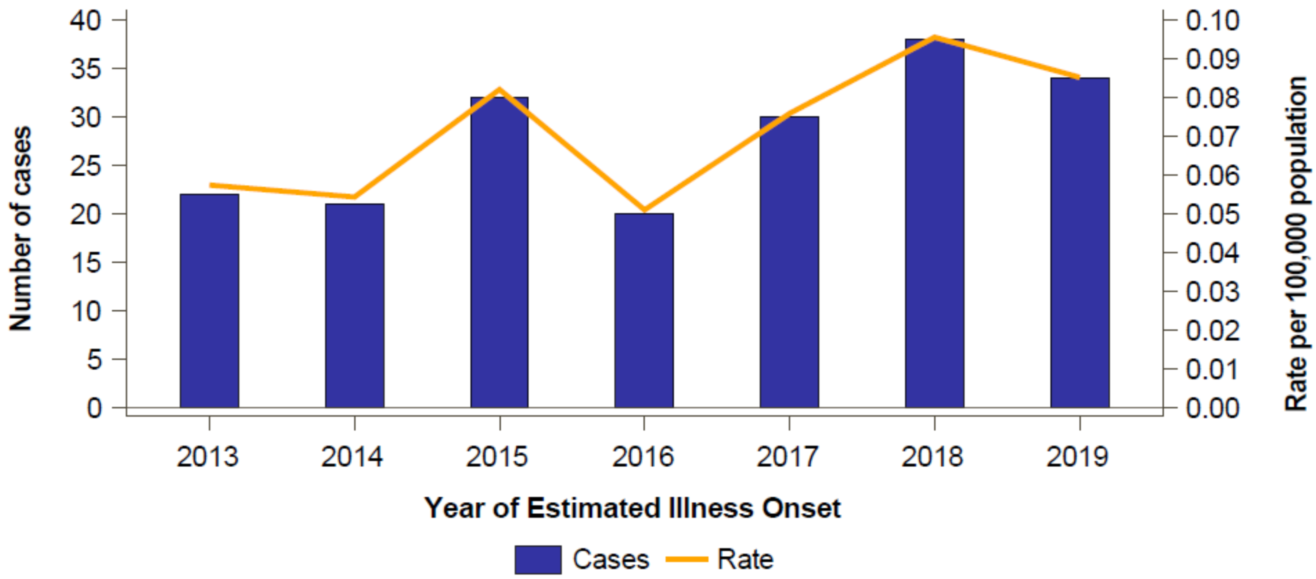
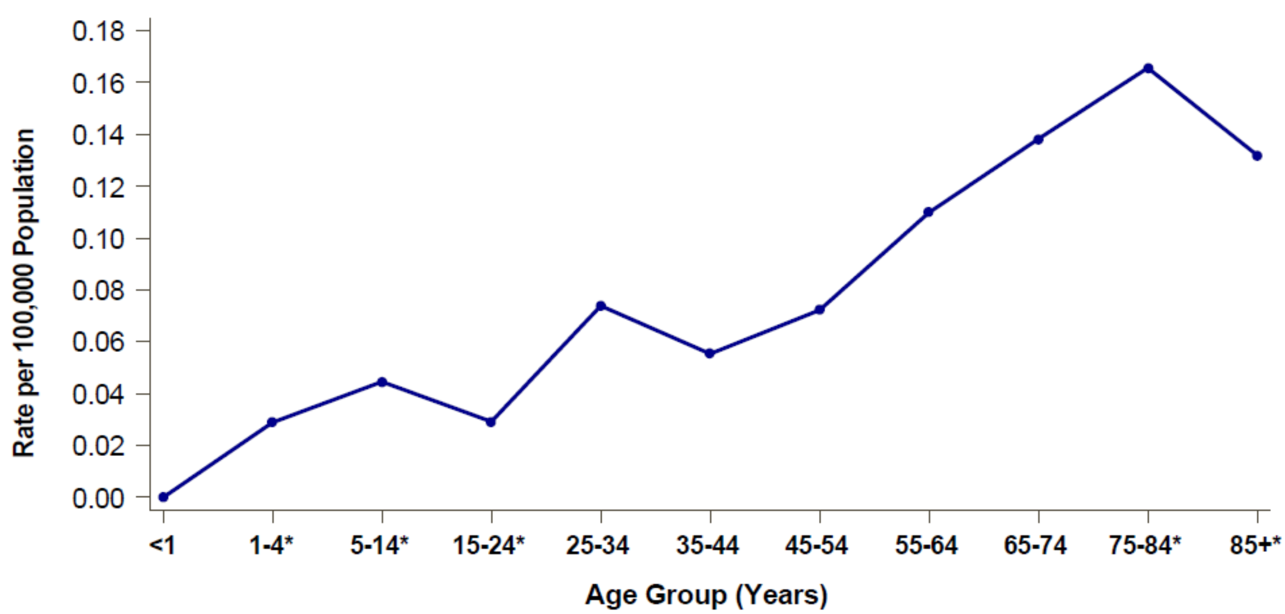
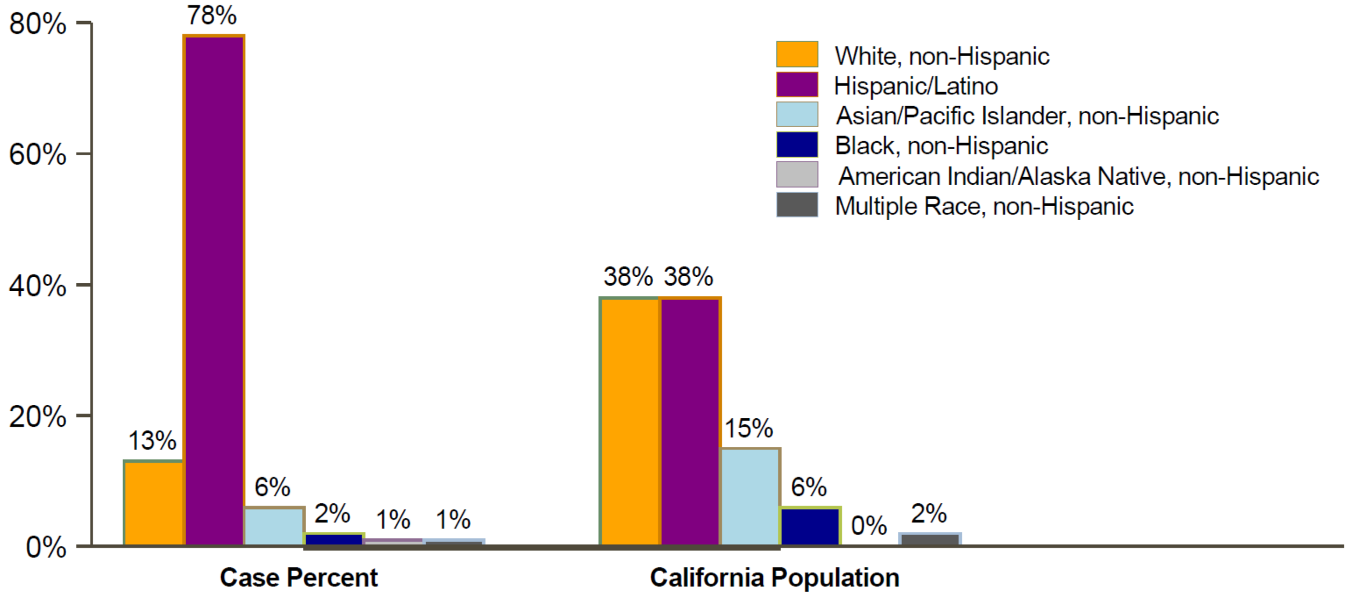


Figure 2. Brucellosis Average Annual Incidence Rates by Age Group, California, 2013-2019



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

Figure 3. Brucellosis Cases and Population by Race/Ethnicity, California, 2013-2019



6.1% (n=12) of reported incidents of Brucellosis did not identify race/ethnicity and 3.6% (n=7) 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

Brucellosis in California is uncommon and primarily a foodborne disease caused by consuming dairy products, some of which are acquired from outside the U.S., particularly Mexico. Cultural preference for these products has led to *Brucella* infections in California, particularly among Hispanic/Latino residents. Increased public education on the risk of brucellosis should target Hispanic/Mexican-American communities in a language-appropriate and culturally respectful manner.[12]

Most members of the general public can eliminate their risk of brucellosis by selecting and consuming only domestic commercial dairy products that are labelled as pasteurized. Veterinarians and others who have contact with live animals should wear protective clothing, including gloves, gowns, and masks, when they have contact with reproductive tissues and periparturient fluids.

Prepared by Inderbir Sohi, Yanyi Djamba, Curtis Fritz, Amanda Kamali, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, January 2021

References

[1] Facts About Brucellosis. National Brucellosis Eradication Program. U.S. Department of Agriculture, Animal and Plant Health Inspection Service website. Accessed February 12, 2021. https://www.aphis.usda.gov/animal_health/animal_diseases/brucellosis/downloads/bruc-facts.pdf; https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/cattle-disease-information/national-brucellosis-eradication

[2] Centers for Disease C, Prevention. Brucella suis infection associated with feral swine hunting - three states, 2007-2008. *MMWR Morb Mortal Wkly Rep.* 2009;58(22):618-21.

[3] Meltzer E, Sidi Y, Smolen G, Banai M, Bardenstein S, Schwartz E. Sexually transmitted brucellosis in humans. *Clin Infect Dis*. 2010 Jul 15;51(2):e12-5. doi: 10.1086/653608. PMID: 20550455.

[4] Bioterrorism Agents/Diseases, Category B. Emergency Preparedness and Response, U.S. Centers for Disease Control and Prevention website. Updated April 4, 2018. Accessed February 12, 2021. https://emergency.cdc.gov/agent/agentlist-category.asp#b

[5] Brucellosis. U.S. Centers for Disease Control and Prevention website. Updated March 8, 2019. Accessed February 12, 2021. https://www.cdc.gov/brucellosis/symptoms/index.html

[6] Brucellosis. California Department of Public Health website. Updated December 6, 2017. Accessed February 12, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Brucellosis.aspx

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

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

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

[10] American Society for Microbiology. Sentinel Level Clinical Laboratory Guidelines for Suspected Agents of Bioterrorism and Emerging Infectious Diseases, *Brucella* species. Revised March 2016. Accessed February 25, 2021. https://asm.org/ASM/media/Policy-and-Advocacy/LRN/Sentinel%20Files/Brucella-2016-March.pdf

[11] Brucellosis (*Brucella* spp.) 2010 Case Definition. National Notifiable Diseases Surveillance System. U.S. Centers for Disease Control and Prevention website. Accessed January 25, 2021. https://wwwn.cdc.gov/nndss/conditions/brucellosis/case-definition/2010/

[12] Bell RA, Hillers VN, Thomas TA. Hispanic grandmothers preserve cultural traditions and reduce foodborne illness by conducting safe cheese workshops. *J Am Diet Assoc.* 1999; 99(9): 1114-6.

Key Findings

Campylobacteriosis is an infection caused by *Campylobacter*, a type of bacteria that live naturally in the intestines and feces (poop) of many animals, including chickens, turkeys, and cows. Campylobacteriosis can make people sick with diarrhea, fever, and stomach cramps. People can get campylobacteriosis by eating or drinking something that has been contaminated with *Campylobacter*. Foods likely to be contaminated by *Campylobacter* include raw or undercooked poultry (or something that touched it), and raw (unpasteurized) milk. *Campylobacter* is the most common bacterial cause of diarrhea reported in the U.S., causing over a million infections each year.

Campylobacteriosis in California from 2013 through 2019

Total Cases: There were a total of 61,310 new campylobacteriosis cases from 2013 through 2019. This is an average of 8,759 cases each year.

Rate: The average annual rate of new campylobacteriosis cases during 2013-2019 was about 22 cases per 100,000 people in California.

- **By County**: The average rates were highest in San Francisco County (about 51 cases per 100,000 people), Marin County (about 42 cases per 100,000 people), and Mendocino County (about 39 cases per 100,000 people).
- **By Sex**: The average rate was higher in males (24 cases per 100,000 people) than in females (about 20 cases per 100,000 people).
- **By Age Group**: The average rates were highest in children aged 1 to 4 years (about 40 cases per 100,000 children in this age group) and children aged less than 1 year (38 cases per 100,000 children in this age group).
- **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 (53%).
- **By Month**: There were more cases of campylobacteriosis in June through August (about 6,721 cases each month) than in all other months (about 4,572 cases each month).

To help prevent campylobacteriosis, do not eat undercooked poultry or drink unpasteurized milk. It is also important to follow food safety guidelines when preparing food, especially by keeping raw poultry away from ready-to-eat foods and cooking food to the right temperature. To prevent the spread of *Campylobacter,* people should always wash their hands with soap and water before preparing food, immediately after handling any raw poultry or meat, and after touching animals (including farm animals, chickens, and turkeys) or being in areas where animals live.

For more information about campylobacteriosis in California, please visit the CDPH Campylobacteriosis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Campylobacter are among the most commonly reported enteric bacterial pathogens in the United States, causing an estimated 1.3 million illnesses, 13,240 hospitalizations, and 119 deaths each year.[1] Of the approximately 20 *Campylobacter* species identified, the species *Campylobacter jejuni* causes about 90% of human *Campylobacter* illness in the U.S.[2] In 2018, the overall incidence rate of campylobacteriosis in the U.S. was 21.5 cases per 100,000 population.[3] The national *Healthy People 2020* target objective for campylobacteriosis was to have an annual incidence rate lower than 8.5 cases per 100,000 population.[4]

Many animals, particularly poultry such as chickens and turkeys, but also cows and other mammals, can carry *Campylobacter* without becoming ill. Most people get campylobacteriosis from eating raw or undercooked poultry or eating something that has been contaminated by raw poultry (such as through contact with a cutting board). People can also get infected from eating or drinking other items that have been contaminated with *Campylobacter*, such as unpasteurized milk, meat, produce, seafood, and untreated water.[5] Exposure to infected animals and their environments can also result in infection; since 2016, the U.S. Centers for Disease Control and Prevention (CDC) has investigated several outbreaks linked to contact with puppies.[6, 7]

Most people with campylobacteriosis have diarrhea (often bloody), abdominal pain, and fever. Symptoms usually begin within 2 to 5 days after exposure, and last about 1 week. Treatment with antibiotics is not usually necessary. Asymptomatic infections may also occur. For some patients, illness may be severe and require hospitalization and antibiotic treatment, and death can result. Persons at higher risk for severe disease include adults aged 65 years and older, pregnant women, and immunocompromised persons. Complications, including irritable bowel syndrome, Guillain-Barré syndrome, and reactive arthritis, may also occur.[2] The identification of human and animal *Campylobacter* isolates with fluoroquinolone resistance has led to restrictions on the use of some fluoroquinolones in poultry in the U.S.[8]

This report describes the epidemiology of confirmed and probable campylobacteriosis infections in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual 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 campylobacteriosis for earlier surveillance periods can be found in the *Epidemiologic Summary of Campylobacteriosis 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 campylobacteriosis to their local health department within one working day of identification or immediately by telephone if an outbreak is suspected.[12] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of *Campylobacter* infection to either the California Reportable Disease Information Exchange (CalREDIE) via electronic laboratory reporting or to 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 campylobacteriosis 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. During the surveillance period, CDC defined a confirmed case of campylobacteriosis as an infection in which *Campylobacter* was isolated from a clinical specimen, including asymptomatic and extraintestinal infections. From 2013 through 2014, a probable case was defined as a clinically compatible illness with an established epidemiologic link to a confirmed case. Beginning in 2015, a probable case was defined as an infection in which *Campylobacter* was detected in a clinical specimen using a culture-independent diagnostic test (CIDT), or one with clinically compatible illness and an established epidemiologic link to a probable or confirmed case.[14]

Epidemiology of Campylobacteriosis in California, 2013-2019

CDPH received reports of 61,310 total cases of campylobacteriosis with estimated symptom onset dates from 2013 through 2019. This corresponds to an average of 8,759 cases each year and an average annual incidence rate of 22.3 cases per 100,000 population. Incidence rates increased 25% during this surveillance period, from 20.0 per 100,000 (7,696 cases) in 2013 to 25.0 per 100,000 (10,001 cases) in 2019 [Figure 1].

County-specific average annual incidence rates per 100,000 population during 2013-2019 ranged from 0 to 50.7, with the highest rates in San Francisco County (50.7 per 100,000; 3,092 cases), Marin County (41.8 per 100,000; 765 cases), and Mendocino County (39.2 per 100,000; 243 cases) [Figure 2]. Of the 58 California counties, 56 (96.6%) had an average annual incidence rate that was above the national *Healthy People 2020* target rate for campylobacteriosis of 8.5 cases per 100,000 population.[4] Of note, Los Angeles County had the highest number of campylobacteriosis cases during the surveillance period with 12,845 (21.0%) cases, but its average annual incidence rate was 18.0 per 100,000 population, lower than the state average annual incidence rate.

From 2013 through 2019, the average annual incidence rate was higher among males (24.0 per 100,000; 32,911 cases) than among females (20.1 per 100,000; 27,796 cases); 54.2% of campylobacteriosis case-patients were male and 45.8% were female.

By age group, the average annual campylobacteriosis incidence rates during the surveillance period were highest among children aged 1 to 4 years (40.5 cases per 100,000; 5,601 cases) and children aged less than 1 year (38.0 cases per 100,000; 1,284 cases) [Figure 3].

For campylobacteriosis cases with complete race/ethnicity information (see *Technical Notes*), the highest percentage of cases was among those who reported non-Hispanic White race/ethnicity (53.0%), which was disproportionately higher than the percentage of the non-Hispanic White racial/ethnic population in California during the same time period (53.0% vs. 38.0%, respectively) [Figure 4].

By month, the highest number of cases occurred in June, July, and August, consistent with the summer seasonality of campylobacteriosis [Figure 5]. During 2013-2019, 32.9% (20,162) of all campylobacteriosis cases had estimated symptom onsets during June, July and August, an average of 6,721 cases each month. In comparison, an average of 4,572 cases occurred each month during September through May.

From 2013 through 2019, there were 15 foodborne outbreaks of campylobacteriosis involving 198 California case-patients. The outbreaks ranged in size from 3 to 61 case-patients (median 6 case-patients). Confirmed and suspected outbreak sources included unpasteurized milk, guacamole, oysters, chicken, and pork.[15]

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

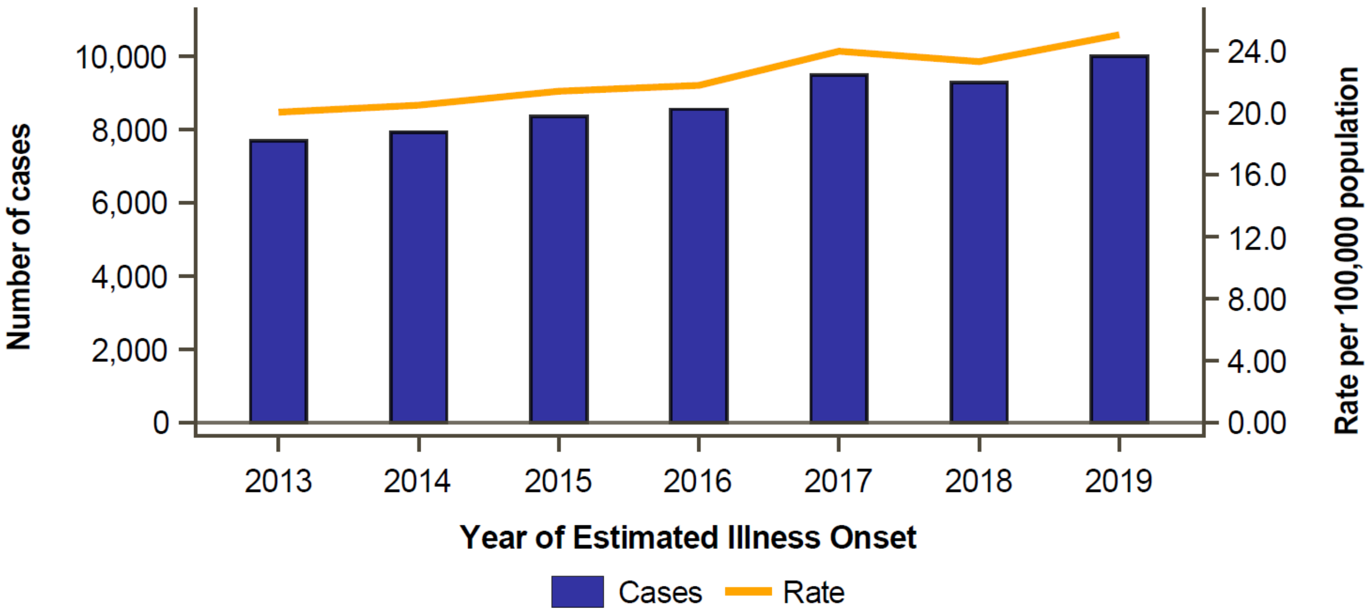


Figure 2. Campylobacteriosis Average Annual Incidence Rates by County, California, 2013-2019

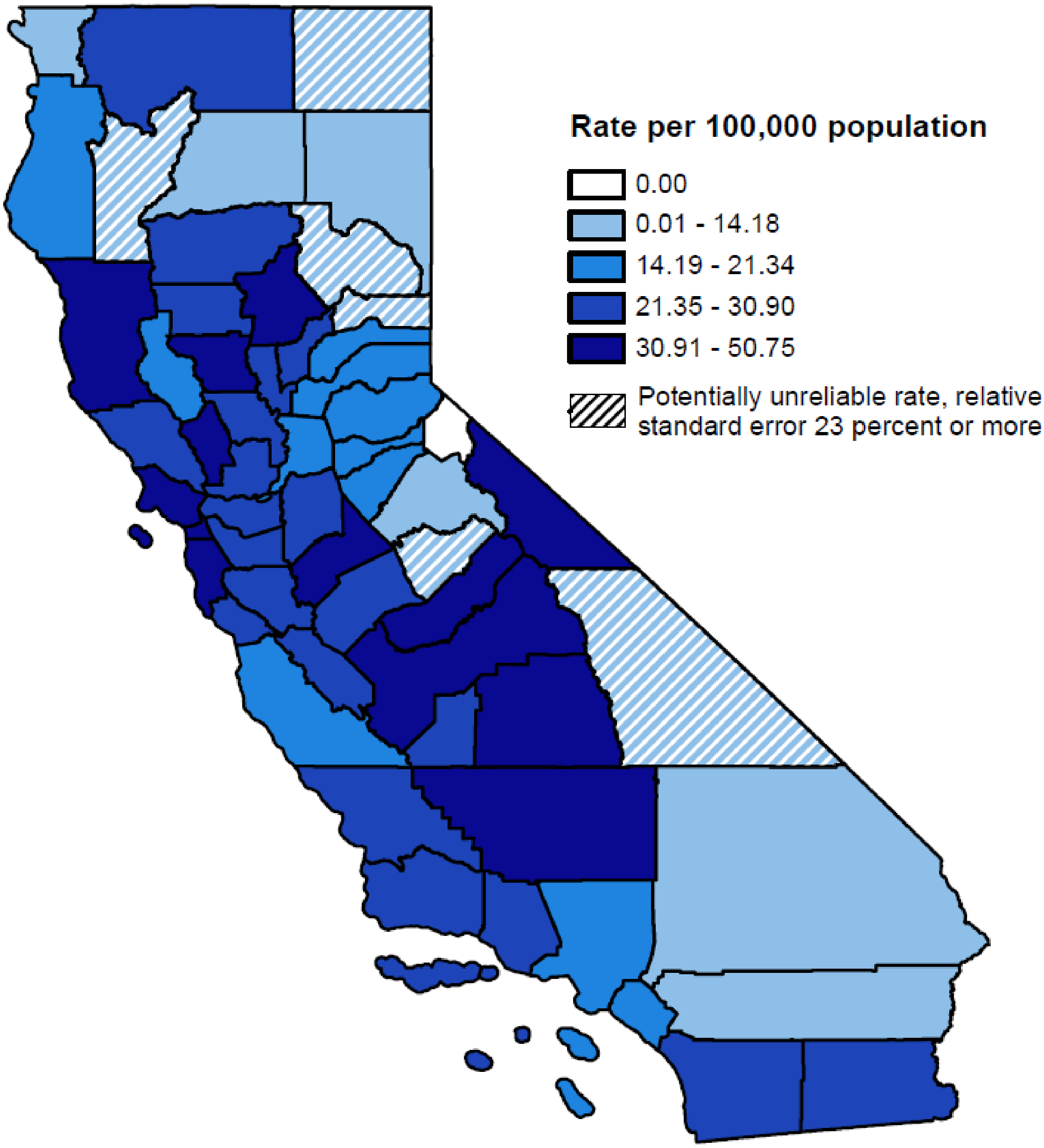


Figure 3. Campylobacteriosis Incidence Rates by Age Group and Year of Estimated Illness Onset, California, 2013-2019

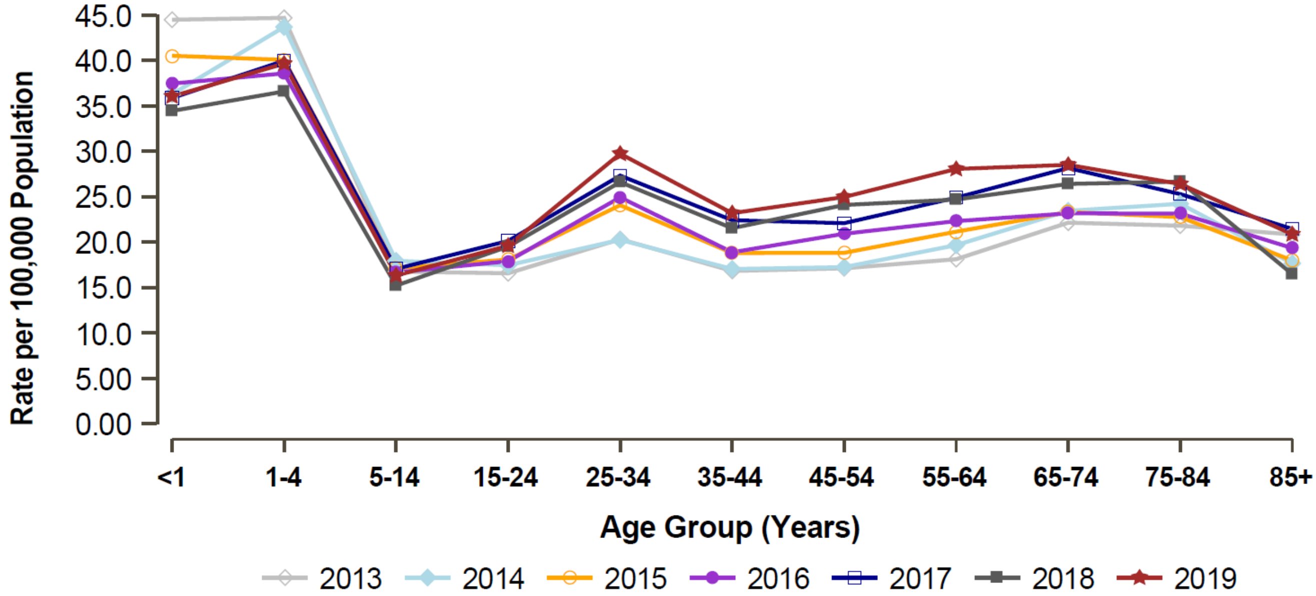
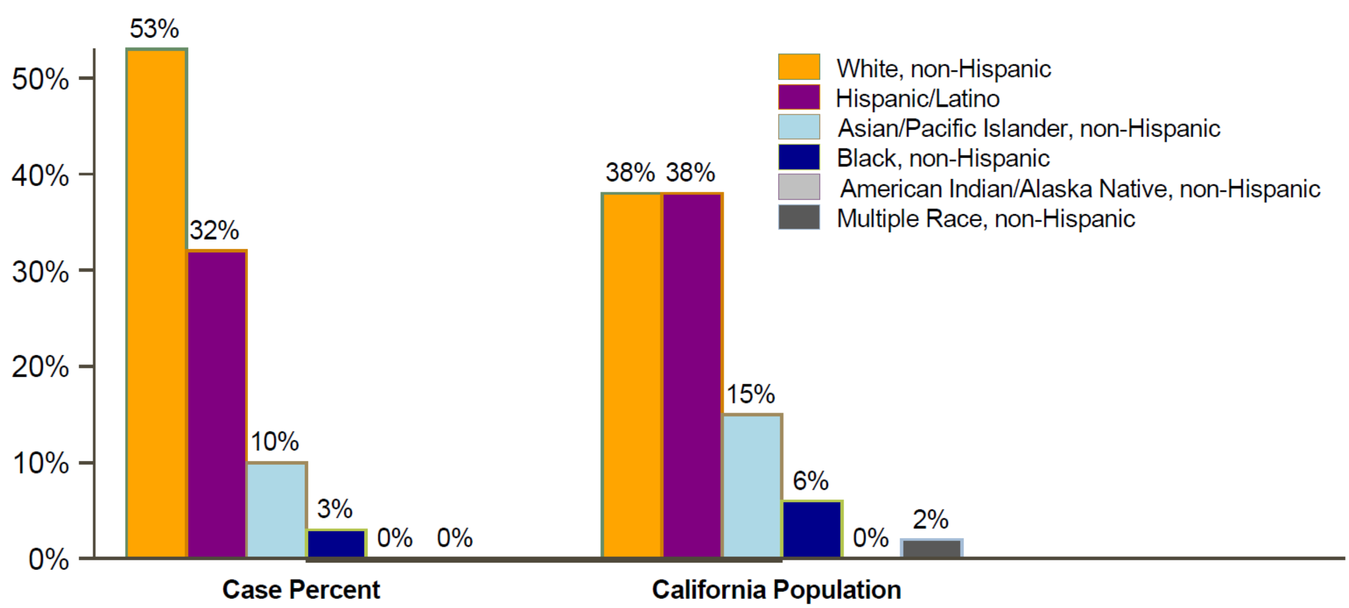
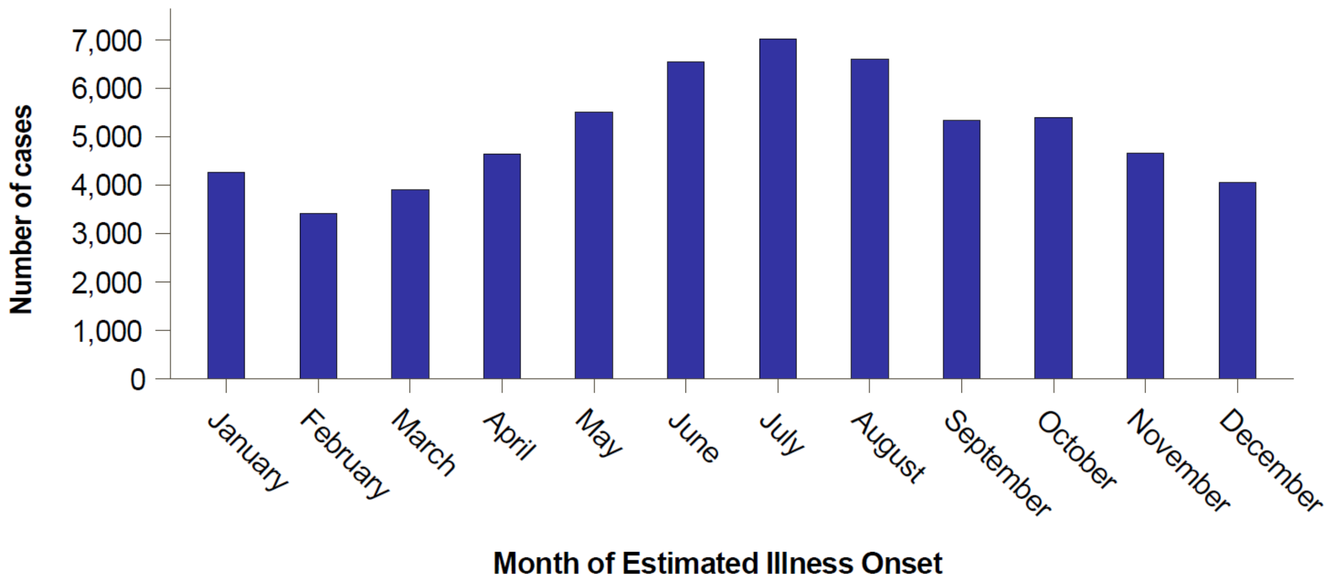


Figure 4. Campylobacteriosis Cases and Population by Race/Ethnicity, California, 2013-2019



40.4% (n=24747) of reported incidents of Campylobacteriosis did not identify race/ethnicity and 8% (n=4876) 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.

Figure 5. Campylobacteriosis Cases by Month of Estimated Illness Onset, California, 2013-2019



Comments

Campylobacteriosis incidence rates per 100,000 population in California increased by 25% during 2013-2019. This increase may be due to the increased use of CIDT and a more inclusive probable case definition. The average annual rate of 22.3 per 100,000 population during 2013-2019 was a continued increase compared to the average annual rate of 18.3 per 100,000 population during 2009-2012 and of 14.4 per 100,000 population during 2001-2008.[10, 11] However, the age group, sex, and regional epidemiologic profiles of incident cases during 2013-2019 were similar to those reported in epidemiologic summaries from earlier years.[10, 11]

During the 2013-2019 surveillance period, 96.6% of California counties had a campylobacteriosis incidence rate above the national *Healthy People 2020* target, compared to 82.8% of counties during the 2009-2012 surveillance period.[11] As it is estimated that only 1 of every 30 people who are infected with *Campylobacter* bacteria seek medical care and are diagnosed with campylobacteriosis, the true infection rates are likely to be much higher.[1]

Most campylobacteriosis cases are thought to be the result of direct or indirect foodborne exposure to contaminated poultry. To address this issue, the U.S. Department of Agriculture implemented the performance standard for detection of *Campylobacter* in poultry in 2011 by setting a maximum limit on the percentage of samples that test positive at slaughterhouses.[16] Additional measures were implemented in 2016 to further reduce *Campylobacter* contamination rates in poultry products at processing plants.[17] These efforts are expected to reduce but not eradicate the presence of *Campylobacter* in poultry products. Thus, consumers, including retail and food service establishments, must be educated in safe food handling and preparation methods to further reduce risk. Decreasing the contamination of poultry meat and dairy products, as well as consumer education on safe food handling and avoiding undercooked poultry and unpasteurized milk, may provide the best opportunities for preventing and controlling campylobacteriosis.

To prevent campylobacteriosis, persons should avoid consuming raw or undercooked poultry and unpasteurized milk. Food safety guidelines should be strictly followed when preparing food, especially by keeping raw poultry separate from ready-to-eat foods and by thoroughly cooking food. To prevent the spread of *Campylobacter,* persons should always wash their hands with soap and water before preparing food, immediately after handling raw poultry or meat, and after touching animals (including farm animals, chickens, and turkeys) or being in animal environments.

Prepared by Inderbir Sohi, Yanyi Djamba, Vi Peralta, Akiko Kimura, Jeff Higa, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, July 2021

References

[1] Scallan E, Hoekstra RM, Anquio FJ et al. Foodborne illness acquired in the United States—major pathogens. Emerg Infect Dis 2011;17:7- 15.

[2] *Campylobacter* (Campylobacteriosis) Information for Health Professionals. U.S. Centers for Disease Control and Prevention website. Updated December 23, 2019. Accessed April 21, 2020. https://www.cdc.gov/campylobacter/technical.html

[3] National Notifiable Diseases Surveillance System. *2016-2018 Annual Tables of Infectious Disease Data.* Atlanta, GA: U.S. Centers for Disease Control and Prevention, Division of Health Informatics and Surveillance; 2019. Accessed November 8, 2020. https://wwwn.cdc.gov/nndss/data-and-statistics.html

[4] *Healthy People 2020* Food Safety Objectives. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion website. Updated October 8, 2020. Accessed October 18, 2020. https://www.healthypeople.gov/2020/topics-objectives/topic/food-safety/objectives

[5] Food Safety, Raw Milk Questions and Answers. U.S. Centers for Disease Control and Prevention website. Updated June 15, 2017. Accessed May 10, 2021. https://www.cdc.gov/foodsafety/rawmilk/raw-milk-questions-and-answers.html

[6] Multistate Outbreak of Multidrug-Resistant *Campylobacter* Infections Linked to Contact with Pet Store Puppies. U.S. Centers for Disease Control and Prevention website. Updated January 30, 2018. Accessed April 23, 2021. https://www.cdc.gov/campylobacter/outbreaks/puppies-9-17/index.html

[7] Outbreak of Multidrug-resistant *Campylobacter* Infections Linked to Contact with Pet Store Puppies. U.S. Centers for Disease Control and Prevention website. Updated April 15, 2021. Accessed April 23, 2021. https://www.cdc.gov/campylobacter/outbreaks/puppies-12-19/index.html

[8] *Campylobacter* (Campylobacteriosis) Antibiotic Resistance. U.S. Centers for Disease Control and Prevention website. Updated December 23, 2019. Accessed April 23, 2021. https://www.cdc.gov/campylobacter/campy-antibiotic-resistance.html

[9] State of California, Department of Public Health. Technical Notes. In: *Epidemiologic Summaries of Selected Communicable Diseases in California, 2013-2019.* 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. Campylobacteriosis. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008.* Sacramento, CA; 2009. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[11] State of California, Department of Public Health. Campylobacteriosis. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012.* Sacramento, CA; 2015. Accessed October 18, 2020. 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

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

[14] Campylobacteriosis (*Campylobacter* spp.) 2015 Case Definition. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed July 13, 2021. https://ndc.services.cdc.gov/case-definitions/campylobacteriosis-2015/

[15] National Outbreak Reporting System (NORS). U.S. Centers for Disease Control and Prevention website. Updated November 4, 2019. Data extracted on May 4, 2021. https://www.cdc.gov/nors/index.html

[16] U.S. Department of Agriculture, Food Safety and Inspection Service. New Performance Standards for Salmonella and Campylobacter in Young Chicken and Turkey Slaughter Establishments: Response to Comments and Announcement of Implementation Schedule. 76 FR 15282. Office of Federal Register, National Archives and Records Administration. Published March 21, 2011. Accessed April 23, 2021. https://www.govinfo.gov/content/pkg/FR-2011-03-21/pdf/2011-6585.pdf

[17] U.S. Department of Agriculture, Food Safety and Inspection Service. New Performance Standards for Salmonella and Campylobacter in Not-Ready-to-Eat Comminuted Chicken and Turkey Products and Raw Chicken Parts and Changes to Related Agency Verification Procedures: Response to Comments and Announcement of Implementation Schedule. 81 FR 7285. Office of Federal Register, National Archives and Records Administration. Published February 11, 2016. Accessed April 23, 2021. https://www.govinfo.gov/content/pkg/FR-2016-02-11/pdf/2016-02586.pdf

Key Findings

Chikungunya is an infectious disease caused by a virus that spreads from the bite of an infected mosquito. The mosquitoes that can spread the chikungunya virus, *Aedes aegypti* and *Aedes albopictus*, have invaded many areas of California. At this time, *Aedes* mosquitoes in California are not known to be infected with chikungunya, and locally acquired cases of chikungunya have not been reported. So far in California, cases of chikungunya have been reported only in people who were infected while traveling outside of California. Chikungunya occurs in many tropical and subtropical areas of the world, including Africa, Asia, and Central and South America.

Chikungunya in California from 2017 through 2019

Total Cases: A total of 98 chikungunya cases were reported from 2017 through 2019. Required reporting for this disease began in mid-2016.

Rate: The average annual rate of new chikungunya cases during 2017-2019 was less than 1 case per 100,000 people in California.

- **By County**: There were 7 California counties that reported at least 1 case of chikungunya each year during 2017-2019, with an average rate of less than 1 case per 100,000 people.
- **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 45 to 64 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 (62%) was in people who reported non-Hispanic Asian/Pacific Islander race/ethnicity.

To help prevent chikungunya, people who travel to areas where chikungunya occurs should take steps to prevent mosquito bites by using mosquito repellent on clothes and exposed skin, sleeping under a mosquito bed net, and keeping mosquitoes out of living spaces by using window and door screens. After returning from an area where chikungunya occurs, people should continue to use mosquito repellent for three weeks to prevent spreading chikungunya to mosquitoes around their home.

For more information about chikungunya in California, please visit the CDPH Chikungunya webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Chikungunya is a viral infection that is primarily transmitted through bites from infected mosquitoes, specifically *Aedes aegypti* and *Aedes albopictus*. Mosquitoes become infected when they feed on a person who is already infected with the virus.[1] Chikungunya can also spread via blood-borne transmission. The highest risk of virus transmission to a mosquito or through blood to another individual occurs when a patient is viremic during their first week of illness. In utero transmission is rare but has been documented.[2]

The incubation period for chikungunya is usually 3-7 days, and the most commonly reported symptoms include acute onset of fever and severe pain in multiple joints. Other symptoms may include headache, muscle pain, joint swelling, fatigue, nausea, vomiting, diarrhea, or rash. Acute symptoms will usually resolve within 7-10 days. People at risk for severe disease include newborns exposed at birth, adults 65 years and older, and persons with underlying medical conditions.[3] There is no vaccine or antiviral therapy for chikungunya, and treatment typically includes rest, fluids, and the use of non-steroidal anti-inflammatory drugs to relieve symptoms.[4] Mortality from chikungunya is rare and occurs mostly in older individuals.[3] Chikungunya virus infection is similar to dengue virus infection in that both viruses are transmitted by the same mosquitoes and the infections have similar clinical features. As co-infection is possible in the same patient, it is important to rule out dengue virus infection because proper clinical management of dengue can improve outcome.[2]

Globally, chikungunya cases and infections have been identified in tropical and subtropical regions of Africa, Asia, Europe, and the Indian and Pacific Oceans. Since 2013, local transmission of chikungunya has been reported in the Americas, including in Caribbean countries and territories, as well as in the United States and U.S. territories, including Florida, Texas, and Puerto Rico.[5] In California, chikungunya infections have been reported only in people who were infected while traveling outside of California.[6]

This report describes the epidemiology of confirmed and probable chikungunya cases in California from 2017 (the first year case data were available for the full year) through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes.*[7]

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 chikungunya to their local health department within one working day of identification by electronic transmission, fax, or telephone if an outbreak is suspected.[8] Per CCR, Title 17, Section 2505 laboratories are required to report laboratory testing results suggestive of chikungunya virus 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.[9]

California regulations require cases of chikungunya to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed or probable case for neuroinvasive and non-neuroinvasive arboviral diseases, which includes chikungunya.

During the surveillance period (2017-2019), a confirmed case of chikungunya was defined as a clinically compatible case with confirmatory laboratory results. Clinically compatible illness included one or more of the following for neuroinvasive disease: meningitis, encephalitis, acute flaccid paralysis, or other acute signs of central or peripheral neurologic dysfunction, and absence of a more likely clinical explanation. For non-neuroinvasive disease, clinically compatible illness included fever or chills, and both the absence of neuroinvasive disease and the absence of a more likely clinical explanation. Other clinically compatible symptoms for both neuroinvasive and non-neuroinvasive disease can include headache, myalgia, rash, arthralgia, vertigo, vomiting, paresis and/or nuchal rigidity. Confirmatory laboratory criteria included: (i) isolation of chikungunya virus from, or demonstration of specific arboviral or genomic sequences in, tissue, blood, cerebrospinal fluid (CSF), or other body fluid by polymerase chain reaction (PCR) test, immunofluorescence, or immunohistochemistry, or (ii) demonstration of a > 4-fold rise in quantitative antibody titers to chikungunya virus antigens in paired acute and convalescent serum samples, or (iii) Immunoglobulin M (IgM) antibodies in serum with confirmatory demonstration of a > 4-fold rise in PRNT (plaque reduction neutralization test) end point titer between chikungunya virus and other arboviruses tested in a convalescent serum sample, or (iv, for neuroinvasive disease) virus-specific IgM antibodies in CSF and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred. A probable case of chikungunya was defined as a clinically compatible case with virus-specific IgM antibodies in serum or CSF, in the absence of other testing and a more likely explanation. Probable laboratory criteria included a positive chikungunya-specific enzyme-linked immunosorbent assay (ELISA) or immunofluorescence assay (IFA) for IgM on a single acute or convalescent phase serum specimen.[10]

Epidemiology of Chikungunya in California, 2017-2019

CDPH received reports of 98 total cases of chikungunya with estimated symptom onset dates from 2017 through 2019. The overall average annual incidence of chikungunya was 0.1 per 100,000 population [Figure 1].

To date, no locally acquired cases of chikungunya have been reported in California. Of the 82 case-patients with a reported travel destination during the surveillance period, 56 (68.3%) reported travel to Asia, 9 (11.0%) reported travel to parts of North America (Mexico and U.S.), 5 (6.1%) reported travel to Central America, 5 (6.1%) reported travel to South America, and 7 (8.5%) reported travel to other parts of the world.

Statewide from 2017 through 2019, only seven counties reported at least one case for each year of the surveillance period: Alameda, Contra Costa, Los Angeles, Sacramento, San Diego, San Mateo, and Santa Clara counties. Cases from these 7 counties made up 81.6% of the total chikungunya cases reported. Among these 7 counties, the average annual incidence rate of the 3 years was highest in Santa Clara County (0.4 per 100,000; 24 cases), Alameda County (0.2 per 100,000; 12 cases), and Contra Costa County (0.2 per 100,000; 6 cases) [Figure 2].

The average annual incidence rate by sex was 0.1 per 100,000 population for both males and females during the surveillance period. Of the 98 total cases, 57 (58.2%) were among females and 41 (41.8%) were among males.

By age group, the average annual incidence rates were highest among adults aged 45-54 years (0.1 per 100,000; 26 cases) and 55-64 years (0.1 per 100,000; 18 cases). The average annual incidence rate was lowest among children aged 5-14 years (0.01 per 100,000; 2 cases).

For the 71 (72.4%) cases with complete race/ethnicity data, the highest percentage of cases was among those who reported non-Hispanic Asian/Pacific Islander race/ethnicity (62.0%). The percentage of cases among those who reported non-Hispanic Asian/Pacific Islander race/ethnicity was disproportionally higher than the percentage of the non-Hispanic Asian/Pacific Islander racial/ethnic population in California during the same time period (62.0% vs. 15.3%, respectively) [Figure 3].

Figure 1. Chikungunya Cases and Incidence Rates by Year of Estimated Illness Onset, California, 2017-2019

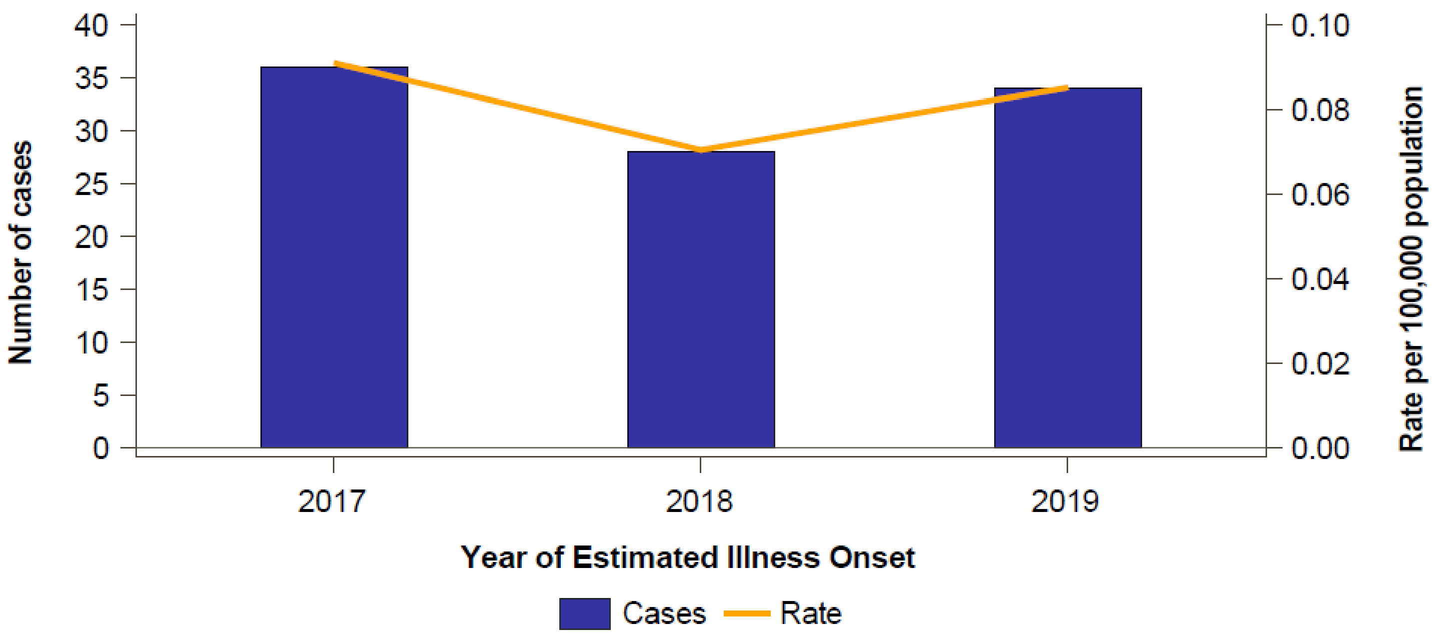


Figure 2. Chikungunya Average Annual Incidence Rates by County, California, 2017-2019

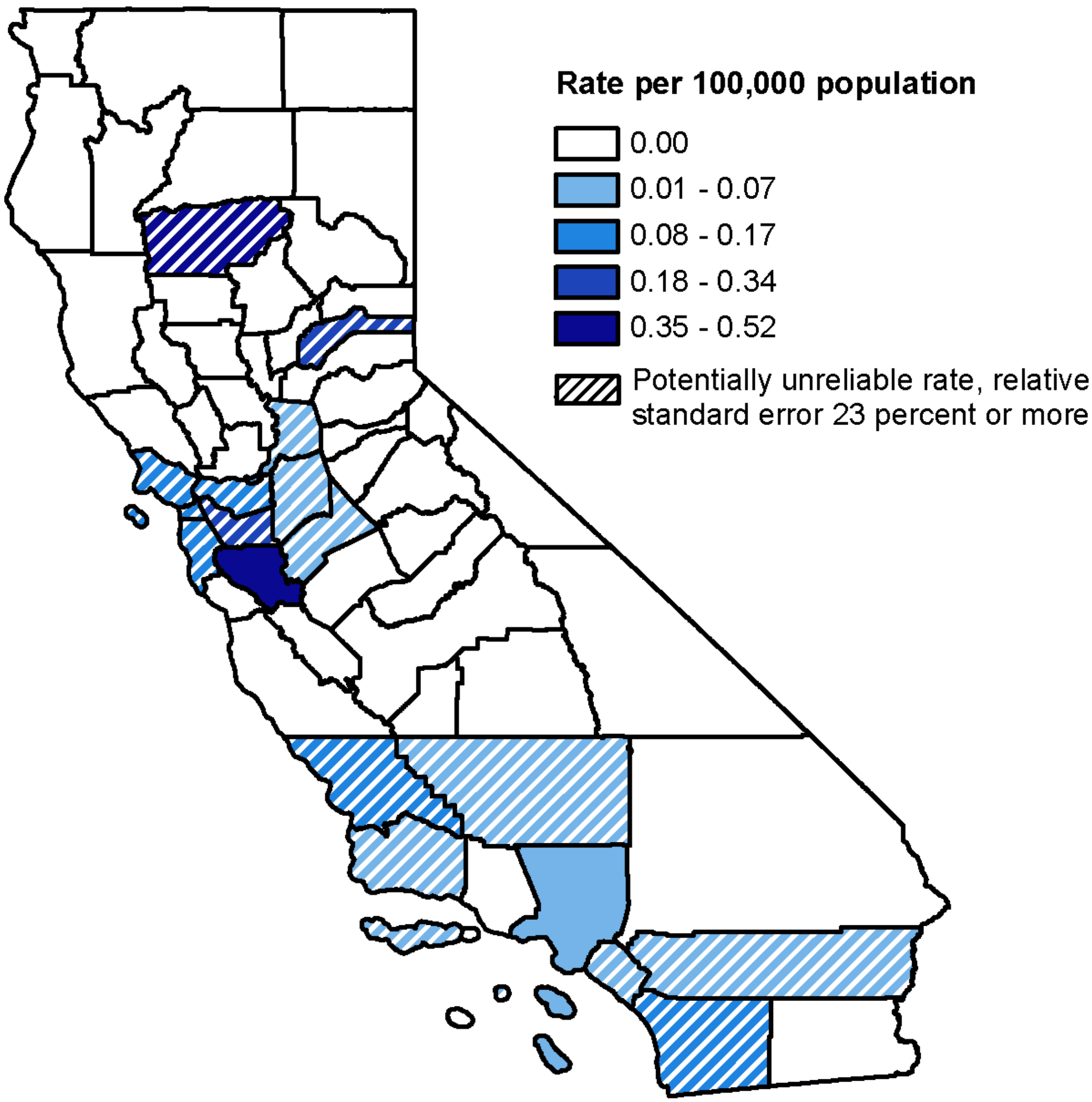
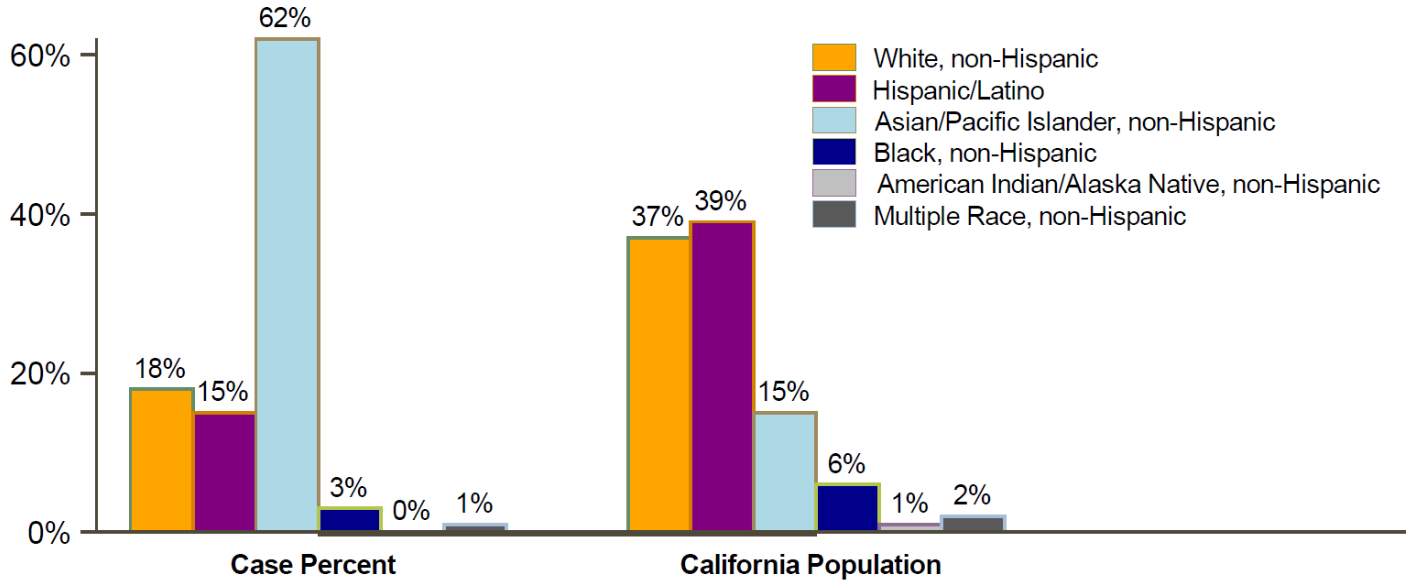


Figure 3. Chikungunya Cases and Population by Race/Ethnicity, California, 2017-2019



26.5% (n=26) of reported incidents of Chikungunya Virus Infection did not identify race/ethnicity and 1% (n=1) 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

Required reporting of chikungunya virus infection began on June 1, 2016. Therefore, this epidemiologic summary only covers the period of 2017 through 2019 for which case data were available for the full year. Descriptions of chikungunya cases in California in 2016 can be found in the CDPH *Vector-Borne Disease Section Annual Report, 2016.*[11]

To prevent chikungunya, persons who travel to areas where chikungunya occurs should take precautions to prevent mosquito bites by using mosquito repellent on clothes and exposed skin, sleeping under a mosquito bed net, and keeping mosquitoes out of living spaces by using window and door screens. After returning from an area where chikungunya occurs, persons should continue to use mosquito repellent for three weeks to prevent spreading chikungunya to mosquitoes around their home.

Prepared by Inderbir Sohi, Yanyi Djamba, Charsey Porse, Vicki Kramer, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, March 2022

References

[1] Chikungunya Virus Transmission. U.S. Centers for Disease Control and Prevention website. Updated December 17, 2018. Accessed November 24, 2020. https://www.cdc.gov/chikungunya/transmission/index.html

[2] Chikungunya Virus Clinical Evaluation & Disease. U.S. Centers for Disease Control and Prevention website. Updated January 13, 2022. Accessed March 15, 2022.

https://www.cdc.gov/chikungunya/hc/clinicalevaluation.html

[3] State of California, Department of Public Health. Appendix D: Chikungunya surveillance case definition, reporting, and laboratory testing. In: *Guidance for Surveillance of and Response to Invasive Aedes Mosquitoes and Dengue, Chikungunya, and Zika in California.* Sacramento, CA; 2021. Accessed March 15, 2022. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/InvasiveAedesSurveillanceandResponseinCA.pdf

[4] Chikungunya Virus Treatment & Prevention. U.S. Centers for Disease Control and Prevention website. Updated January 21, 2022. Accessed March 15, 2022. https://www.cdc.gov/chikungunya/hc/treatment-prevention.html

[5] Chikungunya Virus Geographic Distribution. U.S. Centers for Disease Control and Prevention website. Updated November 6, 2020. Accessed November 24, 2020. https://www.cdc.gov/chikungunya/geo/index.html

[6] Chikungunya. California Department of Public Health website. Updated October 9, 2020. Accessed November 24, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Chikungunya.aspx

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

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

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

[10] Arboviral Diseases, Neuroinvasive and Non-neuroinvasive 2015 Case Definition. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed March 15, 2022. https://ndc.services.cdc.gov/case-definitions/arboviral-diseases-neuroinvasive-and-non-neuroinvasive-2015/

[11] Feiszli T, Wong J, Porse C and Metzger, M. Chapter 4: Mosquito-borne diseases. In: *Vector-Borne Disease Section Annual Report, 2016*. California Department of Public Health, Sacramento, California, 2017. pp 14-21. Accessed March 15, 2022. https://westnile.ca.gov/pdfs/VBDSAnnualReport16.pdf

Key Findings

Creutzfeldt-Jakob disease (CJD) is a rare disease of the brain and nervous system in humans. CJD is part of a group of diseases called prion diseases. In these diseases, prions (proteins that are naturally found in the body) change shape, build up in the brain, and destroy brain and nerve tissue, causing nervous system disorders. These disorders include rapid onset dementia, personality changes, memory problems, impaired vision, difficulty walking, moving, and speaking, all of which get worse over time and ultimately lead to death. There are different types of CJD based on the way the disease is caused.

Creutzfeldt-Jakob Disease in California from 2013 through 2019

Total Cases: There were a total of 221 new CJD cases from 2013 through 2019, with 25 to 36 cases reported per year. Of these cases, 172 (78%) were reported to have died with CJD.

- **By County**: Cases of CJD were reported from 30 counties in California. About 1 out every 3 cases was reported in Los Angeles County (40 cases) and San Diego County (37 cases).
- **By Sex**: The number of CJD cases in males (112 cases) was similar to the number in females (108 cases).
- **By Age Group**: More cases of CJD were reported in people aged 65 to 74 years (82 cases) and 55 to 64 years (66 cases) than in other age groups.
- **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 68%).

CJD is a complicated and difficult disease to diagnose. A confirmed diagnosis of CJD can only be made by examining brain tissue during an autopsy. There is no cure for CJD, and treatment is used only to help manage symptoms or make the patient more comfortable. No specific therapy has been shown to stop the symptoms of CJD from getting worse over time.

For more information about CJD, please visit the U.S. Centers for Disease Control and Prevention CJD website. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Transmissible spongiform encephalopathies (TSE) are a group of fatal, rare, progressive neurological disorders that occur in humans and animals. TSE are also referred to as prion diseases.[1] Prions are proteins that occur naturally in the body but have a higher concentration in the brain and nerve tissue. The most common TSE affecting humans is Creutzfeldt-Jakob disease (CJD). Disease occurs when a normal prion in the brain changes shape, causing other normal prions nearby to change. These abnormal prions build up, causing brain and nerve tissue destruction and damage. This leads to progressive dementia, neuromuscular disorders, and death.

CJD is classified into four subtypes: sporadic (also known as classic CJD), familial, iatrogenic, and variant.[2] All forms of CJD are characterized by neurological and psychiatric problems that become progressively worse. However, the different CJD subtypes have distinguishing features including: the age distribution of affected patients, duration of illness, clinical presentation, and the pathology of brain tissue. Sporadic CJD (sCJD) is the most common form of CJD. It is unknown what causes the spontaneous change of normal prions to abnormal prions leading to disease. It typically affects people aged 60 years or older. Once symptoms appear, sCJD progresses very quickly and is usually fatal within a few months of symptom onset. Familial CJD (fCJD) is an inherited condition and accounts for 10-15% of all cases. Symptoms are similar to those of sCJD. Often fCJD is diagnosed at an earlier age, around 50 years, and the course of illness is generally longer than sCJD. Iatrogenic CJD (iCJD) is the inadvertent transmission of CJD through medical or surgical procedures. The signs and symptoms of iCJD often look like sporadic CJD. The age at onset depends on the age at exposure and route of exposure. Variant CJD (vCJD) is believed to occur primarily through the consumption of beef infected with Bovine Spongiform Encephalopathy (BSE), commonly known as “Mad Cow Disease”. Initial symptoms of vCJD are typically characterized as psychiatric or behavioral changes, and painful sensory symptoms. For patients with vCJD, age of onset is usually less than 55 years of age, and the duration of illness is greater than one year.[2]

vCJD is the name of the disease in humans that have acquired it through eating beef that had BSE. Mad Cow Disease is the name of the prion disease that occurs in cattle. sCJD is the most common type of CJD and is not the same as vCJD or Mad Cow Disease.

There is no evidence of person-to-person transmission of CJD. In very rare circumstances CJD has been acquired iatrogenically. Documented transmission has been linked to the use of contaminated growth hormone prepared from human pituitary glands, dura mater, corneal grafts, and contaminated neurosurgical instruments.[3]

Symptoms of CJD can be similar to other rapid onset neurological disorders. There is currently no single diagnostic test for CJD. When a physician suspects CJD, the first concern is to rule out treatable forms of dementia. Physicians suspect CJD on the basis of the typical signs and symptoms and progression of the disease. CJD causes unique changes in brain tissue; the only way to confirm a diagnosis of CJD is by brain autopsy.[4]

This report describes the epidemiology of confirmed and probable CJD cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes.*[5]

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 CJD to their local health department within seven calendar days of identification.[6]

California regulations require cases of CJD to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention diagnostic criteria of a confirmed and probable case. During the surveillance period (2013-2019), a confirmed case of classic or sporadic CJD was defined as a case meeting at least one of the following criteria: diagnosed by standard neuropathological techniques; and/or immunocytochemically; and/or Western blot confirmed protease-resistant PrP; and/or presence of scrapie-associated fibrils. A probable case was defined as a case with one of the following scenarios: (1) neuropsychiatric disorder and positive RT-QuIC in CSF or other tissues, or (2) rapidly progressive dementia and at least two out of the following four clinical features:

- Myoclonus
- Visual or cerebellar signs
- Pyramidal/extrapyramidal signs
- Akinetic mutism

AND a positive result on at least one of the following laboratory tests:

- Typical EEG (periodic sharp wave complexes) during an illness of any duration
- Positive 14-3-3 CSF assay in patients with a disease duration of less than 2 years
- High signal in caudate/putamen on magnetic resonance imaging (MRI) brain scan or at least two cortical regions (temporal, parietal, occipital) either on diffusion-weighted imaging (DWI) or fluid attenuated inversion recovery (FLAIR)

AND without routine investigations indicating an alternative diagnosis.

A case of iatrogenic CJD was defined as progressive cerebellar syndrome in a recipient of human cadaveric-derived pituitary hormone; or sporadic CJD with a recognized exposure risk, e.g., antecedent neurosurgery with dura mater implantation.

A case of familial CJD was defined as definite or probable CJD plus definite or probable CJD in a first degree relative; and/or neuropsychiatric disorder plus disease-specific PrP gene mutation.[7]

A confirmed case of variant CJD was defined as a case with confirmation by brain biopsy or autopsy; confirmatory features include:

- Numerous widespread kuru-type amyloid plaques surrounded by vacuoles in both the cerebellum and cerebrum – florid plaques.
- Spongiform change and extensive prion protein deposition shown by immunohistochemistry throughout the cerebellum and cerebrum.

A probable case of variant CJD was defined as:

- Age < 55 years at presentation/death
- Psychiatric symptoms at onset and/or persistent painful sensory symptoms
- Dementia, and development ≥ 4 months after illness onset of at least two of the following five neurologic signs: poor coordination, myoclonus, chorea, hyperreflexia, or visual signs (If persistent painful sensory symptoms exist, ≥ 4 months delay in the development of the neurologic signs is not required)
- A normal or an abnormal EEG, but not characteristic of classic or sporadic CJD
- Duration of illness > 6 months
- Routine investigations of the patient do not suggest an alternative, non-CJD diagnosis
- No history of receipt of cadaveric human pituitary growth hormone or a dura mater graft
- No history of CJD in a first degree relative or prion protein gene mutation in the patient
- Bilateral pulvinar sign on MRI in the presence of above criteria
- History of residence or travel to a BSE-affected country after 1980 increases the index of suspicion.[8]

Epidemiology of Creutzfeldt-Jakob Disease in California, 2013-2019

CDPH received reports of 221 total cases of CJD with estimated symptom onset dates from 2013 through 2019. The highest number of cases was reported in 2017 (36 cases) and the fewest number was reported in 2015 (25 cases). CJD case counts remained relatively stable throughout the surveillance period [Figure 1]. During the surveillance period, 172 (77.8%) case-patients were reported to have died with CJD.

Statewide from 2013 through 2019, cases of CJD were reported from 30 counties in California, and 5 counties reported at least 1 case of CJD for each year of the surveillance period: Los Angeles, Orange, San Bernardino, San Diego, and Santa Clara. Of all CJD cases in California, 34.8% occurred in two counties: Los Angeles County (40 cases) and San Diego County (37 cases) [Figure 2].

From 2013 through 2019, the number of cases among males (112 cases) was similar to the number of cases among females (108 cases); 50.9% of CJD case-patients were male and 49.1% were female.

By age group, case-patients were aged 25 to 34 years (1 case), 35 to 44 years (4), 45 to 54 years (21), 55 to 64 years (66), 65 to 74 (82), 75 and 85 years (38 years), and 85 years and older (9). No cases of CJD were reported in those aged less than 25 years.

For CJD cases with complete race/ethnicity data (see *Technical Notes*), cases reported non-Hispanic White race/ethnicity more frequently than would be expected compared to the percentage of this population in California during the same time period (67.8% vs. 38.0%, respectively) [Figure 3].

Figure 1. Creutzfeldt-Jakob Disease Incidence Rates by Year of Estimated Illness Onset, California, 2013-2019

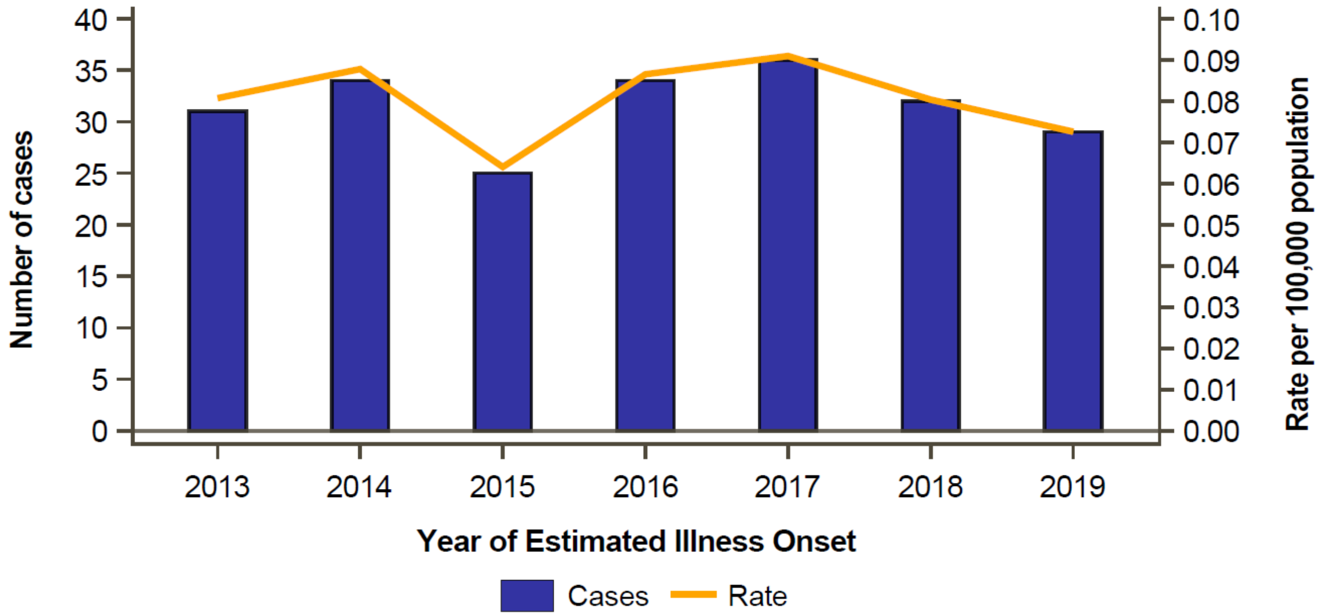


Figure 2. Creutzfeldt-Jakob Disease Total Case Count by County, California, 2013-2019

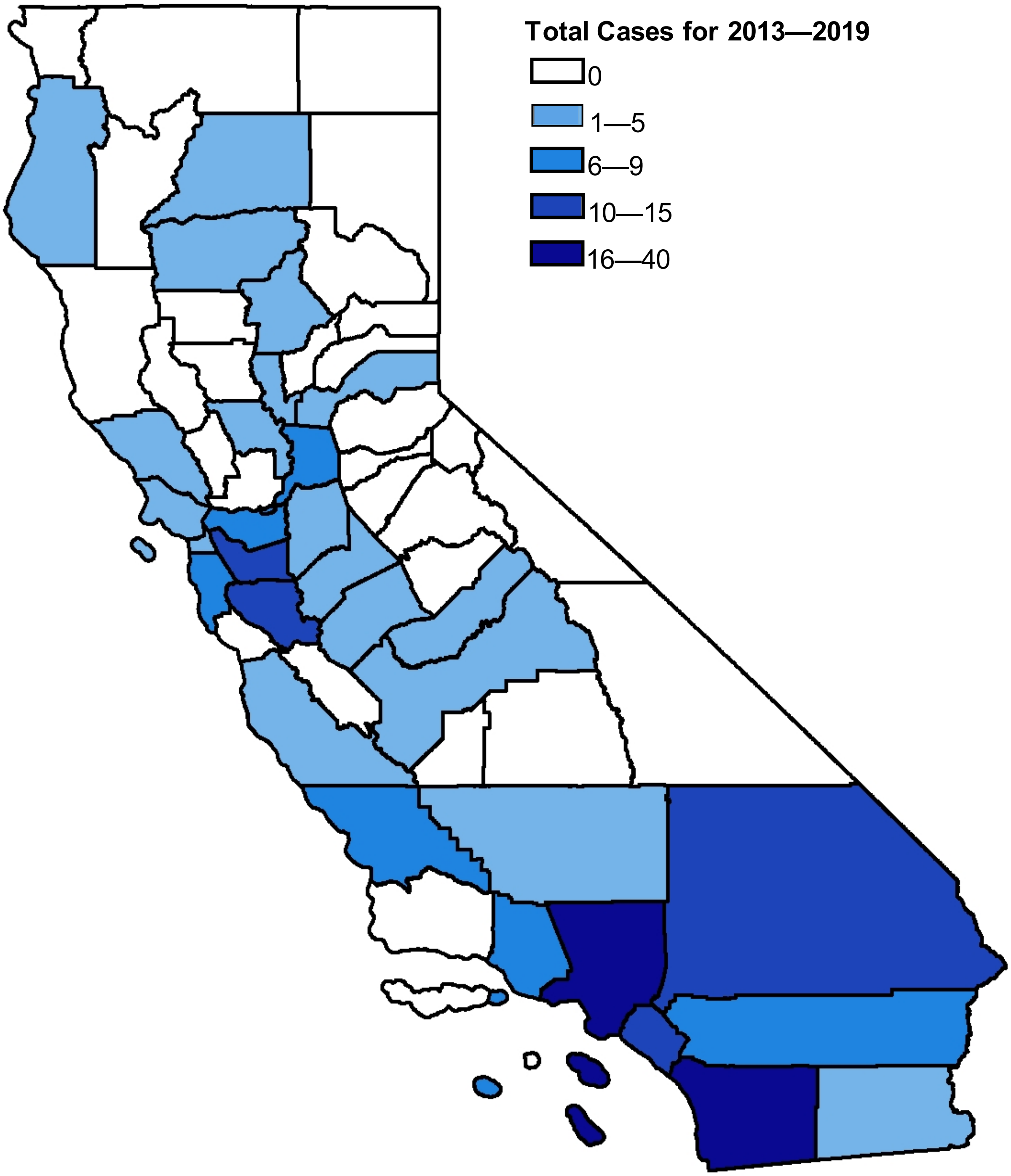
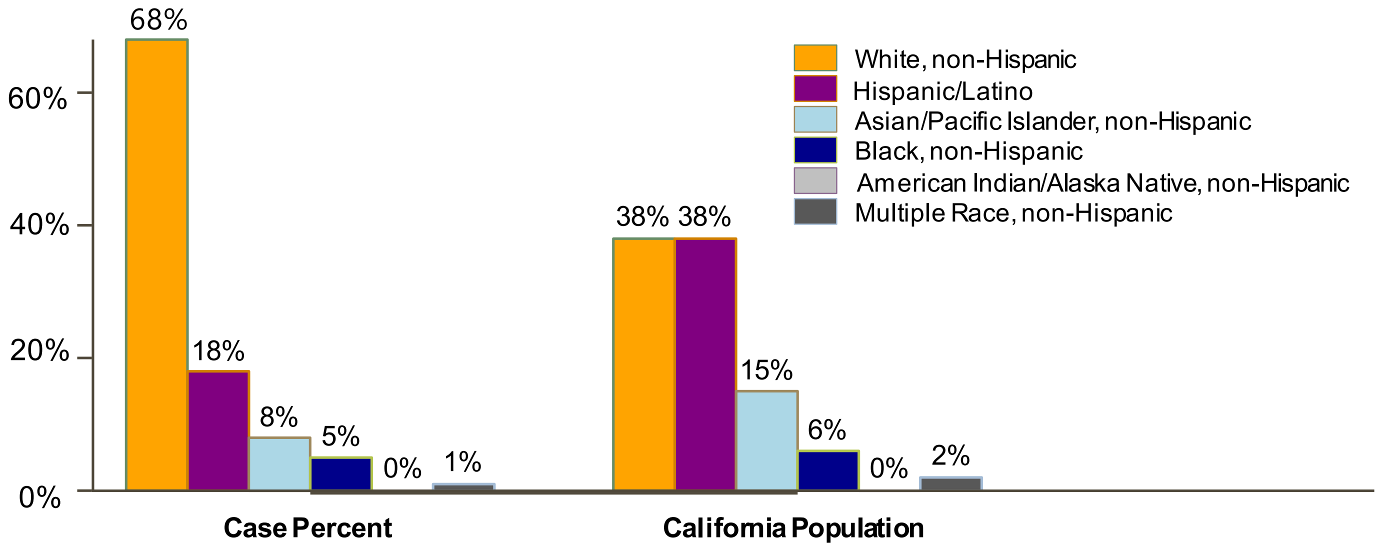


Figure 3. Creutzfeldt-Jakob Disease Cases and Population by Race/Ethnicity, California, 2013-2019



21.3% (n=47) of reported incidents of Creutzfeldt-Jakob Disease did not identify race/ethnicity and 1.4% (n=3) 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

CJD is a complicated and difficult disease to diagnose. A confirmed diagnosis of CJD can only be made by examination of brain tissue on autopsy. There is no cure for CJD; treatment is aimed at alleviating symptoms. No specific therapy has been shown to stop disease progression. As such, CJD is always fatal. From 2013 through 2019 in California, 77.8% of case-patients (172 cases) were reported to have died with CJD.

Prepared by Alyssa Nguyen, Yanyi Djamba, Susan Brooks, Alexander Yu, Allyx Nicolici, and Duc Vugia – Infectious Diseases Branch, December 2021

References

[1] Prion Diseases. U.S. Centers for Disease Control and Prevention website. Updated November 17,2021. Accessed December 8, 2021. https://www.cdc.gov/prions/index.html

[2] Creutzfeldt-Jakob Disease (CJD) Background Information. California Emerging Infections Program website. Accessed December 16, 2020. http://ceip.us/projects/cjd/background-information/

[3] Creutzfeldt-Jakob Disease, Classic (CJD). Infection Control. U.S. Centers for Disease Control and Prevention website. Updated November 17, 2021. Access December 8, 2021. https://www.cdc.gov/prions/cjd/infection-control.html

[4] Creutzfeldt-Jakob Disease, Classic (CJD). About CJD. U.S. Centers for Disease Control and Prevention website. Updated October 18, 2021. Accessed December 8, 2021. https://www.cdc.gov/prions/cjd/about.html

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

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

[7] Creutzfeldt-Jakob Disease, Classic (CJD). Diagnostic Criteria. U.S. Centers for Disease Control and Prevention website. Updated January 24, 2019. Accessed December 16, 2020. https://www.cdc.gov/prions/cjd/diagnostic-criteria.html

[8] Variant Creutzfeldt-Jakob Disease (vCJD). Diagnostic Criteria. U.S. Centers for Disease Control and Prevention website. Updated October 18, 2021. Accessed December 14, 2021. https://www.cdc.gov/prions/vcjd/diagnostic-criteria.html

Key Findings

Cryptosporidiosis is an infectious disease caused by *Cryptosporidium* parasites that can infect people and animals and cause watery diarrhea. These parasites can be found in soil, food, and water and on surfaces that have been contaminated by the feces (stool or poop) of infected people or animals. People can get cryptosporidiosis by accidentally swallowing parasites in water while enjoying recreational water (for example, swimming pools or lakes), by drinking or eating contaminated water or food, or through contact with an infected person's stool. Cryptosporidiosis can make anyone sick, but young children, pregnant women, and people with weakened immune systems are more likely to get sick and dehydrated if they are infected.

Cryptosporidiosis in California from 2013 through 2019

Total Cases: There were a total of 3,558 new cryptosporidiosis cases from 2013 through 2019.

Rate: The average annual rate of new cryptosporidiosis cases during 2013-2019 was about 1 case per 100,000 people in California. The annual rate more than doubled from 2013 (about 1 case per 100,000 people) through 2019 (about 2 cases per 100,000 people).

- **By County**: The average rate was highest in Inyo County (about 15 cases per 100,000 people), followed by Butte County (about 7 cases per 100,000 people), and Marin County (about 6 cases per 100,000 people).
- **By Sex**: The average rate was slightly higher in males than in females, each group with about 1 case per 100,000 people.
- **By Age Group**: The average rates were highest in adults aged 25 to 34 years and children aged 1 to 4 years (about 2 cases per 100,000 people in both age groups).
- **By Race/Ethnicity**: For cases where race and ethnicity information was available, the highest percentage of cases was among people who reported non-Hispanic White race/ethnicity (about 56%).
- **By Month**: There were more cases of cryptosporidiosis in July and August (about 453 cases each month) than in all other months (about 265 cases each month).

To help prevent accidentally swallowing parasites and getting cryptosporidiosis, do not drink untreated water from lakes, streams, ponds, or shallow wells. If swimming at a pool, lake, or other recreational water area, do not swallow the water, and do not swim or let kids swim if sick with diarrhea. Remember to always wash hands with soap and water after using the toilet or caring for someone with diarrhea.

For more information about cryptosporidiosis in California, please visit the CDPH Cryptosporidiosis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Cryptosporidiosis is a worldwide diarrheal disease caused by intestinal infection with the microscopic parasite *Cryptosporidium*. Cryptosporidia live in the intestines of infected humans and animals and are shed prolifically in feces, where they can contaminate water, food, soil, and surfaces; accidental ingestion of as few as 10 *Cryptosporidium* oocysts can cause infection.[1] The U.S. Centers for Disease Control and Prevention (CDC) has estimated that *Cryptosporidium* species cause 748,000 infections per year in the U.S.[2, 3] In the U.S., cryptosporidiosis is the most frequently recognized cause of disease and outbreak associated with water among humans and is a recognized cause of drinking water, recreational water, and foodborne-associated outbreaks.[1, 4, 5] Leading causes of *Cryptosporidium* infection include ingestion of untreated drinking water, recreational water, or contaminated food, contact with infected livestock, international travel to endemic areas, and contact with infected persons, including exposure through sexual contact.[1] Accidental swallowing or intentional drinking of recreational water (e.g., swimming pools and lakes) are particularly important pathways for infection as *Cryptosporidium* is resistant to many chemical disinfectants including chlorine.[5] Asymptomatic infections in people and animals are also a frequent source of *Cryptosporidium* transmission.[2]

Symptoms of cryptosporidiosis include watery diarrhea, stomach cramps, nausea, vomiting, and dehydration, which can lead to weight loss; some infections are asymptomatic. Symptomatic illness usually begins 2-10 days after exposure and can last 1-2 weeks. Shedding of the parasite in the stool can last weeks after symptoms subside, contributing to further transmission.[6] Groups at risk for severe illness include young children, pregnant women, and immunocompromised persons. Persons with weakened immune systems may develop serious, chronic, and sometimes fatal illness; infected immunocompromised persons may also be carriers of *Cryptosporidium* but have no symptoms.[6]

Because routine stool testing for ova and parasites does not normally include techniques necessary to detect *Cryptosporidium*, heath care providers should specifically request testing in suspect cases. Molecular techniques (e.g., polymerase chain reaction – PCR) including multiplex PCR assays are also available, sensitive, and commonly used to detect cryptosporidia.[7] However, molecular techniques are not able to distinguish between viable and non-viable organisms, and detection by PCR does not always indicate active disease. Infected persons can shed Cryptosporidia irregularly in their stool, so multiple stool samples should be collected and tested to accurately diagnose and detect cryptosporidiosis.[8] Most persons with healthy immune systems will recover without specific treatment, although symptom management, hydration, and treatment of diarrhea may be recommended. Treatment in HIV-positive patients may include anti-retroviral therapy to improve immune status.[9]

This report describes the epidemiology of confirmed and probable cryptosporidiosis cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes.*[10] The epidemiologic description of cryptosporidiosis for earlier surveillance periods can be found in the *Epidemiologic Summary of Cryptosporidiosis in California, 2001-2008 and 2009-2012.*[11, 12]

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 cryptosporidiosis to their local health department within one working day of identification or immediately by telephone if an outbreak is suspected.[13] Per CCR, Title 17, Section 2505, laboratories are also required to report laboratory testing results suggestive of *Cryptosporidium* 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.[14]

California regulations require cases of cryptosporidiosis to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the CDC/Council of State and Territorial Epidemiologists 2012 surveillance case definition of a confirmed or probable case. During the surveillance period (2013-2019), a confirmed case of cryptosporidiosis was defined as a diagnosis of *Cryptosporidium* spp. infection based on evidence of *Cryptosporidium* organisms or DNA in stool, intestinal fluid, tissue samples, biopsy specimens, or other biological sample by certain laboratory methods with a high positive predictive value (e.g., direct fluorescent antibody [DFA] test, PCR, enzyme immunoassay [EIA], OR light microscopy of stained specimens). A probable case of cryptosporidiosis was defined as a diagnosis of *Cryptosporidium* spp. infection determined only by antigen screening test method, such as immunochromatographic card/rapid card test; or a laboratory test of unknown method; OR by gastrointestinal illness characterized by diarrhea and one or more of the following: diarrhea duration of 72 hours or more, abdominal cramping, vomiting, or anorexia that is epidemiologically linked to a confirmed case of *Cryptosporidium* spp. infection.[15]

Epidemiology of Cryptosporidiosis in California, 2013-2019

CDPH received reports of 3,558 total cases of cryptosporidiosis with estimated symptom onset dates from 2013 through 2019. The average annual incidence of cryptosporidiosis during 2013-2019 was 1.3 per 100,000 population. Incidence rates increased by 138% from 2013 (0.8 per 100,000; 307 cases) through 2019 (1.9 per 100,000; 747 cases) [Figure 1].

Statewide from 2013 through 2019, 24 California counties reported at least 1 case of cryptosporidiosis for each year of the surveillance period. County-specific average annual incidence rates per 100,000 population ranged from 0 to 15.4, with the highest average annual rates in Inyo County (15.4 per 100,000; 20 cases), Butte County (6.8 per 100,000; 106 cases), and Marin County (5.8 per 100,000; 106 cases) [Figure 2]. By region (see *Technical Notes*), the average annual incidence rate for the surveillance period was higher in Northern California (1.9 cases per 100,000; 1,830 cases) than in Southern California (1.0 per 100,000; 1,728 cases).

From 2013 through 2019, the average annual incidence rate was higher among males (1.4 per 100,000; 1,975 cases) than among females (1.1 per 100,000; 1,548 cases); 56.1% of cryptosporidiosis case-patients were male and 43.9% were female.

By age group, average annual incidence rates were highest among adults aged 25-34 years (1.9 cases per 100,000; 704 cases) and children aged 1-4 years (1.5 cases per 100,000; 210 cases) [Figure 3].

For the 2,397 cryptosporidiosis cases with complete race/ethnicity information, the highest percentage of cases was among those who reported non-Hispanic White race/ethnicity (55.9%). Cases reported non-Hispanic White race/ethnicity more frequently and non-Hispanic Asian/Pacific Islander race/ethnicity less frequently than would be expected compared to the percentage of these groups in California during the same time period (55.9% vs. 38.0%, respectively, for non-Hispanic White race/ethnicity; 6.3% vs. 14.8%, respectively, for non-Hispanic Asian/Pacific Islander race/ethnicity) [Figure 4].

By month, the highest number of cases occurred in July and August [Figure 5]. During 2013-2019, 25.5% (906) of all cryptosporidiosis cases had estimated symptom onsets during July and August, an average of 453 cases each month. In comparison, an average of 265 cases occurred each month during September through June.

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

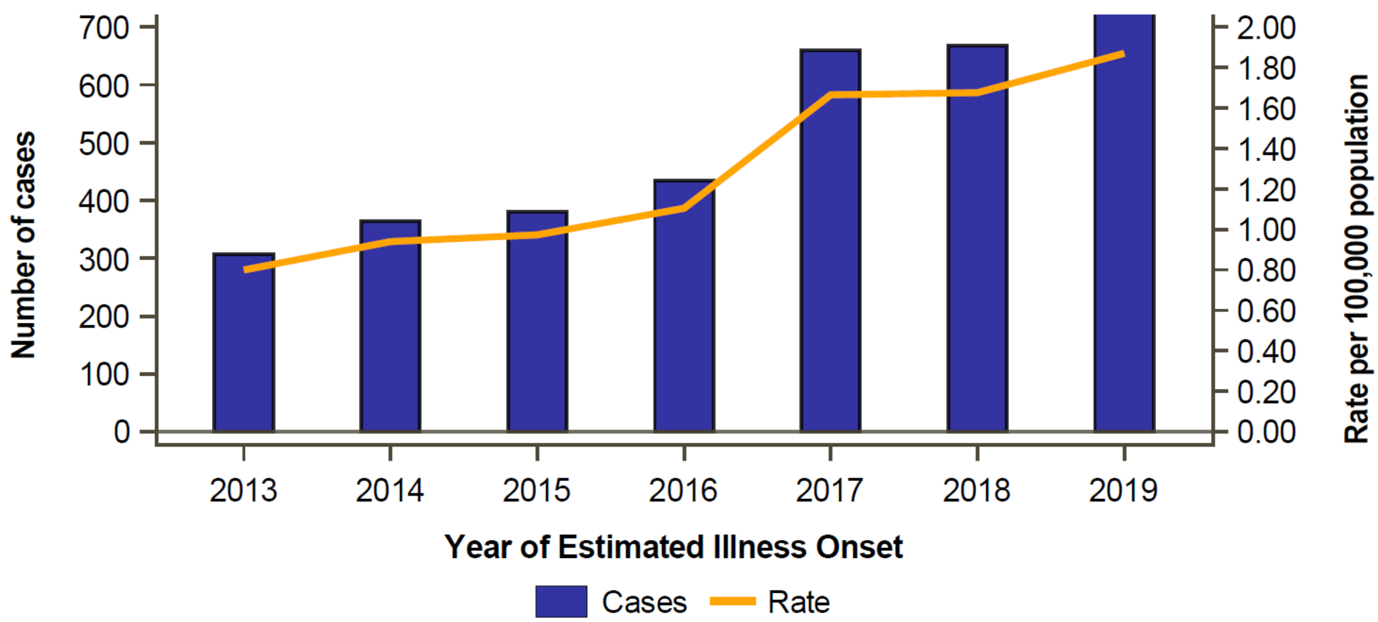


Figure 2. Cryptosporidiosis Average Annual Incidence Rates by County, California, 2013-2019

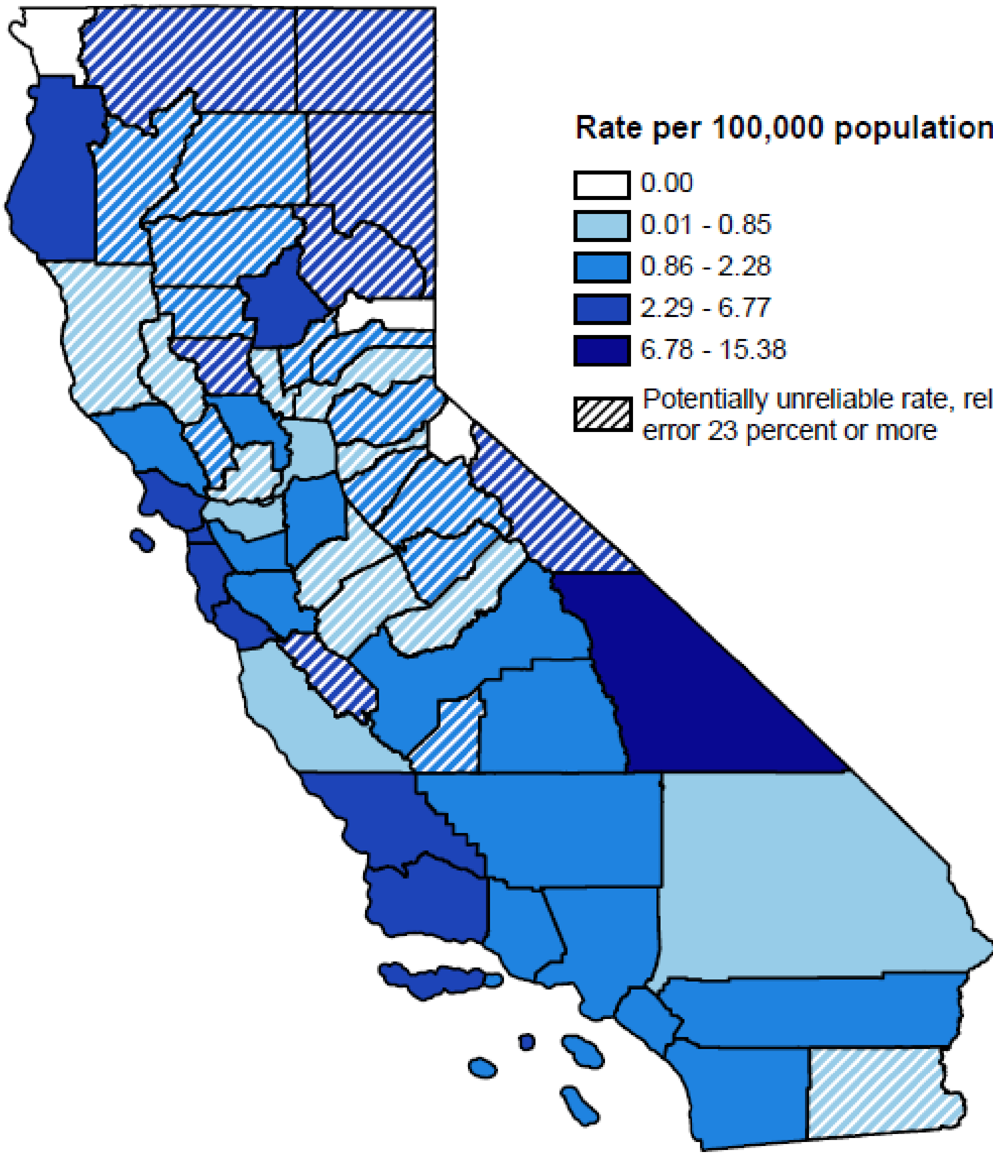


Figure 3. Cryptosporidiosis Incidence Rates by Age Group and Year of Estimated Illness Onset, California, 2013-2019

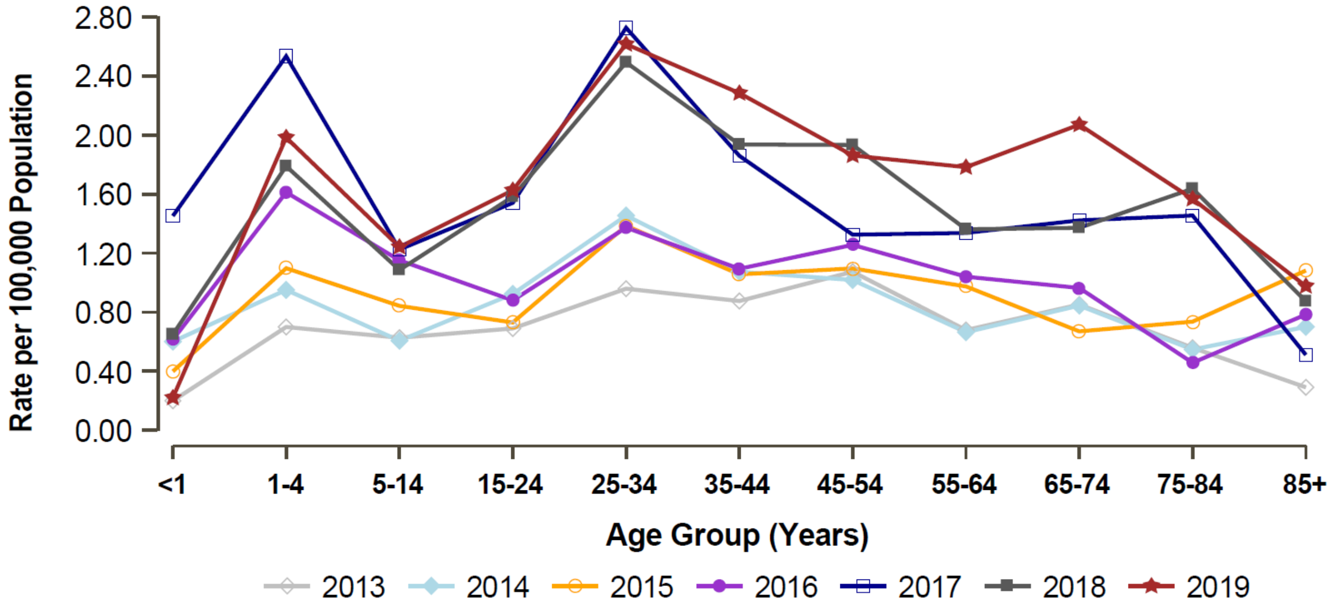
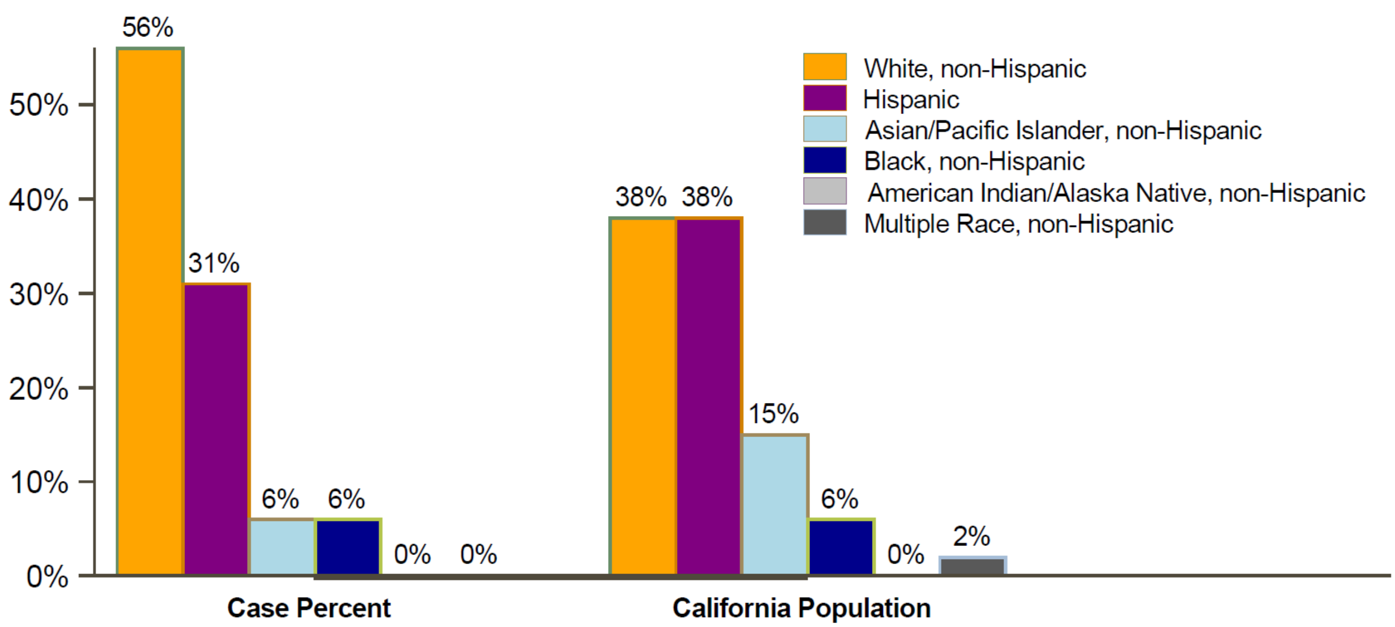
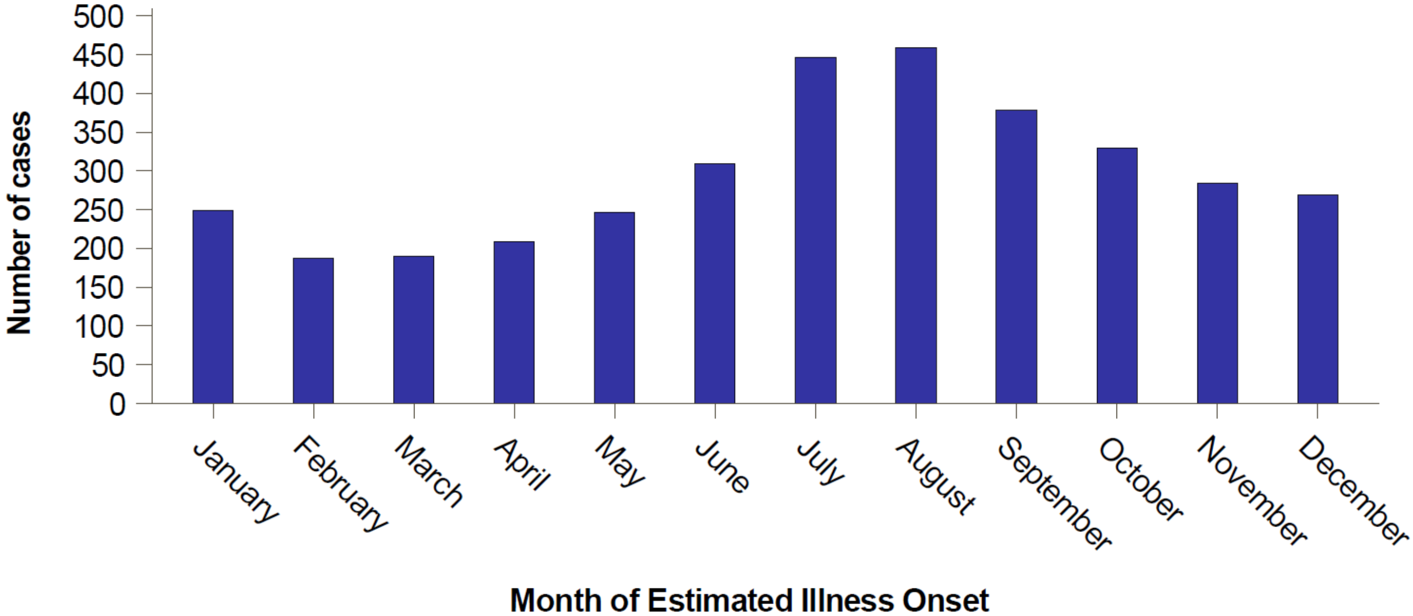


Figure 4. Cryptosporidiosis Cases and Population by Race/Ethnicity, California, 2013-2019



28.5% (n=1014) of reported incidents of Cryptosporidiosis did not identify race/ethnicity and 4.1% (n=147) 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.

Figure 5. Cryptosporidiosis Cases by Month of Estimated Illness Onset, California, 2013-2019



Comments

Incidence of cryptosporidiosis per 100,000 population in California increased by 138% from 2013 (0.8 per 100,000; 307 cases) through 2019 (1.9 per 100,000; 747 cases).

Overall, incidence rates increased slightly during the 2013-2019 surveillance period (average annual rate of 1.3 per 100,000 population) compared to the 2009-2012 surveillance period (average annual rate of 1.0 per 100,000 population) as described in previous epidemiologic summaries.[12] The race/ethnicity, sex, seasonality, and regional epidemiologic profiles of incident cases were similar to those reported in epidemiologic summaries from earlier years.[11, 12]

Cryptosporidium presents special challenges to public health because of its low infectious dose combined with its resistance to chlorine disinfection. Decreasing human or animal fecal contamination of recreational or drinking water, education regarding hand hygiene and safe sexual practices, and targeted education of high-risk groups likely offer the best opportunities for reducing cryptosporidiosis.

To prevent cryptosporidiosis, persons should not drink untreated water from lakes, streams, ponds, or shallow wells. Additionally, persons swimming in recreational water areas should avoid swallowing recreational water and should prohibit children with diarrhea from swimming. Thorough handwashing with soap and water after using the toilet or caring for an individual with diarrhea can also help mitigate the spread of cryptosporidiosis.

Prepared by Inderbir Sohi, Yanyi Djamba, Alexander Yu, Akiko Kimura, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, September 2021

References

[1] Parasites – *Cryptosporidium* (also known as "Crypto"), General Information for the Public. U.S. Centers for Disease Control and Prevention website. Updated February 8, 2021. Accessed April 20, 2021. https://www.cdc.gov/parasites/crypto/general-info.html

[2] Painter JE, Hlavsa MC, Collier SA, Xiao L, Yoder JS; Centers for Disease Control and Prevention. Cryptosporidiosis surveillance -- United States, 2011-2012. MMWR 2015;64(SS03):1-14. https://www.cdc.gov/mmwr/pdf/ss/ss6403.pdf

[3] Scallan E, Hoekstra RM, Angulo FJ et al. Foodborne illness acquired in the United States—major pathogens. *Emerg Infect Dis*. 2011 Jan; 17(1):7-15.

[4] Parasites – *Cryptosporidium* (also known as "Crypto"). U.S. Centers for Disease Control and Prevention website. Updated July 1, 2021. Accessed April 20, 2021. https://www.cdc.gov/parasites/crypto/

[5] Carpenter C, Fayer R, Trout J, et al. Chlorine Disinfection of Recreational Water for Cryptosporidium parvum. *Emerging Infectious Diseases*. 1999;5(4):579-584. doi:10.3201/eid0504.990425.

[6] Parasites – *Cryptosporidium* (also known as "Crypto"), General Information for Immunocompromised Persons. U.S. Centers for Disease Control and Prevention website. Updated February 8, 2021. Accessed April 20, 2021. https://www.cdc.gov/parasites/crypto/gen_info/infect_ic.html

[7] Aghamolaie S, Rostami A, Fallahi Sh, Tahvildar Biderouni F, Haghighi A, Salehi N. Evaluation of modified Ziehl-Neelsen, direct fluorescent-antibody and PCR assay for detection of *Cryptosporidium* spp. in children faecal specimens. *J Parasit Dis*. 2016;40(3):958-963. doi:10.1007/s12639-014-0614-4

[8] Parasites – *Cryptosporidium* (also known as "Crypto"), Diagnosis & Detection. U.S. Centers for Disease Control and Prevention website. Updated December 2, 2016. Accessed April 20, 2021. https://www.cdc.gov/parasites/crypto/diagnosis.html

[9] Parasites – *Cryptosporidium* (also known as "Crypto"), Treatment. U.S. Centers for Disease Control and Prevention website. Updated August 16, 2017. Accessed April 20, 2021. https://www.cdc.gov/parasites/crypto/treatment.html

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

[11] State of California, Department of Public Health. Cryptosporidiosis. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008.* Sacramento, CA; 2009. Accessed April 20, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSumma

riesofSelectedCommDiseasesinCA2001-2008.pdf

[12] State of California, Department of Public Health. Cryptosporidiosis. In*: Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012*. Sacramento, CA; 2015. Accessed April 20, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf

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

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

[15] Cryptosporidiosis (*Cryptosporidium* spp.) 2012 Case Definition. 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/cryptosporidiosis-2012/

Key Findings

Cyclosporiasis is an infection caused by a parasite called *Cyclospora cayetanensis*. This parasite can be found in food and water that has been contaminated by the feces (stool or poop) of infected people. People can get cyclosporiasis by eating or drinking something that is contaminated with *Cyclospora.* Cyclosporiasis can cause watery diarrhea, stomach cramps, and loss of appetite. Cyclosporiasis is most common in tropical and subtropical areas of the world. In the United States, foodborne outbreaks of cyclosporiasis have been linked to various types of fresh produce, mostly imported from other countries.

Cyclosporiasis in California from 2013 through 2019

Total Cases: There were a total of 367 new cyclosporiasis cases from 2013 through 2019.

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

- **By County**: The average rate was highest in San Francisco County (less than 1 case per 100,000 people).
- **By Sex**: The average rate was similar in males and females, each group with less than 1 case per 100,000 people.
- **By Age Group**: The average rates were highest in adults aged 35 to 44 years and 65 to 74 years, but rates were less than 1 case per 100,000 people in each age group.
- **By Race/Ethnicity**: For cases where race and ethnicity information was available (about 67%), the highest percentage of cases was in people who reported non-Hispanic White race/ethnicity (about 57%).
- **By Month**: Most cyclosporiasis cases (about 89%) occurred from May through August.

To help prevent cyclosporiasis, it is important to follow food safety guidelines and wash hands with soap and water before and after handling fruits and vegetables. Before eating, cutting, or cooking fruits and vegetables, wash preparation utensils and surfaces, and wash fresh produce thoroughly under clean, running water. People traveling in tropical or subtropical areas of the world should be careful with what they eat or drink and remember to "boil it, cook it, peel it, or forget it". Travelers should drink only bottled water and drinks, or boil water for one minute before drinking, and eat only foods that have been thoroughly cooked. Fruit that can be peeled is safest to eat when it is peeled by the person who is eating it.

For more information about cyclosporiasis, please visit the CDPH Cyclosporiasis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Cyclosporiasis is transmitted by ingesting *Cyclospora cayetanensis* oocysts, usually within contaminated food or water.[1] *Cyclospora* is shed in the feces from an infected person; after being passed in feces, *Cyclospora* take days to weeks in the environment to become infectious to another person. Therefore, it is unlikely that the infection is passed directly from person to person.[2] Cyclosporiasis occurs in many countries throughout the world and is most common in tropical and subtropical regions. In the United States, foodborne outbreaks of cyclosporiasis have been linked to various types of fresh produce, including raspberries, cilantro, basil, snow peas, and mixed salad imported from Latin America.[2]

Symptoms of cyclosporiasis usually begin one to two weeks after ingestion of infective *Cyclospora* oocysts. Symptoms may include: watery diarrhea, loss of appetite, weight loss, bloating, stomach cramps, increased gas, nausea, and fatigue. Vomiting and low-grade fever may also occur. If not treated, symptoms may persist for several days to several weeks. Some symptoms, such as diarrhea, may seem to go away and then return (relapse). Some people who are infected with *Cyclospora* do not have any symptoms.[3] Cyclosporiasis is usually not life threatening, and most people with healthy immune systems will recover without treatment. Immunocompromised persons or those with preexisting medical conditions may be at higher risk for severe or prolonged illness; antibiotics or medication to alleviate symptoms may be used to treat cyclosporiasis.[4]

This report describes the epidemiology of confirmed and probable cyclosporiasis cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes*.[5]

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 cyclosporiasis to their local health department within seven calendar days of identification or immediately by telephone if an outbreak is suspected.[6] Per CCR, Title 17, Section 2505, laboratories are also required to report laboratory testing results suggestive of cyclosporiasis (*Cyclospora cayetanensis*) to either the California Reportable Diseases Information Exchange (CalREDIE) via electronic laboratory reporting or the local health department; notification should occur within one day after the health care provider has been notified of the laboratory testing result.[7]

California regulations require cases of cyclosporiasis to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed or probable case. During the surveillance period (2013-2019), a confirmed case of cyclosporiasis was defined as a case with clinically compatible illness and at least one of the following criteria for laboratory confirmation: detection of *Cyclospora* organisms or DNA in stool, intestinal fluid/aspirate, or intestinal biopsy specimens. Clinically compatible illness includes one or more of the following: watery diarrhea, loss of appetite, weight loss, abdominal cramps/bloating, nausea, body aches, and fatigue, vomiting and lowgrade fever. A probable case was defined as a case that meets the clinical description and is epidemiologically linked to a confirmed case.[8]

Epidemiology of Cyclosporiasis in California, 2013-2019

CDPH received reports of 367 total cases (334 confirmed and 33 probable) of cyclosporiasis with estimated symptom onset dates from 2013 through 2019. This corresponds to an average annual incidence rate of 0.1 cases per 100,000 people. Annual cyclosporiasis incidence increased from 2 cases (0.01 per 100,000 people in 2013) to 89 cases (0.2 per 100,000 people in 2019) during the surveillance period. The highest annual incidence rate occurred in 2018 (0.4 per 100,000; 172 cases) [Figure 1]. Of 189 case-patients with reported travel history, 81 (42.9%) reported international travel.

County-specific average annual incidence rates per 100,000 population from 2013 through 2019 ranged from 0 to 0.7, with the highest average rate in San Francisco County (0.7 per 100,000, 43 cases), followed by San Mateo County (0.7 per 100,000, 37 cases) and Ventura County (0.5 per 100,000 people, 28 cases) [Figure 2]. By region (see *Technical Notes*) average annual incidence rates were highest in the Bay Area (0.3 per 100,000; 145 cases), the Central Coast (0.2 per 100,000; 19 cases) and the South Coast (0.1 per 100,000; 133 cases).

From 2013 through 2019, average annual incidence was similar among males (0.1 per 100,000; 189 cases) and females (0.1 per 100,000; 177 cases).

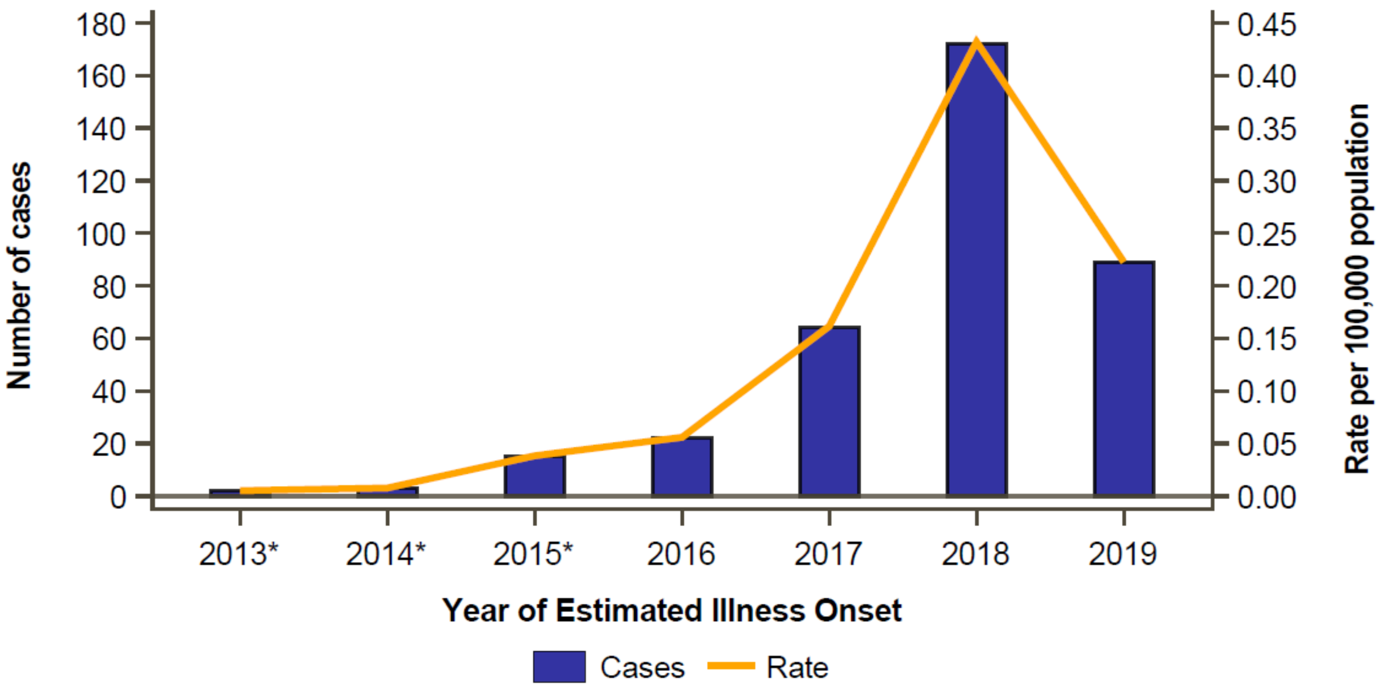
By age group, average annual incidence rates were highest among adults aged 35-44 years (0.2 cases per 100,000; 78 cases), followed by those aged 65-74 years (0.2 per 100,000; 45 cases) and 75-84 years (0.2 per 100,000; 22 cases).

For cyclosporiasis cases with complete race/ethnicity information (67.3%), the highest percentage of cases was among those who reported non-Hispanic White race/ethnicity (56.9%); cases reported non-Hispanic White race/ethnicity more frequently than would be expected based on the percentage of the non-Hispanic White racial/ethnic population in California during the same time period (56.9% vs. 38.0%, respectively) [Figure 4].

By month during the surveillance period, the highest number of cases occurred during warmer-weather months; during 2013-2019, 88.5% (325) of all cyclosporiasis cases had estimated illness onsets in May, June, July, and August [Figure 5].

During this surveillance period, three outbreaks of cyclosporiasis involving 86 California case-patients were identified. All three outbreaks occurred in spring (May and June) of 2018 and involved multiple jurisdictions. One involved case-patients from other states. One outbreak implicated a confirmed food source (fresh basil); sources of the other two outbreaks were not able to be determined.

Figure 1. Cyclosporiasis Cases by Year of Estimated Illness Onset, California, 2013-2019



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

Figure 2. Cyclosporiasis Average Annual Incidence by County, California, 2013-2019

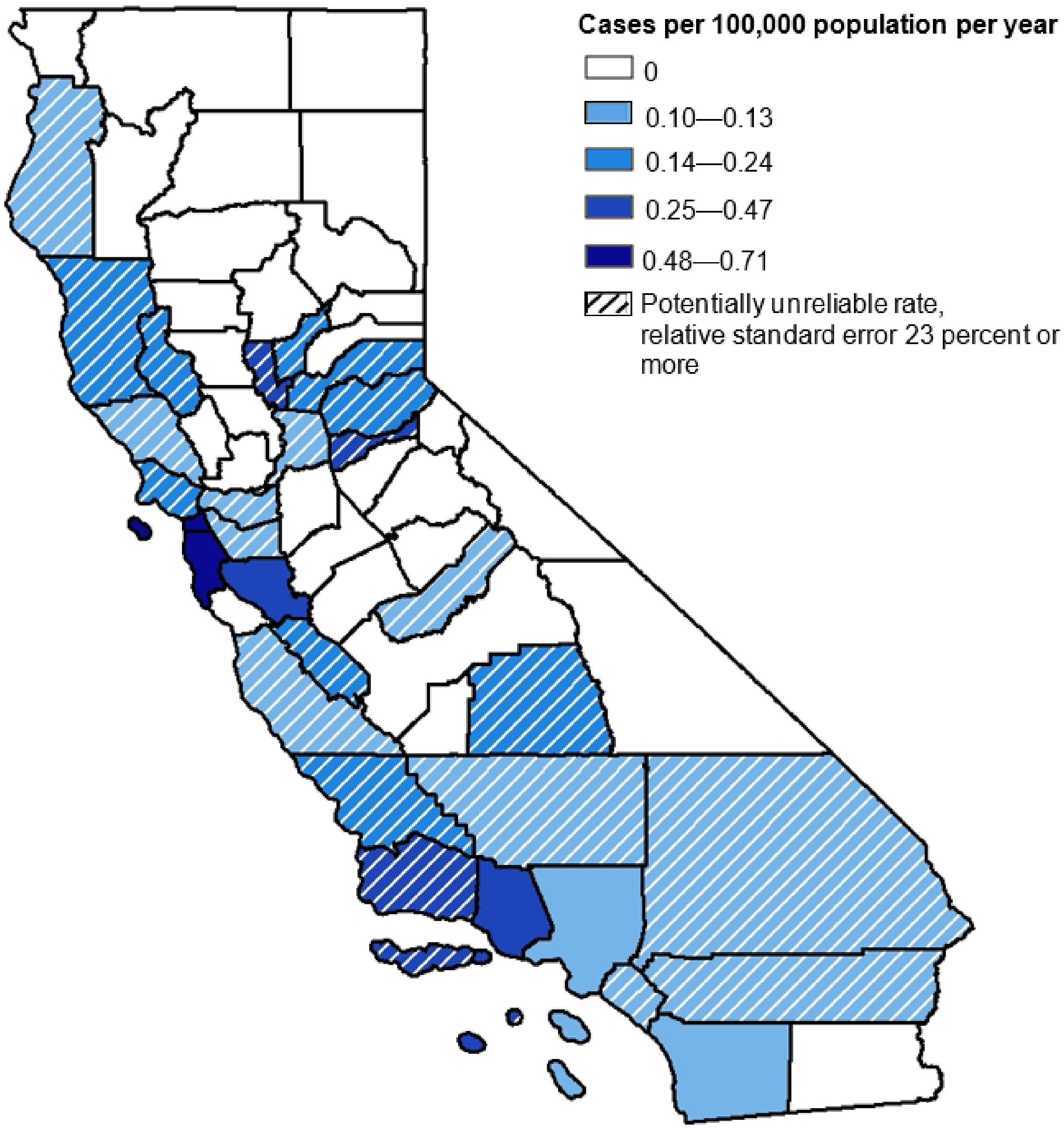
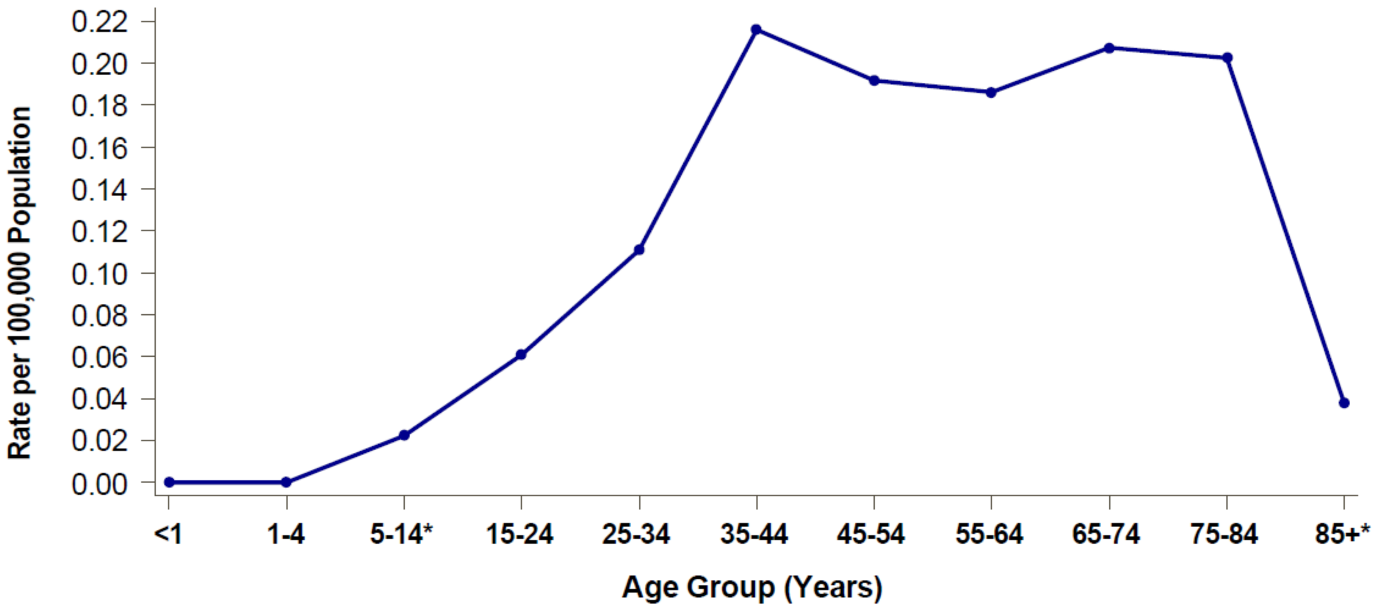
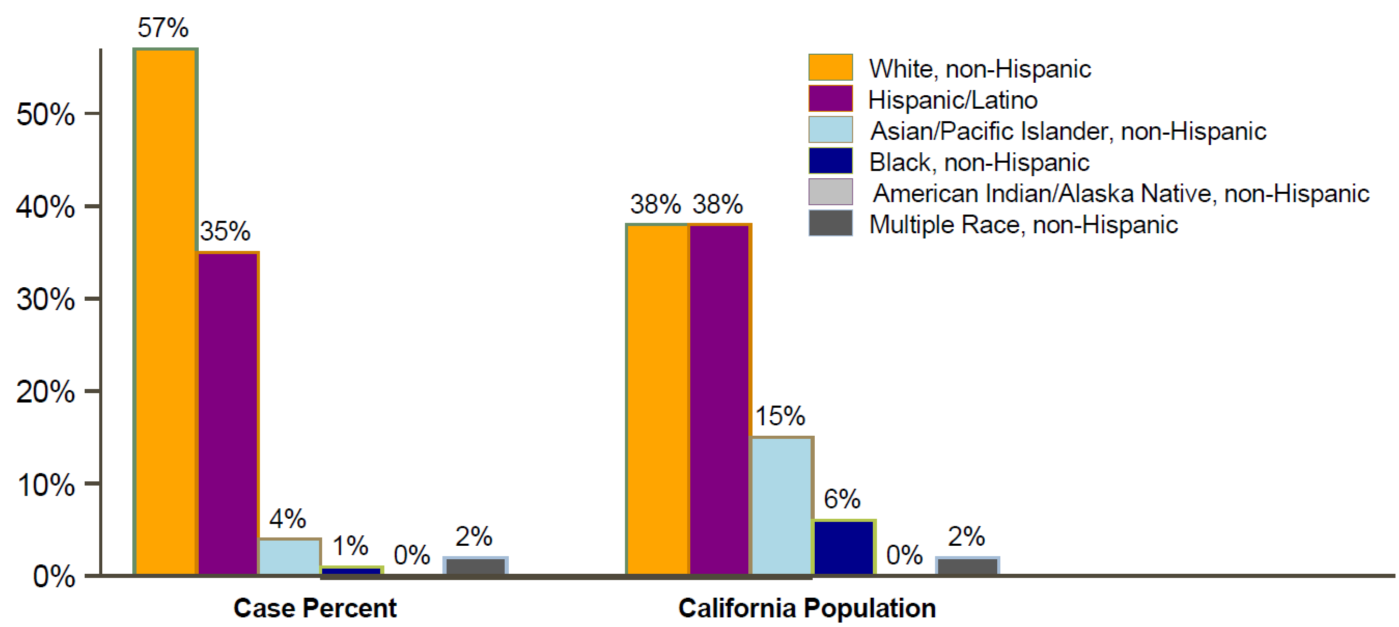


Figure 3. Cyclosporiasis Average Annual Incidence Rates by Age Group, California, 2013-2019



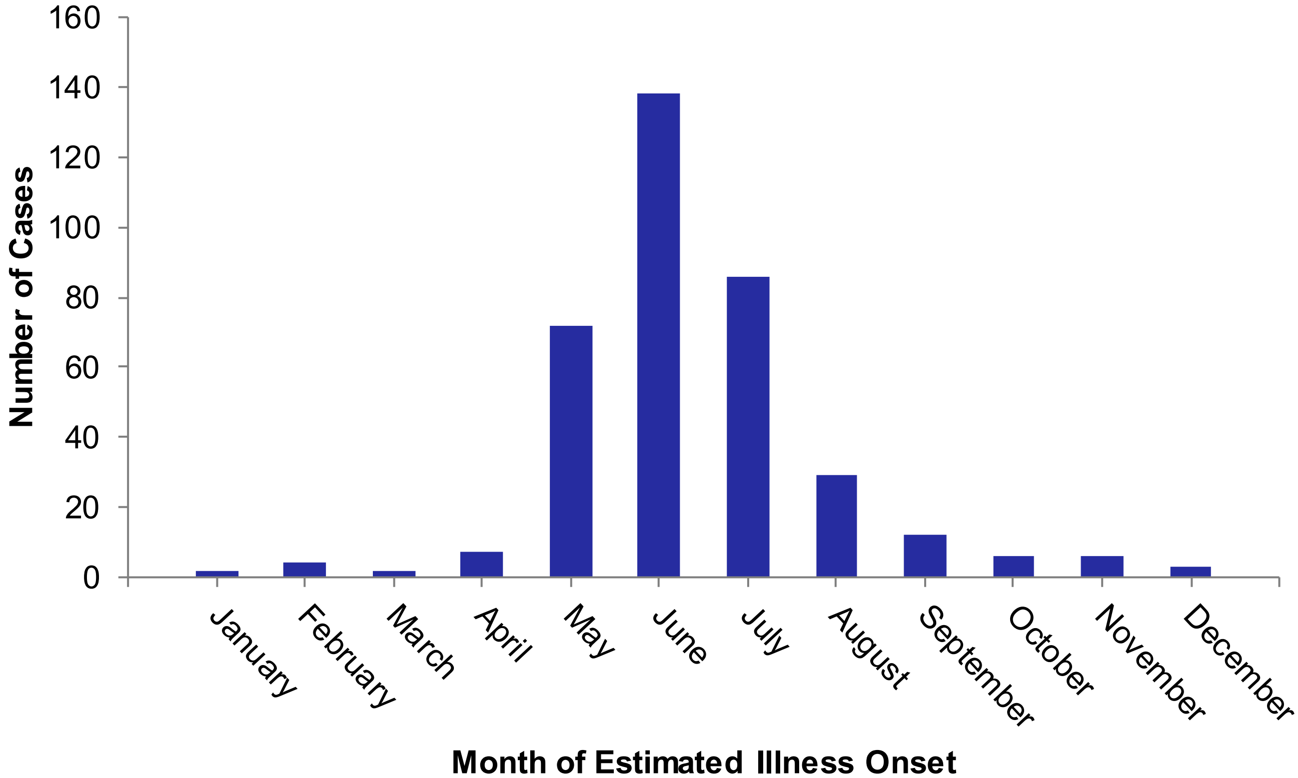
*Potentially unreliable rate: relative standard error 23 percent or more.

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



32.7% (n=120) of reported incidents of Cyclosporiasis did not identify race/ethnicity and 4.1% (n=15) 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.

Figure 5. Cyclosporiasis Cases by Month of Estimated Illness Onset, California, 2013-2019



Comments

Incidence rates per 100,000 population of cyclosporiasis in California increased from 2013 (0.01 per 100,000; 2 cases) through 2019 (0.2 per 100,000 people; 89 cases) but remained low overall. The sharp increase in cases in 2018 was driven by the three outbreaks that occurred in that year.

To prevent *Cyclospora* infection, persons should follow recommendations for safe handling of fruits and vegetables, and practice proper hand hygiene before preparing or eating food. This includes washing cutting boards, utensils, dishes, and surfaces with soap and water prior to preparing food. All fruits and vegetables should also be thoroughly washed under clean, running water before preparing or eating. Travelers to cyclosporiasis-endemic areas (including tropical and subtropical regions) should adhere to strict food safety precautions; while traveling, persons should drink only bottled, canned, or properly treated/filtered water and drinks, and eat only foods that have been thoroughly cooked. Raw fruits that can be peeled are safest when peeled by the person who eats them.[9]

Prepared by Alyssa Nguyen, Yanyi Djamba, Alexander Yu, Akiko Kimura, Allyx Nicolici, Duc Vugia – Infectious Diseases Branch, May 2022

References

[1] Parasites – Cyclosporiasis (*Cyclospora* Infection) Resources for Health Professionals. U.S. Centers for Disease Control and Prevention website. Updated October 21, 2020. Accessed December 1, 2020. https://www.cdc.gov/parasites/cyclosporiasis/health_professionals/index.html

[2] Cyclosporiasis. California Department of Public Health website. Updated November 2015. Accessed December 1, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Cyclosporiasis.aspx

[3] Parasites – Cyclosporiasis (*Cyclospora* Infection) Disease. U.S. Centers for Disease Control and Prevention website. Updated May 11, 2018. Accessed December 1, 2020. https://www.cdc.gov/parasites/cyclosporiasis/disease.html

[4] Parasites – Cyclosporiasis (*Cyclospora* Infection) Treatment. U.S. Centers for Disease Control and Prevention website. Updated June 10, 2018. Accessed December 1, 2020. https://www.cdc.gov/parasites/cyclosporiasis/treatment.html

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

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

[7] Reportable Conditions: Notification by Laboratories, 17 CCR § 2505 (2021). https://govt.westlaw.com/calregs/Document/I1947D280662411E384928538D6692020

[8] Cyclosporiasis (*Cyclospora cayetanensis*) 2010 Case Definition. National Notifiable Diseases Surveillance System. U.S. Centers for Disease Control and Prevention. Accessed December 1, 2020. https://ndc.services.cdc.gov/case-definitions/cyclosporiasis-2010/

[9] Griffin PM and Hill V. Chapter 2: Preparing international travelers, food & water precautions. In: CDC Yellow Book 2020: Health Information for International Travel. Oxford University Press; 2019. Accessed May 9, 2022. https://wwwnc.cdc.gov/travel/yellowbook/2020/preparing-international-travelers/food-and-water-precautions

Key Findings

Dengue is an infectious disease caused by any one of four dengue viruses that are spread from the bite of an infected mosquito. The mosquitoes that can spread dengue viruses, *Aedes aegypti* and *Aedes albopictus,* have invaded many areas of California. At this time, *Aedes* mosquitoes in California are not known to be infected with dengue, and locally acquired cases of dengue have not been reported. So far in California, cases of dengue have been reported only in people who were infected while traveling outside of California. Dengue occurs in many tropical and subtropical areas of the world, including Africa, Asia, the Middle East, Central and South America, as well as some areas of the United States and U.S. territories.

Dengue in California from 2013 through 2019

Total Cases: There were a total of 1,101 new dengue cases from 2013 through 2019.

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

- **By County**: There were 11 California counties that reported at least 1 case of dengue each year during 2013-2019, with an average rate of about 1 case per 100,000 people.
- **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 35 to 44 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 percentages of cases were in people who reported Hispanic/Latino race/ethnicity (about 38%) and non-Hispanic Asian/Pacific Islander race/ethnicity (about 34%).

To help prevent dengue, which can be life-threatening in severe cases, people who travel to areas where dengue is common should take steps to prevent mosquito bites. Important prevention steps include using mosquito repellent on clothes and exposed skin, sleeping under a mosquito bed net, and keeping mosquitoes out of living spaces by using window and door screens. After returning from an area where dengue is common, people should continue to use mosquito repellent for three weeks to prevent spreading dengue to mosquitoes around their home.

For more information about dengue in California, please visit the CDPH Dengue webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Dengue is a viral infection that is caused by any one of four related dengue viruses (DENV-1, DENV-2, DENV-3, and DENV-4) and is primarily transmitted through bites from infected mosquitoes, specifically *Aedes aegypti* and *Aedes albopictus*. These mosquitoes are not native to California but have been detected in multiple counties throughout the state.[1] Dengue is not transmitted from person to person. Around 40% of the world's population, which equates to around 3 billion people, live in an area where there is risk of dengue; this includes countries in Africa, Asia, the Middle East, Central and South America, and the Pacific Islands, as well as parts of the United States and U.S. territories, including Florida, Hawaii, Texas, and Puerto Rico.[2] Globally, up to 400 million people are infected with dengue annually and approximately 100 million people become sick from infection.[3] In California, dengue infections have been reported only in people who were infected while traveling outside of California.[1]

About 1 in 4 people who are infected with dengue will develop symptoms, which can be either mild or severe. Symptoms of mild dengue can be confused with other illnesses and include fever, nausea and vomiting, aches and pains, or a rash. Symptoms usually last 2-7 days, and most patients recover within a week. There is no specific antiviral therapy to treat dengue infection, but symptoms can be treated with increased fluid intake, rest, and acetaminophen to control fever and pain (aspirin or ibuprofen should *not* be taken). Dengue may become severe for about 5% of individuals that have the virus, resulting in shock, internal bleeding, and potentially death. Severe dengue is a medical emergency. The warning signs for severe dengue include stomach pain, bleeding from the nose or gums, and vomiting and tiredness; symptoms of severe dengue typically begin 1-2 days after fever has subsided. Individuals most at risk for severe dengue include those who have previously had dengue in the past, as well as infants and pregnant women.[4]

This report describes the epidemiology of confirmed and probable dengue cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes.*[5]

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 dengue to their local health department within one working day of identification by electronic transmission, fax, or telephone, if an outbreak is suspected.[6] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of dengue virus 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.[7]

California regulations require cases of dengue to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists case definition of a confirmed and probable case. Prior to 2015 during the surveillance period (2013-2019), the surveillance case definition for dengue included three subtypes: dengue fever, dengue hemorrhagic fever, and dengue shock syndrome. A confirmed case of dengue was defined as a clinically compatible case of one of the three dengue subtypes with confirmatory laboratory results. Confirmatory laboratory results included: (i) isolation of dengue virus from or demonstration of specific arboviral antigen or genomic sequences in tissue, blood, cerebrospinal fluid (CSF), or other body fluid by polymerase chain reaction (PCR) test, immunofluorescence or immunohistochemistry, or (ii) seroconversion from negative for dengue virus-specific serum Immunoglobulin M (IgM) antibody in an acute phase (≤ 5 days after symptom onset) specimen to positive for dengue-specific serum IgM antibodies in a convalescent-phase specimen collected ≥ 5 days after symptom onset, or (iii) demonstration of a ≥ 4-fold rise in reciprocal Immunoglobulin G (IgG) antibody titer or Hemagglutination inhibition titer to dengue virus antigens in paired acute and convalescent serum samples, or (iv) demonstration of a ≥ 4-fold rise in PRNT (plaque reduction neutralization test) end point titer (as expressed by the reciprocal of the last serum dilution showing a 90% reduction in plaque counts compared to the virus infected control) between dengue viruses and other flaviviruses tested in a convalescent serum sample, or (v) virus-specific IgM antibodies demonstrated in CSF. A probable case was defined as a clinically compatible case of one of the three dengue subtypes with laboratory results indicative of presumptive infection, defined as dengue-specific IgM antibodies present in serum with a positive/negative ratio equal or greater than 2.0.[8]

Beginning in 2015, the subtypes for dengue were modified to include dengue, dengue-like illness, and severe dengue. A confirmed case of dengue was defined as a clinically compatible case of dengue, dengue-like illness, or severe dengue with confirmatory laboratory results. Confirmatory laboratory results included: (i) detection of DENV nucleic acid in serum, plasma, blood, CSF, other body fluid or tissue by validated reverse transcriptase-PCR, or (ii) detection of DENV antigens in tissue by a validated immunofluorescence or immunohistochemistry assay, or (iii) detection in serum or plasma of DENV NS1 antigen by a validated immunoassay, or (iv) cell culture isolation of DENV from a serum, plasma, or CSF specimen, or (v) detection of IgM anti-DENV by validated immunoassay in a serum specimen or CSF in a person living in a dengue endemic or non-endemic area of the United States without evidence of other flavivirus transmission (e.g., WNV, SLEV, or recent vaccination against a flavivirus [e.g., YFV, JEV]), or (vi) detection of IgM anti-DENV in a serum specimen or CSF by validated immunoassay in a traveler returning from a dengue endemic area without ongoing transmission of another flavivirus (e.g., WNV, JEV, YFV), clinical evidence of co-infection with one of these flaviviruses, or recent vaccination against a flavivirus (e.g., YFV, JEV); or (vii) IgM anti-DENV seroconversion by validated immunoassay in acute (i.e., collected < 5 days of illness onset) and convalescent (i.e., collected > 5 days after illness onset) serum specimens; or (viii) IgG anti-DENV seroconversion or ≥ 4-fold rise in titer by a validated immunoassay in serum specimens collected > 2 weeks apart, and confirmed by a neutralization test (e.g., PRNT) with a > 4-fold higher end point titer as compared to other flaviviruses tested. A probable case was defined as a clinically compatible case of one of the three dengue subtypes with laboratory results indicative of probable infection, which included (1) detection of IgM anti-DENV by validated immunoassay in a serum specimen or CSF in a person living in a dengue endemic or non-endemic area of the United States with evidence of other flavivirus transmission (e.g., WNV, SLEV), or recent vaccination against a flavivirus (e.g., YFV, JEV), or (2) detection of IgM anti-DENV in a serum specimen or CSF by validated immunoassay in a traveler returning from a dengue endemic area with ongoing transmission.[8]

Epidemiology of Dengue in California, 2013-2019

CDPH received reports of 1,101 total cases of dengue with estimated symptom onset dates from 2013 through 2019. The overall average annual incidence of dengue during 2013-2019 was 0.4 per 100,000 population [Figure 1].

To date, no locally acquired cases of dengue have been reported in California. Of the 968 case-patients with a reported travel destination during the surveillance period, 446 (47.0%) reported travel to Asia, 224 (23.6%) reported travel to parts of North America (Mexico and U.S.), 133 (14.0%) reported travel to Central America, and 165 (17.0%) reported travel to other parts of the world.

Statewide from 2013 through 2019, 11 counties reported at least 1 case for each year of the surveillance period: Alameda, Contra Costa, Los Angeles, Orange, Riverside, Sacramento, San Diego, San Francisco, San Mateo, Santa Clara, and Yolo counties. Cases from these 11 counties made up 79.7% of the total dengue cases reported. Among these 11 counties, the average annual incidence rate of the seven years was highest in Santa Clara (1.0 per 100,000; 132 cases), San Mateo (1.0 per 100,000; 51 cases), and Alameda (0.9 per 100,000; 104 cases) counties [Figure 2].

The average annual incidence rate by sex was 0.4 per 100,000 population for both males and females during the surveillance period. Of the 1,098 total cases reported with complete sex data, 568 (51.7%) were among females and 530 (48.3%) were among males.

By age group, the average annual incidence rates were highest among adults aged 35-44 years (0.6 per 100,000; 213 cases) and 25-34 years (0.5 per 100,000; 197 cases). The average annual incidence rate was lowest among infants under one year of age (0.03 per 100,000; 1 case) [Figure 3].

For the 772 dengue cases with complete race/ethnicity data, the highest percentages of cases were among those who reported Hispanic/Latino race/ethnicity (38.2%) and non-Hispanic Asian/Pacific Islander race/ethnicity (33.7%) [Figure 4].

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

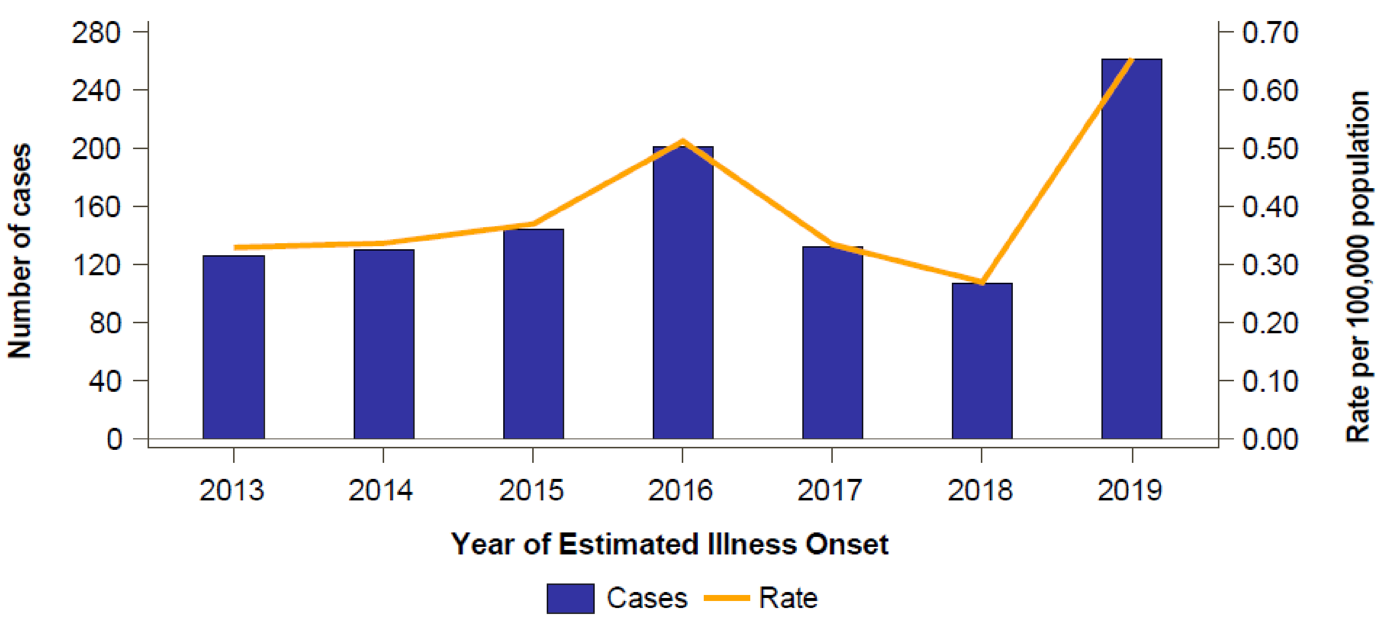


Figure 2. Dengue Average Annual Incidence Rates by County, California, 2013-2019

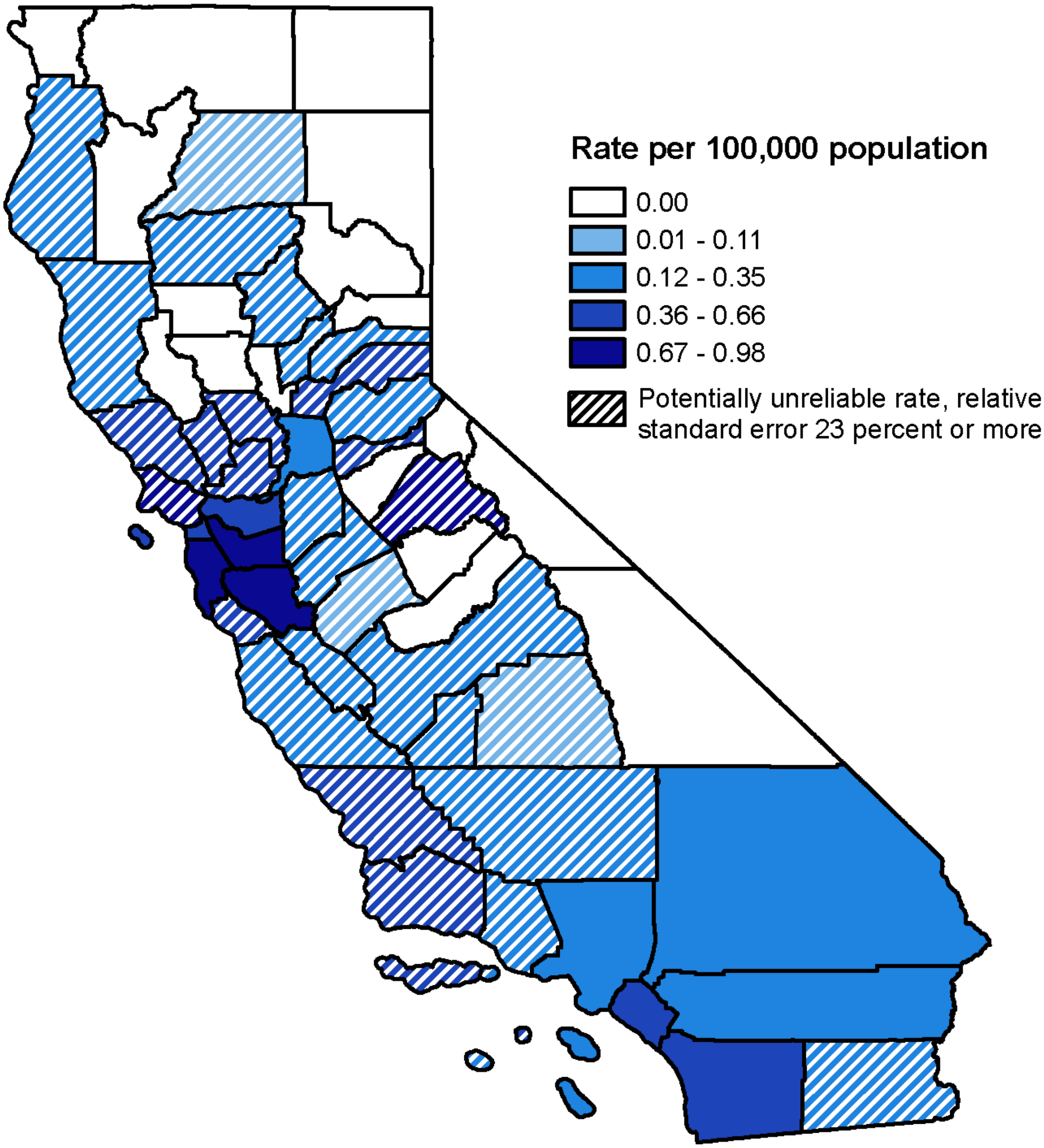
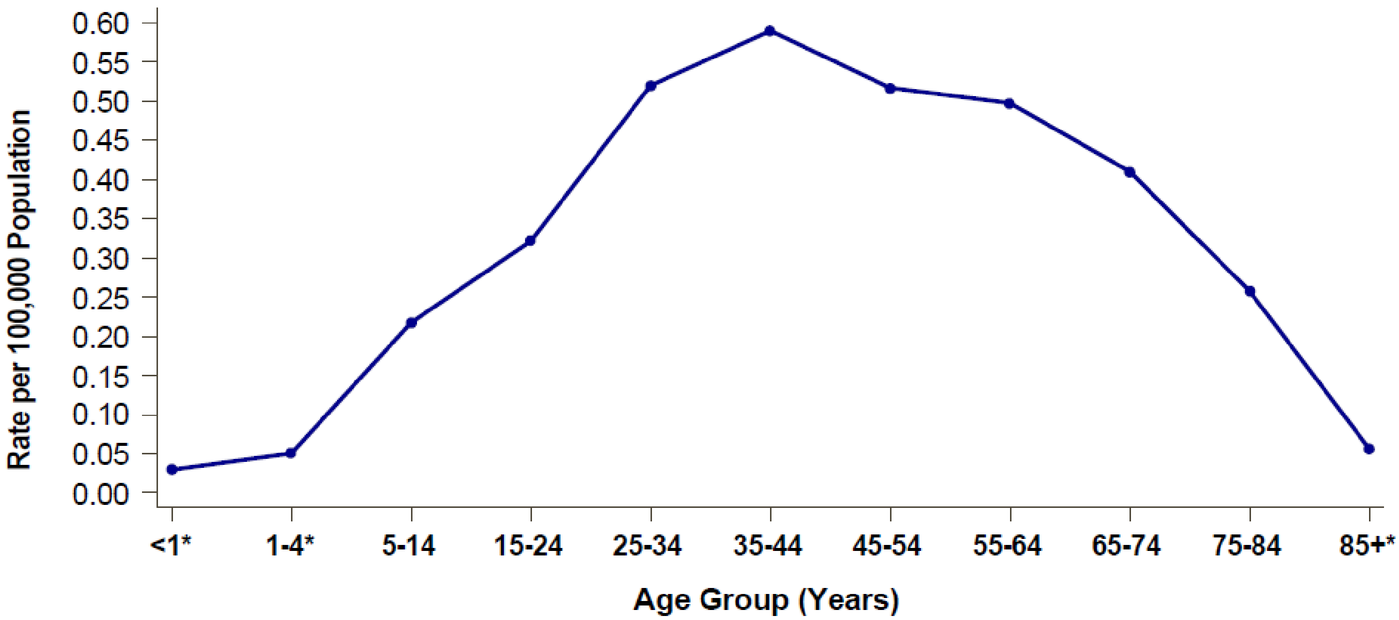
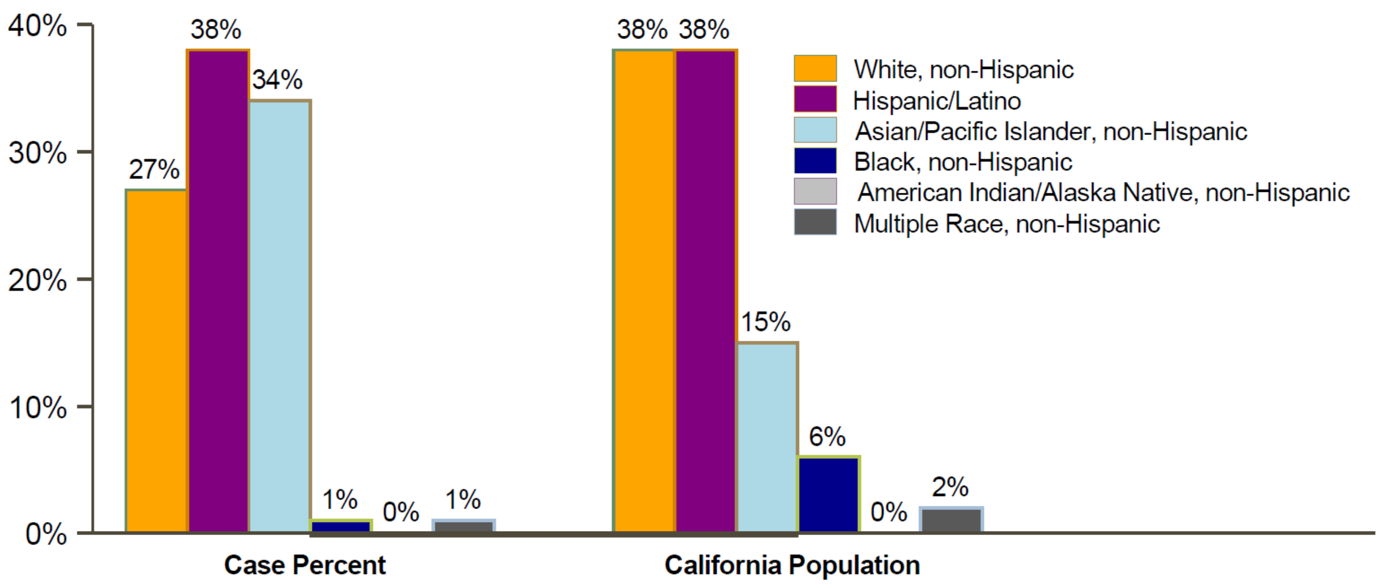


Figure 3. Dengue Average Annual Incidence Rates by Age Group, California, 2013-2019



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

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



27.2% (n=300) of reported incidents of Dengue Virus Infection did not identify race/ethnicity and 2.6% (n=29) 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.

Prepared by Inderbir Sohi, Yanyi Djamba, Charsey Porse, Vicki Kramer, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, January 2021

Comments

Dengue can be life-threatening in severe cases. Persons who travel to areas with risk of dengue should take precautions to prevent mosquito bites by using mosquito repellent on clothes and exposed skin, sleeping under a mosquito bed net, and keeping mosquitoes out of living spaces by using window and door screens. After returning from travel to an area with risk of dengue, persons should continue to use mosquito repellent for three weeks to prevent spreading dengue virus to mosquitoes around their home.

References

[1] Dengue. California Department of Public Health website. Updated October 9, 2020. Accessed November 30, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Dengue.aspx

[2] Areas with Risk of Dengue. U.S. Centers for Disease Control and Prevention website. Updated September 26, 2019. Accessed November 30, 2020. https://www.cdc.gov/dengue/areaswithrisk/index.html

[3] About Dengue: What You Need to Know. U.S. Centers for Disease Control and Prevention website. Updated May 3, 2019. Accessed November 30, 2020. https://www.cdc.gov/dengue/about/index.html

[4] Dengue Symptoms and Treatment. U.S. Centers for Disease Control and Prevention website. November 23, 2020. Accessed November 30, 2020. https://www.cdc.gov/dengue/symptoms/index.html

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

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

[7] Reportable Conditions: Notification by Laboratories, 17 CCR § 2505 (2021). https://govt.westlaw.com/calregs/Document/I1947D280662411E384928538D6692020

[8] Dengue Virus Infections, Case Definitions, 2010 & 2015. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed November 30, 2020. https://ndc.services.cdc.gov/case-definitions/dengue-virus-infections-2010/; https://wwwn.cdc.gov/nndss/conditions/dengue-virus-infections/case-definition/2015/

Key Findings

Giardiasis is an infection caused by *Giardia* parasites that live in the intestines of infected people and animals and shed in stool (poop). Symptoms of giardiasis include diarrhea, stomach cramps, nausea, and bloating. People can get giardiasis by drinking, eating, or accidentally swallowing something that has been contaminated with even a tiny amount of poop from an infected person or animal. *Giardia* can spread in childcare settings, untreated river water, swimming pool water, and areas where infected animals are kept. People can also get infected with *Giardia* while traveling in areas with poor sanitation and by exposure to poop during sexual contact with someone who is infected.

Giardiasis in California from 2013 through 2019

Total Cases: There were a total of 16,170 new giardiasis cases from 2013 through 2019. This is an average of 2,310 cases each year.

Rate: The average annual rate of new giardiasis cases during 2013-2019 was about 6 cases per 100,000 people in California.

- **By County**: The average rate was highest in San Francisco County (about 23 cases per 100,000 people), followed by Plumas and Marin counties (both with 16 cases per 100,000 people).
- **By Sex:** The average rate was almost twice as high in males (about 8 cases per 100,000 people) than in females (4 cases per 100,000 people).
- **By Age Group**: The average rate was highest in children aged 1 to 4 years (about 8 cases per 100,000 people in this age group), followed by adults aged 25 to 34 years and 45 to 64 years (about 7 cases per 100,000 people in both of these age groups).
- **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 61%).
- **By Month**: Overall, there were more giardiasis cases in the summer months of July, August, and September than in any other month.

To help prevent giardiasis, people should wash their hands with soap and water before preparing or eating food, and after using the toilet, changing diapers, or touching animals or handling animal poop. Do not swim or let kids swim if sick with diarrhea, and avoid swallowing swimming pool water and untreated water, such as from a river or lake. It is also important to wait to have sex of any kind for several weeks after having diarrhea from giardiasis.

For more information about giardiasis in California, please visit the CDPH Giardiasis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Giardiasis is a worldwide diarrheal disease caused by the parasite *Giardia duodenalis* (also referred to as *Giardia lamblia* or *Giardia intestinalis*). In the United States, giardiasis is the most common intestinal parasitic disease[1] and one of the most common causes of waterborne diseases in people,[2] with an estimated more than 1.2 million cases occurring annually.[3] Since 2011, the incidence rate of reported giardiasis cases in the U.S. has remained fairly stable, with less than 7.0 new cases per 100,000 population reported each year.[3]

Giardia form an outer shell, or cyst, that can survive in the environment for long periods of time.[4] *Giardia* cysts may be found in water, soil, food, or on surfaces that have been contaminated with feces from infected persons or animals. Millions of cysts are shed in the feces of an infected person or animal, but ingestion of as few as 10 cysts can cause giardiasis.[5] People can become infected in many ways, such as by drinking untreated contaminated surface or well water, by accidentally swallowing contaminated swimming pool water (*Giardia* cysts are moderately resistant to chlorine[4]), by eating contaminated foods, or by having close contact with an infected person, particularly in a childcare setting or during sexual activity.[1]

Symptoms of giardiasis include diarrhea, nausea, bloating, stomach cramps, and dehydration. Acute illness begins 1-2 weeks after exposure and can last 2-6 weeks. Some infections can cause chronic giardiasis with waxing and waning symptoms for months or longer, leading to malnutrition, weight loss, and loose stools.[6] Other infections can remain asymptomatic. *Giardia* can be diagnosed by a stool test, but because cysts are shed in feces intermittently, it is often difficult to diagnose *Giardia*. There are several prescription drugs that treat *Giardia*.[2]

This report describes the epidemiology of confirmed and probable giardiasis cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes*.[7] The epidemiologic description of giardiasis for earlier surveillance periods can be found in the *Epidemiologic Summary of Giardiasis in California, 2001-2008 and 2009-2012.*[8, 9]

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 giardiasis to their local health department within seven calendar days of identification or immediately by telephone if an outbreak is suspected.[10] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of giardiasis 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.[11]

California regulations require cases of giardiasis to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed or probable case. During the 2013-2019 surveillance period, a confirmed case of giardiasis was defined as one with laboratory detection of *Giardia* organisms, along with clinically compatible illness (as characterized by gastrointestinal symptoms, such as diarrhea, abdominal cramps, bloating, weight loss, or malabsorption). A probable case was defined as one with clinically compatible illness and an established epidemiologic link to a laboratory-confirmed case.[12]

Epidemiology of Giardiasis in California, 2013-2019

CDPH received reports of 16,170 total cases of giardiasis with estimated symptom onset dates from 2013 through 2019. This corresponds to an average of 2,310 cases each year and an average annual incidence rate of 5.9 cases per 100,000 population. Incidence rates increased 32.0% from 2013 (5.0 per 100,000; 1,939 cases) to 2019 (6.6 per 100,000; 2,630 cases) [Figure 1].

County-specific average annual incidence rates per 100,000 population during 2013-2019 ranged from 0 (Alpine County) to 23.2 (San Francisco County, 1,414 cases) [Figure 2]. In addition to San Francisco County, average incidence rates of giardiasis were higher in Plumas County (16.0 per 100,000; 21 cases), Marin County (16.0 per 100,000; 292 cases), Mendocino County (11.9 per 100,000; 74 cases), and Alameda County (11.8 per 100,000; 1,350 cases). Average incidence rates for the surveillance period were 1.5 times higher in Northern California (7.3 per 100,000; 8,705 cases) than in Southern California (4.8 per 100,000; 7,465 cases). By region (see *Technical Notes*), the Bay Area (10.7 per 100,000; 5,760 cases) had the highest average incidence rate, followed by the San Diego Region (8.3 per 100,000; 2,026 cases).

From 2013 through 2019, the average annual incidence rate of giardiasis was almost twice as high among males (7.6 per 100,000; 10,330 cases) than among females (4.0 per 100,000; 5,567 cases); of cases with information on sex, 65.0% of giardiasis case-patients were male and 35.0% were female.

Average annual giardiasis incidence during the surveillance period was highest among children aged 1 to 4 years (8.4 per 100,000; 1,162 cases), followed by adults aged 25 to 34 years (7.3 per 100,000; 2,759 cases) and adults aged 45 to 64 years (6.8 per 100,000; 4,679 cases). Annual incidence rates increased overall from 2013 through 2019 in all age groups except for children aged 1 to 4 years and persons aged 15 to 24 years [Figure 3]. Rates increased most among adults aged 25 to 34 years (71.5% rise from 2013 [5.3 per 100,000; 287 cases] to 2019 [9.1 per 100,000; 493 cases]), and among adults aged 55 to 64 (62.7% rise from 2013 [5.3 per 100,000; 233 cases] to 2019 [8.6 per 100,000; 419 cases]).

For giardiasis cases with complete race/ethnicity information (see *Technical Notes*), the highest percentage of cases was among case-patients who reported non-Hispanic White race/ethnicity (61.1%). Case-patients reported non-Hispanic White race/ethnicity more frequently than would be expected based on the demographic profile of California during the same time period (61.1% vs. 38.0%, respectively) [Figure 4].

From 2013 through 2019, the highest number of giardiasis cases by month of estimated illness onset occurred in the summer months of July, August, and September [Figure 5].

There were no reported waterborne or foodborne outbreaks of giardiasis that occurred in California during the 2013-2019 surveillance period.

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

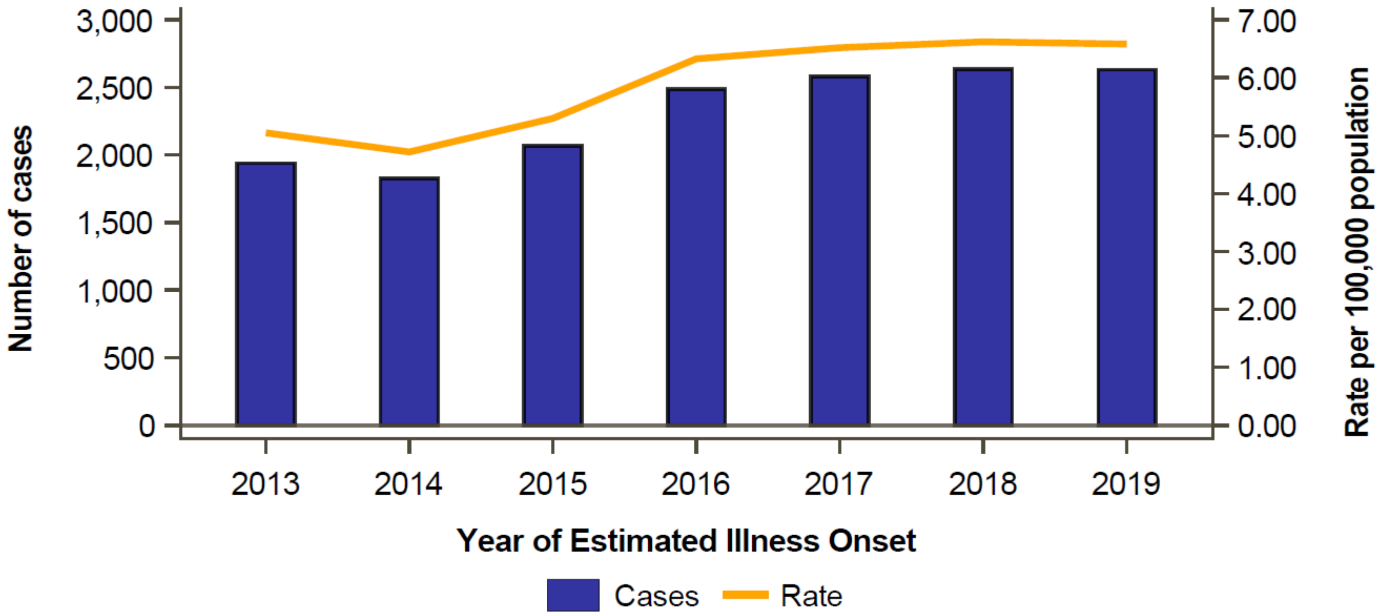


Figure 2. Giardiasis Average Annual Incidence Rates by County, California, 2013-2019

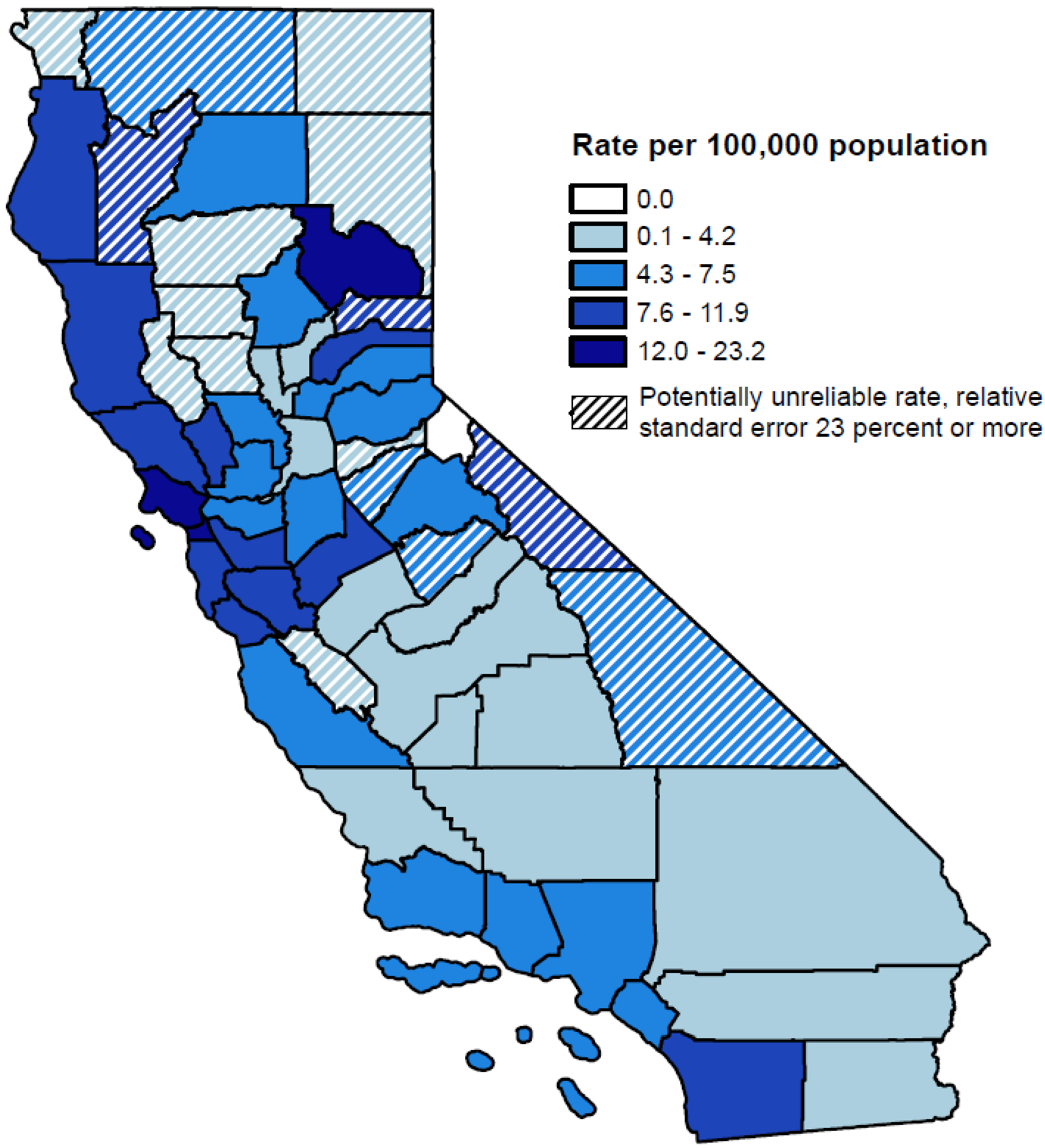


Figure 3. Giardiasis Incidence Rates by Age Group and Year of Estimated Illness Onset, California, 2013-2019

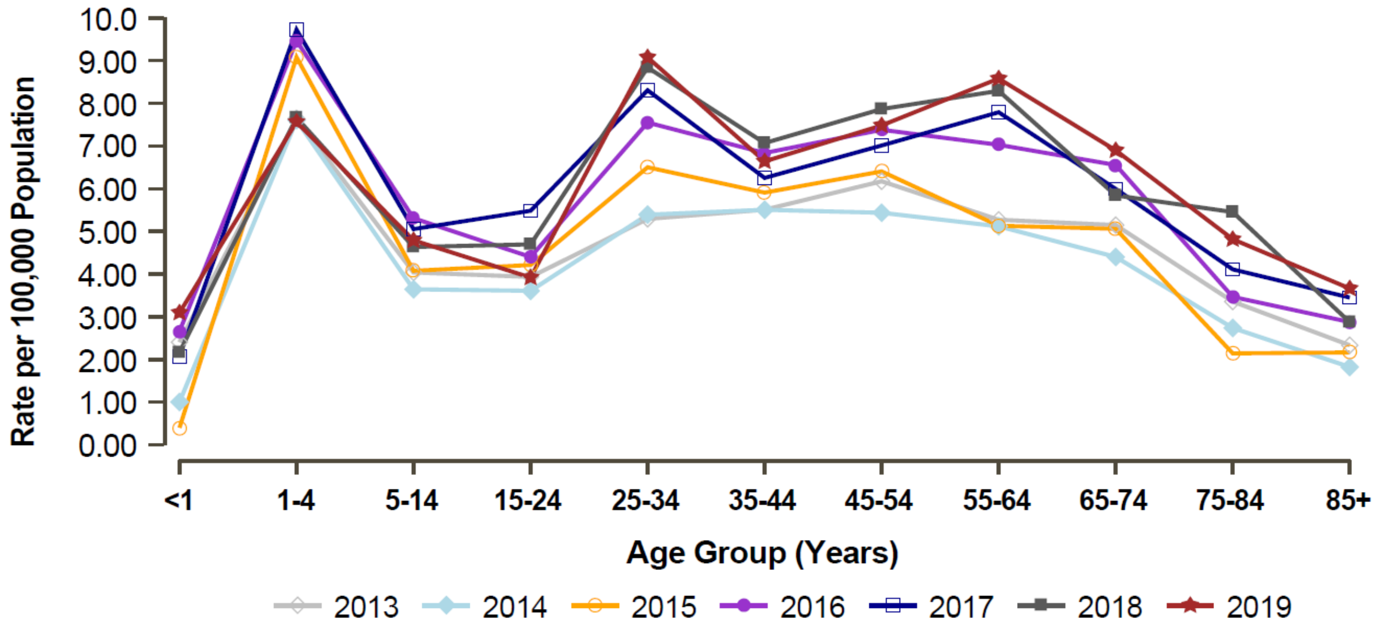
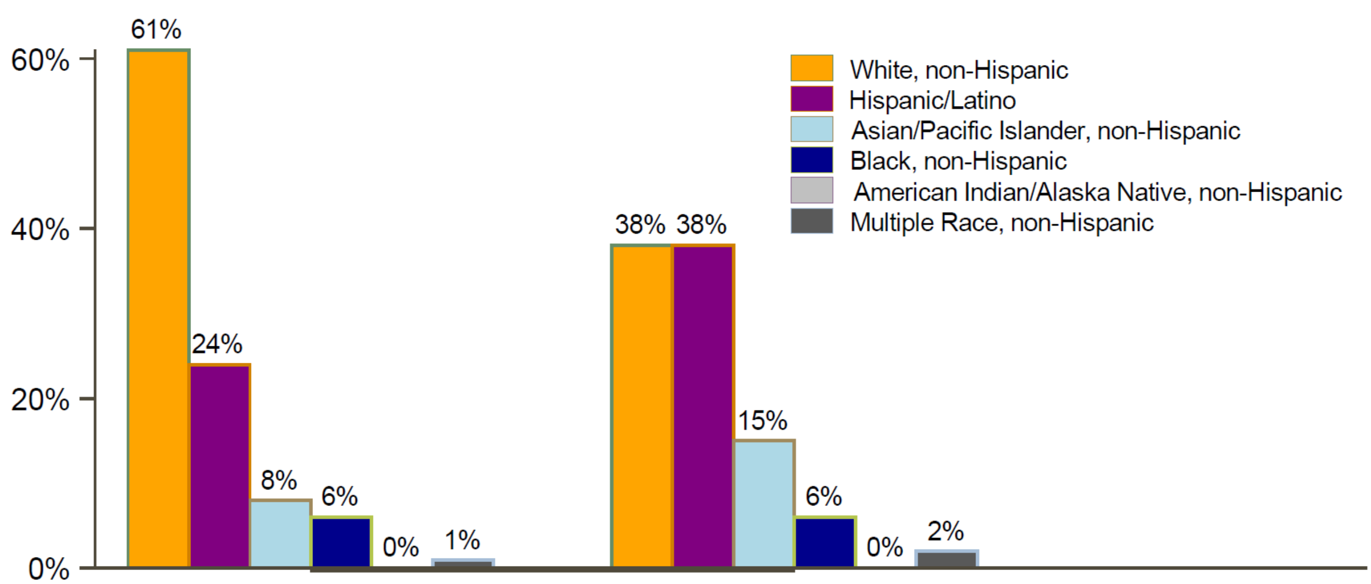
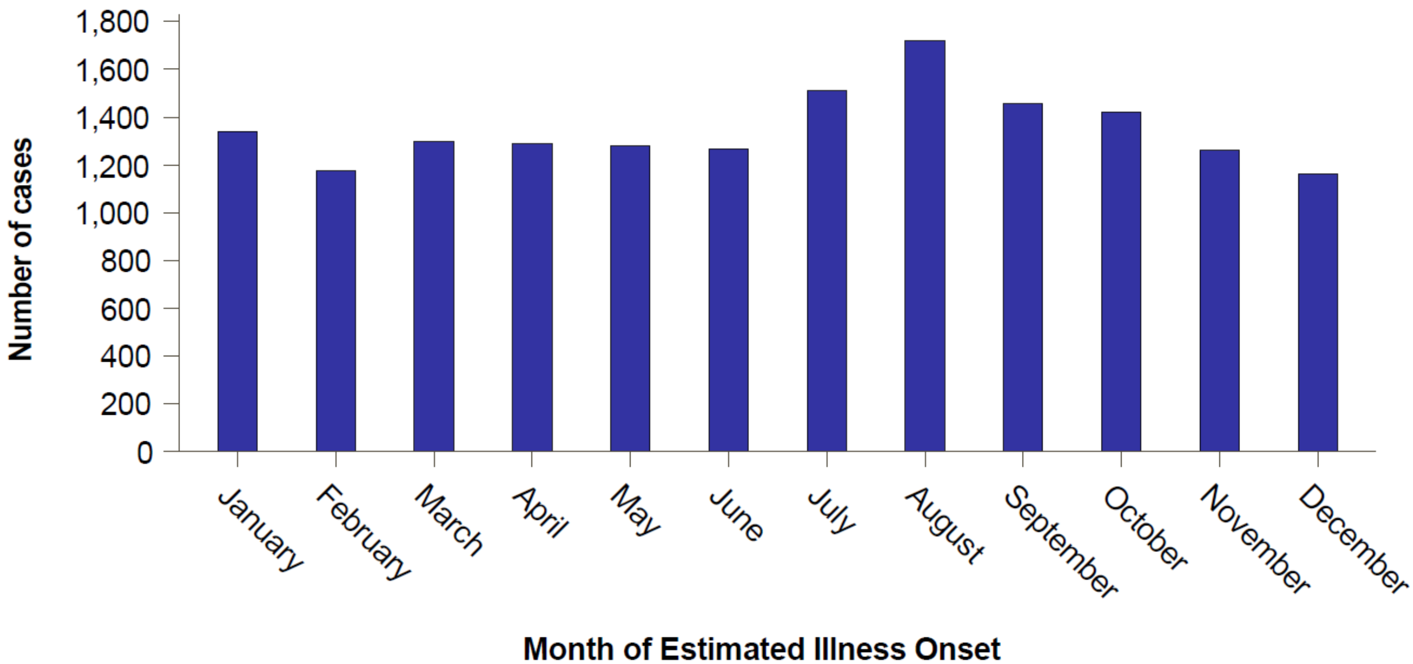


Figure 4. Giardiasis Cases and Population by Race/Ethnicity, California, 2013-2019



36.5% (n=5903) of reported incidents of Giardiasis did not identify race/ethnicity and 5.4% (n=866) 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.

Figure 5. Giardiasis Cases by Month of Estimated Illness Onset, California, 2013-2019



Comments

Incidence rates of giardiasis per 100,000 Californians increased moderately from 5.0 in 2013 to 6.6 in 2019. The peak rate was in 2018 and 2019 (6.6 per 100,000 population in both years). Cases are likely to be underreported and therefore rates are likely to be underestimated because infected persons may have no symptoms and giardiasis can be difficult to diagnose.[13]

Overall, incidence rates during the 2013-2019 surveillance period (average rate of 5.9 per 100,000) increased moderately compared to the 2009-2012 surveillance period (average rate of 4.7 per 100,000), as described in previous epidemiologic summaries.[8] The sex, racial/ethnic, and regional epidemiologic profiles of incident cases were similar to those reported in epidemiologic summaries from earlier years.[7, 8] However, unlike in previous surveillance periods, the 2013-2019 surveillance period saw an increased incidence among adults aged 25 to 34 years and 45 to 64 years as compared to other age groups; during 2013-2019, adults in these age groups were almost as likely to get giardiasis as children aged 1 to 4 years.

California's 2013-2019 rates were similar to national giardiasis incidence rates. However, the age distribution of incident cases in the U.S. and California differed; children aged 1 to 4 years in both the U.S. and California had the highest incidence rates, but adults in California experienced higher incidence compared to adults in the U.S. The distribution of giardiasis cases by sex in the U.S. and California was similar.[14, 15, 16, 17]

To prevent *Giardia* infection, persons should practice proper hand hygiene before preparing or eating food, and after using the toilet, changing diapers, or touching animals or handling animal feces. Persons experiencing diarrhea should avoid swimming and should also avoid sexual contact for several weeks after diarrhea from giardiasis has subsided. Persons swimming or recreating in and around water should avoid swallowing swimming pool water and untreated water, such as from rivers or lakes.

Prepared by Kirsten Knutson, Yanyi Djamba, Alexander Yu, Akiko Kimura, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, May 2022

References

[1] Parasites – *Giardia*, Transmission. U.S. Centers for Disease Control and Prevention website. Updated February 26, 2021. Accessed April 2, 2021. https://www.cdc.gov/parasites/giardia/infection-sources.html

[2] Giardiasis. California Department of Public Health website. Updated March 2015. Accessed April 2, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Giardiasis.aspx

[3] U.S. Centers for Disease Control and Prevention (CDC). Giardiasis Summary Report – National Notifiable Diseases Surveillance System, United States, 2018. Atlanta, Georgia: U.S. Department of Health and Human Services, CDC, 2019. Updated February 18, 2020. Accessed April 2, 2021. https://www.cdc.gov/healthywater/surveillance/giardiasis/giardiasis-2018.html

[4] Parasites – *Giardia*, Pathogen and Environment. U.S. Centers for Disease Control and Prevention website. Updated February 26, 2021. Accessed June 30, 2021. https://www.cdc.gov/parasites/giardia/pathogen.html

[5] Conners EE, Miller AD, Balachandran N et al Giardiasis Outbreaks — United States, 2012–2017*. MMWR Morb Mortal Wkly Rep*. 2021 Mar 5;70(9);304–307.

[6] Parasites – *Giardia*, Illness and Symptoms. U.S. Centers for Disease Control and Prevention website. Updated February 26, 2021. Accessed April 4, 2022. https://www.cdc.gov/parasites/giardia/illness.html

[7] State of California, Department of Public Health. Technical notes. In*: Epidemiologic Summaries of Selected General Communicable Diseases in California, 2013-2019.* Sacramento, CA; 2021. Accessed April 2, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesTechnicalNotes2013-2019.pdf

[8] State of California, Department of Public Health. Giardiasis. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008*. Sacramento, CA; 2009. Accessed April 6, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[9] State of California, Department of Public Health. Giardiasis. In*: Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012*. Sacramento, CA; 2015. Accessed April 6, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf

[10] Reportable Diseases and Conditions: Reporting to the Local Health Authority, 17 CCR § 2500 (2021).
https://govt.westlaw.com/calregs/Document/IA48A8EC35A2011EC8227000D3A7C4BC3

[11] Reportable Diseases and Conditions: Notification by Laboratories, 17 CCR § 2505 (2021).
https://govt.westlaw.com/calregs/Document/IA4E977A35A2011EC8227000D3A7C4BC3

[12] Giardiasis 2011 Case Definition. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Updated April 16, 2021. Accessed June 30, 2021. https://ndc.services.cdc.gov/case-definitions/giardiasis-2011/

[13] Scallan E, Hoekstra RM, Angulo FJ et al. Foodborne illness acquired in the United States—major pathogens. *Emerg Infect Dis*. 2011 Jan; 17(1):7-15.

[14] Adams DA, Thomas K, Jajosky RA et. al. Summary of notifiable diseases and conditions--United States, 2014. *MMWR Morb Mortal Wkly Rep.* 2016 Oct 14;63(54):1-152.

[15] Adams DA, Fullerton K, Jajosky R et.al. Summary of notifiable diseases and conditions--United States, 2013. *MMWR Morb Mortal Wkly Rep.* 2015 Oct 23;62(53):1-119.

[16] Adams DA, Thomas K, Jajosky RA et al. Summary of notifiable diseases and conditions--United States, 2015. *MMWR Morb Mortal Wkly Rep.* 2017 Aug 11;64(53):1-143.

[17] National Notifiable Diseases Surveillance System. *2016-2018 Annual Tables of Infectious Disease Data.* Atlanta, GA: U.S. Centers for Disease Control and Prevention, Division of Health Informatics and Surveillance; 2019. Accessed April 26, 2021.
https://wwwn.cdc.gov/nndss/data-and-statistics.html

Key Findings

Legionellosis is an infection caused by *Legionella* bacteria, which naturally live in fresh water sources and can grow and spread in human-made water systems. People can become infected with *Legionella* when they breathe in small droplets of water containing the bacteria. These bacteria can infect the lungs and cause Legionnaires' disease (a severe type of pneumonia or lung infection), or Pontiac fever (a less serious disease). Most healthy people exposed to *Legionella* bacteria do not get sick. People at higher risk of getting legionellosis include older adults, people who smoke, and people with lung disease or other chronic illnesses that weaken the immune system.

Legionellosis in California from 2013 through 2019

Total Cases: There were a total of 3,159 new legionellosis cases from 2013 through 2019, including 2,933 (about 93%) cases of Legionnaires' disease. Of the total cases, 2,991 (about 95%) patients were reported to have been hospitalized, and 319 (about 10%) were reported to have died with legionellosis.

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

- **By County**: The average rate was highest in Los Angeles County, with about 2 cases per 100,000 people. Most cases (about 73%) in California were reported from the Southern California region.
- **By Sex**: The average rate was higher in males than females, but each group had about 1 case per 100,000 people.
- **By Age Group**: The average rates were highest in adults aged 85 years and older (about 7 cases per 100,000 people in this age group) and 75 to 84 years (about 5 cases per 100,000 people in this age group).
- **By Race/Ethnicity**: For cases where race and ethnicity information was available, there were higher percentages of cases in people who reported non-Hispanic White race/ethnicity (about 53%) and non-Hispanic Black race/ethnicity (about 15%) than compared to the percentages of these groups in California.

The best way to prevent legionellosis is for building owners and managers to maintain and keep clean the water systems in buildings, hot tubs, cooling towers, and decorative fountains to prevent *Legionella* bacteria from growing in the water and spraying into the air. People who have a higher risk of getting legionellosis should also avoid risky water exposures, including hot tubs and decorative water fountains.

For more information about legionellosis in California, please visit the CDPH Legionellosis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Legionella bacteria cause Legionnaires' disease and Pontiac fever, which are collectively known as legionellosis, but are clinically and epidemiologically distinct syndromes. Pontiac fever is a self-limited, nonpneumonic, influenza-like illness, whereas Legionnaires' disease is a serious bacterial pneumonia with substantial morbidity and mortality.[1] The vast majority of reported legionellosis cases are Legionnaires' disease. Infection occurs via inhalation of aerosolized water or aspiration of water contaminated with *Legionella* bacteria, which commonly grow in freshwater sources and amplify in human-made water systems.[2] Warm temperatures and biofilms support bacterial growth, and hot tubs, cooling towers, and potable water systems have been implicated exposure sources in legionellosis outbreaks in California.

While most people exposed to *Legionella* do not become ill, risk factors for Legionnaires' disease include advanced age, current or historical smoking, chronic lung disease, and immune system deficiencies due to disease or medication.[3] Exposure to hot tubs and a recent overnight stay outside of the home (e.g., in a healthcare facility or hotel) are also considered risk factors for disease; hotels, resorts, hospitals, and long-term care facilities often use complex water systems that can grow and aerosolize *Legionella* and expose vulnerable populations.[2, 3]

Legionella is an important respiratory bacterial pathogen in the United States. The crude national incidence rate has increased 5.5-fold from 0.42 per 100,000 population in 2000 to 2.29 per 100,000 in 2017.[4] Nearly 10,000 cases of Legionnaires' disease were reported by health departments in the U.S. in 2018. However, these reported numbers of cases may be underestimates as legionellosis is likely underdiagnosed.[5] *L. pneumophila* serogroup 1 is the most frequently identified serogroup among reported cases in California (the causative agent in about 95% of California patients). Most cases are currently diagnosed by urine antigen, which is highly specific only for *L. pneumophila* serogroup 1, thus disease caused by other serogroups or species is less likely to be diagnosed.[6] Though used less commonly for diagnosis, culture methods are critically important for legionellosis surveillance and outbreak investigation; culture methods can detect all species and serogroups, and yield isolates that can be compared to other clinical or environmental samples during outbreak investigations.[7] In recent years, *Legionella* has been a commonly reported pathogen associated with drinking water outbreaks.[8, 9]

This report describes the epidemiology of confirmed legionellosis cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes.*[10] The epidemiologic description of legionellosis for earlier surveillance periods can be found in the *Epidemiologic Summary of Legionellosis in California, 2001-2008 and 2009-2012*.[11, 12]

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 legionellosis to their local health department within seven working days of identification or immediately by telephone if an outbreak is suspected.[13] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of

Legionella spp. (antigen or culture) to either the California Reportable Diseases Information Exchange (CalREDIE) via electronic laboratory reporting or the local health department; notification should occur within one working day after the health care provider has been notified.[14]

California regulations require cases of legionellosis to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed case. During the surveillance period (2013-2019), a confirmed case of legionellosis was defined as a case with clinically compatible symptoms that met at least one of the following criteria for laboratory confirmation: by culture, isolation of any *Legionella* organism from respiratory secretions, lung tissue, pleural fluid, or other normally sterile fluid; by detection of *L. pneumophila* serogroup 1 antigen in urine using validated reagents; or by seroconversion, fourfold or greater rise in specific serum antibody titer to *L. pneumophila* serogroup 1 using validated reagents.[15]

Epidemiology of Legionellosis in California, 2013-2019

CDPH received reports of 3,159 total cases of legionellosis among case-patients with estimated symptom onset dates from 2013 through 2019, including 2,933 (92.8%) cases classified as Legionnaires' disease. The average annual incidence of legionellosis for the surveillance period was 1.2 per 100,000 population. Average annual incidence rates increased 180% from 2013 (0.5 per 100,000; 204 cases) through 2019 (1.4 per 100,000; 542 cases), with fluctuations over time [Figure 1]. Of the total cases reported during the surveillance period, 2,991 (94.7%) case-patients were reported to have been hospitalized and 319 (10.1%) were reported to have died with legionellosis.

County-specific average annual incidence rates per 100,000 population during 2013-2019 ranged from 0 to 1.6, with the highest average rate in Los Angeles County (1.6 per 100,000; 1,175 cases) [Figure 2]. By region (see *Technical Notes*), average annual incidence rates for the surveillance period were 66.7% higher in Southern California (1.2 per 100,000; 2,297 cases) than in Northern California (0.6 cases; 862 cases). Legionellosis cases in Southern California accounted for 72.7% of all legionellosis cases reported in California during the surveillance period. Overall, average annual incidence rates increased in both Southern and Northern California during the surveillance period; rates increased by 185% in Southern California (from 0.5 to 1.4 per 100,000) and by 183% in Northern California (from 0.3 to 0.9 per 100,000) from 2013 through 2019.

During 2013-2019, the average annual incidence rate was higher among males (1.4 per 100,000; 1,932 cases) than among females (0.9 per 100,000; 1,221 cases); 61.3% of legionellosis case-patients were male and 38.7% were female.

Average annual legionellosis incidence rates increased with increasing age; rates were highest among adults aged 85 years and older (6.6 per 100,000; 348 cases) and 75-84 years (5.3 per 100,000; 576 cases) [Figure 3].

For legionellosis cases with complete race/ethnicity information (see *Technical Notes*), the highest percentage of cases was among those who reported non-Hispanic White race/ethnicity (53.1%). The percentages of cases who reported non-Hispanic White race/ethnicity and non-Hispanic Black race/ethnicity were disproportionately higher than the percentages of the non-

Hispanic White and non-Hispanic Black racial/ethnic populations in California during the same time period (53.1% vs. 38.0%, respectively, for non-Hispanic White race/ethnicity; 14.7% vs. 6.0%, respectively, for non-Hispanic Black race/ethnicity) [Figure 4].

Of the 3,159 total reported cases of legionellosis, 525 (16.6%) case-patients reported spending at least one night away from home in a non-healthcare setting (e.g., hotel, vacation rental, cruise ship, etc.) during the ten days prior to illness onset, and were considered to be travel-associated cases. An additional 103 (3.3%) case-patients reported spending the entire ten days prior to illness onset in a healthcare facility (e.g., hospital, long term care facility, skilled nursing facility, etc.), and were considered to be healthcare-associated cases.

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

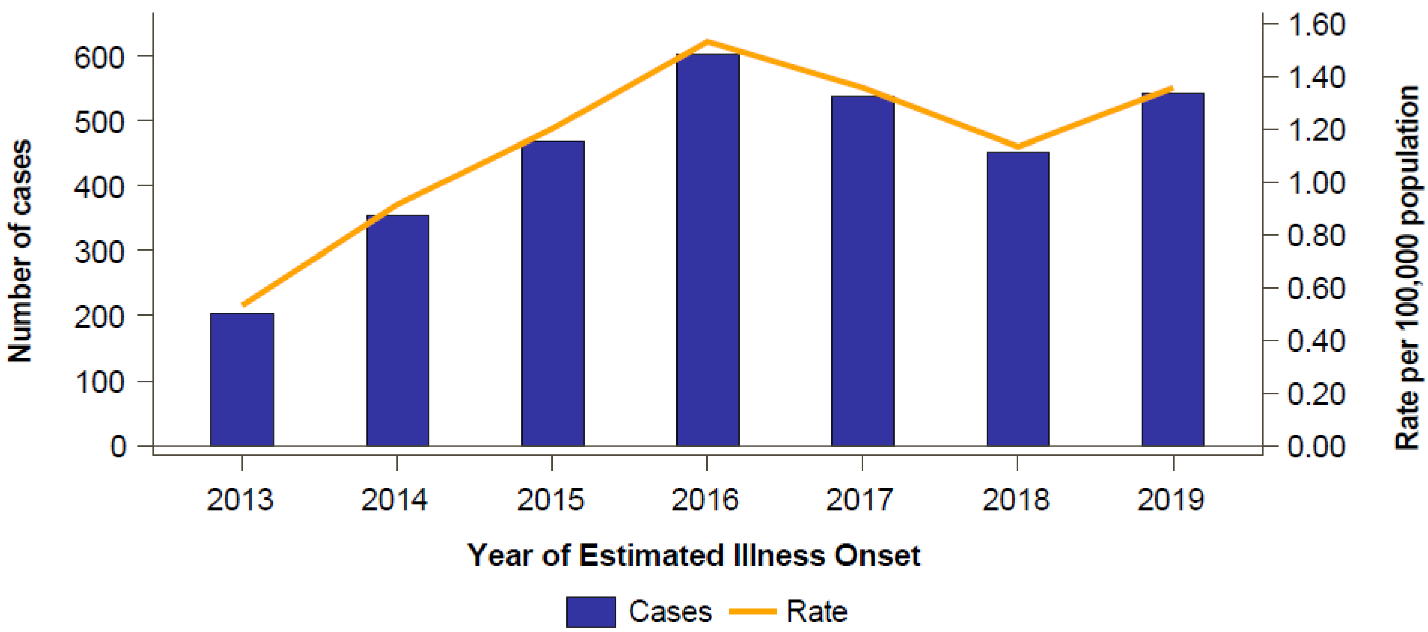


Figure 2. Legionellosis Average Annual Incidence Rates by County, California, 2013-2019

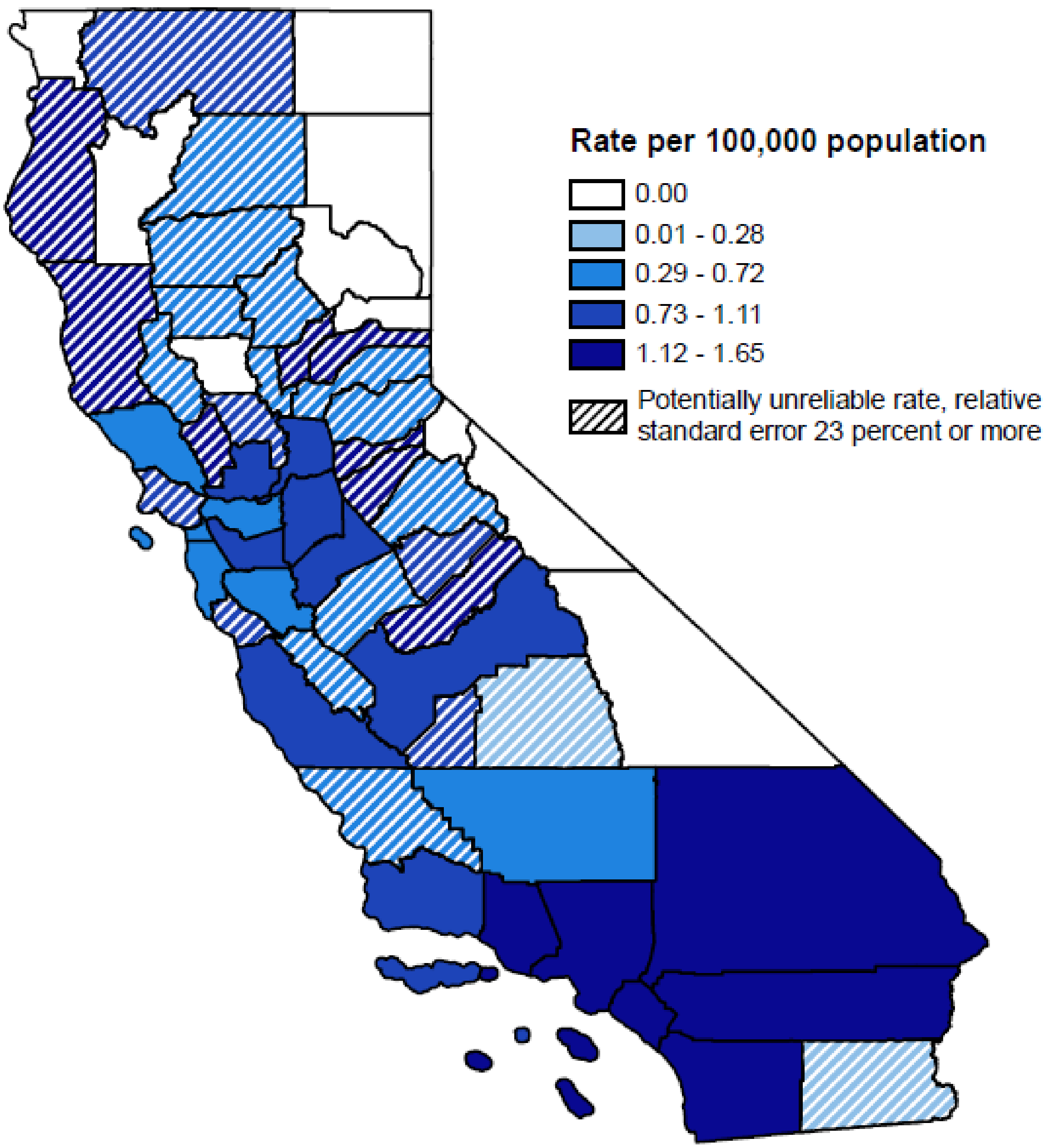
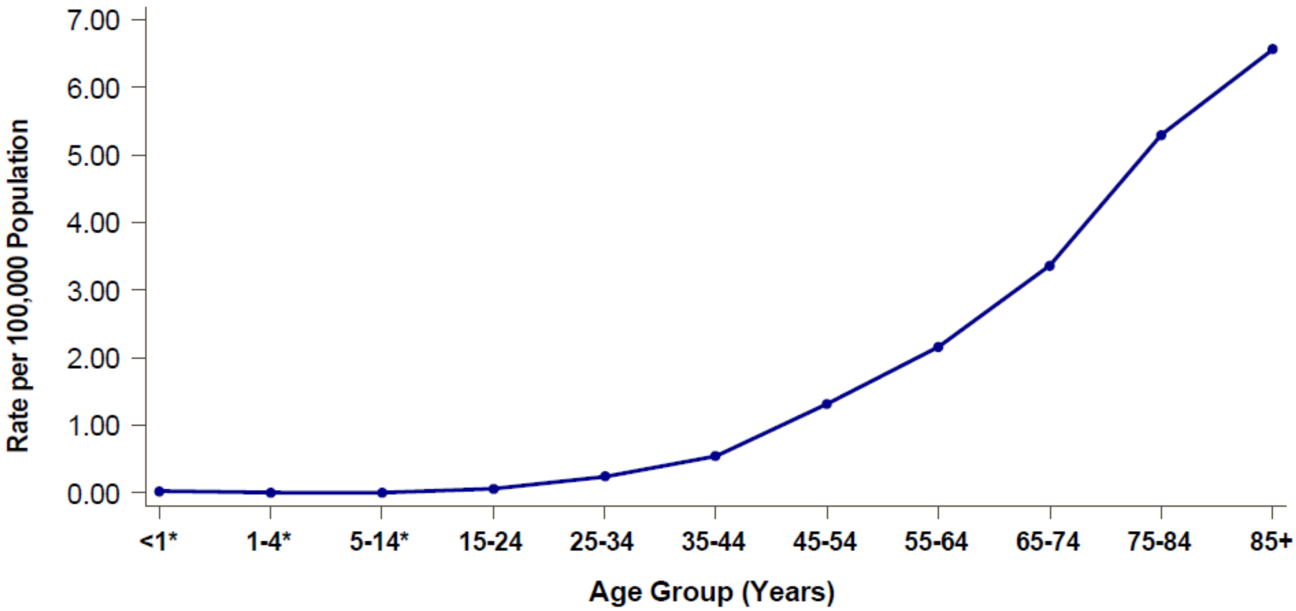
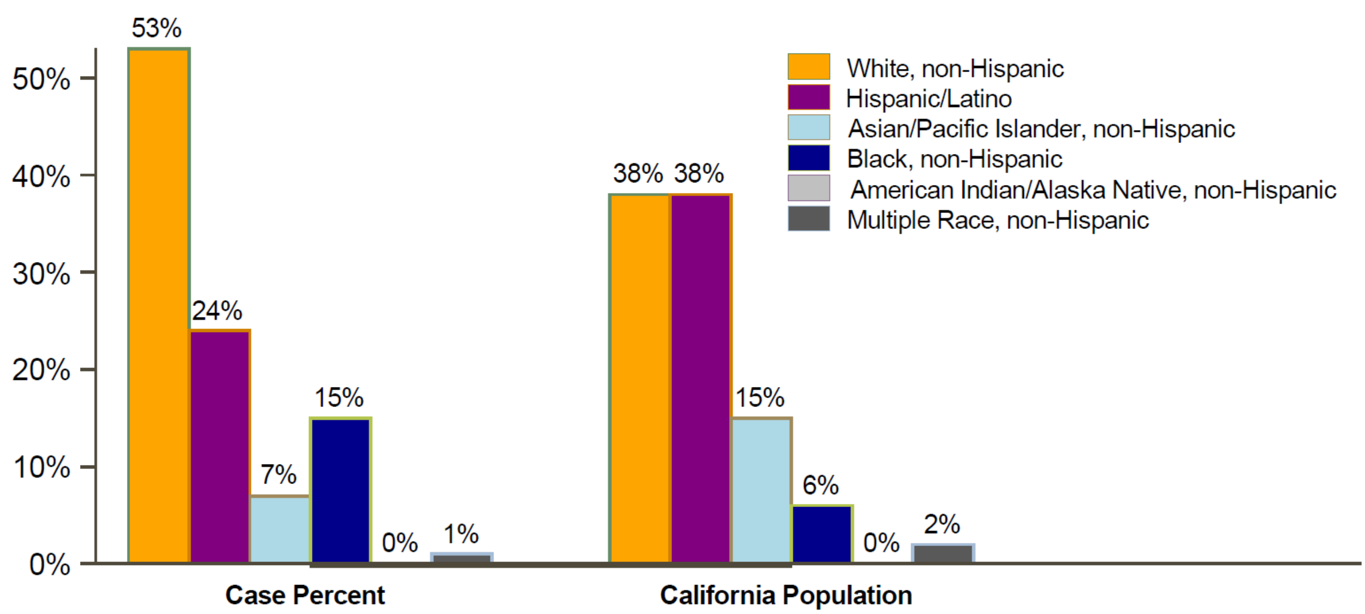


Figure 3. Legionellosis Average Annual Incidence Rates by Age Group, California, 2013-2019



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

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



12.1% (n=383) of reported incidents of Legionellosis did not identify race/ethnicity and 2.1% (n=67) 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 rate of legionellosis in California increased by 94.9% from the 2009-2012 surveillance period (0.6 per 100,000; 885 total cases) compared to the 2013-2019 surveillance period (1.2 per 100,000; 3,159 total cases).[12] Similar to the 2009-2012 surveillance period, average legionellosis incidence rates increased with increasing age and were highest among adults aged 85 years and older (6.6 per 100,000; 348 cases) for the 2013-2019 surveillance period.[12]

By region, average annual legionellosis rates during 2013-2019 increased in both Northern (0.6 per 100,000) and Southern California (1.2 per 100,000) when compared to the 2009-2012 surveillance period (Northern California: 0.3 per 100,000; Southern California: 0.8 per 100,000). The reason for the increase in average annual legionellosis rates is uncertain but could be due to a combination of factors[4], including: an aging population; an increase in the number of people with immunocompromising conditions or medications[16]; better detection due to increased awareness and testing; aging building infrastructure and plumbing; increased use of water-saving features resulting in temporary or prolonged water stagnation in pipes; an increase in *Legionella* in the environment due to warmer temperatures; and differences in the duration of surveillance periods (4 years in 2009-2012 vs. 7 years in 2013-2019).

The best way to prevent legionellosis is to minimize the growth and spread of *Legionella* in water systems through routine cleaning and maintenance. Building owners and operators can develop water management plans to identify water system areas at increased risk for *Legionella* growth and spread, document plans for routine cleaning and maintenance, establish water system control limits (e.g., temperature and disinfectant levels), and designate corrective actions if control limits are not met.

Prepared by Inderbir Sohi, Kirsten Knutson, Yanyi Djamba, Sarah Rutschmann, Akiko Kimura, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, July 2021

References

1 *Legionella* (Legionnaires' Disease and Pontiac Fever), Clinical Features. U.S. Centers for Disease Control and Prevention website. Updated January 15, 2020. Accessed December 23, 2020. https://www.cdc.gov/legionella/clinicians/clinical-features.html

2 *Legionella* (Legionnaires' Disease and Pontiac Fever), Disease Specifics. U.S. Centers for Disease Control and Prevention website. Updated March 25, 2021. Accessed July 29, 2021. https://www.cdc.gov/legionella/clinicians/disease-specifics.html

3 What Clinicians Need to Know about Legionnaires' Disease. U.S. Centers for Disease Control and Prevention. Updated February 24, 2020. Accessed July 29, 2021. https://www.cdc.gov/legionella/downloads/fs-legionella-clinicians.pdf

4 Legionnaires' Disease Surveillance Summary Report, United States 2016-2017. U.S. Centers for Disease Control and Prevention. February 2020. Accessed March 5, 2021. https://www.cdc.gov/legionella/health-depts/surv-reporting/2016-17-surv-report-508.pdf

[5] *Legionella* (Legionnaires' Disease and Pontiac Fever), History, Burden, and Trends. U.S. Centers for Disease Control and Prevention website. Updated April 30, 2018. Accessed March 5, 2021. https://www.cdc.gov/legionella/about/history.html

[6] Fields BS, Benson RF, Besser RE. *Legionella* and Legionnaires' disease: 25 years of investigation. *Clin Microbiol Rev*. 2002;15(3):506-526. doi:10.1128/cmr.15.3.506-526.2002

[7] *Legionella* (Legionnaires' Disease and Pontiac Fever), Diagnosis, Treatment, & Prevention. U.S. Centers for Disease Control and Prevention website. Updated January 15, 2020. Accessed March 5, 2021. https://www.cdc.gov/legionella/clinicians/diagnostic-testing.html

[8] Waterborne Disease & Outbreak Surveillance Reporting, Surveillance Reports for Drinking Water-associated Disease & Outbreaks. U.S. Centers for Disease Control and Prevention website. Updated January 19, 2021. Accessed May 20, 2021. https://www.cdc.gov/healthywater/surveillance/drinking-surveillance-reports.html

[9] Benedict KM, Reses H, Vigar M, et al. Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water — United States, 2013–2014. MMWR Morb Mortal Wkly Rep 2017;66:1216–1221. DOI: http://dx.doi.org/10.15585/mmwr.mm6644a3

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

[11] State of California, Department of Public Health. Legionellosis. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008.* Sacramento, CA; 2009. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[12] State of California, Department of Public Health. Legionellosis. In*: Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012.* Sacramento, CA; 2015. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf

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

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

[15] Legionellosis/Legionnaires' Disease or Pontiac Fever 2005 Case Definition. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed July 28, 2021. https://ndc.services.cdc.gov/case-definitions/legionellosis-2005/

[16] Parr A, Whitney EA, Berkelman RL. Legionellosis on the Rise: A Review of Guidelines for Prevention in the United States. *J Public Health Manag Pract*. 2015;21(5):E17-E26. doi:10.1097/PHH.0000000000000123

Key Findings

Listeriosis is an infection caused by *Listeria*, a type of bacteria that is common in the environment and can make some people very sick. People usually get listeriosis by eating food that is contaminated with *Listeria* bacteria, especially raw (uncooked) food, unpasteurized milk or milk products, and deli meats and soft cheeses that may have been contaminated during or after processing. Listeriosis mainly affects older adults, people with weakened immune systems, and pregnant women and their newborns. It is rare for healthy people in other groups to get sick with listeriosis. Listeriosis is uncommon, but it can cause severe disease and death. It is usually a mild illness for pregnant women but can cause severe disease in the newborn or in the fetus, resulting in stillbirth.

Listeriosis in California from 2013 through 2019

Total Cases: There were a total of 812 new listeriosis cases from 2013 through 2019. This is an average of 116 cases each year.

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

- **By County**: Of the 11 California counties that had at least one case each year, the average rate was highest in San Mateo County and San Francisco County (both with about 1 case per 100,000 people).
- **By Sex**: More cases were female (about 58%) than male (about 42%), but the average rates for both females and males were less than 1 case per 100,000 people.
- **By Age Group**: The average rates were highest in adults aged 65 years or older and children less than 1 year of age, but both groups had about 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 40%).
- **By Month:** There were more listeriosis cases in June through September (about 93 cases each month) than in all other months (about 55 cases each month).

To help prevent listeriosis, pregnant women, older adults, and people with weakened immune systems should avoid foods that are more likely to be contaminated with *Listeria*, or make sure that these foods are thoroughly cooked before eating. These foods include raw (unpasteurized) milk and milk products, soft cheeses, hot dogs, lunch/deli meats, refrigerated smoked fish, and raw sprouts.

For more information about listeriosis in California, please visit the CDPH Listeriosis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

In the United States, listeriosis is an uncommon but serious foodborne illness associated with an estimated 1,600 infections and 260 deaths annually.[1, 2] Listeriosis is caused by the bacterium *Listeria monocytogenes*, which is ubiquitous in the environment in soil, vegetation, and untreated water, and can also infect various animals. The national *Healthy People 2020* target objective for listeriosis is for an incidence rate lower than 0.2 new cases per 100,000 population.[3]

Consuming foods contaminated with *Listeria* is the leading source of infection. *Listeria* has been found in raw foods, including unpasteurized milk and milk products, smoked/cured meat or fish, and produce, and has also been found in foods that became contaminated during or after processing, such as ready-to-eat deli meats and soft cheeses.[4] Cooking and pasteurizing kills *Listeria*, but unlike other foodborne pathogens, *Listeria* can survive and multiply in refrigerated temperatures.[5, 6] Transmission between mother and fetus or newborn can occur during pregnancy or delivery.

Most *Listeria* infections occur in immunocompromised persons, adults aged 65 years and older, and pregnant women, their fetuses, and newborns.[7] Onset of symptoms after consumption can range from as little as one day to more than two months.[8] Invasive listeriosis may present clinically as septicemia or meningoencephalitis, with a high mortality rate. Symptoms vary depending on primary site of infection but may include gastroenteritis, fever, head and muscle aches, stiff neck, and convulsions. Most patients with listeriosis require hospitalization; immunocompromised persons and adults 65 years and older are at greatest risk. In pregnant women, listeriosis may present with mild or no symptoms, but may result in premature delivery, miscarriage, stillbirth, or serious infection in the newborn.[7]

This report describes the epidemiology of confirmed listeriosis cases in California from 2013 through 2019, plus probable cases in 2019 (due to a 2019 revision of the case definition). A description of listeriosis outbreaks involving California case-patients that occurred during 2013-2019 is also included. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual 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 listeriosis for earlier surveillance periods can be found in the *Epidemiologic Summary of Listeriosis 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 listeriosis to their local health department within one working day of identification or immediately by telephone if an outbreak is suspected.[12] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of *Listeria* 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 listeriosis to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention (CDC)/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed (2013-2018) or confirmed and probable (2019) case.[14] From 2013-2018, a confirmed case of listeriosis was defined as an infection in which *L. monocytogenes* is isolated from a normally sterile site, or, in the setting of a miscarriage or stillbirth, *L. monocytogenes* is isolated from placental or fetal tissue. In 2019, the surveillance definition for a confirmed case of listeriosis was expanded to include several additional sterile sites (pleural, peritoneal, pericardial, vitreous fluid, etc.). In addition, in the setting of pregnancy, products of conception (chorionic villi, placenta, fetal tissue amniotic fluid, etc.) were included for maternal case-patients, and tracheal aspirate and meconium were specified for neonatal case-patients.

In 2019, the surveillance case definition added a probable case classification for listeriosis, which was defined as meeting presumptive laboratory criteria or having an epidemiologic linkage for pregnancy-associated listeriosis. *Listeria* detected from culture-independent diagnostic testing meets presumptive laboratory evidence. In the setting of pregnancy, a mother (who does not meet confirmed case classification) who gave birth to a confirmed/probable neonate (< 28 days old), meets the probable surveillance case definition. A neonate (who does not meet confirmed case classification) with a mother who meets confirmed/probable case classification from products of conception OR a clinically compatible neonate (who does not meet confirmed case classification) with a mother who meets confirmed/probable case definition from a sterile site, also meets the probable surveillance case definition.[15]

Epidemiology of Listeriosis in California, 2013-2019

CDPH received reports of 812 cases of listeriosis with estimated symptom onset dates from 2013 through 2019. This is an average annual incidence rate of 0.3 cases per 100,000 population. Incidence rates during the 2013-2019 surveillance period were relatively stable, with a minor decrease in 2018 [Figure 1]. During the surveillance period, 148 (18.2%) case-patients were reported to have died with listeriosis.

Statewide from 2013 through 2019, only 11 California counties reported at least one case for each year of the surveillance period: Alameda, Los Angeles, Orange, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Mateo, Santa Clara, and Sonoma. Among these 11 counties, the average incidence rate was highest in San Mateo County (0.7 per 100,000; 37 cases), San Francisco County (0.6 per 100,000; 34 cases), and San Diego County (0.4 per 100,000; 97 cases). Of the 58 California counties, 30 (51.7%) had an average annual incidence rate that was above the national *Healthy People 2020* target rate for listeriosis of 0.2 per 100,000 population.[3]

Of all listeriosis cases from 2013 through 2019, 57.9% were female and 42.1% were male. The average annual incidence rate was slightly higher among females (0.3 per 100,000; 469 cases) than among males (0.2 per 100,000; 341 cases).

Average annual listeriosis incidence rates during the 2013-2019 surveillance period were highest among adults aged 65 years or older (1.2 per 100,000; 450 cases, not shown) and children aged less than 1 year (1.0 per 100,000; 34 cases) [Figure 2].

For listeriosis cases with complete race/ethnicity information (see *Technical Notes*), the highest percentage of cases was among case-patients who reported non-Hispanic White race/ethnicity (39.6%). However, case-patients reported non-Hispanic Asian/Pacific Islander race/ethnicity (22.3%) more frequently and Hispanic/Latino race/ethnicity (32.2%) less frequently than would be expected compared to the percentage of these groups in California (14.8% and 38.5%, respectively) [Figure 3].

Listeriosis occurs seasonally, with the highest number of cases occurring during warm-weather months. During 2013-2019, 45.8% (372) of all listeriosis cases had estimated symptom onsets during June, July, August, and September, an average of 93 cases each month. In comparison, an average of 55 cases occurred each month during October through May [Figure 4].

From 2013 through 2019, there were 14 foodborne outbreaks of listeriosis involving 68 California case-patients. Thirteen (92.9%) outbreaks involved patients in multiple states[16] and were primarily due to commercially distributed food products. Some notable multi-state listeriosis outbreaks involving California residents that led to food recalls included those associated with the consumption of caramel apples, frozen vegetables, prepackaged leafy greens, and enoki mushrooms.

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

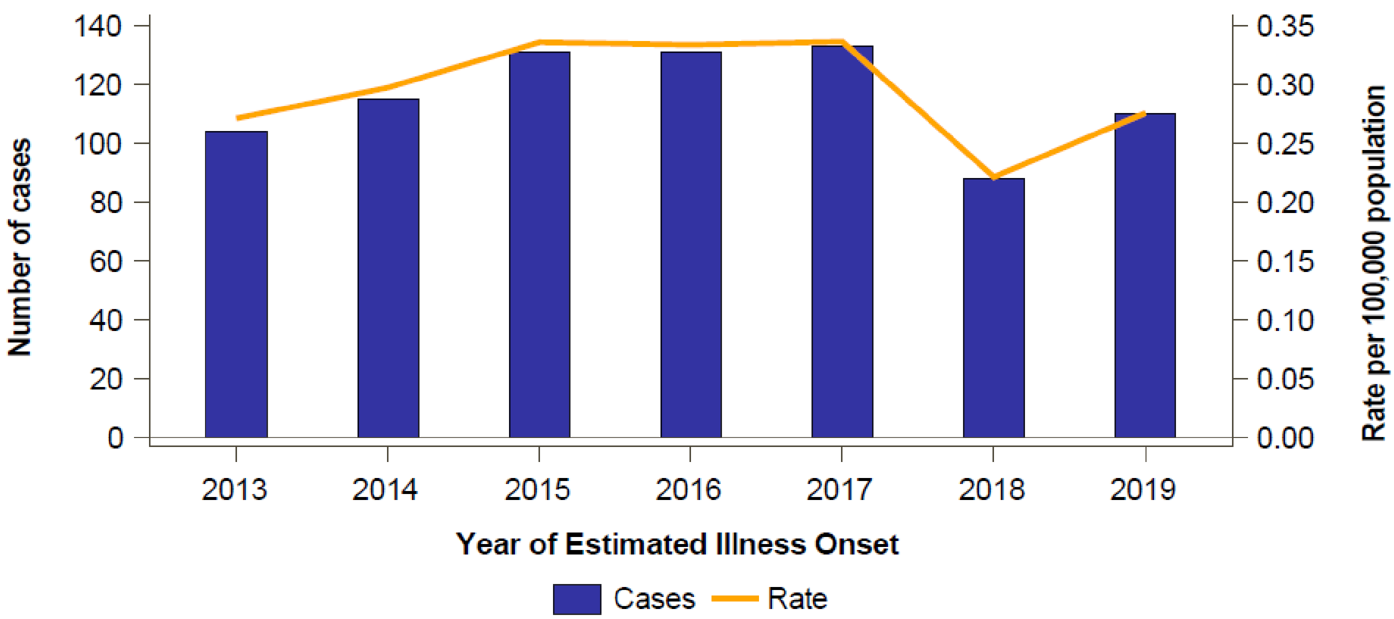
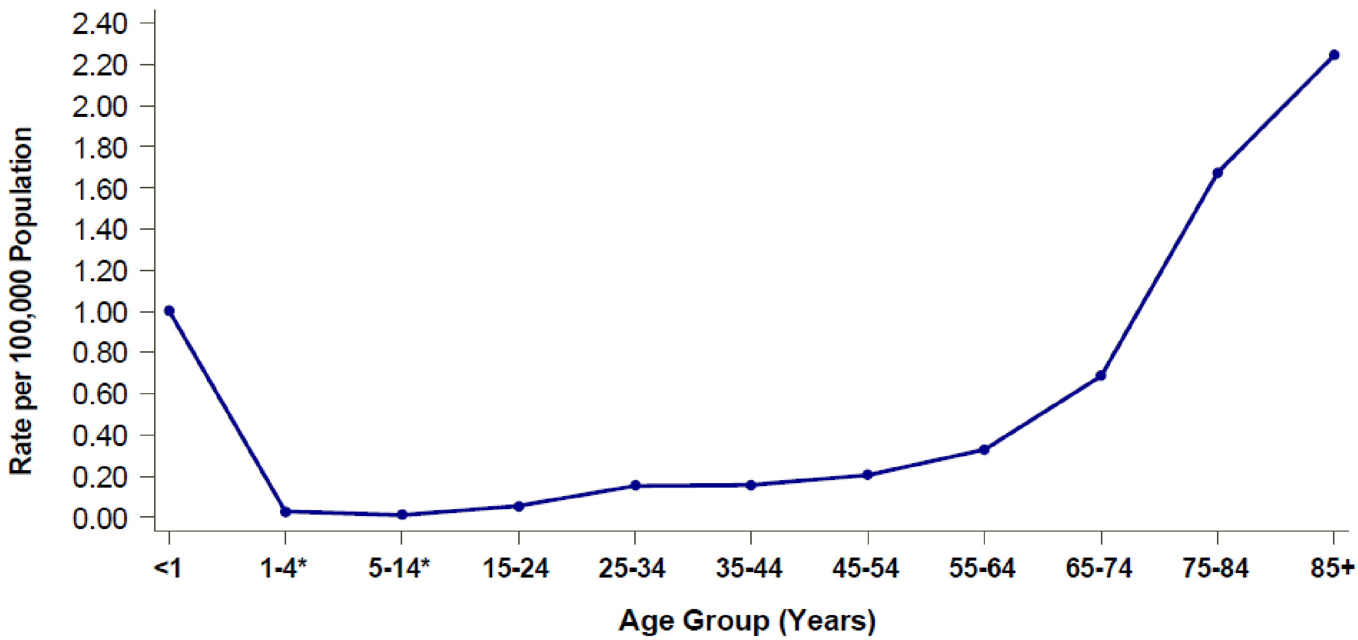
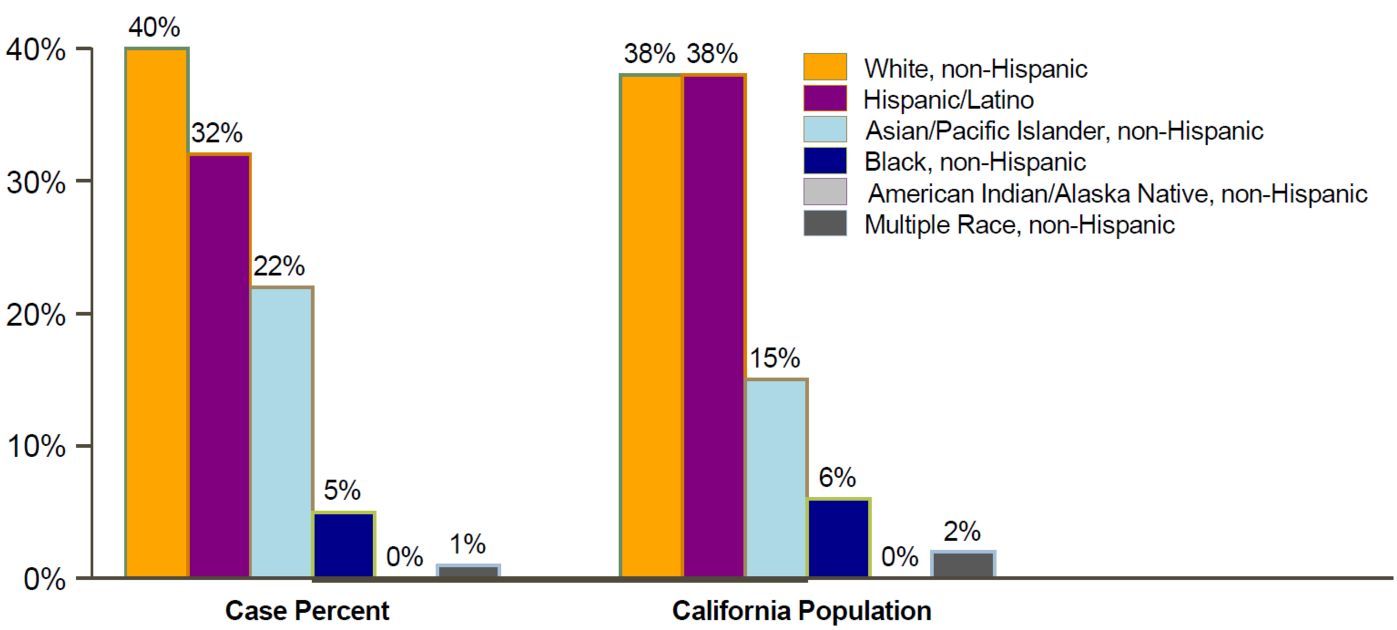


Figure 2. Listeriosis Average Annual Incidence Rates by Age Group, California, 2013-2019



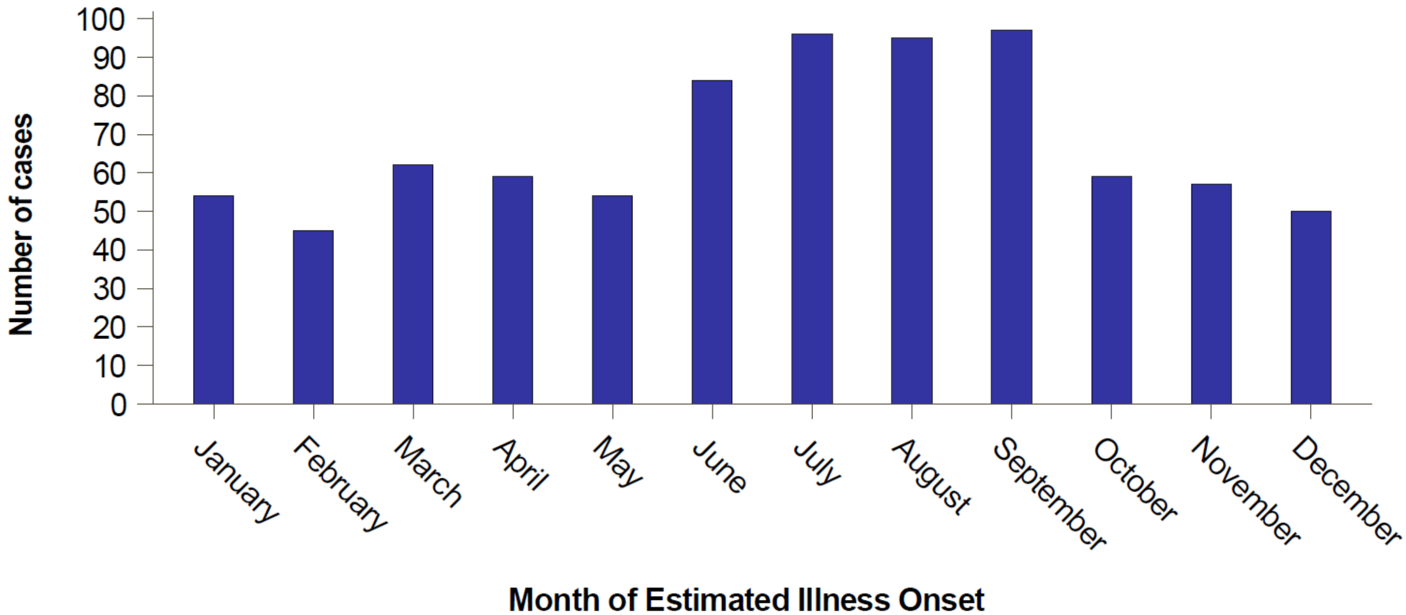
*Potentially unreliable rate: relative standard error 23 percent or more.

Figure 3. Listeriosis Cases and Population by Race/Ethnicity, California, 2013-2019



8.5% (n=69) of reported incidents of Listeriosis did not identify race/ethnicity and 3.2% (n=26) 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.

Figure 4. Listeriosis Cases by Month of Estimated Illness Onset, California, 2013-2019



Comments

Incidence rates per 100,000 population of listeriosis in California were relatively stable from 2013 through 2019; average annual incidence rates ranged from 0.2 per 100,000 population (in 2018) to 0.3 per 100,000 population (in 2017). Each year during the surveillance period, the statewide average annual incidence rate of listeriosis was greater than the national *Healthy People 2020* target objective of an incidence rate lower than 0.2 new cases per 100,000 population.[3]

Overall, incidence rates during the 2013-2019 surveillance period were similar to rates during the 2009-2012 surveillance period: the average rate was 0.3 per 100,000 population during both surveillance periods. The age group, sex, and racial/ethnic epidemiologic profiles of incident cases were similar to those reported in epidemiologic summaries from earlier years, except adults 85 years of age or older had a higher incidence during the 2013-2019 surveillance period.[10, 11]

National listeriosis incidence rates during the surveillance period were comparable to California's rates. The age distribution of incident cases in California and in the U.S. were similar; children aged less than 1 year and adults aged 65 years and older experienced the highest rates of listeriosis.[17, 18, 19, 20]

Continuing to screen and recall commonly contaminated foods, such as queso fresco and other soft cheeses, deli meats, and raw produce, and educational outreach to high-risk populations, such as pregnant women, the immunocompromised, and adults aged 65 years and older, may provide the best opportunities for reducing the incidence of listeriosis. Additionally, continued surveillance of human infections, especially in combination with enhanced molecular characterization of infecting strain types, may help detect dispersed, previously unrecognized disease clusters.

To prevent listeriosis, pregnant women, older adults, and immunocompromised persons should avoid foods that are more likely to be contaminated with *Listeria* or ensure that these foods are thoroughly cooked before eating. Foods more likely to be contaminated include unpasteurized milk and milk products, soft cheeses, hot dogs, lunch/deli meats, refrigerated smoked fish, and raw sprouts.

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References

[1] Scallan E, Hoekstra RM, Angulo FJ et al. Foodborne illness acquired in the United States—major pathogens. Emerg Infect Dis. 2011 Jan; 17(1):7-15.

[2] *Listeria* (Listeriosis) Information for Health Professionals and Laboratories. U.S. Centers for Disease Control and Prevention website. Updated March 30, 2021. Accessed May 11, 2021. https://www.cdc.gov/listeria/technical.html

[3] *Healthy People 2020* Food Safety Objectives. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion website. Updated October 8, 2020. Accessed October 18, 2020. https://www.healthypeople.gov/node/4477/data_details

[4] Listeriosis. California Department of Public Health website. Updated November 30, 2020. Accessed May 11, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Listeriosis.aspx

[5] *Listeria* (Listeriosis) Prevention. U.S. Centers for Disease Control and Prevention website. Updated June 17, 2019. Accessed May 11, 2021. https://www.cdc.gov/listeria/prevention.html

[6] Keep *Listeria* Out of Your Kitchen. U.S. Food and Drug Administration website. Updated May 10, 2013. Accessed May 11, 2021. https://www.fda.gov/consumers/consumer-updates/keep-listeria-out-your-kitchen

[7] *Listeria* (Listeriosis) Questions and Answers. U.S. Centers for Disease Control and Prevention website. Updated December 12, 2016. Accessed May 11, 2021. https://www.cdc.gov/listeria/faq.html

[8] Goulet V, King LA, Vaillant V et al. What is the incubation period for listeriosis? BMC Infect Dis. 2013 Jan 10;13:11.

[9] State of California, Department of Public Health. Technical notes. In*: Epidemiologic Summaries of Selected Communicable Diseases in California, 2013-2019.* 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. Listeriosis. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008*. Sacramento, CA; 2009. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[11] State of California, Department of Public Health. Listeriosis. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012*. Sacramento, CA; 2009. Accessed September 8, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/ListeriosisEpiSummary09-12.pdf

[12] Reportable Diseases and Conditions: Reporting to the Local Health Authority, 17 CCR § 2500 (2021). 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

[14] Listeriosis (*Listeria monocytogenes*) Case Definitions. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed August 30, 2021. https://ndc.services.cdc.gov/conditions/listeriosis/

[15] Listeriosis (*Listeria monocytogenes*) 2019 Case Definition. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed August 30, 2021. https://ndc.services.cdc.gov/case-definitions/listeriosis-2019/

[16] National Outbreak Reporting System (NORS). U.S. Centers for Disease Control and Prevention website. Updated November 4, 2019. Data extracted on December 16, 2020. https://www.cdc.gov/nors/index.html

[17] National Notifiable Diseases Surveillance System. *2018 Annual Tables of Infectious Disease Data*. Atlanta, GA: U.S. Centers for Disease Control and Prevention, Division of Health Informatics and Surveillance; 2019. Accessed November 17, 2020. https://wonder.cdc.gov/nndss/static/2018/annual/2018-table4-H.pdf

[18] Adams DA, Fullerton K, Jajosky R et.al. Summary of notifiable diseases and conditions--United States, 2013. MMWR Morb Mortal Wkly Rep. 2015 Oct 23;62(53):1-119.

[19] Adams DA, Thomas K, Jajosky RA et. al. Summary of notifiable diseases and conditions--United States, 2014. MMWR Morb Mortal Wkly Rep. 2016 Oct 14;63(54):1-152.

[20] Adams DA, Thomas K, Jajosky RA et al. Summary of notifiable diseases and conditions--United States, 2015. MMWR Morb Mortal Wkly Rep. 2017 Aug 11;64(53):1-143.

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 California[4]; 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 then in serum. Beginning in 2017, a confirmed case was defined as one with: (i) EM with exposure in a high incidence state[14] (history of tick bite not required), or (ii) EM with known exposure in a low incidence state[13] 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

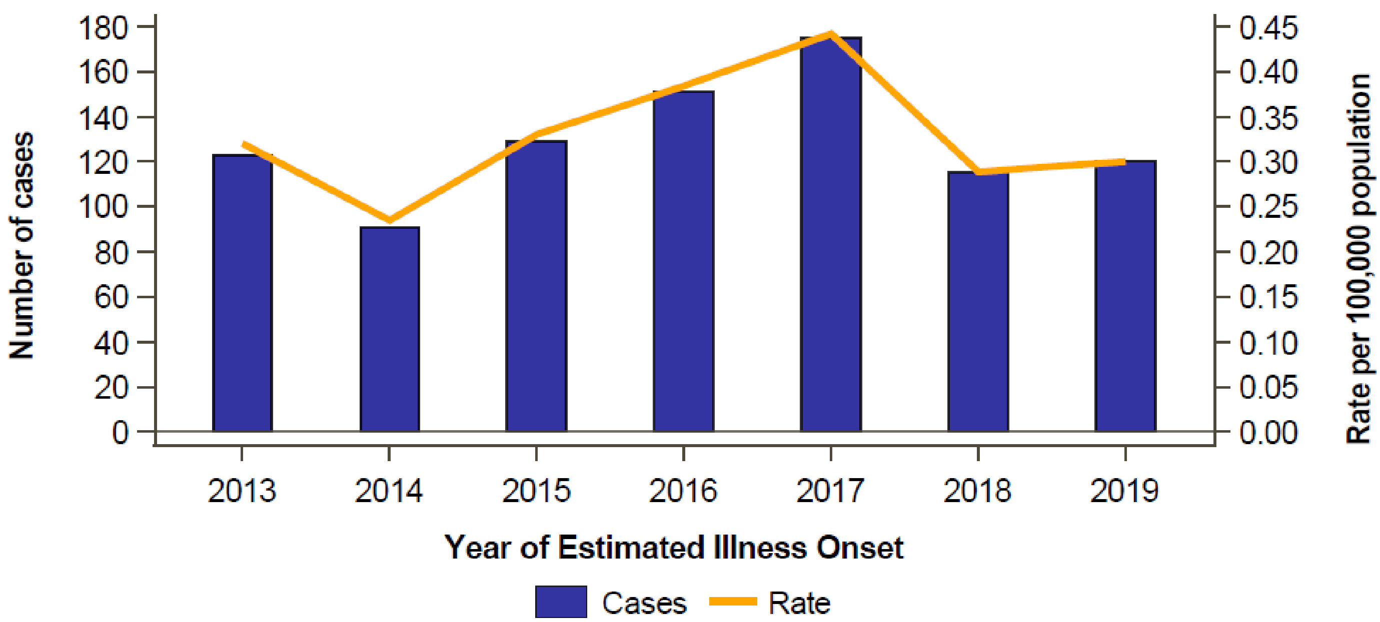


Figure 2. Lyme Disease Average Annual Incidence Rates by County, California, 2013-2019

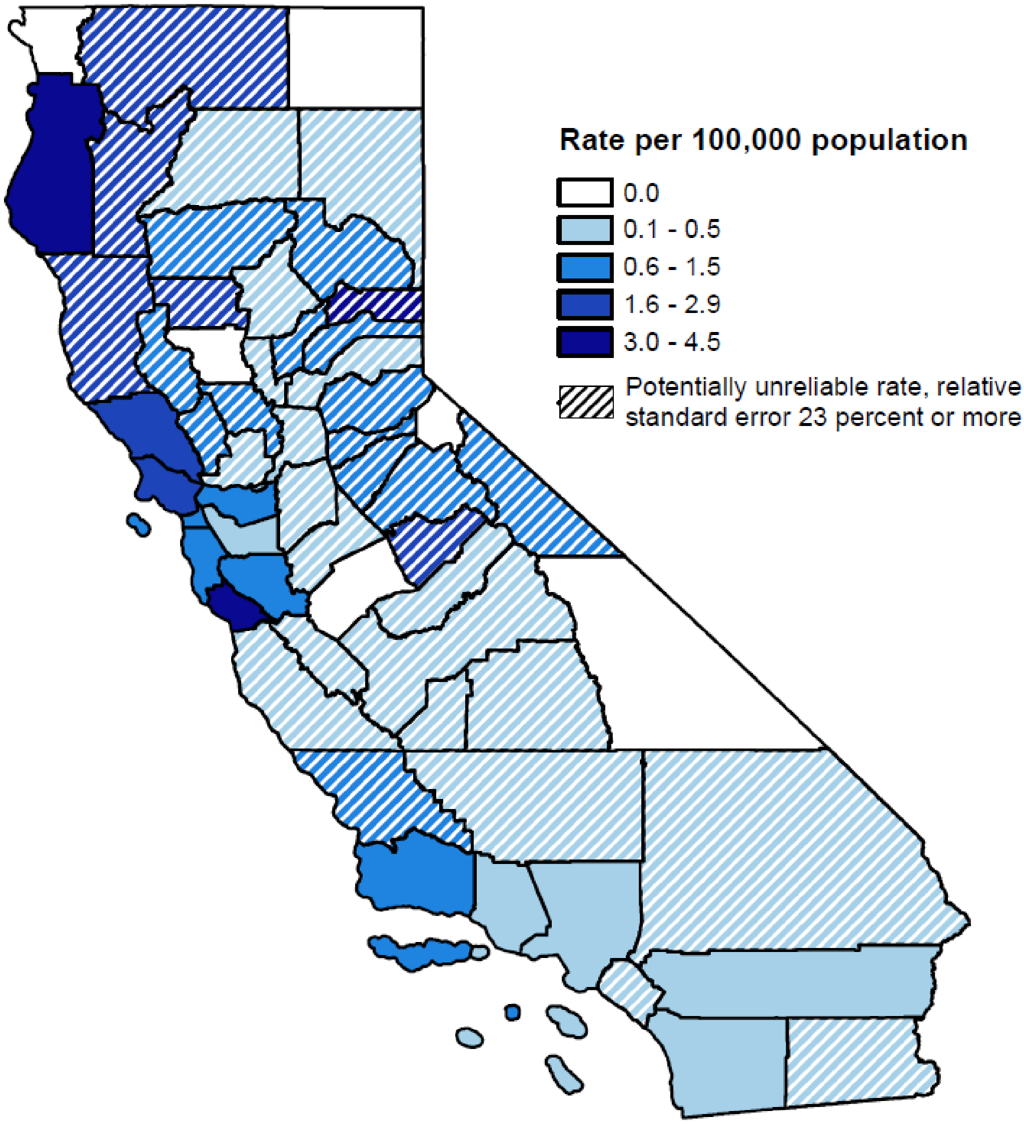
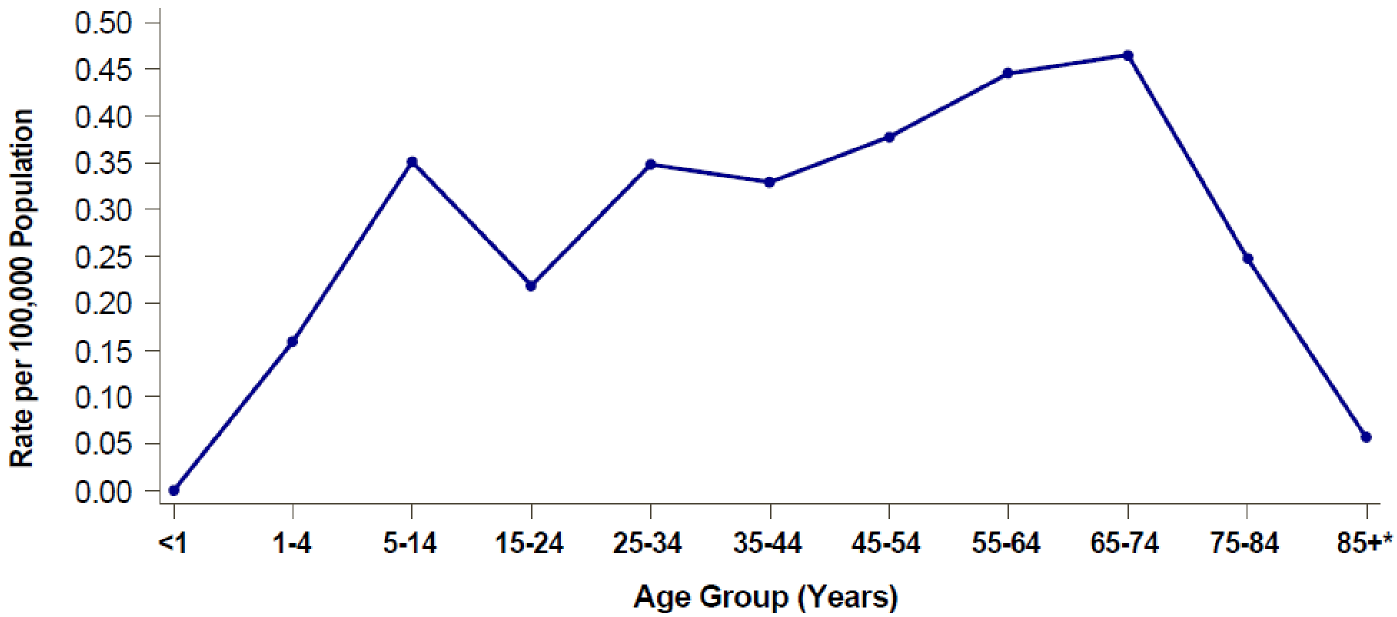
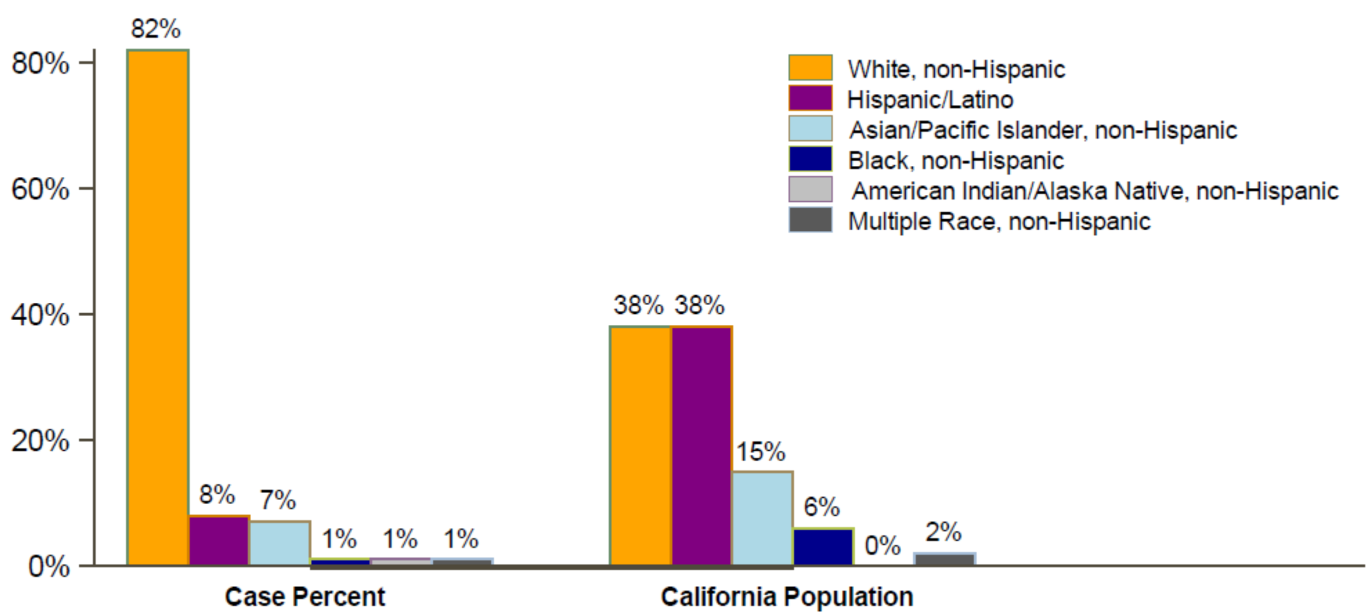


Figure 3. Lyme Disease Average Annual Incidence Rates by Age Group, California, 2013-2019



*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.

Prepared by Inderbir Sohi, Yanyi Djamba, Anne Kjemtrup, Vicki Kramer, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, July 2021

References

[1] Lyme Disease, Data and Statistics. U.S. Centers for Disease Control and Prevention website. 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. 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. Updated May 21, 2021. Accessed May 24, 2021. https://www.cdc.gov/lyme/diagnosistesting/index.html

[8] Lyme Disease, Treatment for erythema migrans. U.S. Centers for Disease Control and Prevention website. 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*. 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.* 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.* 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

[13] Reportable Diseases and Conditions: Notification by Laboratories, 17 CCR § 2505 (2021). 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. 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. 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/

Key Findings

Q fever is an infectious disease caused by *Coxiella burnetii*, a type of bacteria that naturally infect some animals, including goats, sheep, and cattle. These animals can shed Q fever bacteria when they give birth, and also in their milk, urine, or feces (poop). People can get Q fever through contact with an infected animal or by breathing in dust that contains bacteria from an animal's poop, urine, milk, or when it has given birth. People can also get Q fever by eating or drinking raw (unpasteurized) milk and cheese. Q fever usually causes flu-like symptoms in people who are infected and may cause infection in the liver or lungs. People such as veterinarians and farmers who have direct contact with animals, especially when the animals are giving birth, are more likely to get Q fever.

Q Fever in California from 2013 through 2019

Total Cases: There were a total of 276 new Q fever cases from 2013 through 2019.

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

- **By County**: Only three California counties (Los Angeles, Riverside, and Stanislaus) reported at least one case of Q fever each year during 2013-2019, each with a rate of less than 1 case per 100,000 people.
- **By Sex**: The average rate was higher in males than in females, but rates for each group were less than 1 case per 100,000 people.
- **By Age Group**: The average rates were highest in adults aged 55 to 64 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 Hispanic/Latino race/ethnicity (about 46%).

To help prevent Q fever, people should take preventative measures with animals that are giving birth by wearing gloves, keeping pregnant and birthing animals away from other animals and in areas that can be easily cleaned, and by removing and destroying all birth products. It is also important to avoid eating or drinking dairy products, such as milk and cheese, that have not been pasteurized. Veterinarians and people who work on farms, dairies, and in slaughterhouses should practice preventive measures, including wearing masks and gloves, when handling infected animals and their tissues. Proper management of animals, especially pregnant females, and the environment where infected animals live can help to reduce contact with the bacteria that cause Q fever.

For more information about Q fever in California, please visit the CDPH Q Fever webpage.
For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

The causative agent of Q fever, *Coxiella burnetii*, is a zoönotic bacteria that is widespread throughout the United States and the world. Transmission occurs chiefly through inhalation of aerosolized reproductive fluids from infected animals (especially parturient goats, sheep, and cattle). Contact with animal feces, secretions, and excretions (e.g., milk, urine), inhalation of aerosolized particulates from contaminated environmental materials (e.g., hay, dust), consumption of unpasteurized dairy products, and bites by infected ticks may also result in infection. Person-to-person transmission via blood transfusion, transplacental exposure, and sexual contact is possible, but rare.[1, 2] Persons at greatest risk for Q fever infection include veterinarians and those who are employed on ranches, dairy farms, and livestock facilities.[3]

Q fever has an incubation period of 2 to 3 weeks. Clinical manifestations vary widely in severity and symptoms with up to one-half of infections being asymptomatic. Acute Q fever presents most commonly as an influenza-like febrile syndrome; signs of pneumonia and hepatitis are also common. Infected pregnant women are at risk for miscarriage, stillbirth, and pre-term delivery. Less than five percent of infections proceed to chronic Q fever, which manifests most frequently as endocarditis in patients with preexisting cardiac pathology (e.g., valvular disease). Most cases of acute Q fever are self-limited, and patients recover in 1 to 2 weeks without complication.[4] Doxycycline can be used as a first-line antibiotic treatment for non-pregnant adults with acute Q fever and is recommended for patients with, or at increased risk for, chronic Q fever.[5] *C. burnetii* is a highly infectious agent, with as few as one organism capable of causing illness.[6] The bacteria are resistant to heat, desiccation, and common disinfectants[3], and *C. burnetii* is listed among the U.S. Centers for Disease Control and Prevention (CDC) category B bioterrorism agents.[7]

This report describes the epidemiology of Q fever cases in California from 2013 through 2019. Cases that met criteria for confirmed or probable, acute or chronic cases were included. 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.*[8] The epidemiologic description of Q fever for earlier surveillance periods can be found in the *Epidemiologic Summary of Q Fever in California, 2001-2008 and 2009-2012.*[9, 10]

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 Q fever to their local health department within one working day of identification by electronic transmission, fax, or telephone, if an outbreak is suspected.[11] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of *C. burnetii* 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.[12]

California regulations require cases of Q fever 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 and probable case. During the surveillance period (2013-2019), CDC defined a confirmed acute case of Q fever as one with (i) clinically compatible illness or an epidemiological link to a laboratory confirmed case, and (ii) laboratory confirmation defined as ≥ 4-fold change in IgG antibody titer to *C. burnetii* Phase II antigen in paired serum specimens, or isolation of *C. burnetii* from a clinical specimen by culture, or demonstration of *C. burnetii* DNA in a clinical specimen by amplification of a specific target by polymerase chain reaction assay or by immunohistochemical methods. A probable acute case was one with clinically compatible illness and supportive serology, defined as a single elevated IgG antibody titer (≥ 1:128) to Phase II antigen.[13] A confirmed chronic case was defined as one with (i) clinically compatible illness and (ii) laboratory confirmation defined as Phase I IgG antibody to *C. burnetii* of ≥ 1:800. A probable chronic case was one with clinically compatible illness and supportive serology, defined as a single elevated Phase I IgG antibody titer ≥ 1:128 and < 1:800.

Epidemiology of Q Fever in California, 2013-2019

CDPH received reports of 276 total cases of Q fever with estimated symptom onset dates from 2013 through 2019. The average annual incidence of Q fever for the surveillance period was 0.1 per 100,000 population. Incidence rates fluctuated over time but showed a slight increase from 2013 (0.05 per 100,000; 19 cases) through 2019 (0.12 per 100,000; 46 cases) [Figure 1]. Of the 252 Q fever cases with a disease type classification, 209 (82.9%) were classified as acute disease and 43 (17.1%) as chronic disease.

Statewide from 2013 through 2019, only 3 counties reported at least 1 case of Q fever for each year of the surveillance period with the following average annual incidence rates: Los Angeles (0.03 per 100,000; 25 cases), Riverside (0.3 per 100,000; 57 cases), and Stanislaus (0.5 per 100,000; 18 cases) counties. Cases from these three counties comprised 36.2% of the total Q fever cases reported.

From 2013 through 2019, incidence was higher among males (0.16 per 100,000, 226 total cases) than among females (0.04 per 100,000, 50 total cases). Of the 276 total cases reported with complete sex data, 226 (81.9%) were among males and 50 (18.1%) were among females.

By age group, average annual incidence rates were highest among adults aged 55-64 years (0.3 per 100,000; 82 cases) and 65-74 years (0.2 per 100,000; 45 cases) [Figure 2].

For Q fever cases with complete race/ethnicity data (see *Technical Notes*), the highest percentage of cases was among those who reported Hispanic/Latino race/ethnicity (45.8%) [Figure 3].

Among the 276 total cases of Q fever, 63 (22.8%) reported exposure to goats, and 55 (20.0%) reported exposure to cattle. During the 2-3 weeks preceding onset of illness, 61 (22.1%) case-patients reported employment at or visiting an animal farm or ranch, 12 (4.3%) reported employment at or visiting specifically a dairy farm, and 11 (3.9%) reported employment in veterinary medicine. Twenty-eight case-patients (10.1%) reported consuming unpasteurized milk or another unpasteurized dairy product during the incubation period.

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

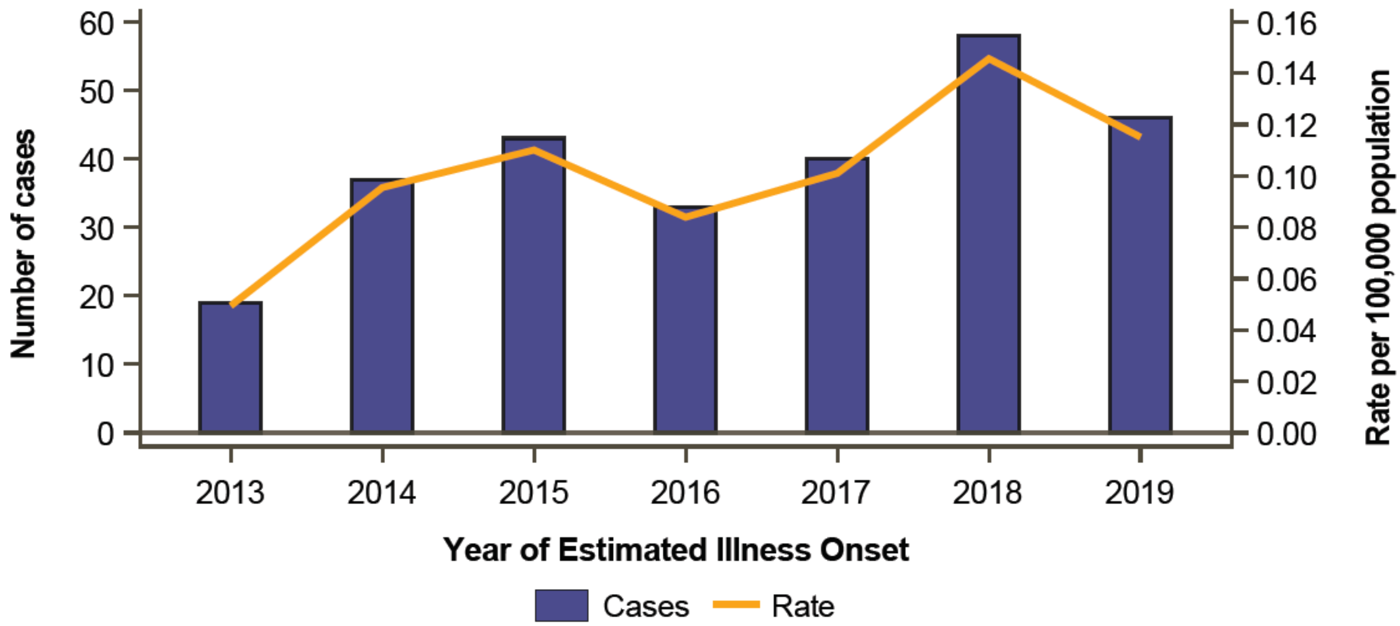
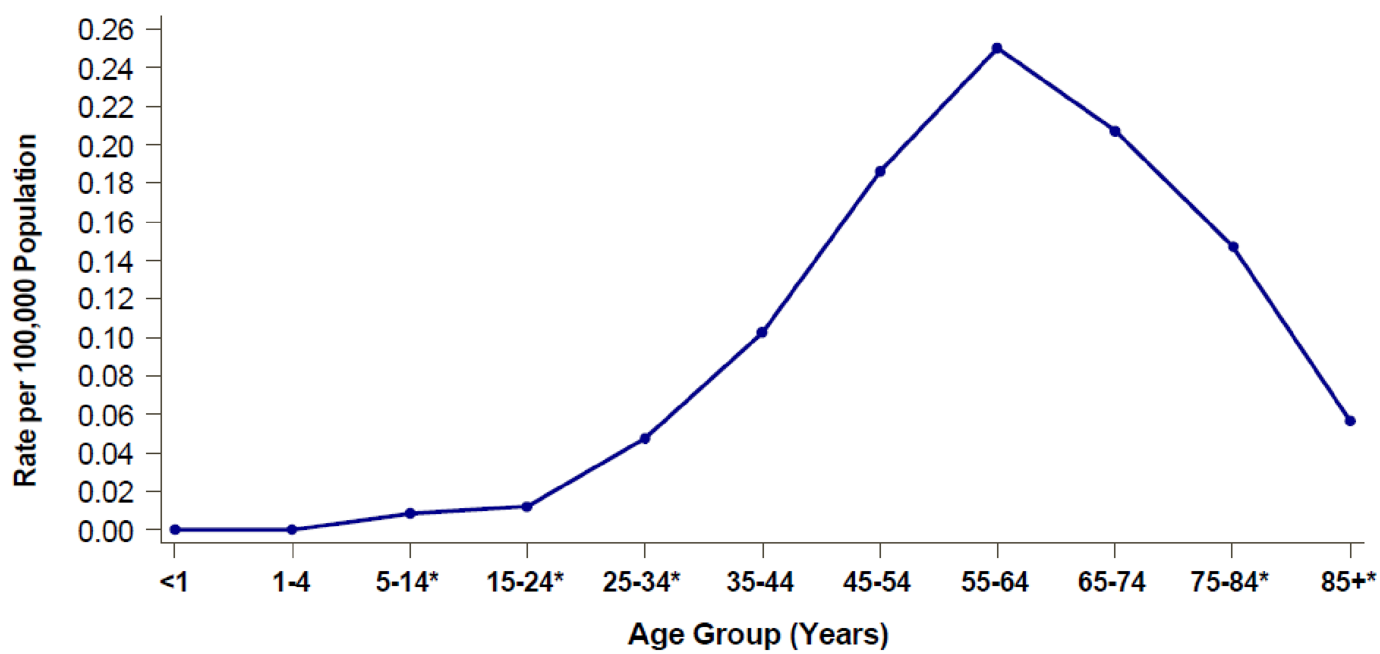
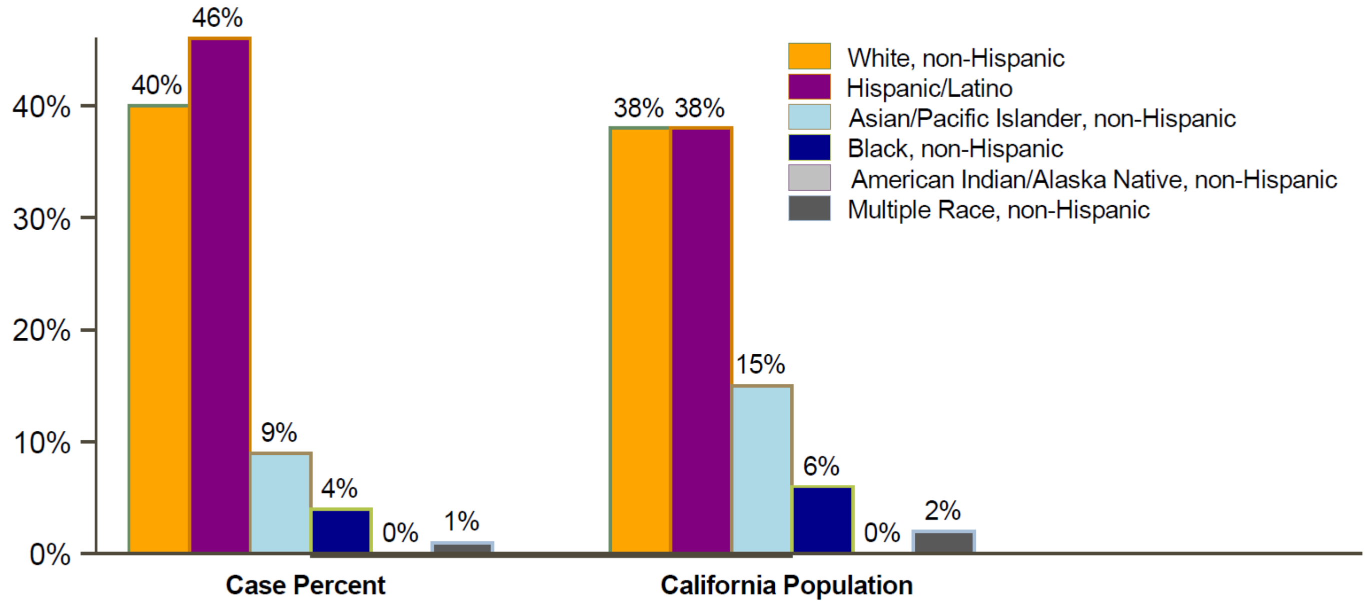


Figure 2. Q Fever Average Annual Incidence Rates by Age Group, California, 2013-2019



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

Figure 3. Q Fever Cases and Population by Race/Ethnicity, California, 2013-2019



18.5% (n=51) of reported incidents of Q Fever did not identify race/ethnicity and 4% (n=11) 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 rate of Q fever in California increased by 100% from the 2009-2012 surveillance period (0.05 per 100,000; 69 total cases) to the 2013-2019 surveillance period (0.10 per 100,000; 276 total cases). Average annual Q fever incidence rates were also similar in trend between the two surveillance periods for age group and sex.[10]

To reduce transmission of Q fever bacteria, persons in higher risk occupations, including farmers, veterinarians, and slaughterhouse workers, should exercise caution and utilize personal protective equipment when in contact with infected ruminants, their tissues, and their environments. Personal protective equipment should also be used when in contact with birthing ruminants; animal birthing areas should be kept separate, clean, and have all birth products promptly removed and destroyed. Proper management of ruminants, especially pregnant females, and the environment where infected ruminants live can help to reduce contact with the bacteria that cause Q fever. Persons should also avoid consuming unpasteurized dairy products to prevent Q fever.

Prepared by Inderbir Sohi, Yanyi Djamba, Curtis Fritz, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, July 2021

References

[1] Q Fever Fact Sheet. California Department of Public Health website. Updated December 6, 2017. Accessed June 1, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/QFeverFactSheet.pdf

[2] Q Fever, Information for Healthcare Providers. U.S. Centers for Disease Control and Prevention website. Updated January 15, 2019. Accessed June 1, 2021. https://www.cdc.gov/qfever/healthcare-providers/index.html

[3] Q Fever, Transmission. U.S. Centers for Disease Control and Prevention website. Updated January 15, 2021. Accessed June 1, 2021. https://www.cdc.gov/qfever/transmission/index.html

[4] Q Fever, Signs and Symptoms. U.S. Centers for Disease Control and Prevention website. Updated January 15, 2021. Accessed June 1, 2021. https://www.cdc.gov/qfever/healthcare-providers/index.html#signs-symptoms

[5] Q Fever, Treatment. U.S. Centers for Disease Control and Prevention website. Updated January 15, 2021. Accessed June 1, 2021. https://www.cdc.gov/qfever/healthcare-providers/index.html#treatment

[6] McQuiston JH, Childs JE, Thompson HA. Q fever. J Am Vet Med Assoc 2002; 221:796-799.

[7] Bioterrorism Agents/Diseases, Category B. Emergency Preparedness and Response, U.S. Centers for Disease Control and Prevention website. Updated April 4, 2018. Accessed June 1, 2021. https://emergency.cdc.gov/agent/agentlist-category.asp#b

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

[9] State of California, Department of Public Health. Q fever. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008*. Sacramento, CA; 2009. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[10] State of California, Department of Public Health. Q fever. In*: Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012.* Sacramento, CA; 2015. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf

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

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

[13] Q Fever (*Coxiella burnetii*) 2009 Case Definition. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed June 1, 2021. https://ndc.services.cdc.gov/case-definitions/q-fever-2009/

Epidemiologic Summary of Salmonellosis (Non-typhoidal) in California, 2013 - 2019

Key Findings

Salmonellosis is an infection caused by *Salmonella*, a type of bacteria that naturally live in the intestines and feces (poop) of many animals, including reptiles, poultry, and livestock such as cows and pigs. Salmonellosis can make people sick with diarrhea, fever, and stomach cramps. People can get infected with *Salmonella* bacteria in many ways, including eating or drinking something that has been contaminated with animal poop and having contact with infected animals, animal areas, or other people infected with *Salmonella*. Salmonellosis is one of the most commonly reported gastrointestinal infections reported in the U.S., causing thousands of hospitalizations and hundreds of deaths per year.

Salmonellosis in California from 2013 through 2019

Total Cases: There were a total of 38,119 new salmonellosis cases from 2013 through 2019. This is an average of 5,446 cases each year.

Rate: The average annual rate of new salmonellosis cases during 2013-2019 was about 14 cases per 100,000 people in California.

- **By County**: The average rate was highest in Imperial County (about 28 cases per 100,000 people), followed by Sierra County (about 23 cases per 100,000 people), and Placer and Marin Counties (both with about 19 cases per 100,000 people).
- **By Sex:** The average rate was slightly higher in females (about 14 cases per 100,000 people) than in males (about 13 cases per 100,000 people).
- **By Age Group**: The average rates were highest in children aged less than 1 year (65 cases per 100,000 people in this age group) and aged 1 to 4 years (about 32 cases per 100,000 people in this age group).
- **By Race/Ethnicity**: For cases where race and ethnicity information was available, the highest percentages of cases were in people who reported non-Hispanic White race/ethnicity (about 41%) and Hispanic/Latino race/ethnicity (about 41%).
- **By Month**: There were more cases of salmonellosis in August (4,810 cases, about 13%) than in any other month.

To help prevent salmonellosis, people should wash their hands with soap and water before preparing or eating food, after using the toilet, and after touching animals (including farm animals, pet reptiles, live poultry, and amphibians) or being in areas where animals live. It is also important to follow food safety guidelines when preparing food, especially by cooking food to the right temperature and refrigerating food right away to prevent bacteria from growing.

For more information about salmonellosis in California, please visit the CDPH Salmonellosis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Non-typhoidal *Salmonella* are among the most commonly reported enteric bacterial pathogens in the United States, causing an estimated 1.35 million infections, 26,500 hospitalizations, and 420 deaths each year.[1] Of the approximately 2,000 *Salmonella* serotypes that cause human illness, the most common in the United States are Typhimurium, Enteritidis, and Newport.[2] In 2018, the overall incidence rate of salmonellosis in the U.S. was 18.6 cases per 100,000 population.[3] The national *Healthy People 2020* target objective for salmonellosis was to have an incidence rate lower than 11.4 cases per 100,000 population.[4]

Consuming foods directly or indirectly contaminated with the feces of infected animals is the leading cause of salmonellosis. However, direct contact with infected people, consumption of foods handled by ill persons, or exposure to infected animals (notably poultry, petting zoo and farm animals, and reptiles such as pet turtles) and their environments may also result in infection. *Salmonella* is a commonly identified etiology in foodborne disease outbreaks, though most individual salmonellosis cases are not associated with recognized outbreaks.

Most people with salmonellosis have diarrhea, fever, and abdominal pain. Some may also have vomiting, nausea, or a headache. Symptoms usually begin within 6 hours to 6 days after infection and last 4-7 days. Treatment with antibiotics is not usually necessary.[1] However, for some patients, illness may be severe and require hospitalization; those at higher risk include children aged 5 years and younger, adults aged 65 years and older, and immunocompromised persons.[1, 5] Although rare, *Salmonella* can cause invasive disease, including meningitis, pneumonia, and sepsis; death can result. Reactive arthritis is a rare, long-term complication.[6] Asymptomatic infections may also occur.

This report describes the epidemiology of confirmed and probable non-typhoidal salmonellosis cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes*.[7] The epidemiologic description of non-typhoidal salmonellosis for earlier surveillance periods can be found in the *Epidemiologic Summary of Salmonellosis (Non-typhoidal) in California, 2001-2008 and 2009-2012.*[8, 9]

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 salmonellosis to their local health department within one working day of identification or immediately by telephone if an outbreak is suspected.[10] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of *Salmonella* 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.[11] Per CCR, Title 17, Section 2612, The organism isolated from the suspected salmonellosis patient must be submitted to a local public health laboratory or California Department of Public Health (CDPH) Microbial Diseases Laboratory for definitive identification and serotyping.[12]

California regulations require cases of salmonellosis to be reported to CDPH. CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention/Council of State and

Territorial Epidemiologists surveillance case definition of a confirmed or probable case. During the surveillance period (2013-2019), a confirmed case of salmonellosis was defined as one in which non-typhoidal *Salmonella* (excluding *S*. Typhi, Paratyphi A, Paratyphi B [tartrate negative], and Paratyphi C) was isolated from a clinical specimen, including laboratory-confirmed asymptomatic and extraintestinal infections. From 2013 through 2016, a probable case of salmonellosis was defined as one with clinically compatible illness and an established epidemiologic link to a laboratory-confirmed case. Beginning in 2017, a probable case was defined as one in which *Salmonella* was detected in a clinical specimen using a culture-independent diagnostic test (CIDT), or one who had clinically compatible illness and an established epidemiologic link to either a laboratory-confirmed or CIDT-positive case.[13]

Epidemiology of Salmonellosis in California, 2013-2019

CDPH received reports of 38,119 total cases of non-typhoidal salmonellosis with estimated symptom onset dates from 2013 through 2019. This corresponds to an average of 5,446 cases each year and an average annual incidence rate of 13.9 cases per 100,000 population. Incidence rates increased slightly from 2013 (13.1 per 100,000; 5,014 cases) to 2019 (14.2 per 100,000; 5,672 cases), with moderate fluctuations over time [Figure 1]. The highest incidence rate occurred in 2018 (15.8 per 100,000; 6,303 cases), and the lowest incidence rate occurred in 2016 (12.1 per 100,000; 4,760 cases). Deaths were reported among 183 (0.5%) case-patients at the time of case report. Case fatality rates were greatest among case-patients aged 65 years and older (1.8%).

County-specific average annual incidence rates per 100,000 population from 2013 through 2019 ranged from 0 (Alpine County) to 27.6 (Imperial County, 359 cases) [Figure 2]. In addition to Imperial County, average annual incidence rates of salmonellosis were highest in Sierra County (22.7 per 100,000; 5 cases), Placer County (19.4 per 100,000; 514 cases), and Marin County (19.1 per 100,000; 349 cases). Of the 58 total California counties, 44 (75.9%) had an average annual incidence rate that was above the national *Healthy People 2020* target rate for salmonellosis of 11.4 cases per 100,000 population.[4] Of note, Los Angeles County had the highest number of salmonellosis cases during the surveillance period with 8,588 total cases and an average annual incidence rate of 12.0 per 100,000 population.

From 2013 through 2019, the average annual incidence rate was slightly higher among females (14.4 per 100,000; 19,909 cases) than among males (13.1 per 100,000; 17,980 cases); 52.6% of salmonellosis case-patients were female and 47.5% were male.

Average annual salmonellosis incidence rates during the surveillance period were highest among children aged less than 1 year (65.0 per 100,000; 2,200 cases) and children aged 1 to 4 years (32.4 per 100,000; 4,481 cases), followed by adults aged 75 years and older (16.2 per 100,000; 2,623 cases, not shown) [Figure 3]. Incidence rates were most variable over time among children aged less than 1 year; during 2013-2019 in this age group, rates ranged from 58.5 per 100,000 (282 cases) in 2017 to 81.0 per 100,000 (374 cases) in 2018.

For salmonellosis cases with complete race/ethnicity information (see *Technical Notes*), the highest percentages of cases were among those who reported non-Hispanic White race/ethnicity (41.2%) and Hispanic/Latino race/ethnicity (40.6%). The distribution of cases by reported race/ethnicity was similar to the demographic profile of California during the same time period [Figure 4].

Salmonellosis occurs seasonally, with the highest number of cases occurring during warmer-weather months. From 2013 through 2019, more case-patients had estimated symptom onsets during August (4,810 cases; 12.6%) than any other month [Figure 5].

From 2013 through 2019, there were 133 foodborne outbreaks of salmonellosis involving more than 2,500 California case-patients; 2018 had the most outbreaks with 25 (18.8%). The most common serotypes associated with outbreaks were *S*. Enteritidis (27 outbreaks) and *S*. Newport (16 outbreaks). Sixty-seven (50.4%) outbreaks involved patients exposed in multiple states[14] and were primarily due to widely distributed food products. Some notable multi-state salmonellosis outbreaks involving California residents that led to food recalls included: a 2013-2014 *S*. Heidelberg outbreak associated with chicken (634 cases in U.S., 490 from California); a 2015 *S*. Poona outbreak associated with imported cucumbers (907 cases in U.S., 245 from California); and a 2018-2019 *S*. Newport outbreak associated with ground beef (403 cases in U.S., 143 from California).[15, 16, 17] There were also multi-state salmonellosis outbreaks linked to other foods or ingestibles such as kratom, dried coconut, tahini, raw nut butters/spreads, and a breakfast cereal.[18] Additionally, California case-patients have been involved in several multi-state outbreaks associated with contact with animals such as backyard poultry, small turtles, bearded dragons, geckos, hedgehogs; and pet food and treats such as pig ear dog treats and frozen feeder rodents.[19]

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

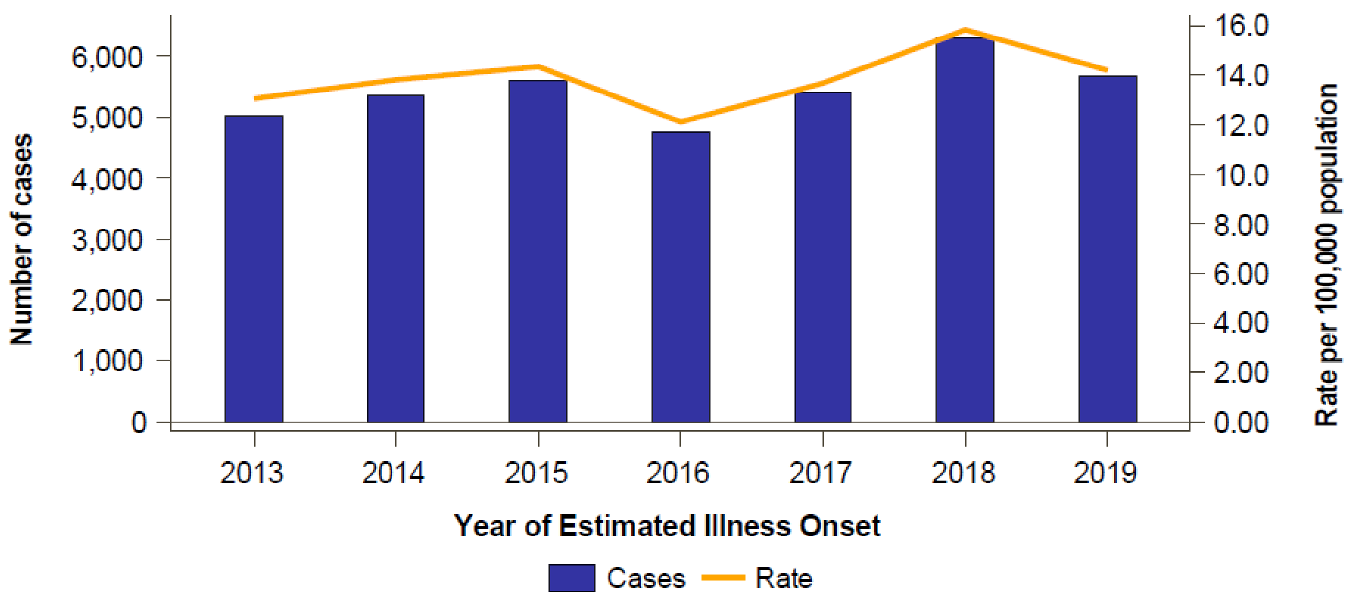


Figure 2. Salmonellosis Average Annual Incidence Rates by County, California, 2013-2019

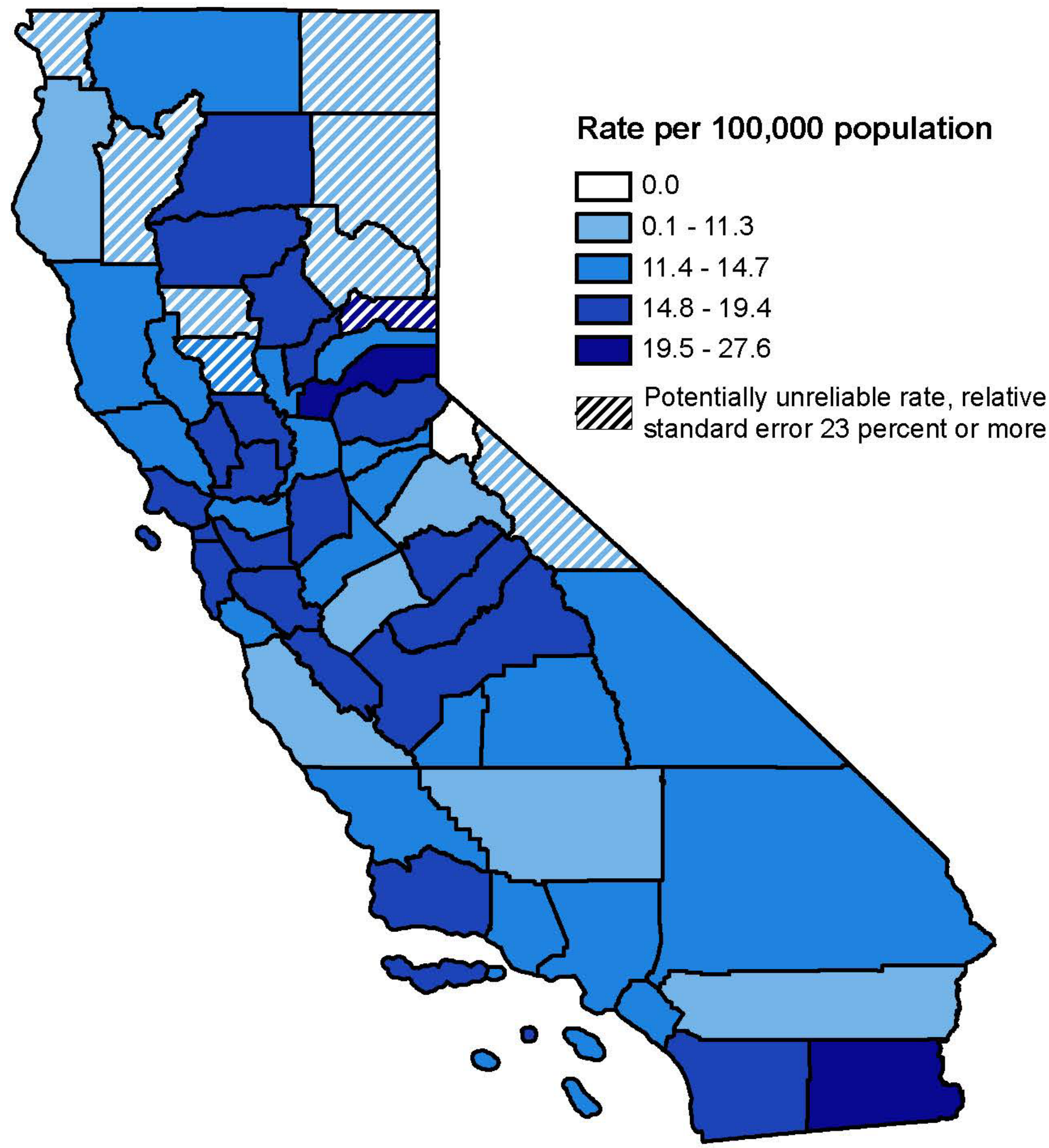


Figure 3. Salmonellosis Incidence Rates by Age Group and Year of Estimated Illness Onset, California, 2013-2019

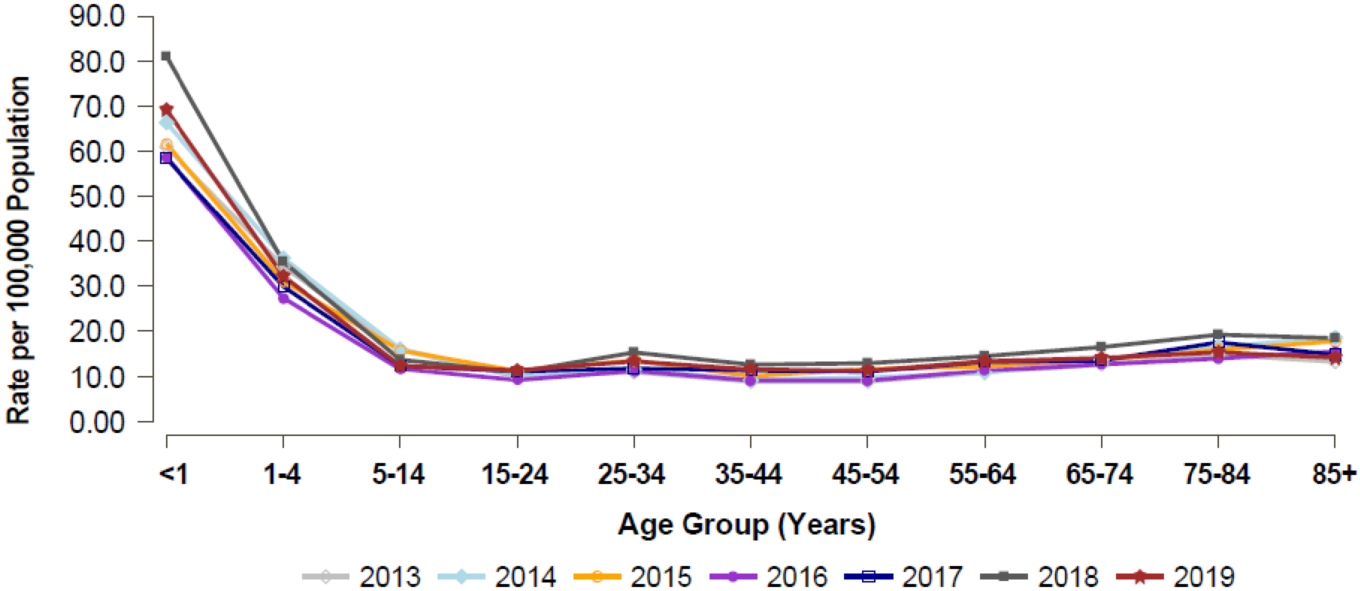
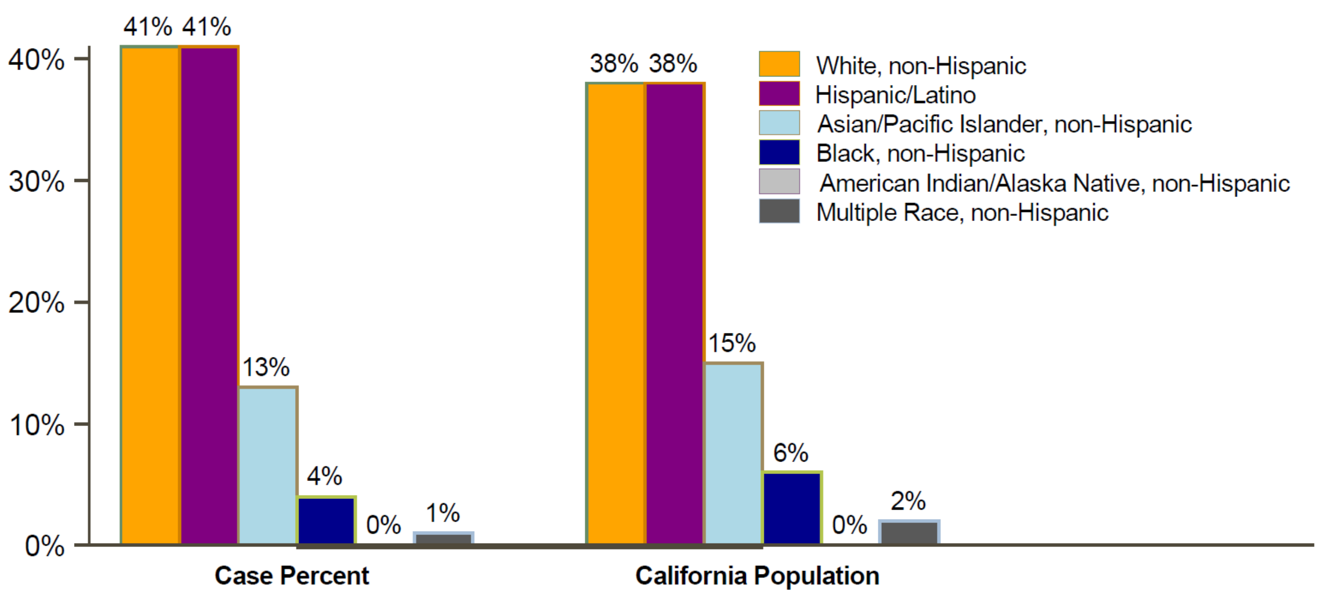
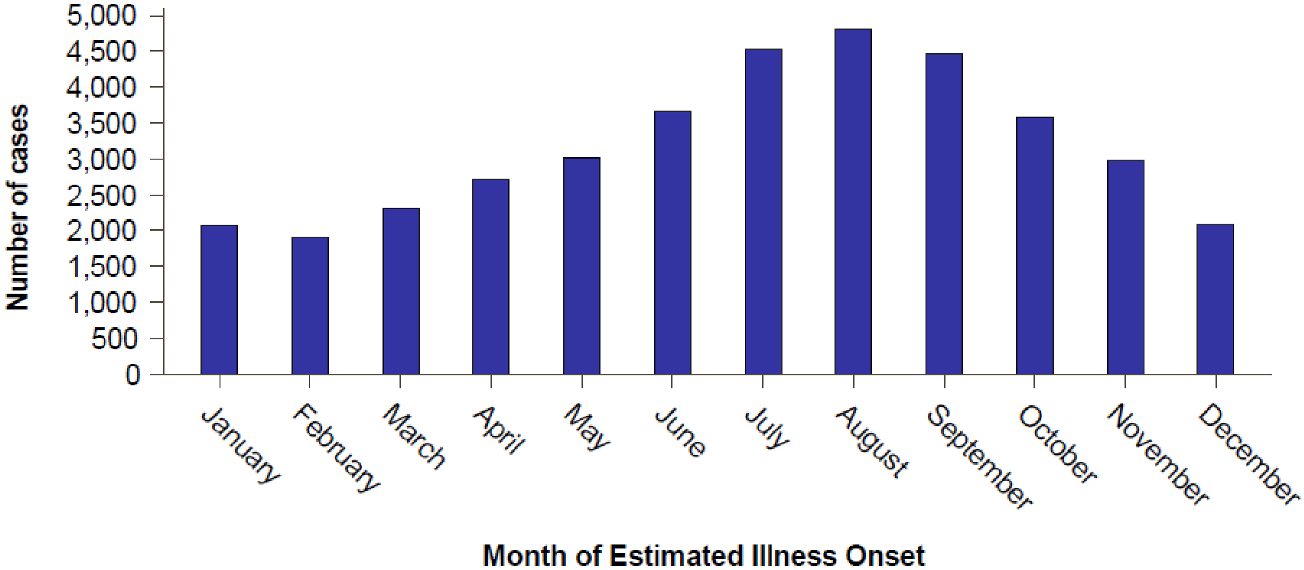


Figure 4. Salmonellosis Cases and Population by Race/Ethnicity, California, 2013-2019



13.6% (n=5191) of reported incidents of Salmonellosis did not identify race/ethnicity and 2.9% (n=1090) 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.

Figure 5. Salmonellosis Cases by Month of Estimated Illness Onset, California, 2013-2019



Comments

Incidence rates per 100,000 population of salmonellosis infection among Californians increased slightly from 2013 through 2019, with minor fluctuations during the 7-year period. The peak rate of this surveillance period was in 2018 (15.8 per 100,000 population). Of note, it is estimated that only 1 of every 29 people who are infected with *Salmonella* bacteria seek medical care and are diagnosed with salmonellosis; therefore, the true rates are likely to be much higher.[20]

Overall, incidence rates increased moderately during the 2013-2019 surveillance period (average annual rate of 13.9 per 100,000 population) compared to the 2009-2012 surveillance period (average annual rate of 12.5 per 100,000 population) as described in previous epidemiologic summaries.[9] This increase may be due to the increased use of CIDT and a more inclusive probable case definition. The increase in incidence was most pronounced in children aged less than 1 year. The age group, racial/ethnic, sex, and regional epidemiologic profiles of incident cases, however, were similar to those reported in epidemiologic summaries from earlier years.[8, 9]

Compared to national salmonellosis incidence rates, California's 2013-2019 rates were lower. However, the age distribution of incident cases in California and in the U.S. were similar; children aged less than five years experienced the highest rates of salmonellosis.[21, 22, 23] Also, the two serotypes most commonly involved in California salmonellosis outbreaks—*S*. Enteritidis and *S*. Newport—were among the serotypes most frequently isolated from laboratory-confirmed *Salmonella* infections nationally.[2]

Preventing contamination and cross-contamination during the processing and production of foods, including both foods of animal origin and produce, is crucial to the mitigation of foodborne disease infections and outbreaks. Long-term prevention of outbreaks necessitates the coordination and implementation of food safety practices among partners throughout the food production chain. Additionally, education of Californians about food safety practices and safe contact with potentially infected animals (especially backyard poultry and pet reptiles) is key to controlling and limiting the impact of salmonellosis in California.

To prevent salmonellosis, persons should wash their hands with soap and water before preparing or eating food, after using the toilet, and after touching animals (including farm animals, pet reptiles, live poultry, and amphibians) or being in animal environments. It is also important to follow food safety guidelines when preparing food, especially by cooking food to the proper temperature and promptly refrigerating food to prevent bacterial growth.

Prepared by Kirsten Knutson, Yanyi Djamba, Jeff Higa, Vi Peralta, Akiko Kimura, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, February 2021

References

[1] *Salmonella*. U.S. Centers for Disease Control and Prevention website. Updated January 13, 2021. Accessed October 19, 2020. https://www.cdc.gov/salmonella/index.html

[2] U.S. Centers for Disease Control and Prevention. *National Enteric Disease Surveillance: Salmonella Surveillance Annual Report, 2016*. Atlanta, GA: U.S. Department of Health and Human Services; 2018. Accessed October 18, 2020. https://www.cdc.gov/nationalsurveillance/pdfs/2016-Salmonella-report-508.pdf

[3] National Notifiable Diseases Surveillance System. *2016-2018 Annual Tables of Infectious Disease Data*. Atlanta, GA: U.S. Centers for Disease Control and Prevention, Division of Health Informatics and Surveillance; 2019. Accessed November 8, 2020. https://www.cdc.gov/nndss/data-statistics/infectious-tables/index.html

[4] *Healthy People 2020* Food Safety Objectives. Office of Disease Prevention and Health Promotion website. Updated October 8, 2020. Accessed October 18, 2020. https://www.healthypeople.gov/2020/topics-objectives/topic/food-safety/objectives

[5] *Salmonella*: Information for Healthcare Professionals and Laboratories. U.S. Centers for Disease Control and Prevention website. Updated November 19, 2013. Accessed October 19, 2020. https://www.cdc.gov/salmonella/general/technical.html

[6] State of California, Department of Public Health. Salmonellosis (Nontyphoidal). In: *CDPH IDB Guidance for Managing Select Communicable Diseases*. Sacramento, CA; 2020. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/IDBGuidanceforCALHJs-Salmonellosis.pdf

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

[8] State of California, Department of Public Health. Salmonellosis. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008.* Sacramento, CA; 2009. Accessed October 18, 2020.
https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[9] State of California, Department of Public Health. Salmonellosis. In*: Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012.* Sacramento, CA; 2015. Accessed October 18, 2020.
https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf

[10] Reportable Diseases and Conditions: Reporting to the Local Health Authority, 17 CCR § 2500 (2021).
https://govt.westlaw.com/calregs/Document/I01D4328129FA11EDA5B6DDCDF7AC13B6

[11] Reportable Diseases and Conditions: Notification by Laboratories, 17 CCR § 2505 (2021).
https://govt.westlaw.com/calregs/Document/I1AE261C029FA11EDA5B6DDCDF7AC13B6

[12] Reportable Diseases and Conditions: Salmonella Infections (Other Than Typhoid Fever), 17 CCR § 2612 (2021).
https://govt.westlaw.com/calregs/Document/IA6B6E4A35A2011EC8227000D3A7C4BC3

[13] Salmonellosis (*Salmonella* spp.) Case Definitions 2012 & 2017. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed October 19, 2020.
https://ndc.services.cdc.gov/case-definitions/salmonellosis-2012/
https://ndc.services.cdc.gov/case-definitions/salmonellosis-2017/

[14] National Outbreak Reporting System (NORS). U.S. Centers for Disease Control and Prevention website. Updated November 4, 2019. Data extracted on December 16, 2020.
https://www.cdc.gov/nors/index.html

[15] Multistate Outbreak of Multidrug-Resistant Salmonella Heidelberg Infections Linked to Foster Farms Brand Chicken (Final Update). U.S. Centers for Disease Control and Prevention website. Updated July 31, 2014. Accessed December 31, 2020.
https://www.cdc.gov/salmonella/heidelberg-10-13/index.html

[16] Multistate Outbreak of Salmonella Poona Infections Linked to Imported Cucumbers (Final Update). U.S. Centers for Disease Control and Prevention website. Updated March 18, 2016. Accessed on December 31, 2020. https://www.cdc.gov/salmonella/poona-09-15/index.html

[17] Multistate Outbreak of Salmonella Infections Linked to Ground Beef. U.S. Centers for Disease Control and Prevention website. Updated March 22, 2019. Accessed on December 31, 2020. https://www.cdc.gov/salmonella/newport-10-18/index.html

[18] Reports of Selected Salmonella Outbreak Investigations. U.S. Centers for Disease Control and Prevention website. Updated January 5, 2021. Accessed on December 31, 2020.
https://www.cdc.gov/salmonella/outbreaks.html.

[19] US Outbreaks of Zoonotic Diseases Spread between Animals & People. U.S. Centers for Disease Control and Prevention website. Updated October 1, 2020. Accessed on December 31, 2020. https://www.cdc.gov/healthypets/outbreaks.html#2015.

[20] Scallan E, Hoekstra RM, Angulo FJ et al. Foodborne illness acquired in the United States—major pathogens. *Emerg Infect Dis*. 2011 Jan; 17(1):7-15.

[21] Adams DA, Fullerton K, Jajosky R et.al. Summary of notifiable diseases and conditions--United States, 2013. *MMWR Morb Mortal Wkly Rep.* 2015 Oct 23;62(53):1-119.

[22] Adams DA, Thomas K, Jajosky RA et. al. Summary of notifiable diseases and conditions--United States, 2014. *MMWR Morb Mortal Wkly Rep.* 2016 Oct 14;63(54):1-152.

[23] Adams DA, Thomas K, Jajosky RA et al. Summary of notifiable diseases and conditions--United States, 2015. *MMWR Morb Mortal Wkly Rep.* 2017 Aug 11;64(53):1-143.

Epidemiologic Summary of Shiga Toxin-producing *Escherichia coli* (STEC) Infections and Hemolytic Uremic Syndrome (HUS) in California, 2013 - 2019

Key Findings

Shiga toxin-producing *E. coli* (STEC) infection is caused by certain *E. coli* bacteria that live in the intestines and feces (poop) of many animals, especially farm animals such as cows and goats. STEC bacteria make toxins that can make people very sick with bloody diarrhea, stomach cramps, vomiting, and fever. Some people with STEC infection can develop hemolytic uremic syndrome (HUS), which is a blood disorder that includes damage to the kidneys and can be deadly. Young children and older adults are more likely to get very sick with STEC and HUS. People can get infected with STEC in many ways, such as by eating or drinking something that has been contaminated with animal poop, and having contact with infected animals, animal areas, or other people infected with STEC.

STEC and HUS in California from 2013 through 2019

Total Cases: There were a total of 9,489 new STEC cases and 398 HUS cases from 2013 through 2019. This is an average of 1,356 STEC and 57 HUS cases each year.

Rate: The average annual rate of new STEC cases during 2013-2019 was about 4 cases per 100,000 people in California. The average annual rate of new HUS cases was less than 1 case per 100,000 people. Annual rates of both STEC and HUS in California increased over time.

- **By County**: Of the 36 counties that had at least one STEC case each year, Marin (about 10 cases per 100,000 people), Glenn (9 cases per 100,000 people), and Sonoma (about 7 cases per 100,000 people) had the highest average rates. Of the 4 counties that had at least one HUS case each year, Sacramento and Alameda (both with less than 1 case per 100,000 people) had the highest average rates.
- **By Sex:** The average rate of STEC was higher in females (about 4 cases per 100,000 people) than in males (about 3 cases per 100,000 people). The average rate of HUS for both females and males was less than 1 case per 100,000 people, but females made up almost 60% of all new HUS cases.
- **By Age Group**: The average rates of STEC were highest in children aged 1 to 4 years (about 16 cases per 100,000 people in this age group) and children aged less than 1 year (about 8 cases per 100,000 people in this age group). Nearly 70% of HUS cases were in children aged 12 years and younger. The average annual rates of HUS were highest in children aged 1 to 4 years (about 1 case per 100,000 people in this age group) and 5 to 14 years (less than 1 case per 100,000 people in this age group).
- **By Race/Ethnicity**: For cases where race and ethnicity information was available, the highest percentage of both STEC and HUS cases was in people who reported non-Hispanic White race/ethnicity (about 45% for STEC and about 56% for HUS).

To help prevent STEC infections and HUS, people should follow food safety guidelines when preparing food, especially by cooking food to the right temperature and refrigerating food right away to prevent bacteria from growing. It is also important for people to wash their hands with soap and water before preparing or eating food, after using the toilet or changing a diaper, and after touching animals (especially farm animals) or being in areas where animals live. People should also avoid swallowing water when swimming or playing in rivers, lakes, and pools because STEC bacteria can also be in untreated water.

For more information about STEC in California, please visit the CDPH STEC webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Shiga toxin-producing *Escherichia coli* (STEC) are important enteric bacterial pathogens in the United States, causing an estimated 265,000 infections, 3,600 hospitalizations, and 30 deaths each year. In 2019, the overall U.S. incidence rate of STEC infection was 5.2 new cases per 100,000 population.[1]

STEC produce Shiga toxin 1 and/or Shiga toxin 2, potent toxins responsible for many of the pathogenic effects of STEC infection. The most widely recognized serogroup among STEC is STEC O157, which causes an estimated 95,000 infections in the U.S. annually. However, numerous other STEC serogroups, which are often grouped together as STEC non-O157, may cause illness similar to O157 and account for an estimated 170,000 infections nationwide each year.[2, 3] The six most common non-O157 serogroups in the U.S. are O26, O103, O111, O121, O145, and O45.[4] The national *Healthy People 2020* target objective for STEC O157 infections was to have an incidence rate lower than 0.6 cases per 100,000 population.[5]

STEC commonly colonize the intestines of ruminant animals, including cows, deer, sheep, pigs, and goats. STEC is transmitted by exposure to the feces of a shedding animal or infected human. Raw and improperly cooked or handled foods of animal origin such as beef and dairy products are the most common sources of STEC infection, but transmission has also occurred through the consumption of contaminated produce such as lettuce and other leafy greens. Illness can also result from waterborne transmission by ingesting contaminated water (e.g., through swimming in a lake), direct contact with shedding animals or their contaminated environments (e.g., through a farm or petting zoo), or direct exposure to infected people or their personal items.[3, 6]

Acute illness, usually gastroenteritis, typically occurs after an incubation period of 3 to 4 days but may occur anywhere from 1 to 10 days after exposure. Illness may be more severe in young children and older patients. Overall, STEC O157 appears to be more likely to cause severe illness than STEC non-O157, though illness severity is also affected by the virulence characteristics of the infecting strain.[3] About 5-10% of STEC case-patients develop hemolytic uremic syndrome (HUS), a potentially life-threatening complication of a STEC infection. HUS is a disease characterized by hemolytic anemia, acute kidney failure, and often a low platelet count, and is the leading cause of short-term acute renal failure in U.S. children.[7] Progression to HUS occurs on average 7 days after symptom onset, and may be delayed until after the STEC infection has cleared.[3] Most cases of HUS are caused by STEC O157, but STEC non-O157 can also cause HUS.[8] For surveillance purposes, post-diarrheal HUS cases without laboratory evidence of an STEC infection are presumed to be related to an undetected STEC infection. The national *Healthy People 2020* target objective for HUS was to have an incidence rate lower than 1 case per 100,000 children aged less than 5 years.[5]

This report describes the epidemiology of confirmed and probable STEC infections in California from 2013 through 2019. The epidemiology of HUS from 2013 through 2019 is also described, including HUS cases in which STEC was identified and post-diarrheal HUS cases without laboratory evidence of an STEC infection. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual 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 STEC and HUS for earlier surveillance periods can be found in the *Epidemiologic Summary of Shiga toxin-producing Escherichia coli (STEC) Infections and Hemolytic Uremic Syndrome (HUS) in California, 2001-2008 and 2009-2012*.[10, 11]

California Reporting Requirements and Surveillance Case Definitions

California Code of Regulations (CCR), Title 17, Section 2500 requires health care providers to report suspected cases of STEC infection to their local health department (LHD) within one working day of identification or immediately by telephone if an outbreak of STEC or case of post-diarrheal HUS is suspected.[12] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of STEC infection to either the California Reportable Disease Information Exchange (CalREDIE) via electronic laboratory reporting or the LHD; reporting must occur within one working day after the health care provider has been notified.[13] Also per CCR, Title 17, Section 2505, STEC isolates, including O157 and non-O157 strains, or Shiga toxin-positive fecal broths, must be submitted to a local public health laboratory or California Department of Public Health (CDPH) Microbial Diseases Laboratory for serotyping and molecular subtyping.[14]

California regulations require cases of STEC infection and post-diarrheal HUS to be reported to CDPH. CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists surveillance case definition (per year of case onset) of a confirmed or probable case.[15, 16]

During the surveillance period (2013-2019), the case definition of an STEC infection was as follows:

- A confirmed case of STEC was defined as an illness with laboratory-confirmed infection with STEC or *E. coli* O157:H7. Serotype O157:H7 isolates were assumed to be Shiga toxin-producing, while for all other serotypes, evidence of toxin production or the presence of Shiga toxin genes was required.
- From 2013 through 2017, a probable case of STEC was defined as an illness with laboratory-confirmed infection with *E. coli* O157 without confirmation of H7 antigen or Shiga toxin production; or as a clinically compatible case that either was epidemiologically linked to a confirmed or probable case or was a member of a defined risk group during an outbreak; or had an elevated antibody titer to a known STEC serotype. Beginning in 2018, a probable case of STEC could also be defined as an illness with detection via culture-independent diagnostic testing (CIDT) of Shiga toxin or Shiga toxin genes in the absence of *Shigella* isolation; or with detection via CIDT of *E. coli* O157, STEC, or Enterohemorrhagic *E. coli* (EHEC).

During the surveillance period (2013-2019), the case definition of HUS was as follows:

- A confirmed case of HUS was defined as an illness with anemia with microangiopathic changes and renal injury that began within three weeks of onset of acute or bloody diarrhea.
- A probable case of HUS was defined as an illness with laboratory evidence of HUS but an unclear history of diarrhea; or as an illness that met all criteria for a confirmed case but did not have confirmed microangiopathic changes.

Epidemiology of STEC Infections and HUS in California, 2013-2019

STEC Infections

CDPH received reports of 9,489 cases of STEC infection with estimated symptom onset dates from 2013 through 2019. This corresponds to an average of 1,355.6 cases per year and an average annual incidence rate of 3.5 cases per 100,000 population. Overall, annual incidence rates increased by 318.8%, from 1.6 per 100,000 (631 cases) in 2013 to 6.7 per 100,000 (2,680 cases) in 2019, with large increases during 2018-2019 [Figure 1]. A total of 2,839 (29.9%) STEC case-patients were hospitalized. Deaths were reported for 33 (0.3%) STEC case-patients by the time of case report; of these 33 STEC patients, 13 (39.4%) had infections that had progressed to HUS.

There were 36 California counties in which at least one case of STEC infection occurred every year during 2013-2019. Of these counties, Marin (9.6 per 100,000; 175 cases), Glenn (9.0 per 100,000; 18 cases), Sonoma (7.4 per 100,000, 260 cases), Placer (6.5 per 100,000, 172 cases), and Santa Clara (6.1 per 100,000, 826 cases) had the highest average annual incidence rates. Los Angeles County had the highest number of STEC cases during the surveillance period with 1,823 total cases and an average annual incidence rate of 2.6 per 100,000 population [Figure 2]. By region (see *Technical Notes*), average incidence rates were twice as high in Northern California (4.8 per 100,000; 5,757 cases) than in Southern California (2.4 per 100,000; 3,732 cases).

From 2013 through 2019, the average annual incidence rate was higher among females (3.6 per 100,000; 4,965 cases) than among males (3.3 per 100,000; 4,515 cases); 52.4% of STEC case-patients were female and 47.6% were male.

Average annual incidence rates for STEC infection during the surveillance period were highest among children aged 1 to 4 years (15.8 per 100,000; 2,186 cases) and children less than 1 year (7.5 per 100,000; 255 cases). The marked increase in STEC infections in 2018 and 2019 was reflected in higher incidence rates in most age groups during those two years [Figure 3].

For STEC cases with complete race/ethnicity information (see *Technical Notes*), cases reported non-Hispanic White race/ethnicity (45.3%) more frequently and non-Hispanic Asian/Pacific Islander race/ethnicity (8.2%) less frequently than would be expected compared to the percentage of these groups in California during the same time period (38.0% and 14.8%, respectively) [Figure 4].

Of all STEC infections during 2013-2019, laboratory stool culture identified a serogroup for 6,655 (70.1%) cases; of these 6,655 cases, 37.1% were STEC O157 (average annual rate of 0.9 per 100,000; 2,468 cases) and 62.9% were STEC non-O157 (average annual rate of 1.5 per 100,000; 4,187 cases) serogroups. STEC O157 yearly incidence rates remained fairly stable during the surveillance period [Figure 5]. Yearly incidence rates of STEC non-O157 serogroup infections increased by 228.6% from 2013 (0.7 per 100,000; 267 cases) through 2019 (2.3 per 100,000; 924 cases). The most common STEC non-O157 serogroups identified were O26, O111, and O103. Of the 2,834 STEC cases for which a serogroup was not identified by a laboratory stool culture, 89.9% (2,549) occurred in 2018-2019.

Each year during 2013 through 2019, the incidence rate of STEC O157 was greater than the national *Healthy People 2020* target objective of 0.6 cases per 100,000 population. There was no *Healthy People 2020* target objective for STEC non-O157.

A total of 339 (3.6%) STEC infections progressed to HUS by the time of case report [Figure 6]. Of 2,441 STEC case-patients aged less than 5 years,158 (6.5%) developed HUS (not shown).

HUS

CDPH received reports of 398 patients with HUS with estimated symptom onset dates from 2013 through 2019. This corresponds to an average of 56.9 cases per year and an average annual incidence rate of 0.14 cases per 100,000 population in California. Overall, yearly incidence rates increased by 13.7% from 2013 through 2019 [Figure 7]. A total of 380 (95.5%) HUS case-patients were reported to be hospitalized. Deaths were reported for 17 (4.3%) HUS case-patients by the time of case report.

Of HUS diagnoses, the majority, 327 cases (82.2%), were associated with an STEC infection; 242 (74.0%) of the 327 cases were associated with an STEC O157 infection. The remaining 71 (17.8%) HUS case-patients did not have laboratory evidence of an STEC infection [Figure 6].

There were 4 counties in which at least one HUS case occurred each year during 2013 through 2019: Sacramento, Alameda, San Diego, and Los Angeles. Of these counties, Sacramento (0.2 per 100,000; 23 cases) and Alameda (0.2 per 100,000; 21 cases) had the highest rates of HUS. By region (see *Technical Notes*), the average annual incidence rate for HUS for the surveillance period was 4.2 times higher in Northern California (0.3 per 100,000; 298 cases) than in Southern California (0.1 per 100,000; 100 cases) [Figure 8].

From 2013 through 2019, the average annual incidence rate of HUS was higher among females (0.2 per 100,000; 234 cases) than among males (0.1 per 100,000; 164 cases); 58.8% of HUS case-patients were female and 41.2% were male.

Of total HUS cases, 69.3% were among children aged 12 years and under. Average annual HUS incidence rates were highest among children aged 1 to 4 years (1.3 per 100,000; 180 cases) and children aged 5 to 14 years (0.3 per 100,000; 99 cases). Only in 2015 (0.8 per 100,000; 21 cases) was the incidence rate in children aged less than 5 years lower than the national *Healthy People 2020* target objective of 1 case per 100,000 population in this age group.

For HUS cases with complete race/ethnicity information (see *Technical Notes*), cases reported non-Hispanic White race/ethnicity (55.6%) much more frequently than would be expected compared to the percentage of this group in California during the same time period (38.0%) [Figure 9].

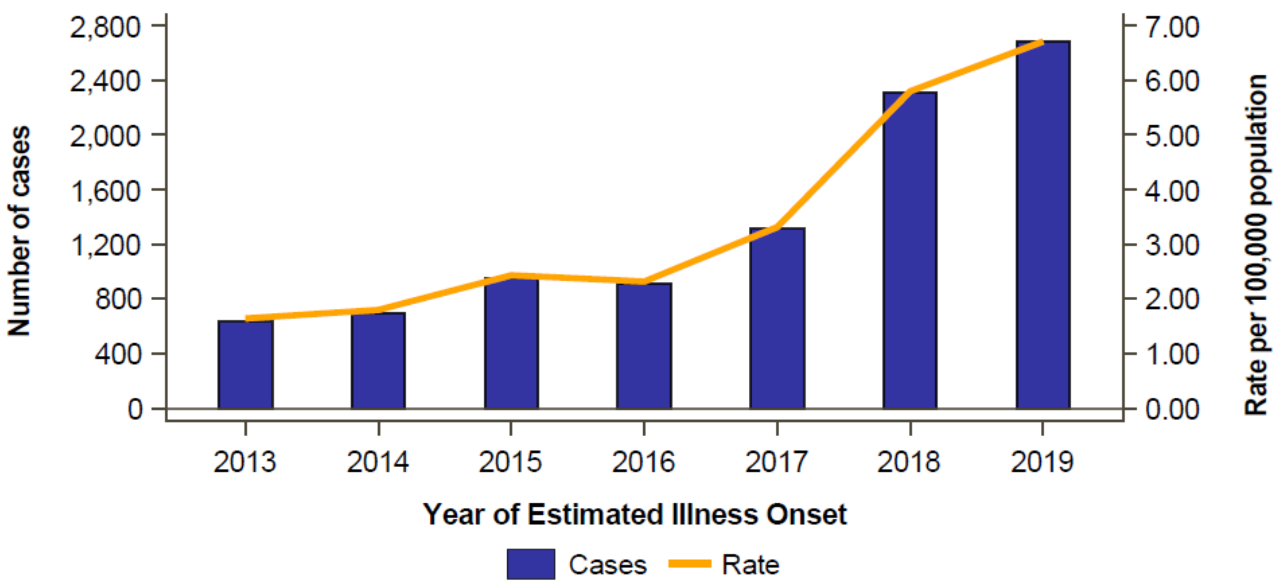
STEC Outbreaks

From 2013 through 2019, there were 49 foodborne outbreaks of STEC involving more than 664 California case-patients; the greatest number of outbreaks occurred in 2018 with 13 (26.5%). Thirty-four (69.4%) outbreaks were caused by STEC O157, 12 (24.5%) outbreaks were caused by STEC non-O157, and 3 (6.1%) outbreaks involved case-patients infected with both STEC O157 and non-O157. STEC O26 was the most common STEC non-O157 serogroup involved in outbreaks. Thirty-six (73.5%) outbreaks involved patients exposed in multiple states[17] and were primarily due to widely distributed food products.

Some notable multi-state STEC outbreaks involving California residents that led to food recalls included: 2018 and 2019 STEC O157 outbreaks associated with romaine lettuce (210 cases in the U.S., with 49 from California in 2018; 167 cases in U.S., with 8 from California in 2019); a 2017 STEC O157 outbreak associated with I.M. Healthy brand SoyNut Butter (32 cases in U.S., with 5 from California), and a 2016 outbreak of both STEC O121 and O26 associated with General Mills flour (63 cases in U.S., with 3 from California). There were also multi-state STEC outbreaks linked to other foods including sprouts, beef, and other leafy greens.

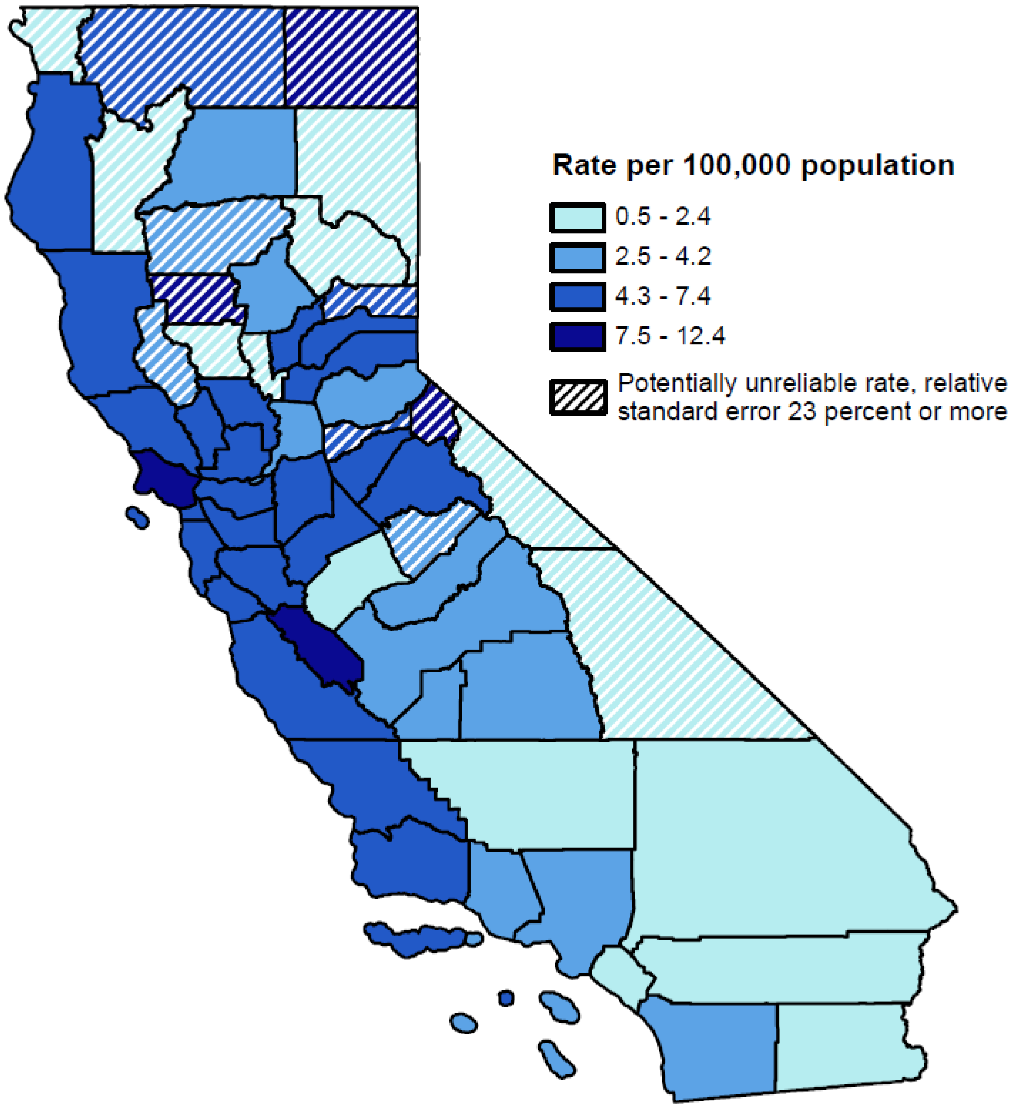
The largest STEC outbreak within California, which involved both STEC O157 and O26 infections, occurred in 2017 and involved 244 recruits at a Marine Corps Recruit Depot in San Diego. Thirty case-patients were hospitalized and 15 had HUS.[17, 18]

Figure 1. Shiga Toxin-producing *E. coli* (STEC) Cases and Incidence Rates by Year of Estimated Illness Onset, California, 2013-2019 *



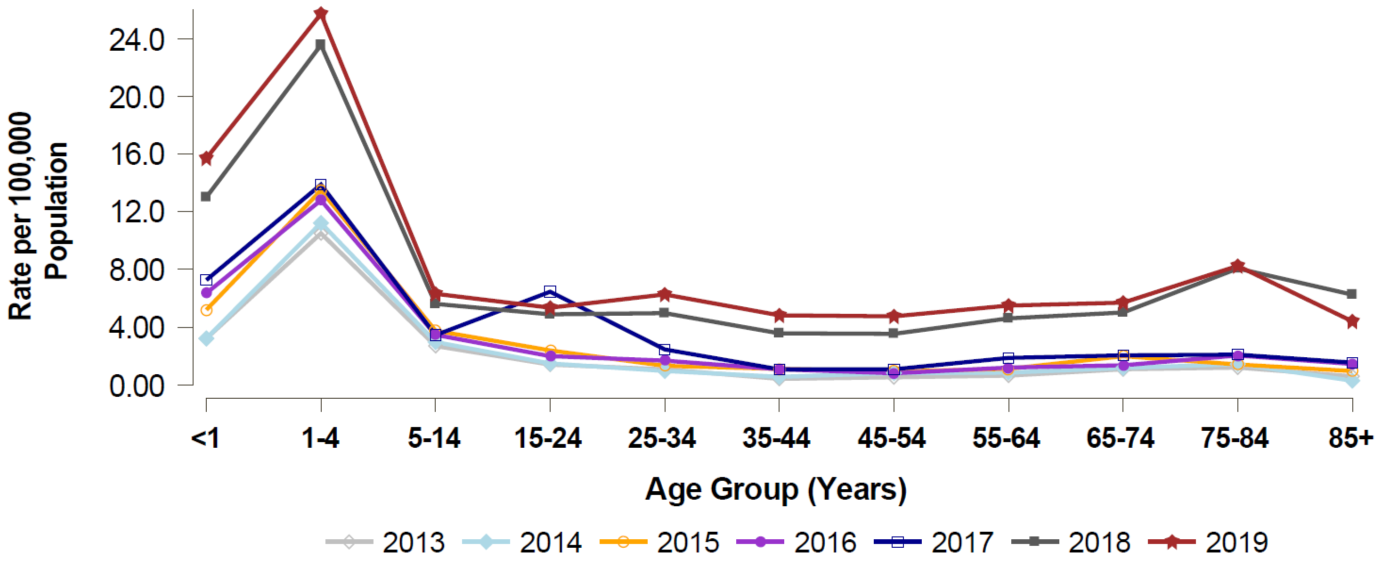
*Includes all reported cases of STEC, both with and without hemolytic uremic syndrome (HUS).

Figure 2. Shiga Toxin-producing *E. coli* (STEC) Average Annual Incidence Rates by County, California, 2013-2019 *



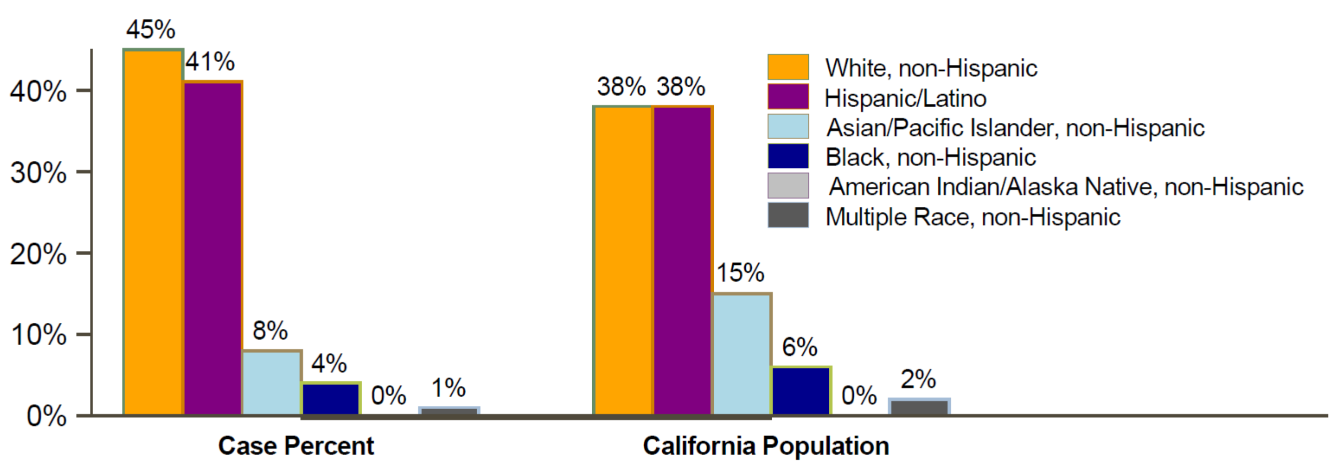
*Includes all reported cases of STEC, both with and without hemolytic uremic syndrome (HUS).

Figure 3. Shiga Toxin-producing *E. coli* (STEC) Incidence Rates by Age Group and Year of Estimated Illness Onset, California, 2013-2019 *



*Includes all reported cases of STEC, both with and without hemolytic uremic syndrome (HUS).

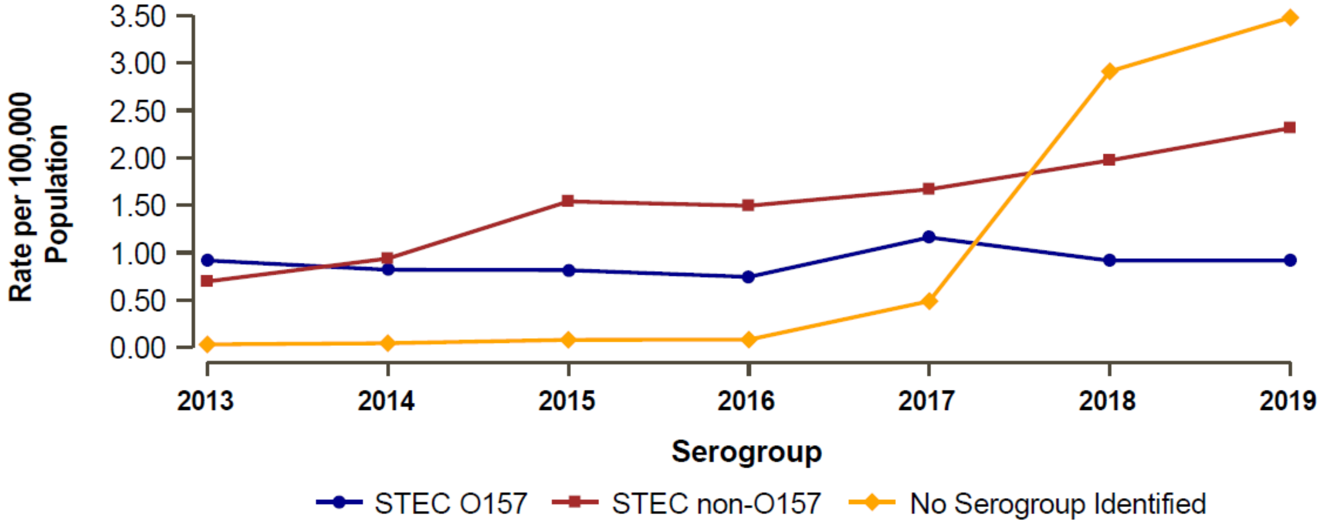
Figure 4. Shiga Toxin-producing *E. coli* (STEC) Cases and Population by Race/Ethnicity, California, 2013-2019 *



16.3% (n=1545) of reported incidents of Shiga toxin-producing E. coli (STEC) did not identify race/ethnicity and 4.4% (n=421) 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.

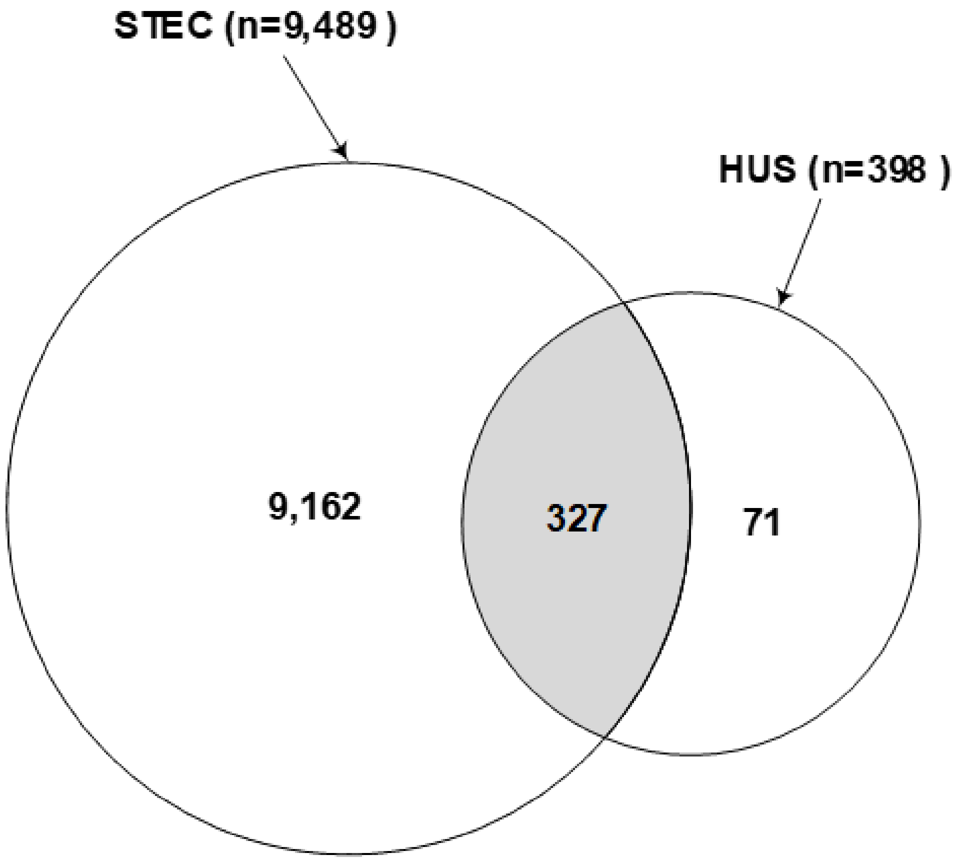
*Includes all reported cases of STEC, both with and without hemolytic uremic syndrome (HUS).

Figure 5. Shiga Toxin-producing *E. coli* (STEC) Incidence Rates by Serogroup and Year of Estimated Illness Onset, California, 2013-2019 *



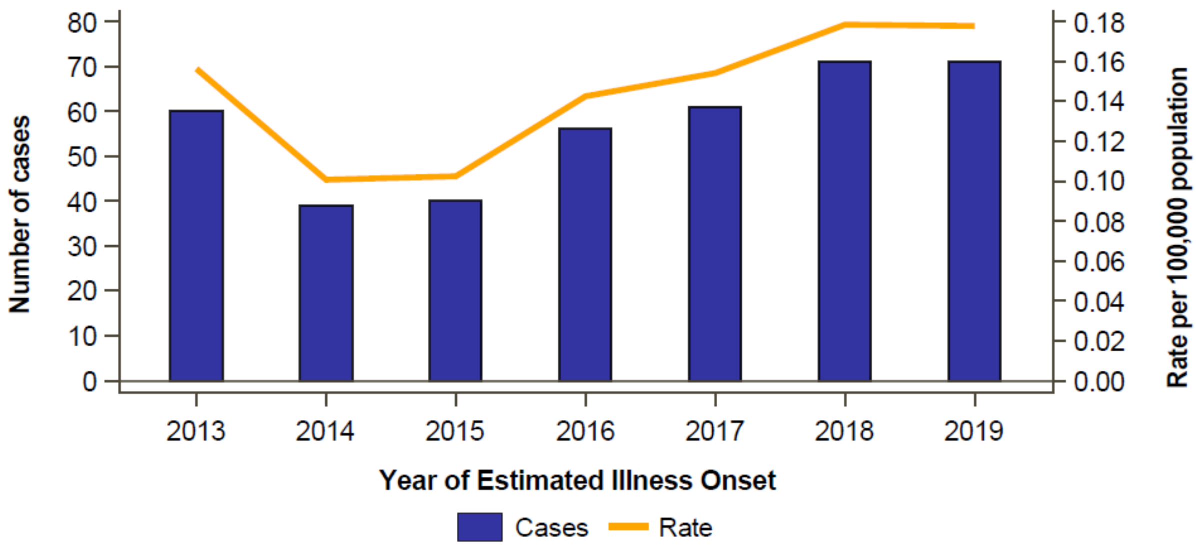
*'STEC O157' and 'STEC non-O157' include reported cases of STEC for which a laboratory (stool) culture identified a STEC serogroup. 'No Serogroup Identified' includes STEC cases that either were not cultured, or the culture did not identify an STEC serogroup. Beginning in 2018, reported probable STEC cases included those identified via culture-independent diagnostic test (CIDT).

Figure 6. Venn Diagram of California Cases of Shiga Toxin-producing *E. coli* (STEC) Infection and Hemolytic Uremic Syndrome (HUS), 2013-2019 *



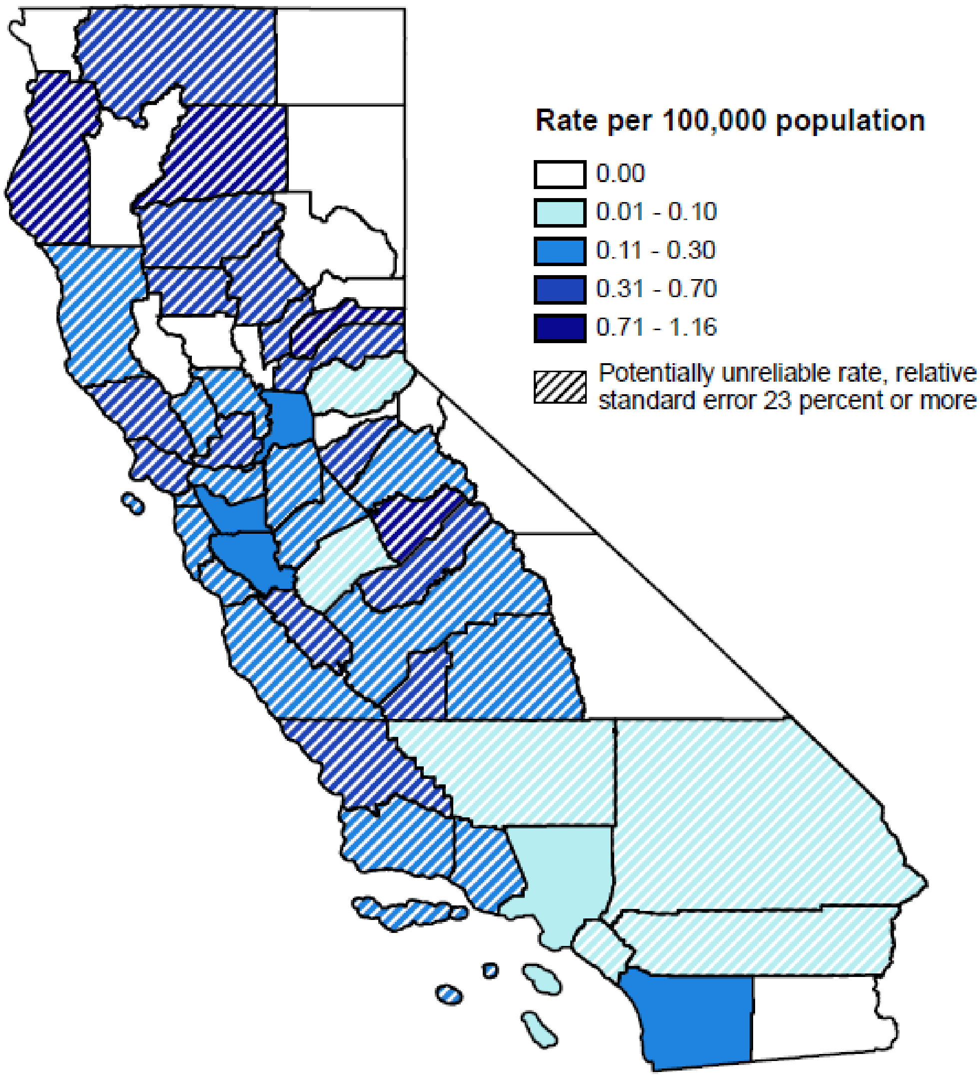
* Drawing not to scale

Figure 7. Hemolytic Uremic Syndrome (HUS) Cases and Incidence Rates by Year of Estimated Illness Onset, California, 2013-2019 *



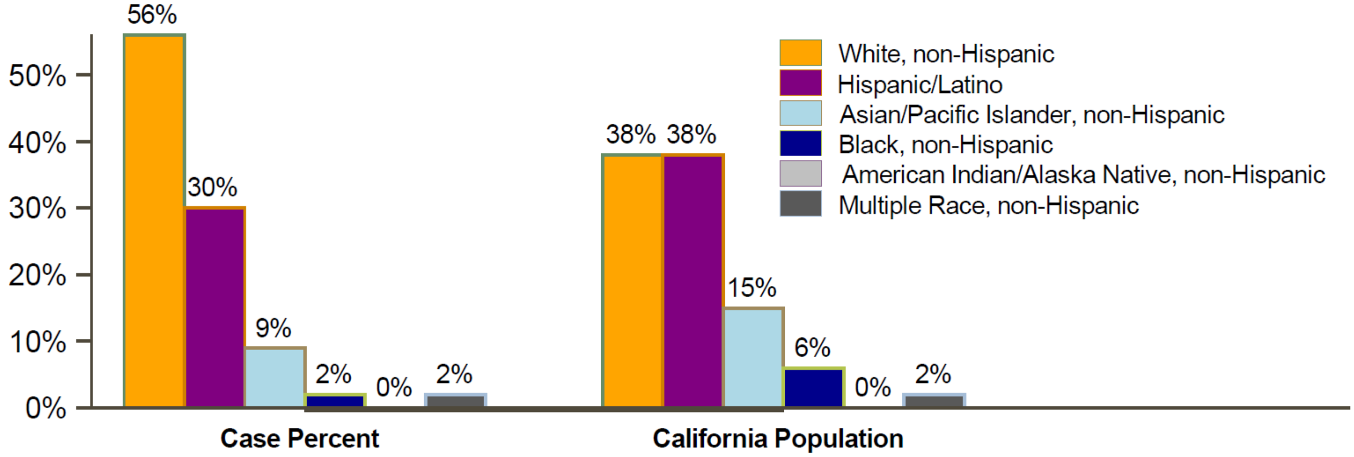
*Includes all reported cases of HUS, both with and without evidence of Shiga toxin-producing *E. coli* (STEC).

Figure 8. Hemolytic Uremic Syndrome (HUS) Average Annual Incidence Rates by County, California, 2013-2019 *



*Includes all reported cases of HUS, both with and without evidence of Shiga toxin-producing *E. coli* (STEC).

Figure 9. Hemolytic Uremic Syndrome (HUS) Cases and Population by Race/Ethnicity, California, 2013-2019 *



14.1% (n=56) of reported incidents of Hemolytic Uremic Syndrome (HUS) did not identify race/ethnicity and 5.5% (n=22) 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.

*Includes all reported cases of HUS, both with and without evidence of Shiga toxin-producing *E. coli* (STEC).

Comments

From 2013 through 2019, incidence rates of reported STEC infection in California increased more than four-fold, most of the increase in 2018 and 2019. The statewide average annual incidence rate of STEC infection during 2013-2019 (3.5 per 100,000 population) was similar to that reported nationally.[2, 19, 20, 21, 22] Similarly, STEC incidence rates in the U.S. increased during 2018-2019.[2] The change in the surveillance case definition in 2018 for probable cases to include CIDT results likely contributed to the substantial rate increase during 2018-2019 in California STEC cases overall and STEC cases with no serogroup identified.

Reported infections caused specifically by STEC non-O157 serogroups also increased during recent years in both California and the U.S.[23, 24] This increase may be influenced by several factors, including increased use of Shiga toxin testing by clinical laboratories, growing awareness of reporting requirements for STEC non-O157, and increasing numbers of Shiga toxin-positive specimens forwarded to a public health laboratory for culture and identification. The rise in incidence may also be due to a true increase in STEC infections, due to yet undefined demographic and environmental risk factors.

HUS incidence rates in California were somewhat variable but increased slightly overall from 2013 to 2019, with an average incidence rate of 0.14 cases per 100,000. Fewer STEC infections progressed to HUS during 2013-2019 (3.6%) than did during the 2009-2012 surveillance period (nearly 10%).[11] As in the U.S. overall, the majority of post-diarrheal HUS diagnoses in California were associated with an STEC infection.[1, 7, 25] Also similar to national trends, California children aged 1 to 4 years experienced the highest rates of STEC infection, as well as of HUS.[2,19-22, 25]

In order to capture the burden of STEC infections in California and to develop a comprehensive public health response, it is crucial that clinical laboratories routinely test all stool specimens collected from patients with symptoms consistent with acute bacterial enteritis for the presence of Shiga toxin and attempt to culture STEC. Suspect STEC specimens must be sent to a public health laboratory for serogrouping and subtyping. Better adherence to these stool culture recommendations can improve surveillance estimates of O157 and non-O157 STEC infections and improve assessment of true disease burden in California.

Avoiding contamination and cross-contamination during the production and processing of foods, including beef and fresh fruits and vegetables, combined with consumer education may provide the best opportunities for preventing and controlling STEC infections and HUS. To help prevent STEC infections and HUS, persons should follow food safety guidelines when preparing food, especially by cooking food thoroughly and promptly refrigerating perishable food to inhibit bacterial growth. Persons should also wash their hands with soap and water before preparing or eating food, after using the toilet or changing a diaper, and after touching animals (especially farm animals) or being in animal environments. Persons should also avoid swallowing water when swimming or recreating in rivers, lakes, and pools because STEC bacteria can also be present in untreated water. Persons with STEC infections who develop symptoms of HUS, which can include decreased frequency of urination, fatigue, and pallor, should immediately consult their healthcare provider.

Prepared by Kirsten Knutson, Yanyi Djamba, Akiko Kimura, Katherine Lamba, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, June 2022

References

[1] U.S. Centers for Disease Control and Prevention. National Shiga Toxin-producing *Escherichia coli* (STEC) Surveillance Overview. Atlanta, Georgia: U.S. Department of Health and Human Services; 2012. http://www.cdc.gov/ncezid/dfwed/pdfs/national-stec-surveillance-overiew-508c.pdf

[2] National Notifiable Diseases Surveillance System. *2019 Annual Tables of Infectious Disease Data.* Atlanta, GA: U.S. Centers for Disease Control and Prevention, Division of Health Informatics and Surveillance; 2021. Accessed November 15, 2021. https://www.cdc.gov/nndss/data-statistics/infectious-tables/index.html

[3] *E. coli* (*Escherichia coli*), Questions and Answers. U.S. Centers for Disease Control and Prevention website. Updated December 1, 2014. Accessed December 2, 2021. https://www.cdc.gov/ecoli/general/index.html

[4] U.S. Centers for Disease Control and Prevention. National Shiga toxin-producing *Escherichia coli* (STEC) Surveillance Annual Report, 2017. Atlanta, Georgia: U.S. Department of Health and Human Services; 2021. Accessed November 9, 2021. https://www.cdc.gov/ecoli/surv2017/index.html

[5] *Healthy People 2020* Food Safety Objectives. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion website. Updated May 25, 2021.

Accessed May 26, 2021. https://www.healthypeople.gov/2020/topics-objectives/topic/food-safety/objectives

[6] Shiga Toxin-Producing *Escherichia coli* (STEC) Fact Sheet. California Department of Public Health website. Updated March 2015. Accessed December 2, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/STECFactSheet.pdf

[7] Hemolytic Uremic Syndrome in Children. National Institute of Diabetes and Digestive and Kidney Diseases website. Updated June 2015. Accessed January 20, 2021. https://www.niddk.nih.gov/health-information/kidney-disease/children/hemolytic-uremic-syndrome

[8] Johnson KE, Thorpe CM, Sears CL. The emerging clinical importance of non-O157 Shiga toxin--producing Escherichia coli. Clin Infect Dis 2006;43:1587--95. https://pubmed.ncbi.nlm.nih.gov/17109294/

[9] State of California, Department of Public Health. Technical notes. In: *Epidemiologic Summaries of Selected Communicable Diseases in California, 2013-2019.* Sacramento, California; 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. Shiga toxin-producing *Escherichia coli* (STEC)-related infections and illnesses. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008*. Sacramento, California, September 2009. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[11] State of California, Department of Public Health. Shiga toxin-producing *Escherichia coli* (STEC) infections and Hemolytic Uremic Syndrome (HUS). In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012.* Sacramento, California, September 2015. 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/I01D4328129FA11EDA5B6DDCDF7AC13B6

[13] Reportable Diseases and Conditions: Notification by Laboratories, 17 CCR § 2505 (2021). https://govt.westlaw.com/calregs/Document/I1AE261C029FA11EDA5B6DDCDF7AC13B6

[14] State of California, Department of Public Health. Conditions for Which Clinical Laboratories Shall Submit an Isolate or a Specimen to the Local Public Health Laboratory. Sacramento, CA; June 2016. Accessed June 18, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/ConditionsforWhichaClinicalLabShallSubmitaCulture.pdf

[15] Shiga Toxin-producing *Escherichia coli* (STEC) Case Definitions, 2006, 2014 & 2018. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed January 13, 2021.
https://ndc.services.cdc.gov/case-definitions/shiga-toxin-producing-escherichia-coli-2006/
https://ndc.services.cdc.gov/case-definitions/shiga-toxin-producing-escherichia-coli-2014/
https://ndc.services.cdc.gov/case-definitions/shiga-toxin-producing-escherichia-coli-2018/

[16] Hemolytic Uremic Syndrome, Post-diarrheal (HUS),1996 Case Definition. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed January 13, 2021.
https://ndc.services.cdc.gov/case-definitions/hemolytic-uremic-syndrome-post-diarrheal-1996/

[17] National Outbreak Reporting System (NORS), U.S. Centers for Disease Control and Prevention website. Updated November 4, 2019. Data extracted on December 16, 2020.
https://www.cdc.gov/nors/index.html

[18] Outbreak of *E. coli* O157:H7 and *E. coli* O26 Infections at a Marine Corps Recruit Depot (MCRD) — San Diego and Camp Pendleton, California, October–November, 2017. Presented at the 67th Annual Epidemic Intelligence Service (EIS) Conference, April 16-19, 2018. Abstract accessed on February 1, 2021.
https://www.cdc.gov/eis/downloads/eis-conference-2018-508.pdf#page=129

[19] Adams DA, Fullerton K, Jajosky R et.al. Summary of notifiable diseases and conditions--United States, 2013. *MMWR Morb Mortal Wkly Rep.* 2015 Oct 23;62(53):1-119.

[20] Adams DA, Thomas K, Jajosky RA et. al. Summary of notifiable diseases and conditions--United States, 2014. *MMWR Morb Mortal Wkly Rep.* 2016 Oct 14;63(54):1-152.

[21] Adams DA, Thomas K, Jajosky RA et al. Summary of notifiable diseases and conditions--United States, 2015. *MMWR Morb Mortal Wkly Rep.* 2017 Aug 11;64(53):1-143.

[22] National Notifiable Diseases Surveillance System. *2016-2018 Annual Tables of Infectious Disease Data.* Atlanta, GA: U.S. Centers for Disease Control and Prevention, Division of Health Informatics and Surveillance; 2019. Accessed November 8, 2020.
https://www.cdc.gov/nndss/data-statistics/infectious-tables/index.html

[23] U.S. Centers for Disease Control and Prevention. National Shiga toxin-producing *Escherichia coli* (STEC) Surveillance Annual Report, 2016. Atlanta, Georgia: U.S. Department of Health and Human Services; 2018. Accessed February 15, 2021.
https://www.cdc.gov/ecoli/surv2016/index.html

[24] Tack DM, Ray L, Griffin PM, et al. Preliminary Incidence and Trends of Infections with Pathogens Transmitted Commonly Through Food — Foodborne Diseases Active Surveillance Network, 10 U.S. Sites, 2016–2019. MMWR Morb Mortal Wkly Rep 2020;69:509–514.

[25] FoodNet Fast: Hemolytic Uremic Syndrome (HUS) Surveillance Tool FAQ. Foodborne Diseases Active Surveillance Network (FoodNet), U.S. Centers for Disease Control and Prevention website. Updated December 5, 2019. Accessed December 12, 2021.
https://www.cdc.gov/foodnet/foodnet-fast/faq-hus-surveillance.html

Key Findings

Shigellosis is an infection caused by *Shigella* bacteria. The most common symptoms of shigellosis include diarrhea, stomach pain and cramps, fever, and a strong urge to pass stool (poop). People get shigellosis when they put something in their mouths or swallow something that has come into contact with the stool of a person who is sick with shigellosis. *Shigella* germs are very contagious, meaning they can easily spread from person to person. Anyone can get shigellosis, but young children, people with weakened immune systems, and men who have sex with men are more likely to get sick.

Shigellosis in California from 2013 through 2019

Total Cases: There were a total of 16,513 new shigellosis cases from 2013 through 2019. This is an average of 2,359 cases each year.

Rate: The average annual rate of new shigellosis cases during 2013-2019 was about 6 cases per 100,000 people in California.

- **By County**: The average rate was highest in San Francisco County (about 24 cases per 100,000 people). By region, rates were almost twice as high in Southern California (about 7 cases per 100,000 people) than in Northern California (about 4 cases per 100,000 people).
- **By Sex:** The average rate was higher in males (about 7 cases per 100,000 people) than in females (about 4 cases per 100,000 people) for each year during 2013-2019.
- **By Age Group**: The average rate was highest in children aged 1 to 4 years, with about 10 cases per 100,000 children in this age group.
- **By Race/Ethnicity**: For cases where race and ethnicity information was available, the highest percentage of cases (about 44%) was in people who reported Hispanic/Latino race/ethnicity.
- **By Month**: Most shigellosis cases (about 55%) occurred in July through November.

The best way to prevent shigellosis and prevent the spread of germs is to wash your hands with soap and water after using the toilet, before preparing food and eating, and after changing a diaper. If you are sick with diarrhea from shigellosis, do not prepare or share food with others, and stay home from school or healthcare, food service, or childcare jobs until you are better. Do not have sex of any kind with someone who currently has diarrhea from shigellosis or has had shigellosis in the past few weeks.

For more information about shigellosis in California, please visit the CDPH Shigellosis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Shigellosis is an intestinal infection caused by highly-infectious *Shigella*, a commonly reported enteric bacterial pathogen estimated to cause about 450,000 cases of shigellosis each year in the United States.[1] *Shigella* species include *S. sonnei, S. flexneri, S. boydii,* and *S. dysenteriae*; *S. sonnei* is the most common species in the U.S followed by *S. flexneri; S. dysenteriae* and *S. boydii* are rare in the U.S.[2, 3] *Shigella* infection is restricted to humans and is predominantly transmitted from person to person through direct or indirect fecal-oral contact. Other sources of infection include ingestion of contaminated food, drinking of recreational water, and sexual contact (especially among men who have sex with men).[1]

Acute illness, usually gastroenteritis, occurs after an incubation period of 1 to 2 days.[4] The severity of shigellosis varies by patient age and by infecting species and is characterized by diarrhea, fever, nausea, cramps, and tenesmus. *S. dysenteriae* is associated with the most severe illnesses, whereas most people with *S. sonnei* infection have self-limited illness.[3] Postinfectious arthritis is a rare complication of *Shigella* infection, especially with *S. flexneri* infection.[1] Populations at increased risk of infection include young children, men who have sex with men, persons with human immunodeficiency virus (HIV) infection, and international travelers. Large outbreaks of shigellosis have occurred, particularly in crowded settings, such as childcare settings, among small social communities, and among persons experiencing homelessness.[5] Point source outbreaks due to contaminated food or water have also occurred.

An estimated 77,000 drug-resistant *Shigella* infections occur each year in the U.S.; the U.S. Centers for Disease Control and Prevention (CDC) has declared antibiotic-resistant *Shigella* a serious public health threat, as resistant *Shigella* infections have increased notably since 2013.[6, 7] Increasing numbers of *Shigella* isolates have demonstrated resistance or decreased susceptibility to antimicrobial agents, including ciprofloxacin and azithromycin. This has been associated with both international travel and domestic acquisition.[8, 9, 10]

This report describes the epidemiology of confirmed and probable shigellosis cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes*.[11] The epidemiologic description of shigellosis for earlier surveillance periods can be found in the *Epidemiologic Summary of Shigellosis in California, 2001-2008 and 2009-2012*.[12, 13]

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 *Shigella* infection to their local health department within one working day of identification or immediately by telephone if an outbreak is suspected.[14] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of *Shigella* species to either the California Reportable Diseases Information Exchange (CalREDIE) via electronic laboratory reporting or the local health department; notification should occur within one working day after the health care provider has been notified of the laboratory testing result.[15]

California regulations require cases of shigellosis to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the CDC/Council of State and Territorial Epidemiologists (CSTE) surveillance case definition of a confirmed or probable case. From 2013-2016, a confirmed case of shigellosis was defined as an infection in which *Shigella* spp. was isolated from a clinical specimen. A probable case of shigellosis was defined as a clinically compatible case epidemiologically linked to a confirmed case or a member of a risk group defined by public health authorities during an outbreak.[16] In 2017, the CSTE case definition for probable cases changed to include an infection in which *Shigella* spp. or *Shigella/*enteroinvasive *E. coli* (EIEC) was detected in a clinical specimen using culture-independent diagnostic testing (CIDT), or a case with clinically compatible illness and an established epidemiologic link to a laboratory-confirmed or laboratory-probable case; the criteria for a confirmed case did not change in 2017.[17]

Epidemiology of Shigellosis in California, 2013-2019

CDPH received reports of 16,513 total cases of shigellosis with estimated symptom onset dates from 2013 through 2019. This corresponds to an average of 2,359 cases each year and an average annual incidence rate of 6.0 cases per 100,000 population. Incidence rates increased from 2013 (2.8 per 100,000; 1,075 cases) to 2019 (8.6 per 100,000; 3,430 cases), with fluctuations over time [Figure 1]. The highest incidence rate occurred in 2018 (8.6 per 100,000; 3,440 cases).

During the surveillance period, *S. sonnei* (Serogroup D) was the most common species identified as the cause of shigellosis (5,928 cases; 35.9%), followed by *S. flexneri* (Serogroup B) (3,007 cases; 18.2%), *S. boydii* (Serogroup C) (80 cases; 0.5%), and *S. dysenteriae* (Serogroup A) (39 cases, 0.2%). There were 7,459 (45.2%) shigellosis cases that did not have an indicated species.

County-specific average annual incidence rates per 100,000 population during 2013-2019 ranged from 0 to 23.6, with the highest average annual rate in San Francisco County (23.6 cases per 100,000; 1,442 total cases), followed by Imperial County (16.1 cases per 100,000; 210 total cases), and Stanislaus County (8.5 cases per 100,000; 325 total cases) [Figure 2]. By region (see *Technical Notes*), average annual incidence rates for the surveillance period were 1.8 times higher in Southern California (6.5 per 100,000; 9,002 cases) than in Northern California (3.6 per 100,000; 7,511 cases). Shigellosis cases in Southern California accounted for 54.5% of all shigellosis cases reported in California during the surveillance period.

From 2013 through 2019, average annual incidence rates were 1.6 times higher among males (7.3 per 100,000; 10,028 cases) than among females (4.5 per 100,000; 6,209 cases); 61.8% of case-patients were male and 38.2% were female.

Average annual shigellosis incidence rates during the surveillance period were highest in children aged 1 to 4 years (9.7 per 100,000; 1,343 cases), followed by adults aged 25 to 34 years (8.1 per 100,000; 3,061 cases) and 45 to 54 years (7.3 per 100,000; 2,643 cases) [Figure 3].

For shigellosis cases with complete race/ethnicity information (see *Technical Notes*), the highest percentage of cases was among those who reported Hispanic/Latino race/ethnicity (44.3%), which was higher than the percentage of the Hispanic/Latino racial/ethnic population in California during the same time period (44.3% vs. 38.5%, respectively) [Figure 4].

Shigellosis cases have been reported year-round, but the highest number of cases during 2013-2019 occurred from July to November (54.5%; 9,001 cases) [Figure 5].

From 2013 through 2019, CDPH received reports of 19 foodborne outbreaks of shigellosis: 16 with an undetermined food source, and 3 with a known or suspected food source. The largest foodborne outbreak during this time period occurred in 2015 in Santa Clara County; 188 cases were associated with consumption of food at a restaurant, but a definitive source was not determined. Person-to-person transmission in certain settings, such as in daycare or among persons experiencing homelessness, were recognized during the surveillance period. [8, 18] However, due to the inherent difficulties in defining outbreaks in these settings, especially as secondary and tertiary spread is known to occur, these outbreaks were not systematically tracked.

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

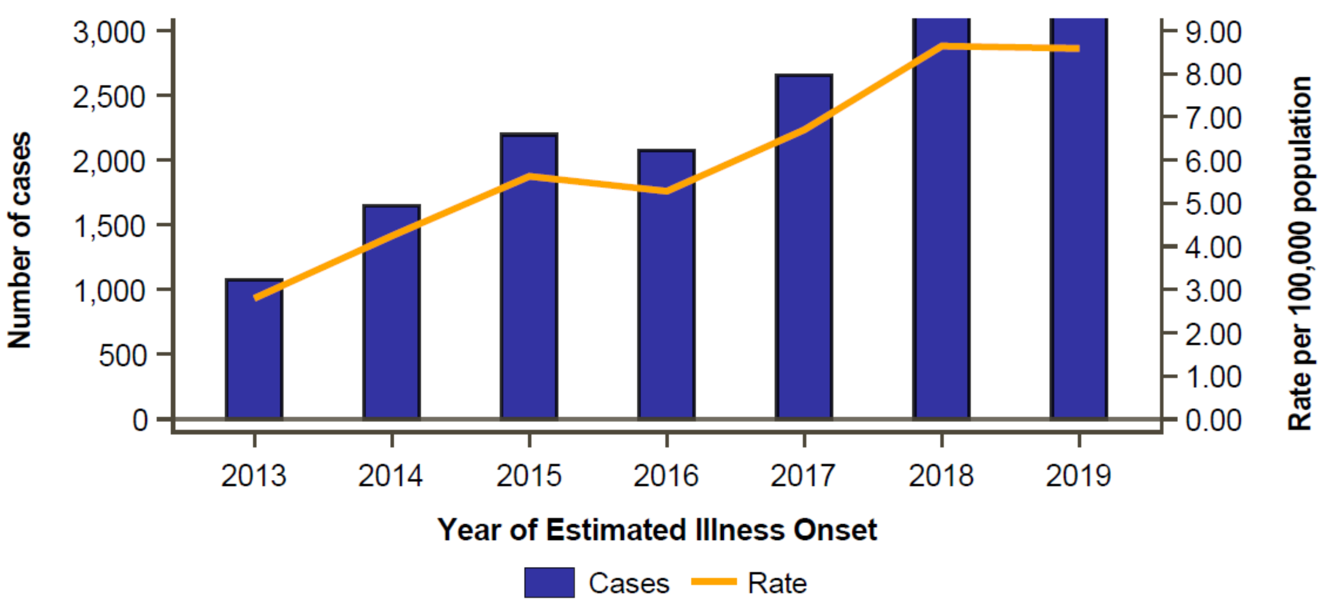


Figure 2. Shigellosis Average Annual Incidence Rates by County, California, 2013-2019

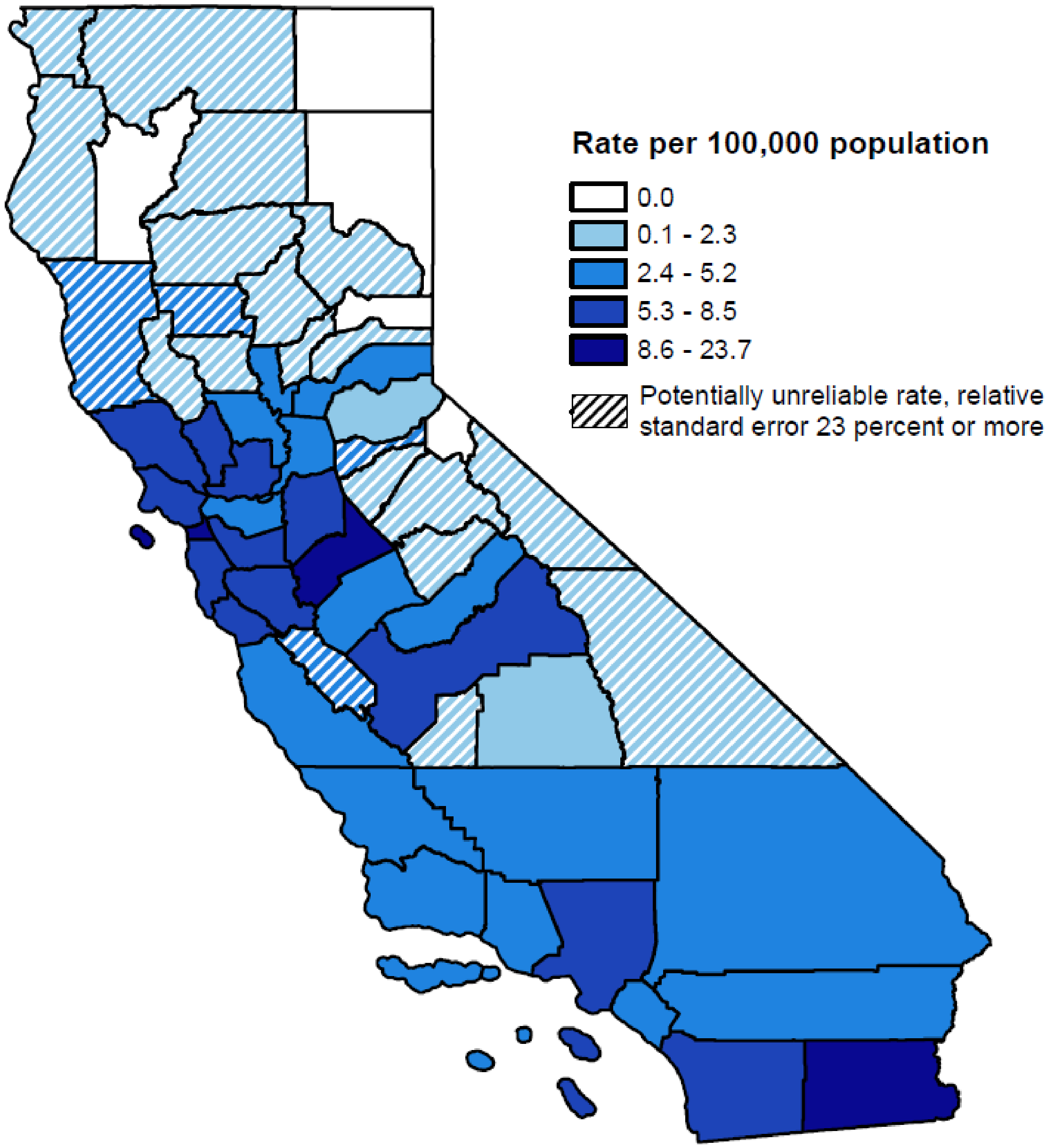


Figure 3. Shigellosis Incidence Rates by Age Group and Year of Estimated Illness Onset, California, 2013-2019

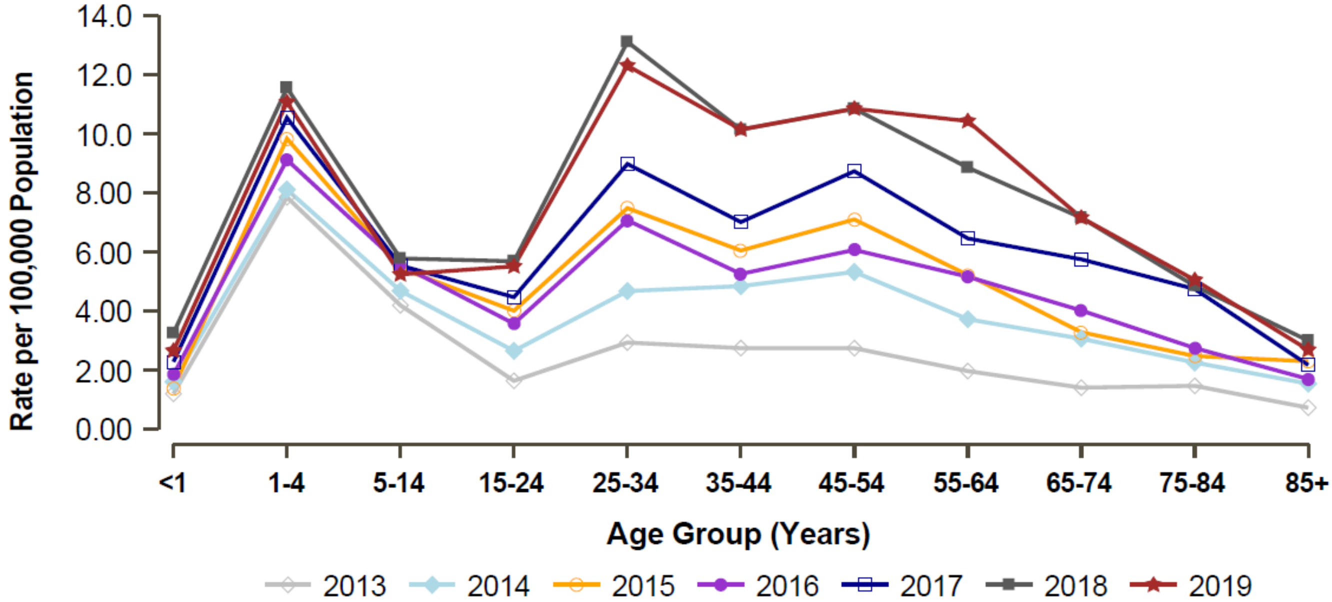
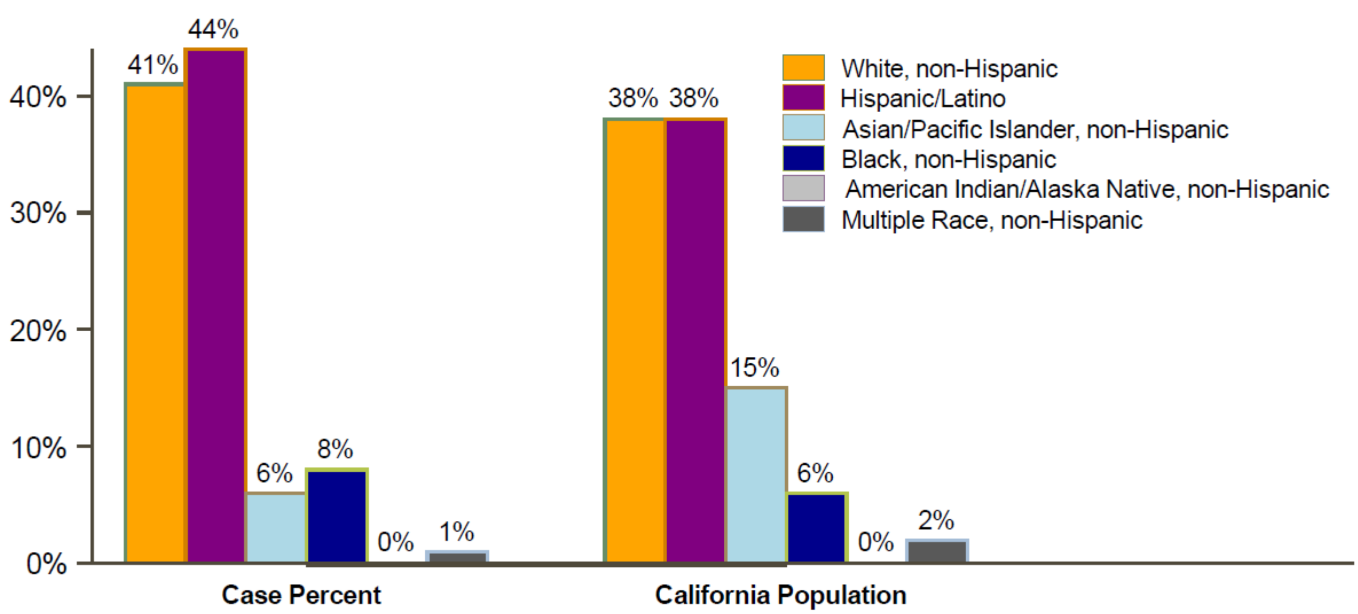
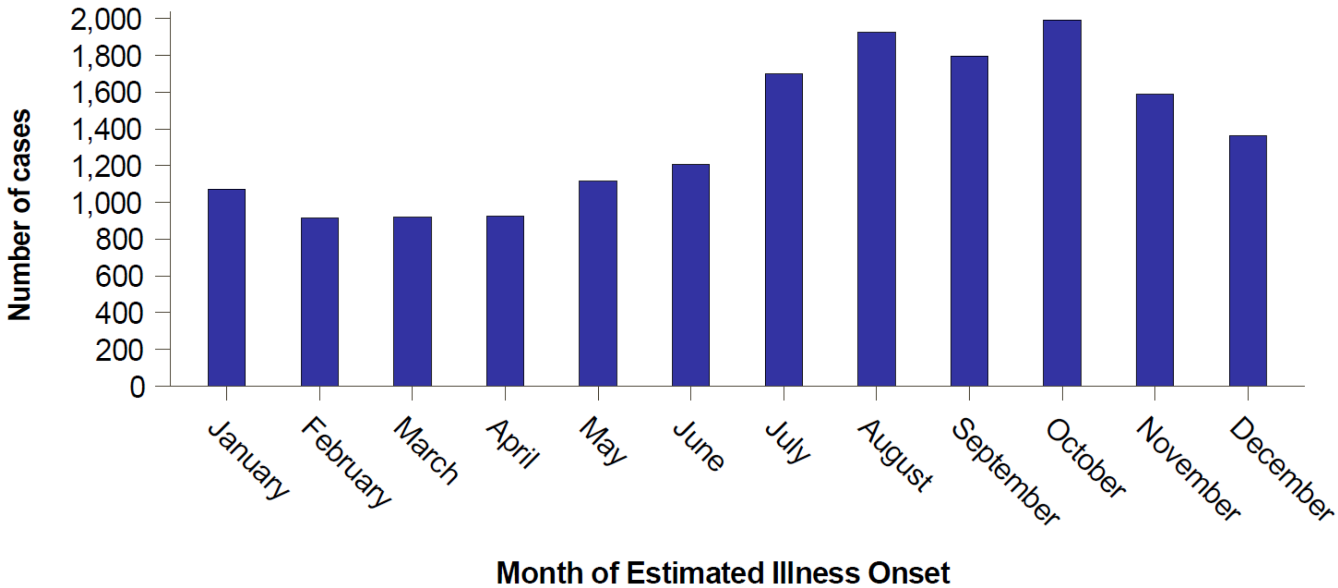


Figure 4. Shigellosis Cases and Population by Race/Ethnicity, California, 2013-2019



10.9% (n=1807) of reported incidents of Shigellosis did not identify race/ethnicity and 3.5% (n=583) 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.

Figure 5. Shigellosis Cases by Month of Estimated Illness Onset, California, 2013-2019



Comments

Detailed case report forms are not required for reporting shigellosis cases to CDPH, thus additional data on exposures were only available for 33% of total shigellosis cases. As such, data on exposures are not further described in this report due to missing data.

Overall, average annual incidence rates of shigellosis in California increased during the 2013-2019 surveillance period (6.0 cases per 100,000 population; 16,513 total cases) compared to the 2009-2012 surveillance period (2.8 cases per 100,000 population; 4,186 cases).[13] In addition, the change in the surveillance case definition in 2017 for probable cases contributed to increasing case counts during the 2013-2019 surveillance period. Similar to the 2009-2012 surveillance period, average shigellosis incidence was highest among children aged 1 to 4 years during the 2013-2019 surveillance period (9.7 per 100,000; 1,343 cases).

For the 2009-2012 surveillance period, average annual incidence rates were slightly higher in Northern California (2.9 per 100,000) than in Southern California (2.7 per 100,000).[13] However, for the 2013-2019 surveillance period, average annual incidence rates were almost twice as high in Southern California (6.5 per 100,000) than in Northern California (3.6 per 100,000).

Of the shigellosis cases with complete race/ethnicity information during the 2009-2012 surveillance period, cases reported Hispanic/Latino race/ethnicity disproportionately more often than would be expected based on the overall demographic profile of California during that time period (54.8% of cases vs. 38.1% of population).[13] This disproportionate difference was reduced but still observed for cases that reported Hispanic/Latino race/ethnicity during the 2013-2019 surveillance period (44.3% of cases vs. 38.5% of California population).

In 2014, the first occurrence of Shiga toxin (Stx)-producing *S. sonnei* was detected in California. Other than in 2014-2015, when clusters of cases were identified in San Diego, San Joaquin, and Stanislaus counties, cases of Stx-producing *Shigella* infections have occurred sporadically and are not considered to have affected the general increase in reported shigellosis. Confirmed cases of Stx-producing *Shigella* are reported as shigellosis cases and are not counted as Stx-producing *Escherichia coli*.[19]

Public health measures such as reporting of cases, education on hand hygiene (washing hands with soap and water for everyone, particularly in group settings such as childcare facilities), and targeted education for high-risk groups likely offer the best opportunities for reducing disease transmission. Given the increased rates of drug-resistant shigellosis, healthcare providers should request antimicrobial susceptibility testing and select an appropriate antibiotic based on the susceptibility profile if treatment is indicated.

To prevent shigellosis, proper hand hygiene is imperative, especially after using the toilet, before preparing food and eating, and after changing diapers. Persons experiencing diarrhea should not prepare or share food with others, and should stay home from school or healthcare, food service, or childcare jobs until symptoms resolve. Sexual activity with persons who have diarrhea or who recently recovered from shigellosis should be avoided.

Prepared by Inderbir Sohi, Yanyi Djamba, Katherine Lamba, Akiko Kimura, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, November 2021

References

[1] *Shigella* – Shigellosis, Information for Healthcare Professionals. U.S. Centers for Disease Control and Prevention website. Updated June 28, 2021. Accessed October 22, 2021. https://www.cdc.gov/shigella/audience-medical-professionals.html

[2] U.S. Centers for Disease Control and Prevention. *National Enteric Disease Surveillance: Shigella Annual Report, 2016.* Atlanta, GA: U.S. Department of Health and Human Services; 2018. Accessed January 20, 2022. https://www.cdc.gov/nationalsurveillance/pdfs/LEDS-Shig-2016-REPORT-508.pdf

[3] Francois Watkins LK and Appiah GD. Chapter 4: Travel-related infectious diseases, shigellosis. In: CDC Yellow Book 2020: Health Information for International Travel. Oxford University Press; 2019. Accessed November 2, 2021. https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/shigellosis

[4] *Shigella* – Shigellosis, Symptoms. U.S. Centers for Disease Control and Prevention website. Updated June 29, 2021. Accessed October 22, 2021. https://www.cdc.gov/shigella/symptoms.html

[5] *Shigella* – Shigellosis, Sources of Infection & Risk Factors. U.S. Centers for Disease Control and Prevention website. Updated July 25, 2017. Accessed October 22, 2021. https://www.cdc.gov/shigella/infection-sources.html

[6] Antibiotic/Antimicrobial Resistance (AR/AMR), Biggest Threats and Data. U.S. Centers for Disease Control and Prevention website. Updated March 2, 2021. Accessed October 22, 2021. https://www.cdc.gov/drugresistance/biggest-threats.html

[7] U.S. Centers for Disease Control and Prevention. Drug-resistant *Shigella*. In: *Antibiotic Resistance Threats in the United States, 2019.* Atlanta, GA; 2019. Accessed October 22, 2021. https://www.cdc.gov/drugresistance/pdf/threats-report/shigella-508.pdf

[8] Bowen A, Hurd J, Hoover C et al. Importation and Domestic Transmission of *Shigella sonnei* Resistant to Ciprofloxacin — United States, May 2014–February 2015. *MMWR Morb Mortal Wkly Rep.* 2015 April 3;64(12):318-320. https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6412a2.htm

[9] Reporter R, Pulido M, Bowen A et al. Notes from the Field: Outbreak of Infections Caused by *Shigella sonnei* with Decreased Susceptibility to Azithromycin — Los Angeles, California, 2012. *MMWR Morb Mortal Wkly Rep.* 2013 March 8;62(09):171-171. https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6209a4.htm

[10] Health Alert Network (HAN) No. 00411 – Update: CDC Recommendations for Managing and Reporting Shigella Infections with Possible Reduced Susceptibility to Ciprofloxacin. U.S. Centers for Disease Control and Prevention website. Issued June 7, 2018. Accessed November 2, 2021. https://emergency.cdc.gov/han/han00411.asp

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

[12] State of California, Department of Public Health. Shigellosis. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008*. Sacramento, CA; 2009. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[13] State of California, Department of Public Health. Shigellosis. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012*. Sacramento, CA; 2015. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf

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

[15] Reportable Conditions: Notification by Laboratories, 17 CCR § 2505 (2021). https://govt.westlaw.com/calregs/Document/I1947D280662411E384928538D6692020

[16] Shigellosis (*Shigella* spp.) 2012 Case Definition. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention. Accessed November 2, 2021. https://ndc.services.cdc.gov/case-definitions/shigellosis-2012/

[17] Shigellosis (*Shigella* spp.) 2017 Case Definition. National Notifiable Diseases Surveillance

System, U.S. Centers for Disease Control and Prevention. Accessed October 12, 2021. https://ndc.services.cdc.gov/case-definitions/shigellosis-2017/

[18] City of Long Beach, Memorandum – Health Department Responds to Outbreak of Shigellosis among Persons Experiencing Homelessness. Issued October 19, 2019. Accessed November 2, 2021. https://www.longbeach.gov/globalassets/city-manager/media-library/documents/memos-to-the-mayor-tabbed-file-list-folders/2018/october-19--2018---health-department-responds-to-outbreak-of-shigellosis-among-persons-experiencing-homelessness

[19] Lamba K, Nelson JA, Kimura AC, et al. Shiga Toxin 1–Producing *Shigella sonnei* Infections, California, United States, 2014–2015. Emerging Infectious Diseases. 2016;22(4):679-686. doi:10.3201/eid2204.151825.

Key Findings

Tularemia is a disease caused by bacteria called *Francisella tularensis* that can infect people and animals. Tularemia is uncommon in California, but people can get tularemia in different ways, including through the bite of infected ticks, or by touching, handling, or eating meat from infected animals. Tularemia can cause severe illness and death.

Tularemia in California from 2013 through 2019

Total Cases: There were a total of 19 new tularemia cases from 2013 through 2019, with 0 to 5 cases reported per year.

- **By County**: Cases of tularemia were reported from 14 counties in California. More than one case was reported from Alameda County (3 cases), Lake County (3 cases), and Monterey County (2 cases).
- **By Sex**: About the same number of cases were reported in males (10 cases) and females (9 cases).
- **By Age Group**: More cases were reported in people aged 5 to 14 years (7 cases) and 65 to 74 years (5 cases) than in other age groups.
- **By Race/Ethnicity**: More cases were in people who reported non-Hispanic White race/ethnicity (9 cases) or Hispanic/Latino race/ethnicity (4 cases) than in other reported races/ethnicities.

To help prevent tularemia, people should not touch or handle dead, wild animals with their bare hands. Hunters and people who process wild game meat should wear gloves while handling wild animal meat. Any meat should be thoroughly cooked before it is eaten. When outdoors in areas where ticks are common, people should wear clothing that covers the arms and legs, use insect repellent to keep ticks from biting, and check their clothes and skin frequently to promptly remove any ticks.

For more information about tularemia in California, please visit the CDPH Tularemia webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

The bacterium that causes tularemia, *Francisella tularensis*, is highly infectious and can enter the human body through the eyes, mouth, lungs, or breaks in the skin. Most commonly, people acquire tularemia through direct contact with tissue of infected wild animals, usually rabbits. Tularemia can also be transmitted through the bite of certain ticks and flies including, in California, the Pacific coast tick (*Dermacentor occidentalis*), the American dog tick (*Dermacentor variabilis*), and deerflies (*Chrysops discalis*). People may also be infected through contact with contaminated water or breathing air in which tularemia organisms have become aerosolized. Rarely, humans can get tularemia if they eat undercooked meat from an infected animal.[1]

Symptoms of tularemia in humans vary depending on the route of entry. The most common clinical forms of tularemia are ulceroglandular, glandular, oculoglandular, oropharyngeal, pneumonic, and typhoidal.[2] In addition to localized manifestations, including conjunctivitis, skin ulcers, and swollen lymph nodes, symptoms may also include chills, fever, headache, generalized body ache, cough, and pain or tightness in the chest, which may appear three to five days after infection. If not treated, tularemia bacteria can spread to other parts of the body and cause a blood infection or meningitis. There are effective antibiotics to treat patients with tularemia, and tularemia is not transmitted from person to person.[1]

This report describes the epidemiology of confirmed and probable tularemia cases in California from 2013 through 2019. Case data 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*.[3]

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 tularemia to their local health department immediately by telephone.[4] Per CCR, Title 17, Section 2505, laboratories are also required to report laboratory testing results suggestive of tularemia to the local health department; reporting must occur within one hour after the health care provider has been notified.[5]

California regulations require cases of tularemia to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed or probable case. During the surveillance period (2013-2019) a confirmed case was defined as one with clinically-compatible illness and at least one of the following confirmatory laboratory results: isolation of *F. tularensis* in a clinical or autopsy specimen, or a fourfold or greater change in serum antibody titer to *F. tularensis* antigen. Clinically compatible illness includes the following:

- Ulceroglandular: cutaneous ulcer with regional lymphadenopathy
- Glandular: regional lymphadenopathy with no ulcer
- Oculoglandular: conjunctivitis with preauricular lymphadenopathy

- Oropharyngeal: stomatitis or pharyngitis or tonsillitis and cervical lymphadenopathy
- Pneumonic: primary pulmonary disease
- Typhoidal: febrile illness without localizing signs and symptoms

From 2013-2016, a probable tularemia case was defined as a one with clinically-compatible illness and at least one of the following presumptive laboratory results: elevated serum antibody titer(s) to *F. tularensis* antigen (without a documented fourfold or greater change) in a patient with no history of tularemia vaccination, or detection of *F. tularensis* in a clinical or autopsy specimen by fluorescent assay. Beginning in 2017, presumptive laboratory evidence also included detection of *F. tularensis* in a clinical or autopsy specimen by a polymerase chain reaction (PCR).[6]

Epidemiology of Tularemia in California, 2013-2019

CDPH received reports of 19 total cases of tularemia with estimated symptom onset dates from 2013 through 2019. In years with reported tularemia cases, the highest number of cases was reported in 2017 (5 cases), and the fewest number was reported in 2013, 2015, and 2016 (2 cases each year). No cases were reported in 2014 [Figure 1].

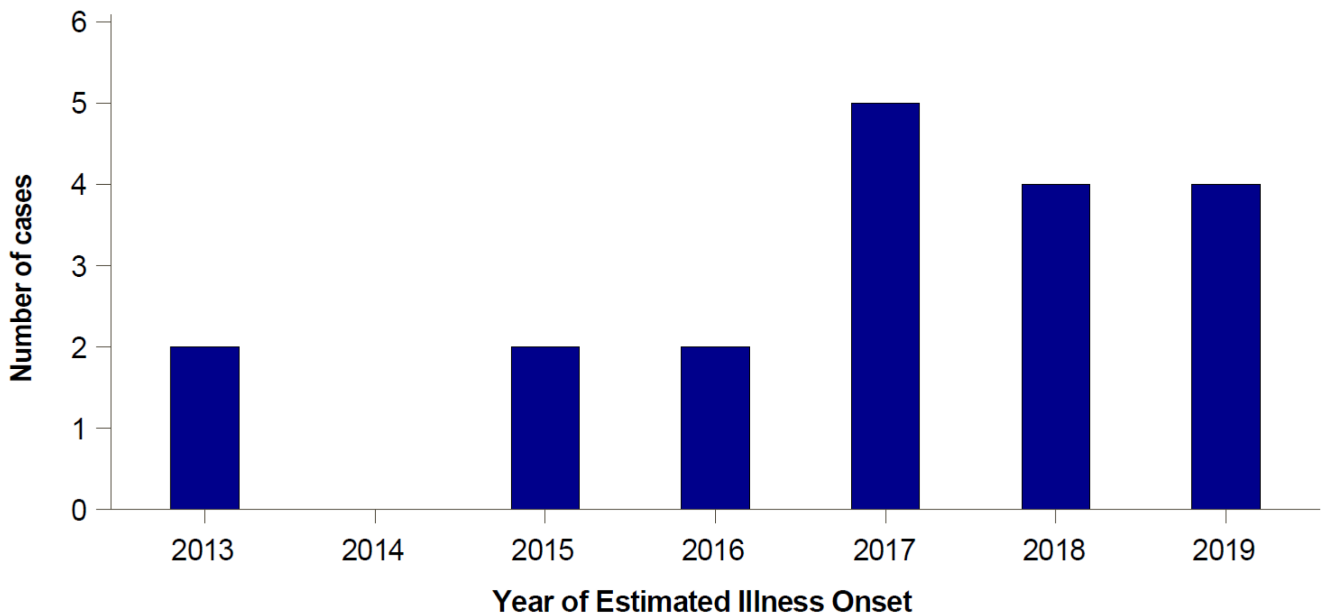
During the surveillance period, cases were reported from 14 California counties, with more than one case reported from Alameda (3 cases), Lake (3), and Monterey (2) counties. By region (see *Technical Notes*), more cases of tularemia were reported in Northern California (18 cases) than in Southern California (1), and the plurality of cases were reported in the Far North (7). No cases of tularemia were reported in the Inland Empire, San Diego, or Sierra regions.

Cases of tularemia were reported equally frequently among males (10 cases) and females (9). By age group, case-patients were aged 5-14 years (7 cases), 15-24 years (1), 45-54 years (3), 55-64 years (1), 65-74 years (5), and 85 years and older (2). No cases were reported among those younger than 5 years, between the ages of 25 and 44 years, and between the ages of 75 and 84 years. By race/ethnicity, case-patients reported non-Hispanic White race/ethnicity (9 cases) or Hispanic/Latino race/ethnicity (4) more frequently than other reported racial/ethnic groups.

Information on symptoms was reported for all 19 case-patients. Symptoms reported included: fever (17 case-patients), lymphadenopathy (11), abdominal pain (7), skin lesion (6), cutaneous ulcer (5), pharyngitis (5), vomiting (5), cough (4), sepsis (3), stomatitis (3), diarrhea (3), conjunctivitis (2), pleuropneumonia (1), and tonsillitis (1). Thirteen patients were hospitalized, and no deaths were reported.

Fifteen (79%) case-patients reported engaging in outdoor occupational or recreational activities in the three weeks preceding onset of illness, including hiking and camping (9 case-patients), farming and ranching (6), gardening and landscaping (6), and hunting and fishing (2). Seven patients reported contact with wild animals including rabbits (2 patients), rodents (3), and other species (4). Eight patients reported a known tick bite or other contact with ticks, and one patient reported known deerfly contact. One patient, an organ transplant recipient, was infected via kidney transplant from a donor later diagnosed with tularemia.[7] Three California patients likely became infected while traveling in other states.

Figure 1. Tularemia Cases by Year of Estimated Illness Onset, California, 2013-2019



Comments

Due to low case counts for tularemia in California from 2013 through 2019, incidence rates were excluded from this report. When the numbers of cases used to compute rates are small, those rates tend to have poor reliability.[3]

To prevent tularemia, persons should avoid bare-handed contact with carcasses or tissues from dead, wild animals. Wild animal meat should be cooked thoroughly before being eaten. When outdoors in areas where ticks are common, persons should wear protective clothing that covers the arms and legs, use insect repellent, and examine clothes and skin frequently to identify and promptly remove any ticks.

Prepared by Alyssa Nguyen, Yanyi Djamba, Curtis Fritz, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, January 2021

References

[1] Tularemia. California Department of Public Health website. Updated August 20, 2020. Accessed November 30, 2020.
https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Tularemia.aspx

[2] Tularemia Signs & Symptoms. U.S. Centers for Disease Control and Prevention website.

Updated December 13, 2018. Accessed December 9, 2020.
https://www.cdc.gov/tularemia/signssymptoms/index.html

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

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

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

[6] Tularemia (*Francisella tularensis*) Case Definition 1999 & 2017. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed December 9, 2020. https://ndc.services.cdc.gov/case-definitions/tularemia-1999/; https://ndc.services.cdc.gov/case-definitions/tularemia-2017/

[7] Nelson CA, Nurua C, Jones JM, et al. *Francisella tularensis* transmission by solid organ transplantation, 2017. *Emerg Infect Dis* 2019; 25:767-775.

Key Findings

Typhoid fever is a potentially life-threatening infectious disease caused by *Salmonella* Typhi bacteria. These bacteria are found only in humans and are passed to others when someone eats or drinks something that is contaminated with *S.* Typhi bacteria. These bacteria can spread from someone infected with *S*. Typhi who does not wash their hands properly after using the toilet. Symptoms include a prolonged high fever, weakness, and stomach pain. Without treatment, typhoid fever can be severe and cause death. Typhoid fever is not common in the United States. Most cases of typhoid fever in the United States and California are reported in people who were infected while traveling internationally in areas with poor water or sanitation systems where the disease is common, including in Asia, Africa, and Latin America.

Typhoid Fever in California from 2013 through 2019

Total Cases: There were a total of 514 typhoid fever cases from 2013 through 2019. Of these cases, four were reported to have died with typhoid fever.

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

- **By County**: There were 8 counties in California that reported at least 1 case of typhoid fever each year during 2013-2019, each with an average rate of less than 1 case per 100,000 people.
- **By Sex:** The average rates for males and females were similar, with rates less than 1 case per 100,000 people for both groups.
- **By Age Group**: The average rates were highest in children aged 1 to 4 years and adults aged 25 to 34 years, but rates in all groups 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 Asian/Pacific Islander race/ethnicity (71%).

To help prevent typhoid fever, people planning to travel in areas where typhoid fever is common should talk to their doctor about getting a typhoid fever vaccine. Whether or not you've been vaccinated, it's important to avoid risky food and drinks while traveling, including foods from street vendors and flavored ices. While traveling, drink only bottled water or boil water for one minute before drinking and eat only foods that have been thoroughly cooked.

For more information about typhoid fever in California, please visit the CDPH Typhoid fever webpage. For details about key infectious diseases in California, please visit the CDPH IDB Surveillance and Statistics Section webpage.

Background

Typhoid fever is caused by *Salmonella* Typhi, an uncommon but important bacterial pathogen, with more than 350 reported cases of culture-confirmed typhoid fever per year in the United States, mostly among travelers.[1] While uncommon in the U.S. and other industrialized regions such as Canada, Western Europe, Australia, and Japan, typhoid fever is highly endemic in low and middle-income countries with limited access to safe drinking water, and where sanitation infrastructure and hygiene practice is poor, including in South Asia and parts of East and Southeast Asia, Africa, the Caribbean, and Central and South America. Most cases (estimated 85%) in the U.S. are in travelers returning from endemic areas (such as India, Pakistan, and Bangladesh). *S.* Typhi infection is restricted to humans (does not occur in animals), and consumption of food or water contaminated by the feces or urine of persons with typhoid fever are the leading sources of exposure.[2]

Typhoid fever is an acute systemic illness with an incubation period usually between 9 and 20 days but can vary from 3 to over 60 days depending on size of the inoculum and host factors.[3] Illness onset is often insidious and non-specific, characterized by fever, malaise, chills, myalgia, headache, and abdominal pain.[4] Most cases in the U.S. are associated with hospitalization. Without therapy, typhoid fever can be a life-threatening disease, with historical death rates before antibiotics ranging between 12% and 30%. Among untreated patients with acute illness, 10% shed bacteria for three months after initial onset of symptoms. Even when treated, up to 2.0-5.0% can become chronic typhoid carriers and bacteria can persist in the biliary tract even after symptoms have resolved.[5, 6] A chronic carrier state may follow acute illness, even mild or subclinical infections.

S. Typhi isolates have shown increasing antimicrobial resistance globally and threaten the ability to treat disease and prevent severe infection. By the 1990s, multi-drug resistant (MDR) *S.* Typhi resistant to first-line drugs (chloramphenicol, ampicillin, and cotrimoxazole) became so common that fluoroquinolones became the drugs of choice for treatment. However, *S.* Typhi with decreased susceptibility or resistance to fluoroquinolones also began to circulate and are now widespread in South Asia.[7] In 2016, an ongoing outbreak of extensively drug-resistant (XDR) *S.* Typhi*,* resistant to fluoroquinolones as well as to third generation cephalosporins (e.g., ceftriaxone) was reported in Pakistan. Between February 2018 and August 2019, 33 XDR *S.* Typhi cases were detected in the U.S. among recent travelers to Pakistan and Iraq.[8] Emergence of this XDR *S.* Typhi strain (and XDR-variant strains that also carry third-generation cephalosporin resistance, but are distinct from the Pakistan XDR strain) has been particularly concerning because it leaves only one oral antibiotic, azithromycin, available for treatment. Recently, multiple reports of azithromycin resistance have also emerged from Pakistan, Bangladesh, and India.[9, 10]

Two typhoid vaccines are currently available in the U.S.; one is an injectable vaccine and the other is an oral vaccine. Both vaccines confer about 50-80% protection in children and adults. Notably, vaccine-induced immunity provides little protection against large challenge doses and protection decreases over time, requiring a booster.[11]

This report describes the epidemiology of confirmed and probable typhoid fever cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes*.[12] The epidemiologic description of typhoid fever for earlier surveillance periods can be found in the *Epidemiologic Summary of Typhoid fever in California, 2001-2008 and 2009-2012.*[13, 14]

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 typhoid fever and carriers of *S.* Typhi to their local health department within one working day of identification or immediately by telephone if an outbreak is suspected.[15] Per CCR, Title 17, Section 2505, clinical and reference laboratories are also required to report laboratory testing results suggestive of *S.* Typhi to either the California Reportable Diseases Information Exchange (CalREDIE) (via electronic laboratory reporting) or the local health department*;* notification should occur within one working day after the health care provider has been notified of the laboratory testing result.[16]

California regulations require cases of typhoid fever and carriers of *S.* Typhi to be reported to CDPH. CDPH officially counted typhoid fever cases that satisfied the U.S. Centers for Disease Control and Prevention (CDC)/Council of State and Territorial Epidemiologists surveillance case definition including confirmed and probable classifications. From 2013 through 2018, a confirmed case of typhoid fever was defined as a case with a compatible clinical syndrome in which *S.* Typhi was cultured from a clinical specimen. A probable case was defined as one with clinically compatible illness and an established epidemiologic link to a laboratory-confirmed case during an outbreak.[17] In 2019, the definition for a confirmed case was updated to require only isolation of *S*. Typhi culture from a clinical specimen, reflecting the high specificity of culture for this disease. A probable case was updated to include cases with clinically compatible illness and detection of *S.* Typhi in a clinical specimen using a culture-independent diagnostic test (CIDT). Cases with clinically compatible illness and an established epidemiologic link to a laboratory-confirmed case during an outbreak remained probable cases.[18]

CDPH defined a convalescent typhoid carrier as a person who shed typhoid bacilli for three or more months after onset of typhoid fever. A chronic typhoid carrier was defined as: (a) a person who continued to excrete typhoid bacilli for more than 12 months after onset of typhoid fever or (b) (i) a person who gave no history of typhoid fever or who had the disease more than one year previously, and (ii) whose feces or urine were found to contain typhoid bacilli on two separate examinations at least 48 hours apart, confirmed by the CDPH Microbial Diseases Laboratory. CDPH defined other typhoid carriers as persons who had typhoid bacilli isolated from surgically removed tissues, organs, or draining lesions and continued to excrete typhoid bacilli for more than 12 months.

Epidemiology of Typhoid Fever in California, 2013-2019

CDPH received reports of 514 total cases (511 confirmed and 3 probable) of typhoid fever with estimated symptom onset dates from 2013 through 2019. This corresponds to an average annual incidence rate of 0.2 cases per 100,000 population [Figure 1]. Deaths were reported among four (0.8%) case-patients at the time of case report.

The first XDR typhoid fever case was reported in 2018; a total of seven cases of XDR or ceftriaxone-resistant typhoid fever were reported during 2018-2019.

During the surveillance period, 450 (90.4%) of the total typhoid fever case-patients reported travel outside of the United States. Of these, case-patients most frequently reported travel to India (280 case-patients) and Mexico (42 case-patients).

Statewide from 2013 through 2019, eight counties reported at least one case for each year of the surveillance period: Alameda, Los Angeles, Orange, Sacramento, San Bernardino, San Diego, San Mateo, and Santa Clara counties. Cases from these 8 counties made up 73.0% of the total typhoid fever cases reported. Among these 8 counties, the highest average annual rate was in Santa Clara County (0.8 per 100,000; 105 total cases). Sutter County (0.9 per 100,000; 6 total cases) also reported high average annual rates, but low case counts [Figure 2]. By region (see *Technical Notes*), the average annual incidence rate for the surveillance period was higher in Northern California (0.3 per 100,000; 325 total cases) than Southern California (0.1 per 100,000; 189 cases total). The Bay Area region reported the highest average annual incidence rate in California (0.4 per 100,000; 239 total cases).

From 2013 through 2019, average annual incidence rates were similar in males (0.2 per 100,000; 264 total cases) and females (0.2 per 100,000; 249 cases); 51.4% of case-patients were male and 48.4% were female.

By age group, the average annual incidence rate during the surveillance period was highest in children aged 1 to 4 years (0.4 per 100,000 population in this age group; 49 cases) followed by adults aged 25 to 34 years (0.3 per 100,000; 118 cases) and children 5 to 14 years (0.3 per 100,000; 49 cases) [Figure 3].

For typhoid fever cases with complete race/ethnicity information (see *Technical Notes*), the highest percentage of cases was among those who reported non-Hispanic Asian/Pacific Islander race/ethnicity (71.0%), which is disproportionally higher than the percentage of the non-Hispanic Asian/Pacific racial/ethnic population in California during the same time period (71.0% vs. 15.0%, respectively) [Figure 4].

From 2013 through 2019, CDPH did not receive any reports of typhoid fever outbreaks.

During 2013-2019, ten persons were reported as chronic typhoid carriers. Chronic carriers were more likely than acute typhoid cases to be older (median age 48 years vs. 27 years).

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

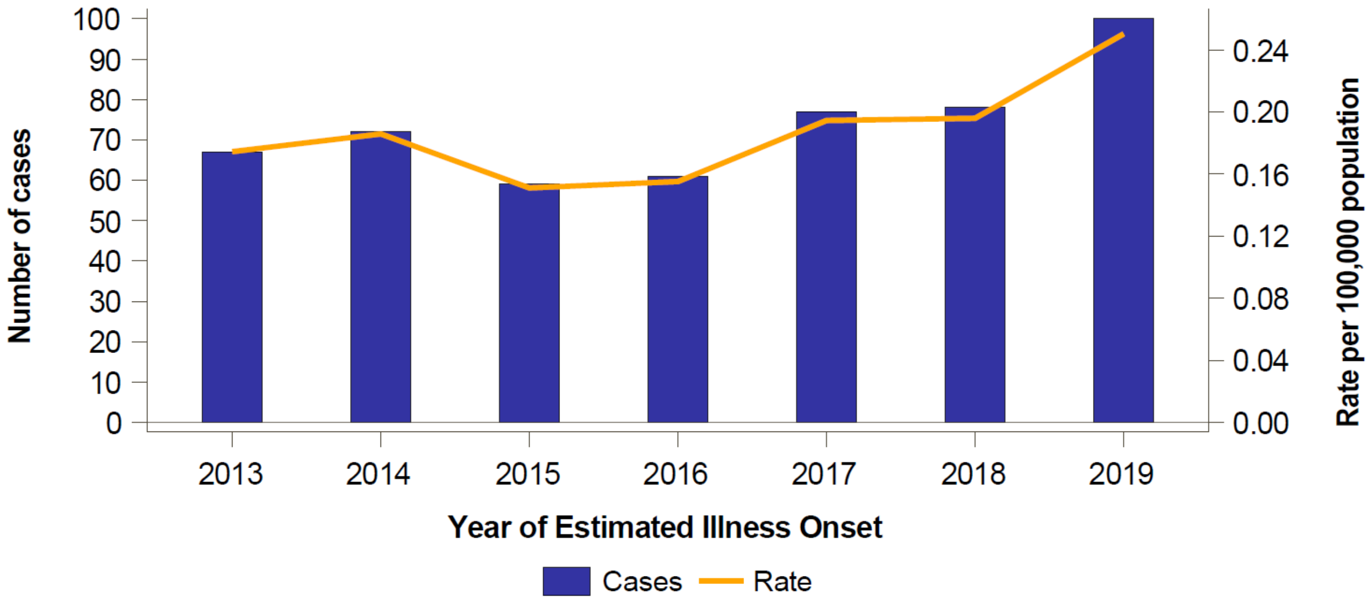


Figure 2. Typhoid Fever Average Annual Incidence by County, California, 2013-2019

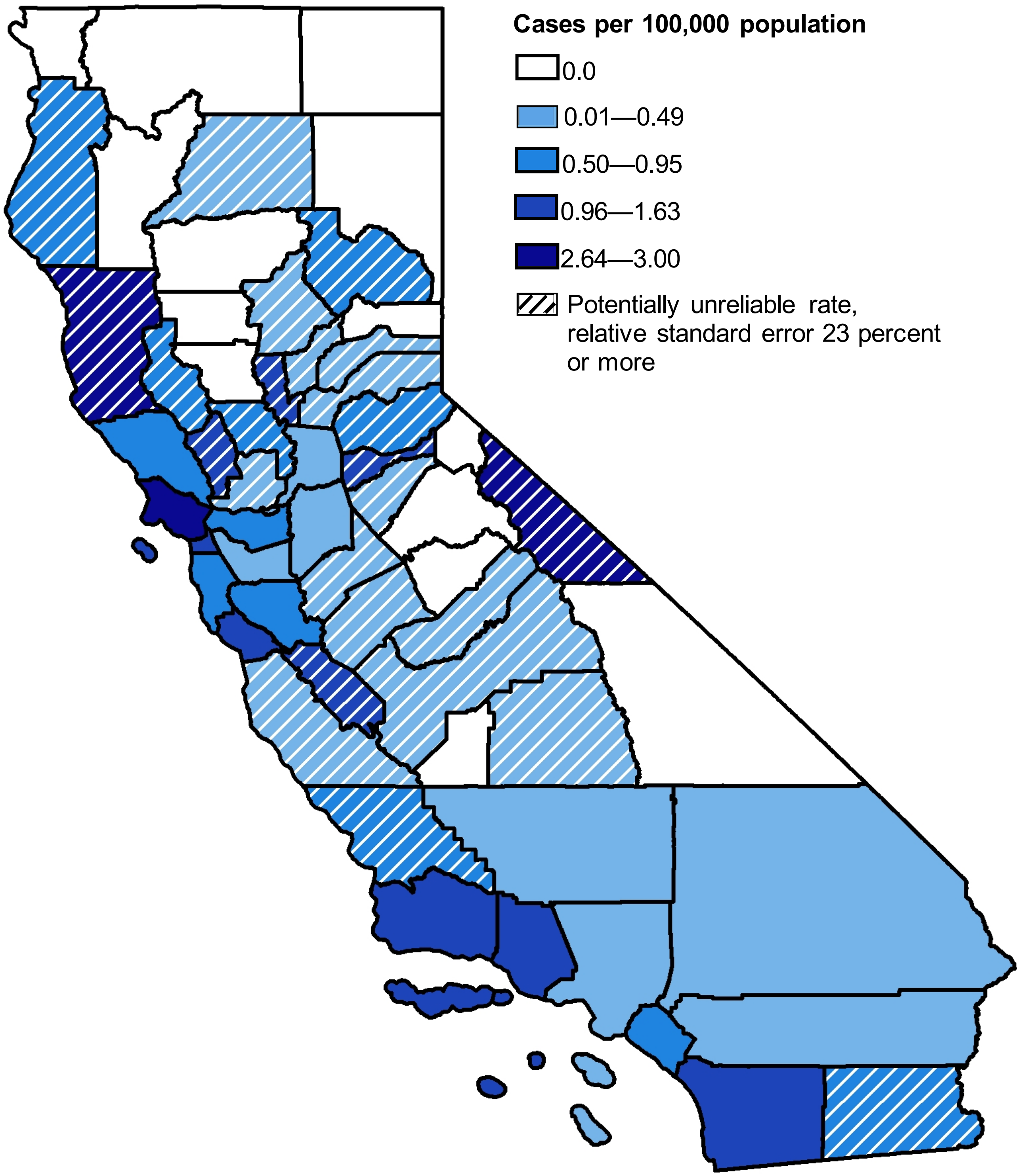
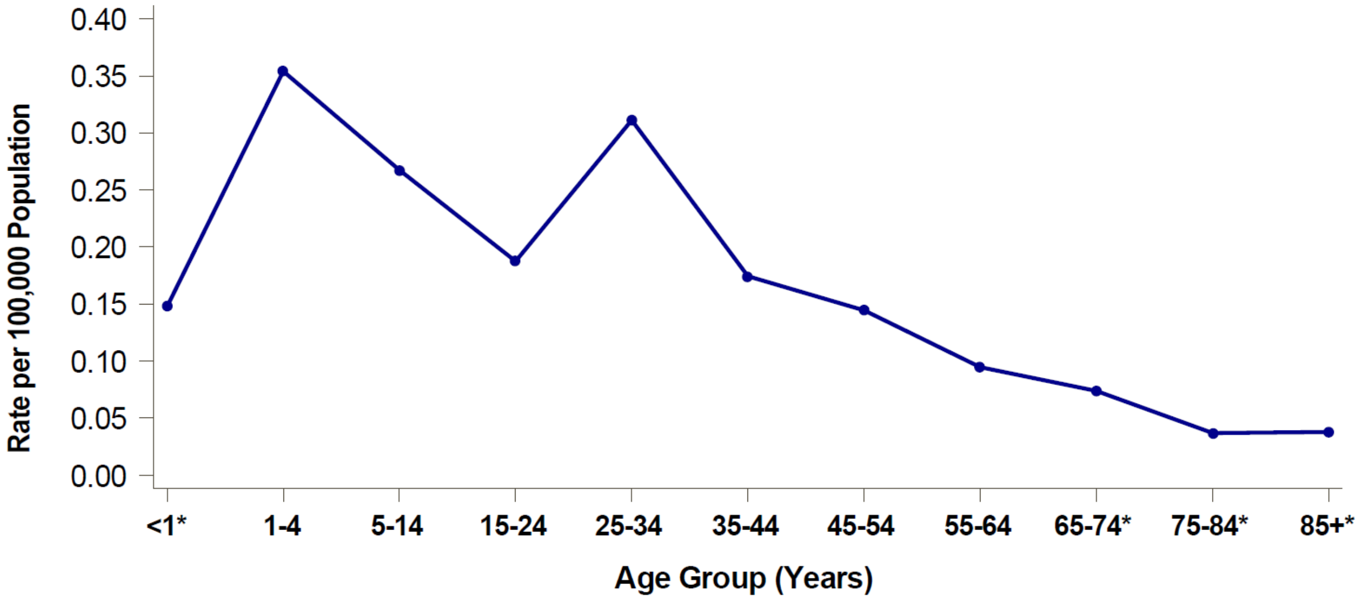
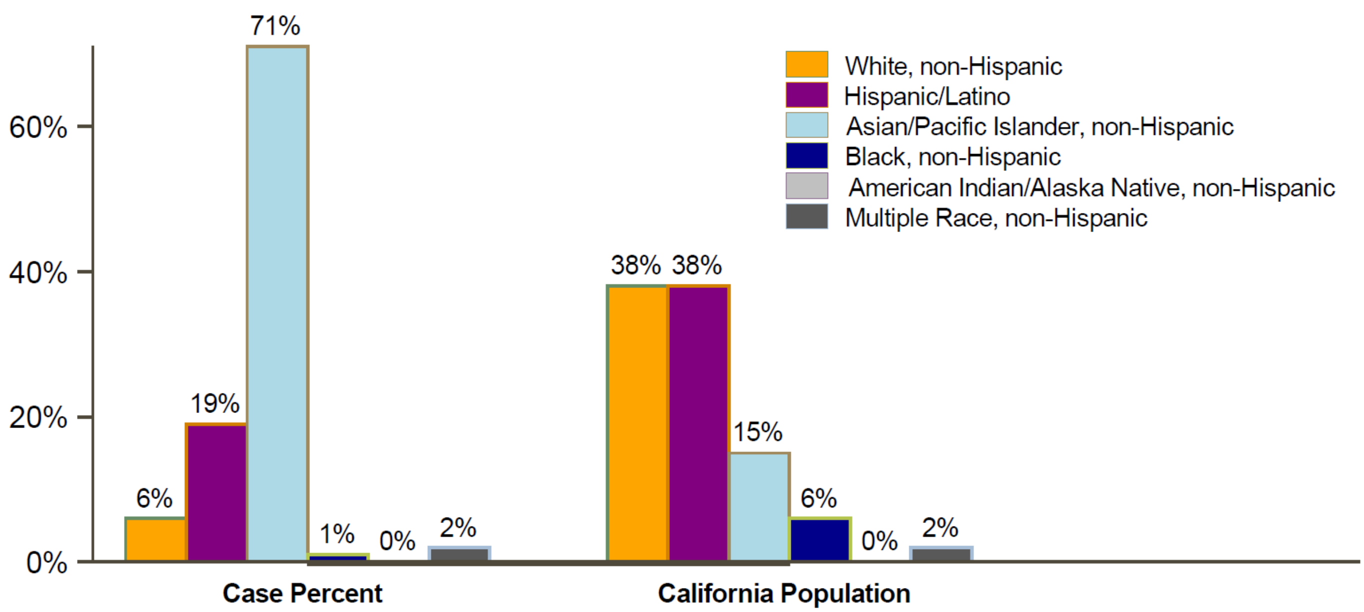


Figure 3. Typhoid Fever Average Annual Incidence Rates by Age Group, California, 2013- 2019



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

Figure 4. Typhoid Fever Cases and Population by Race/Ethnicity, California, 2013-2019



6% (n=31) of reported incidents of Typhoid Fever did not identify race/ethnicity and 6.8% (n=35) 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 typhoid fever in California during the 2013-2019 surveillance period (0.2 per 100,000; 514 total cases) was similar to that of the 2009-2012 surveillance period (0.2 cases per 100,000; 330 total cases).[13] Incidence rates were also similar in trend between the two surveillance periods for age group, sex, and race/ethnicity.[13]

Notably, the first case of XDR typhoid fever was reported in California in 2018, with seven cases of XDR or XDR-variant third-generation cephalosporin-resistant *S*. Typhi reported by end of 2019.

Vaccination against typhoid is recommended for international travelers to destinations where the risk of contracting typhoid fever is high.[19] Persons traveling to areas where water and/or sanitation infrastructure is inadequate (including South Asia) should be vaccinated against typhoid fever before travel, and should avoid risky food and drinks while traveling, including foods from street vendors and flavored ices. While traveling, persons should drink only bottled, canned, or properly treated/filtered drinks, and eat only foods that have been thoroughly cooked. While a typhoid vaccine confers some degree of protection, ensuring the safety of food and water is still the most important protective measure as typhoid immunization provides no protection against infection with *S.* Paratyphi and other potentially food- and water-borne enteric pathogens.

Prepared by Alyssa Nguyen, Yanyi Djamba, Alexander Yu, Akiko Kimura, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, February 2022

References

[1] Typhoid Fever and Paratyphoid Fever, Questions and Answers. U.S. Centers for Disease Control and Prevention website. Updated November 16, 2020. Accessed February 3, 2021. https://www.cdc.gov/typhoid-fever/sources.html

[2] Appiah GD, Hughes MJ, and Chatham-Stephens K. Chapter 4: Travel-related infectious diseases, typhoid & paratyphoid fever. In: *CDC Yellow Book: Health Information for International Travel 2020.* Oxford University Press; 2019. Accessed February 3, 2021. https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/typhoid-and-paratyphoid-fever

[3] Awofisayo-Okuyelu A, McCarthy N, Mgbakor I, Hall I. Incubation period of typhoidal salmonellosis: a systematic review and meta-analysis of outbreaks and experimental studies occurring over the last century. *BMC Infect Dis*. 2018;18(1):483. Published 2018 Sep 27. doi:10.1186/s12879-018-3391-3

[4] Aiemjoy K, Tamrakar D, Saha S, Naga SR, Yu AT, Longley A, Date K, Hemlock C, Qamar FN, Saha SK, Luby SP, Garrett DO, Andrews JR, Bogoch II. Diagnostic Value of Clinical Features to Distinguish Enteric Fever From Other Febrile Illnesses in Bangladesh, Nepal, and Pakistan. Clin Infect Dis. 2020 Dec 1;71(Suppl 3):S257-S265. doi: 10.1093/cid/ciaa1297. PMID: 33258936; PMCID: PMC7705879.

[5] Typhoid Fever and Paratyphoid Fever, Information for Healthcare Professionals. U.S. Centers for Disease Control and Prevention website. Updated May 19, 2020. Accessed February 3, 2021. https://www.cdc.gov/typhoid-fever/health-professional.html

[6] Parry CM, Hien TT, Dougan G, White NJ, Farrar JJ. Typhoid fever. *N Engl J Med*. 2002;347(22):1770-1782. doi:10.1056/NEJMra020201

[7] Browne, A.J., Kashef Hamadani, B.H., Kumaran, E. *et al.* Drug-resistant enteric fever worldwide, 1990 to 2018: a systematic review and meta-analysis. *BMC Med* 18**,** 1 (2020). https://doi.org/10.1186/s12916-019-1443-1

[8] François Watkins LK, Winstead A, Appiah GD, et al. Update on Extensively Drug-Resistant *Salmonella* Serotype Typhi Infections Among Travelers to or from Pakistan and Report of Ceftriaxone-Resistant *Salmonella* Serotype Typhi Infections Among Travelers to Iraq — United States, 2018–2019. MMWR Morb Mortal Wkly Rep 2020;69:618–622. DOI: http://dx.doi.org/10.15585/mmwr.mm6920a2

[9] Iqbal J, Dehraj IF, Carey ME, Dyson ZA, Garrett D, Seidman JC, Kabir F, Saha S, Baker S, Qamar FN. A Race against Time: Reduced Azithromycin Susceptibility in *Salmonella enterica* Serovar Typhi in Pakistan. mSphere. 2020 Jul 22;5(4):e00215-20. doi: 10.1128/mSphere.00215-20. PMID: 32699118; PMCID: PMC7376502.

[10] Hooda Y, Sajib MSI, Rahman H, Luby SP, Bondy-Denomy J, Santosham M, Andrews JR, Saha SK, Saha S. Molecular mechanism of azithromycin resistance among typhoidal Salmonella strains in Bangladesh identified through passive pediatric surveillance. PLoS Negl Trop Dis. 2019 Nov 15;13(11):e0007868. doi: 10.1371/journal.pntd.0007868. PMID: 31730615; PMCID: PMC6881056.

[11] Travelers' Health, Typhoid Fever. U.S. Centers for Disease Control and Prevention website. Updated December 1, 2020. Accessed February 3, 2021. https://wwwnc.cdc.gov/travel/diseases/typhoid

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

[13] State of California, Department of Public Health. Typhoid fever. In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008.* Sacramento, CA; 2009. Accessed December 30, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[14] State of California, Department of Public Health. *Epidemiologic Summary of Typhoid Fever in California, 2009-2012.* Sacramento, CA; 2022. Accessed February 17, 2022. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/TyphoidFeverEpiSummary09-12.pdf

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

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

[17] Typhoid Fever (*Salmonella enterica* serotype Typhi) 1997 Case Definition. National Notifiable Diseases Surveillance System. U.S. Centers for Disease Control and Prevention website. Accessed August 24, 2021. https://ndc.services.cdc.gov/case-definitions/typhoid-fever-1997/

[18] Typhoid Fever (*Salmonella enterica* serotype Typhi) 2019 Case Definition. National Notifiable Diseases Surveillance System. U.S. Centers for Disease Control and Prevention website. Accessed January 7, 2021. https://ndc.services.cdc.gov/case-definitions/salmonella-typhi-infection-2019/

[19] Vaccine Information Statements (VISs). Typhoid VIS (10/30/19). U.S. Centers for Disease Control and Prevention website. Updated October 30, 2019. Accessed November 24, 2021. https://www.cdc.gov/vaccines/hcp/vis/vis-statements/typhoid.html

Epidemiologic Summary of Flea-borne Typhus in California, 2013 - 2019

Key Findings

Flea-borne typhus is an infectious disease caused by a group of bacteria called *Rickettsia* that are spread by fleas. Fleas can become infected when they feed on small animals like rats, opossums, and cats that can carry *Rickettsia*. If a person comes in contact with infected fleas, they can get flea-borne typhus and have symptoms such as fever, headache, chills, and may need hospital care. In California, flea-borne typhus has been reported mainly in areas of Los Angeles and Orange counties.

Flea-borne Typhus in California from 2013 through 2019

Total Cases: There were a total of 744 new flea-borne typhus cases from 2013 through 2019.

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

- **By County**: The average rate was highest in Los Angeles and Orange counties (both with about 1 case per 100,000 people). Almost all (about 97%) flea-borne typhus cases during 2013-2019 were in these two counties.
- **By Sex**: Average rates were higher in males than in females, but rates were less than 1 case per 100,000 people for both groups.
- **By Age Group**: The average rate was highest in adults aged 35 to 64 years, but rates were less than 1 case per 100,000 people in this age group.
- **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 47%).
- **By Month**: There were more flea-borne typhus cases in June, July, and August (about 100 cases each month) than in all other months (about 49 cases each month).

To help prevent flea-borne typhus, people should avoid contact with fleas. Keep fleas off pet cats and dogs by using flea control products and keeping cats indoors. Keep fleas away from your home by preventing stray cats, rats, and other rodents (like opossums) from living around your home. Keep garbage containers covered and do not leave pet food or trash outside that may attract animals.

For more information about flea-borne typhus in California, please visit the CDPH Flea-borne Typhus webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Typhus fever is the collective name for a group of rickettsial diseases caused by bacteria that are spread to humans by fleas, lice, and chiggers. In California, typhus is typically caused by *Rickettsia typhi* and is referred to as flea-borne, murine, or endemic typhus. Flea-borne typhus occurs in tropical and subtropical climates throughout the world.[1, 2]

Flea-borne typhus has been rare in the U.S. since the 1950s due largely to improved sanitation and pest management. Consequently, flea-borne typhus was removed from the U.S. Centers for Disease Control and Prevention (CDC) list of nationally notifiable diseases in 1987.[3] However, it is still endemic to certain areas of Hawaii, Texas, and California; in California, it has been reported mainly in areas of Los Angeles and Orange counties.[1, 2, 4]

Flea-borne typhus is caused by exposure to the feces of infected fleas. Fleas become infected after feeding on small mammals that carry the bacteria, including rats, opossums, and cats. The bacteria are most commonly transferred to a person when the infectious flea feces enter an open flea bite wound, a cut, or a scratch, but can also be inhaled or rubbed into a person's eyes. The bacteria are not spread person to person.[2, 5] Human infections are more common in areas where humans and host animals (particularly rodents) come into regular contact, including in areas with poor sanitation.[6]

Many persons with flea-borne typhus are asymptomatic; however, those who do develop symptoms can have illness ranging from mild to severe. Within 6-14 days after contact with infected fleas, a person may experience symptoms such as fever, head and body aches, chills, cough, nausea, or a maculopapular rash that starts on the trunk and spreads peripherally. Hospitalization occurs for a majority of symptomatic cases in California.[7] Although rare, severe illness can result if an infection is left untreated and can cause damage to one or more organs, including the liver, kidneys, heart, lungs, and brain. Typhus is treated with antibiotics.[5, 6] Due to the non-specific presentation of flea-borne typhus and the unreliability of early diagnostic tests, treatment decisions should be made based on clinical presentation and epidemiologic settings.[7]

This report describes the epidemiology of confirmed and probable flea-borne typhus 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*.[8]

California Reporting Requirements and Surveillance Case Definitions

California Code of Regulations (CCR), Title 17, Section 2500 requires health care providers to report suspected cases of typhus to their local health department within seven calendar days of identification.[9] Per CCR, Title 17, Section 2502, laboratories are required to report laboratory testing results suggestive of *Rickettsia* 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.[10] The organism isolated from the suspected typhus patient should be submitted to the California Department of Public Health (CDPH) Viral and Rickettsial Disease Laboratory or another public health laboratory for definitive identification.[7]

California regulations require cases of typhus to be reported to CDPH. CDPH counted cases that satisfied the CDPH-designated surveillance case definition[11] of a confirmed or probable case. During the 2013-2019 surveillance period, a confirmed case of flea-borne typhus was defined as a clinically compatible illness with laboratory-confirmed infection with *R. typhi* or other *Rickettsia* species, or a clinically compatible illness with laboratory results supportive of infection plus an established epidemiologic link to a confirmed case. A probable case was defined as a clinically compatible illness with laboratory results supportive of *Rickettsia* infection.[7]

Epidemiology of Flea-Borne Typhus in California, 2013-2019

CDPH received reports of 744 total cases of flea-borne typhus with estimated symptom onset dates from 2013 through 2019. This corresponds to an average annual incidence rate of 0.3 cases per 100,000 population in California [Figure 1]. Notably, of all flea-borne typhus cases, 80.4% (598 cases) were reportedly hospitalized.

Statewide during 2013-2019, 720 (96.8%) of flea-borne typhus cases occurred among residents of Los Angeles County (0.8 per 100,000; 593 cases) and Orange County (0.6 per 100,000; 127 cases) [Figure 2]. The remaining 22 cases (3.2%) occurred among residents of thirteen other counties, each reporting an average annual incidence rate of less than 0.1 per 100,000 population.

During the surveillance period, the average annual incidence rate was 0.3 per 100,000 among males (436 cases) and 0.2 per 100,000 among females (316 cases). Overall, 58.5% of case-patients were male and 41.5% were female.

From 2013 through 2019, the average annual flea-borne typhus incidence rate was highest at 0.4 per 100,000 among adults aged 35 to 44 years (127 cases), 45 to 54 years (146 cases), and 55 to 64 years (125 cases) [Figure 3].

Of 646 flea-borne typhus cases with complete race/ethnicity information, the highest percentage of cases was among case-patients who reported non-Hispanic White race/ethnicity. Case-patients reported non-Hispanic White race/ethnicity (47.1%) more frequently and non-Hispanic Asian/Pacific Islander race/ethnicity (7.7%) less frequently than compared to the percentage of these groups in California during the same time period (38.0% and 14.8%, respectively) [Figure 4].

Flea-borne typhus occurs seasonally, with the highest number of cases occurring during warm-weather months. During 2013-2019, 40.3% (300 cases) of all typhus cases had estimated symptom onsets during June, July, and August, an average of 100 cases each month. In comparison, an average of 49 cases occurred each month during September through May [Figure 5].

Figure 1. Flea-borne Typhus Cases and Incidence Rates by Year of Estimated Illness Onset, California, 2013-2019

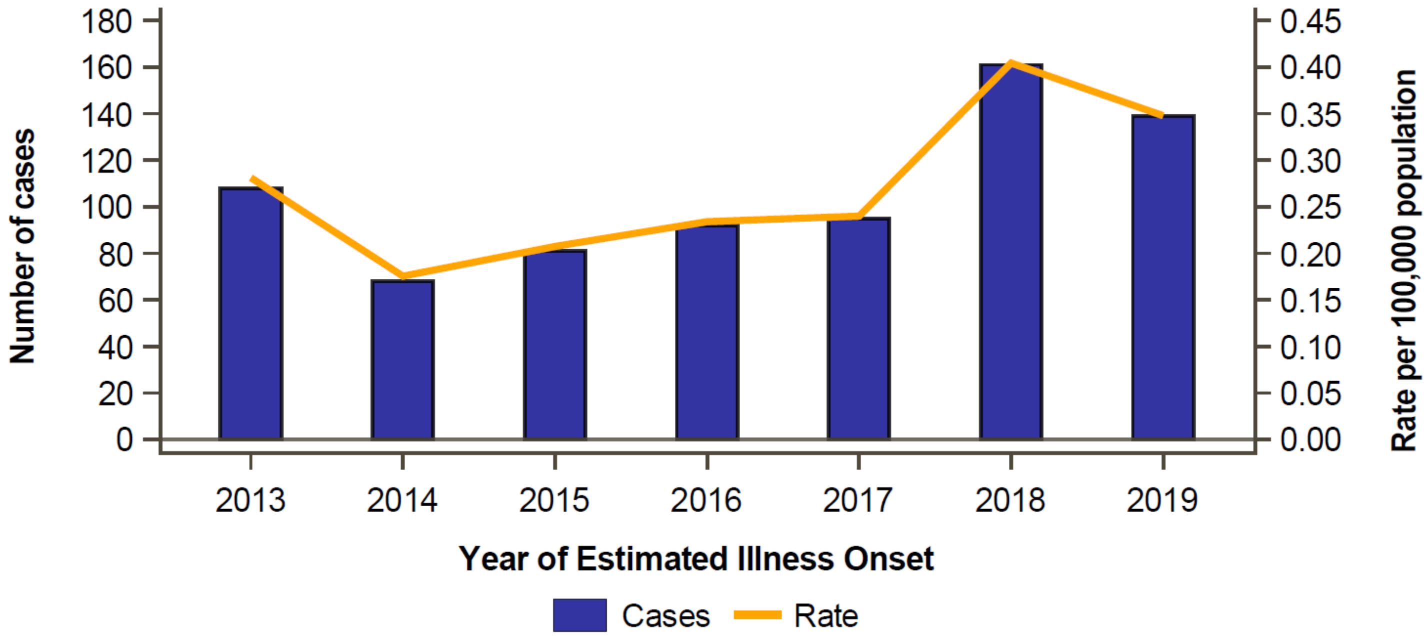


Figure 2. Flea-borne Typhus Average Annual Incidence Rates by County, California, 2013-2019

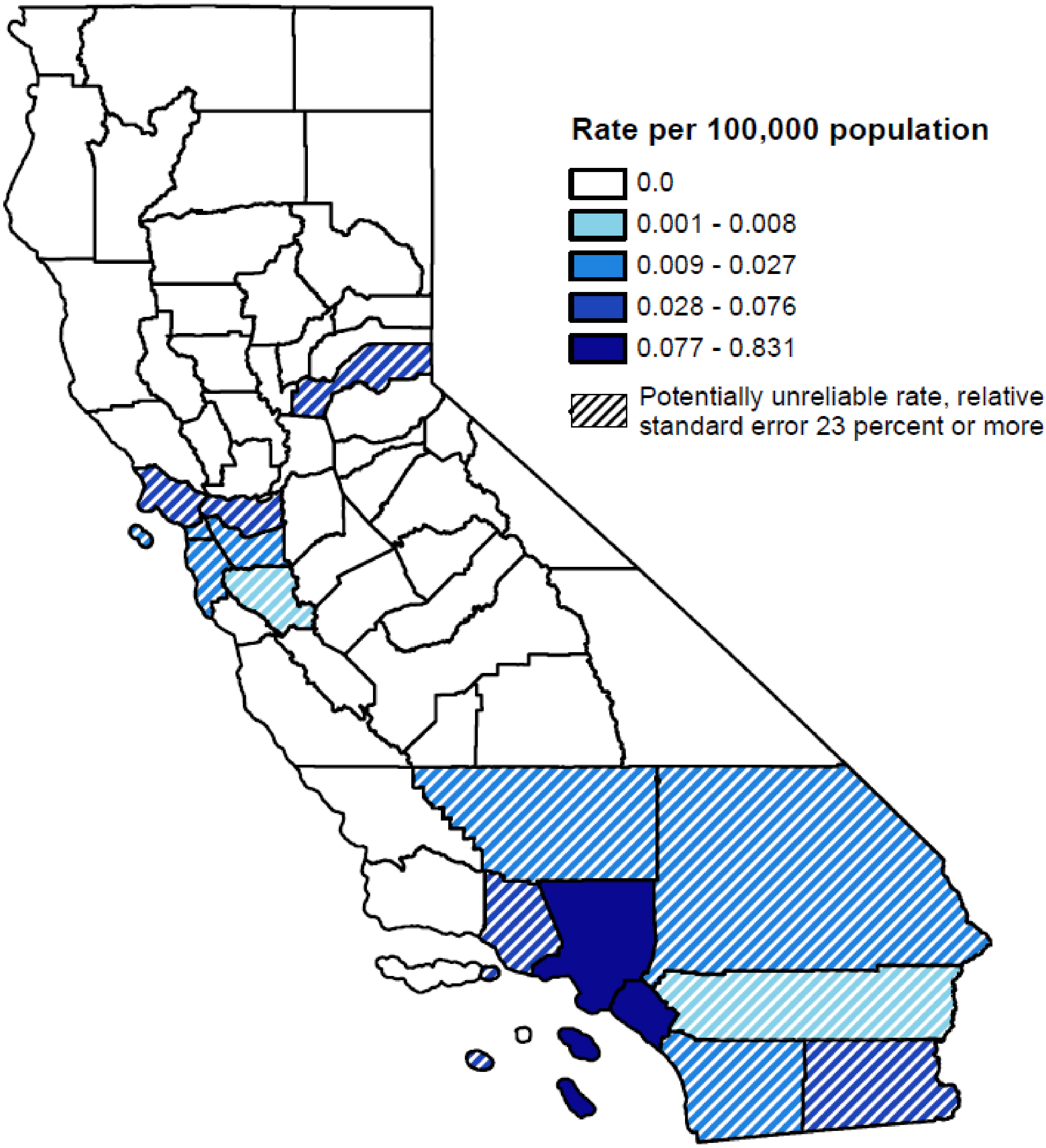
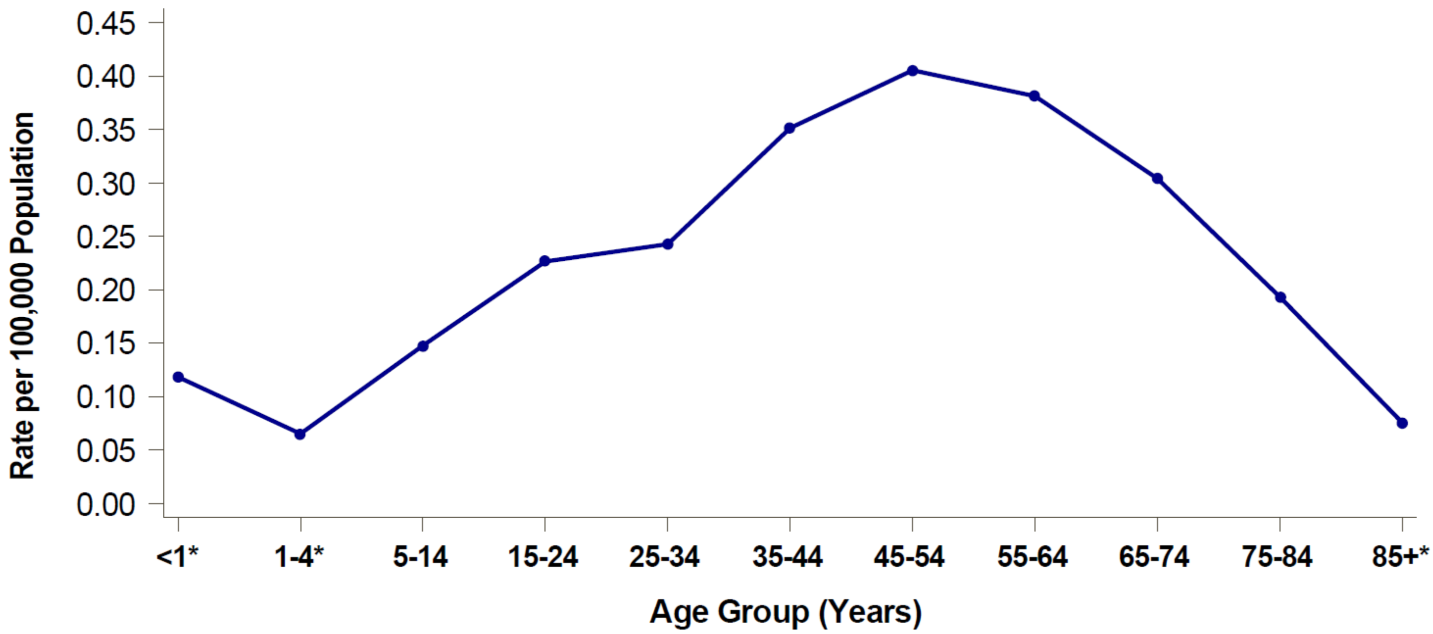
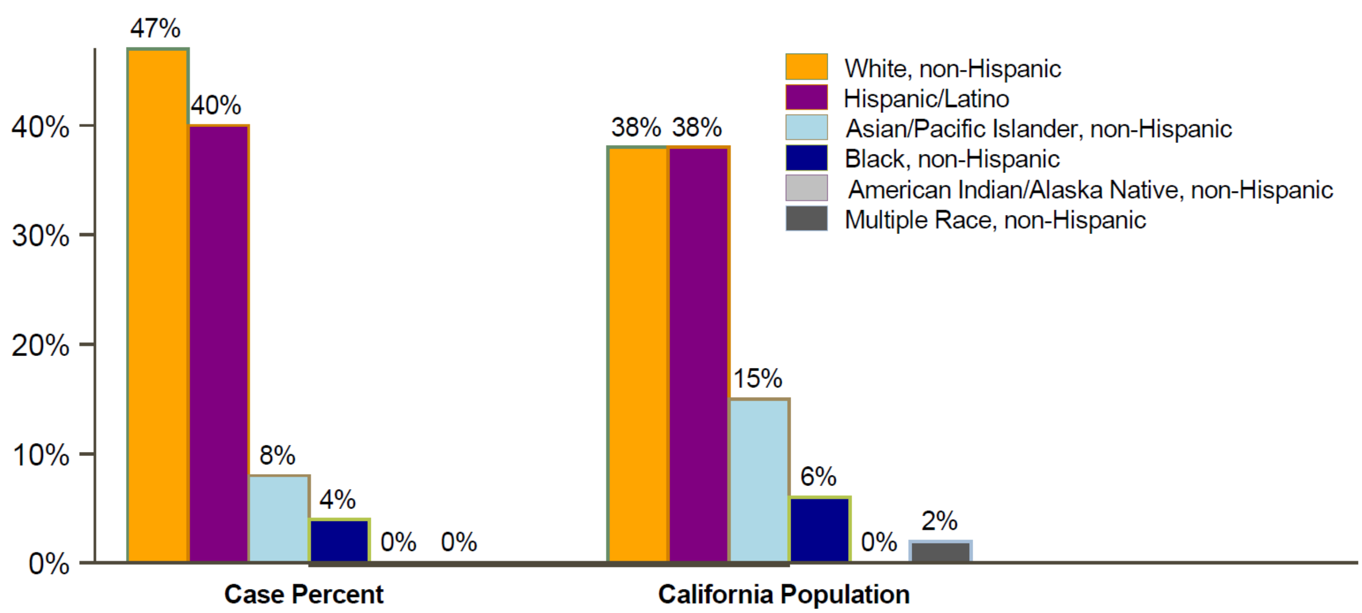


Figure 3. Flea-borne Typhus Average Annual Incidence Rates by Age Group, California, 2013-2019



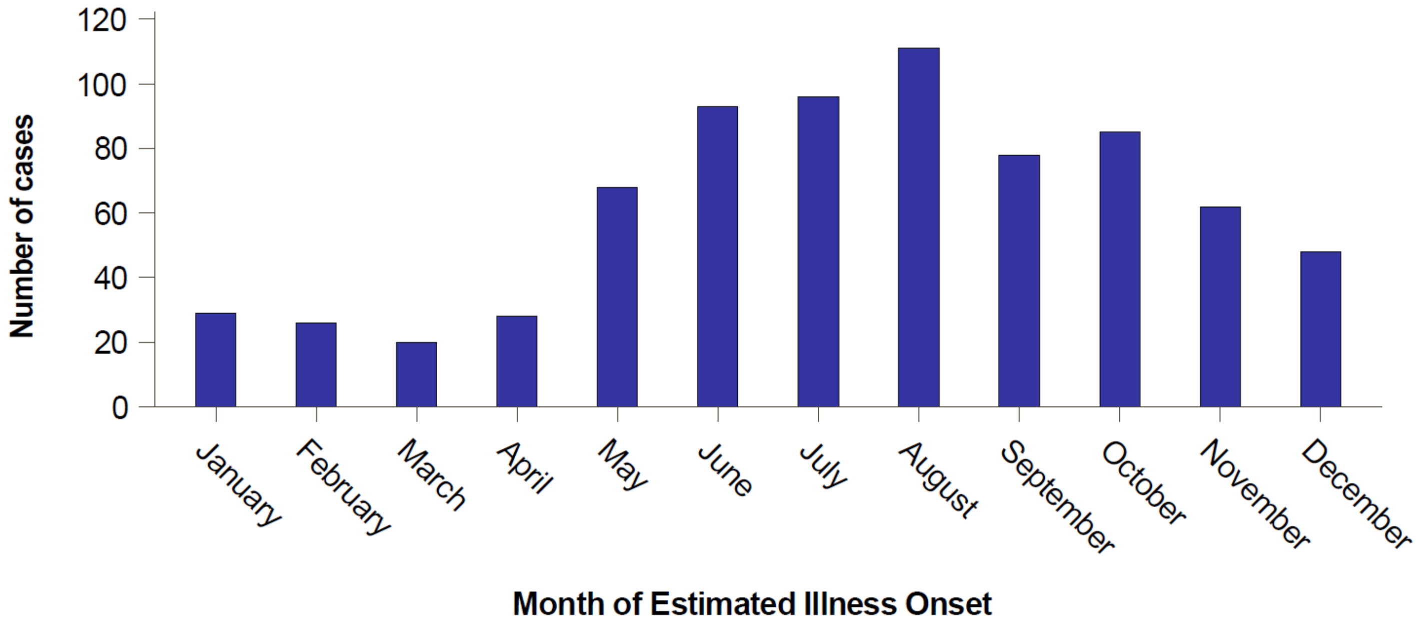
*Potentially unreliable rate: relative standard error 23 percent or more.

Figure 4. Flea-borne Typhus Cases and Population by Race/Ethnicity, California, 2013-2019



10.5% (n=78) of reported incidents of Typhus Fever did not identify race/ethnicity and 2.7% (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.

Figure 5. Flea-borne Typhus Cases by Month of Estimated Illness Onset, California, 2013-2019



Comments

From 2013 through 2019, incidence rates of flea-borne typhus in California remained low with a statewide average annual incidence rate of 0.3 per 100,000 population. Almost all flea-borne typhus cases occurred among Los Angeles and Orange County residents.

To prevent flea-borne typhus, persons should avoid contact with fleas. Pet owners can keep fleas off pet cats and dogs by using flea control products; cats should be kept indoors to minimize contact with fleas outside. Persons should also discourage feral cats, rats, and other rodents, including opossums, from living around homes by covering garbage containers and removing pet food and trash outside that may attract animals.

Prepared by Kirsten Knutson, Yanyi Djamba, Charsey Porse, Vicki Kramer, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, June 2021

References

[1] Typhus Fevers. U.S. Centers for Disease Control and Prevention website. Updated November 13, 2020. Accessed November 23, 2020. https://www.cdc.gov/typhus/index.html

[2] Flea-borne Typhus Fact Sheet. California Department of Public Health website. Updated February 2019. Accessed November 19, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/FleaBorneTyphusFactSheet.pdf.

[3] Typhus Fevers, Historical Trends. U.S. Centers for Disease Control and Prevention website. Updated July 11, 2019. Accessed November 23, 2020. https://www.cdc.gov/typhus/murine/history.html

[4] Flea-borne Typhus Statistics. Texas Department of State Health Services website. Updated March 2, 2021. Accessed March 17, 2021. https://www.dshs.texas.gov/IDCU/disease/murine_typhus/Statistics.aspx

[5] Typhus Fevers, Flea-Borne (Murine) Typhus. U.S. Centers for Disease Control and Prevention website. Updated November 13, 2020. Accessed November 23, 2020. https://www.cdc.gov/typhus/murine/index.html

[6] Typhus Fevers, Information for Healthcare Providers – Murine Typhus. U.S. Centers for Disease Control and Prevention website. Updated March 29, 2021. Accessed May 6, 2021. https://www.cdc.gov/typhus/healthcare-providers/index.html#murine

[7] State of California, Department of Public Health. *Guidance for Flea-Borne Typhus Surveillance and Reporting*. Sacramento, CA; 2019. Accessed November 23, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/FleaBorneTyphusGuidance.pdf

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

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

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

[11] Because flea-borne typhus is not nationally notifiable, the U.S. Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists did not develop a national case definition for typhus.

Epidemiologic Summary of Valley Fever (Coccidioidomycosis) in California, 2013-2019

Please see the Epidemiologic Summary of Valley Fever (Coccidioidomycosis) in California, 2019 (PDF) available on the CDPH Valley Fever Data and Publications webpage.

Epidemiologic Summary of Non-Cholera Vibriosis in California, 2013 - 2019

Key Findings

Vibriosis is an infection caused by *Vibrio* bacteria. Some types of *Vibrio* bacteria produce a toxin that causes the disease known as cholera, but this summary will discuss vibriosis that is not cholera. *Vibrio* bacteria are naturally found in coastal seawater and where rivers meet the sea. Seafood that live in these waters can be contaminated with bacteria, especially in warm conditions when the bacteria grow and thrive. Most people get sick with vibriosis by eating raw or undercooked shellfish (especially oysters) that contain *Vibrio* bacteria or by eating food that has touched contaminated seafood. People can also get a skin infection if they have a cut or open wound that is exposed to seawater or juices from shellfish.

Vibriosis in California from 2013 through 2019

Total Cases: There were a total of 1,691 new vibriosis cases from 2013 through 2019. This is an average of 242 cases each year.

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

- **By County**: The average rate was highest in Marin County (3 cases per 100,000 people). By region in California, the San Diego and Central Coast regions had the highest average yearly rate, with about 1 case per 100,000 people in both regions.
- **By Sex:** The average rate was higher in males than in females, but rates for each group were less than 1 case per 100,000 people.
- **By Age Group**: The average rate was highest in adults aged 35 to 84 years, at about 1 case per 100,000 people.
- **By Race/Ethnicity**: For cases where race and ethnicity information was available, the highest percentage of cases (about 60%) was in people who reported non-Hispanic White race/ethnicity.
- **By Month**: Most vibriosis cases (about 73%) occurred in June through October.

To help prevent vibriosis, thoroughly cook seafood, especially oysters and other shellfish, before eating. Properly boiling or steaming shellfish will kill any bacteria that can cause vibriosis. It's also important to wash your hands with soap and water after handling raw or uncooked shellfish and to keep raw shellfish and its juices separate from ready-to-eat foods. If you have a cut or wound on your skin or a recent tattoo or piercing, stay out of seawater until your skin heals.

For more information about vibriosis in California, please visit the CDPH Vibriosis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Vibriosis is an infection caused by *Vibrio* bacteria, and some *Vibrio* species produce a toxin that causes cholera. However, this summary will discuss vibriosis that is not cholera. At least a dozen non-cholera *Vibrio* species are important enteric bacterial pathogens, accounting for an estimated 80,000 illnesses, 500 hospitalizations, and 100 deaths each year in the United States.[1, 2] In 2018, the overall incidence rate of vibriosis in the U.S. was 0.9 cases per 100,000 population.[3] The national *Healthy People 2020* target objective for vibriosis was to have an annual incidence rate lower than 0.2 cases per 100,000 population.[4]

Vibrio species are natural inhabitants of marine coastal and estuarine environments, and their populations increase during the warm summer months. Shellfish (e.g., oysters, clams, mussels, crabs, shrimp, etc.) and other fish that live in these waters can become contaminated. Consuming raw or undercooked shellfish is the most common cause of non-cholera vibriosis.[5, 6, 7] Exposing wounds to seawater or contaminated raw shellfish harvested from such waters can also cause skin or soft tissue *Vibrio* infection.[8]

In the U.S., the most common species causing vibriosis are *V. parahaemolyticus*, *V. alginolyticus*, and *V. vulnificus*.[1] Depending on the species, the most common clinical presentations are acute gastroenteritis, wound or soft tissue infections, and primary sepsis. *V. parahaemolyticus* infection causes mainly acute gastroenteritis with fever that usually occurs after an incubation period of 24 hours. Symptoms usually last 1-7 days and are often self-limited.[9] *V. alginolyticus* primarily causes soft tissue infections, including those involving the eye and ear.[9, 10] *V. vulnificus* usually cause primary sepsis or wound infections; systemic disease is frequently fatal, especially in persons with chronic liver disease, immunodeficiency, iron storage issues, end-stage renal disease, or diabetes.[9, 11]

This report describes the epidemiology of confirmed and probable non-cholera vibriosis cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes*.[12] The epidemiologic description of non-cholera vibriosis for earlier surveillance periods can be found in the *Epidemiologic Summary of Non-Cholera Vibriosis in California, 2001-2008 and 2009-2012*.[13, 14]

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 *Vibrio* infection to their local health department within one working day of identification or immediately by telephone if an outbreak is suspected.[15] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of *Vibrio* species to either the California Reportable Diseases Information Exchange (CalREDIE) via electronic laboratory reporting or the local health department; notification should occur within one working day after the health care provider has been notified of the laboratory testing result.[16]

California regulations require cases of vibriosis to be reported to the California Department of Public Health (CDPH). CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed or probable case. During the surveillance period (2013-2019), a confirmed case of vibriosis was defined as a case with isolation of a species of the family *Vibrionaceae* (other than toxigenic *Vibrio cholerae* O1 or O139, which are reportable as cholera) from a clinical specimen. From 2013 through 2016, a probable case was defined as a case with clinically compatible illness and an established epidemiologic link to a laboratory-confirmed case. Beginning in 2017, a probable case was defined as a case in which a species of the family *Vibrionaceae* (other than toxigenic *Vibrio cholerae* O1 or O139) was detected in a clinical specimen using a culture-independent diagnostic test (CIDT), or a case with clinically compatible illness and an established epidemiologic link to a laboratory-confirmed or CIDT-positive case.[17]

Epidemiology of Vibriosis in California, 2013-2019

CDPH received reports of 1,691 total cases (1,399 confirmed and 292 probable) of vibriosis with estimated symptom onset dates from 2013 through 2019. This corresponds to an average of 242 cases each year and an average annual incidence rate of 0.6 cases per 100,000 population. Incidence rates increased from 2013 (0.4 per 100,000; 154 cases) to 2019 (0.7 per 100,000; 277 cases), with fluctuations over time [Figure 1]. The highest incidence rate occurred in 2018 (0.9 per 100,000; 338 cases).

During the surveillance period, *V. parahaemolyticus* was the most common species identified as the cause of vibriosis (845 cases, 50.0% of cases), followed by *V. alginolyticus* (269 cases, 15.9%) and non-toxigenic *V. cholerae* (91 cases, 5.4%). Thirty cases (1.8%) of *V. vulnificus* were reported. Among the 1,481 cases with complete hospitalization information, 287 (19.7%) of 1,454 non-*V. vulnificus* cases were hospitalized and 23 of 27 (85%) of *V. vulnificus* cases were hospitalized. Deaths were reported among 30 (1.8%) case-patients at the time of case report. Of these deaths, 10 (33.3%) had *V. vulnificus* infection and the others had infection with another *Vibrio* or unidentified species.

County-specific average annual incidence rates per 100,000 population during 2013-2019 ranged from 0 to 3.0, with the highest average annual rate in Marin County (3.0 cases per 100,000; 55 total cases) [Figure 2]. Of the 58 California counties, 42 (72.4%) had an average annual incidence rate that was above the national *Healthy People 2020* target rate for vibriosis of 0.2 cases per 100,000 population. By region (see *Technical Notes*), the San Diego (1.2 per 100,000; 285 cases) and Central Coast (1.0 per 100,000; 109 cases) regions reported the highest average annual incidence rates in California.

From 2013 through 2019, average annual incidence rates were 1.6 times higher among males (0.8 per 100,000; 1,071 cases) than among females (0.5 per 100,000; 620 cases); 63.3% of case-patients were male and 36.7% were female.

Average annual vibriosis incidence rates during the surveillance period were highest in adults aged 75 to 84 years (1.0 per 100,000; 113 cases), followed by adults aged 65 to 74 years (0.9 per 100,000; 194 cases), 35 to 44 years (0.9 per 100,000; 314 cases), and 55 to 64 years (0.9 per 100,000; 278 cases) [Figure 3].

For vibriosis cases with complete race/ethnicity information (see *Technical Notes*), the highest percentage of cases was among those who reported non-Hispanic White race/ethnicity (59.6%). The percentage of cases among those who reported non-Hispanic White race/ethnicity is disproportionally higher than the percentage of the non-Hispanic White racial/ethnic population in California during the same time period (59.6% vs. 38.0%, respectively) [Figure 4].

Vibriosis cases have been reported year-round, but the highest number of cases occur during warmer-weather months. During 2013-2019, more than half (72.9%; 1,232 cases) of the reported vibriosis cases occurred during the five-month period of June through October, peaking in August with 401 (23.7%) reported cases [Figure 5].

From 2013 through 2019, there were eight foodborne outbreaks of vibriosis involving 26 California case-patients. The greatest number of outbreaks occurred in 2019 (four outbreaks). Four outbreaks involved patients exposed in multiple states. For all eight outbreaks, *V. parahaemolyticus* was the identified species. One multi-state outbreak in 2019 involving multiple pathogens also identified non-toxigenic *V. cholerae*.[18] The implicated food source for all outbreaks was oysters from oyster beds outside of California.[19]

Figure 1. Vibriosis (Non-Cholera) Cases and Incidence Rates by Year of Estimated Illness Onset, California, 2013-2019

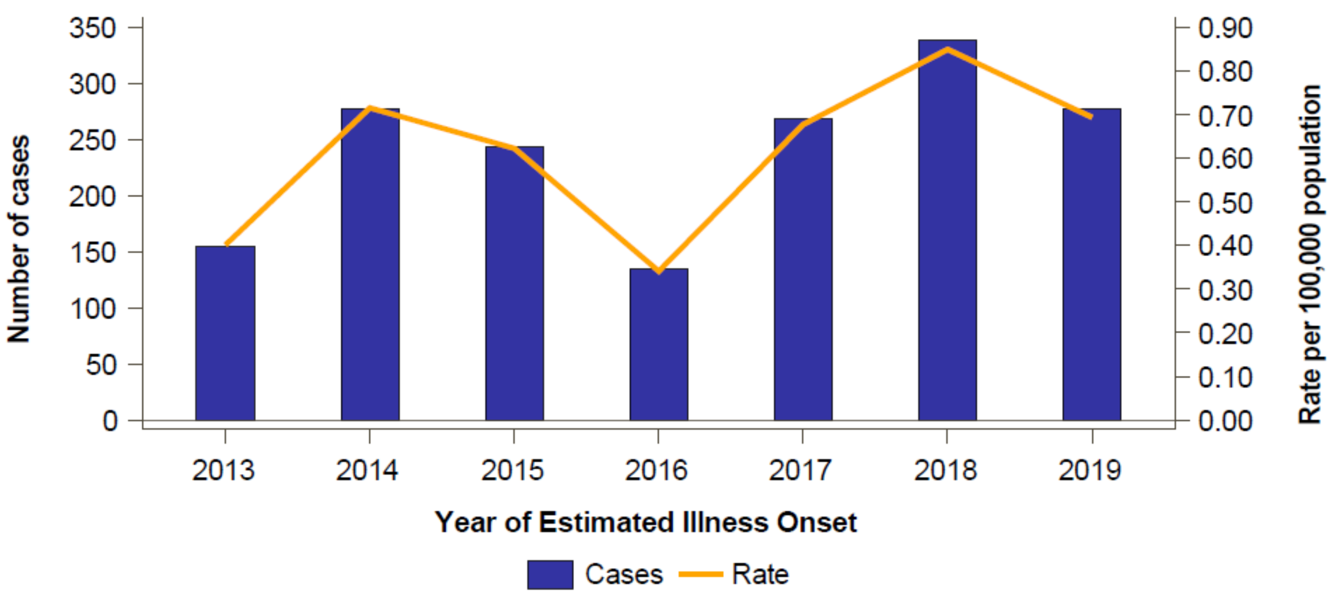


Figure 2. Vibriosis (Non-Cholera) Average Annual Incidence Rates by County, California, 2013-2019

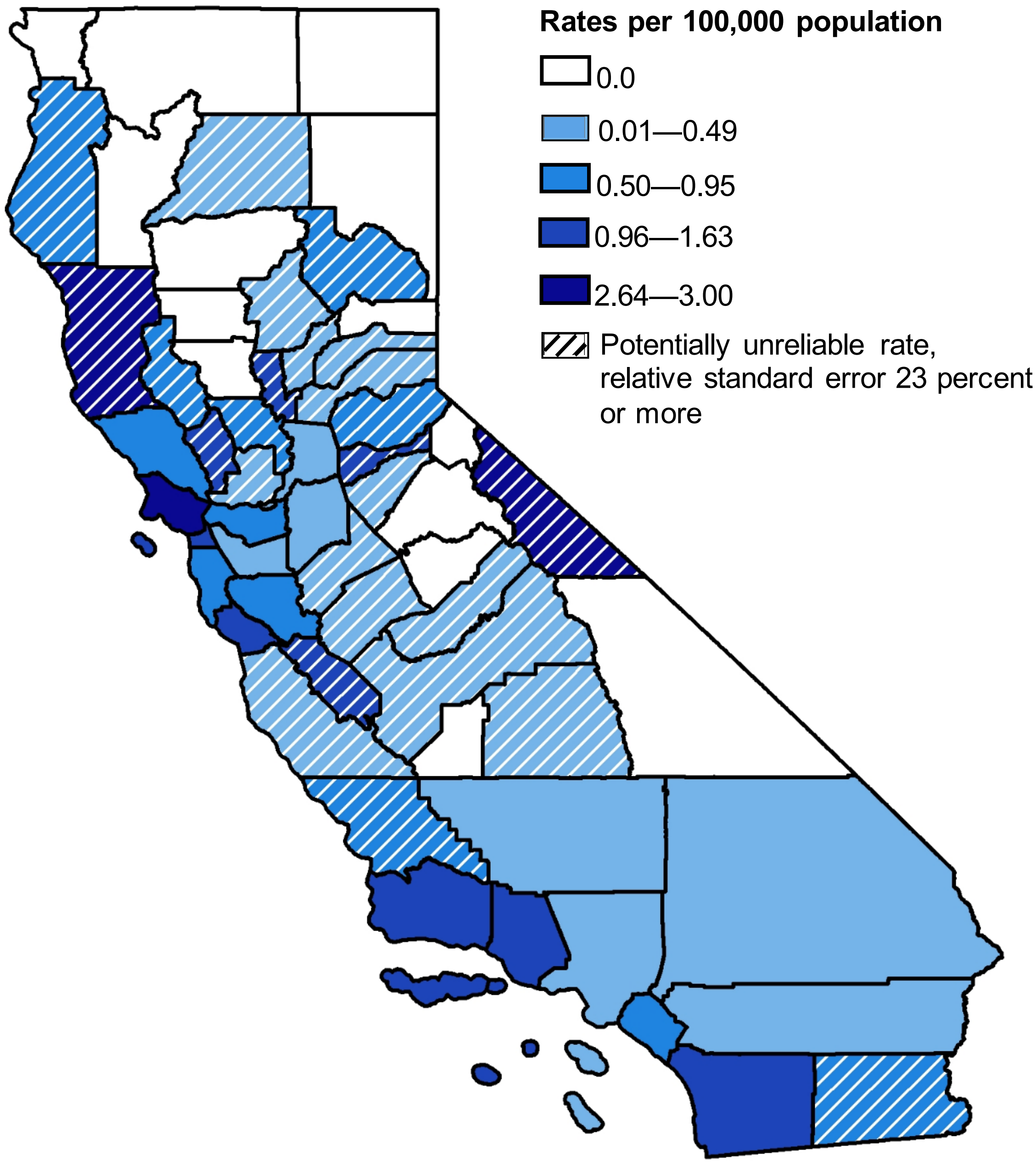
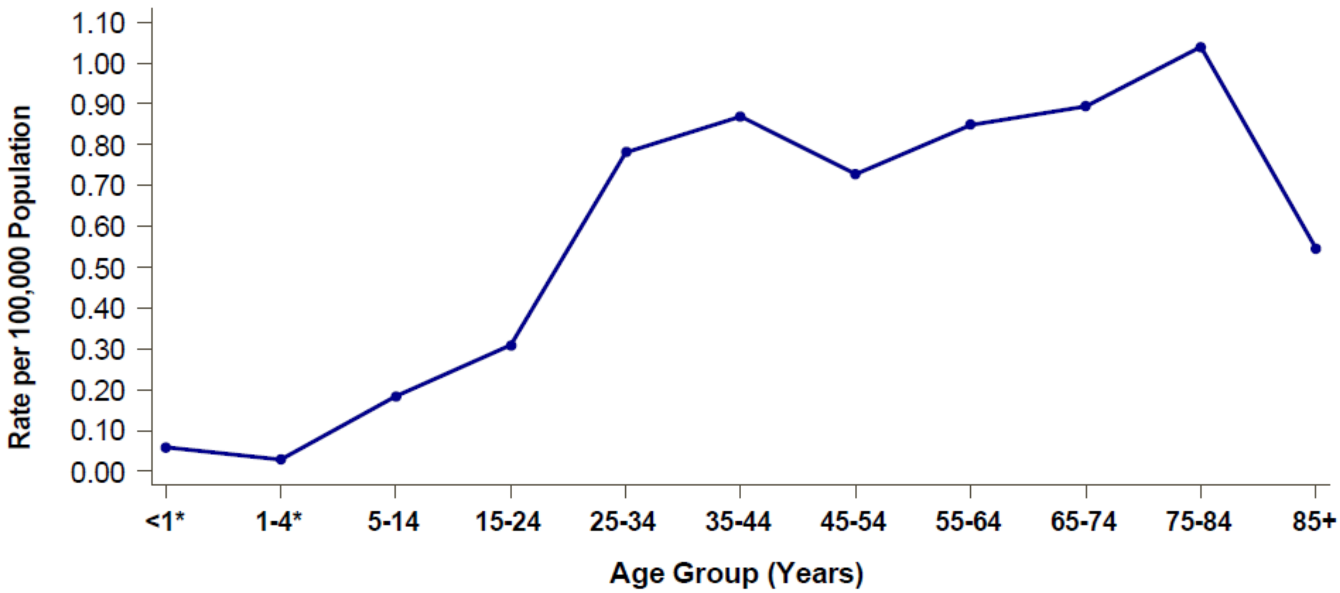
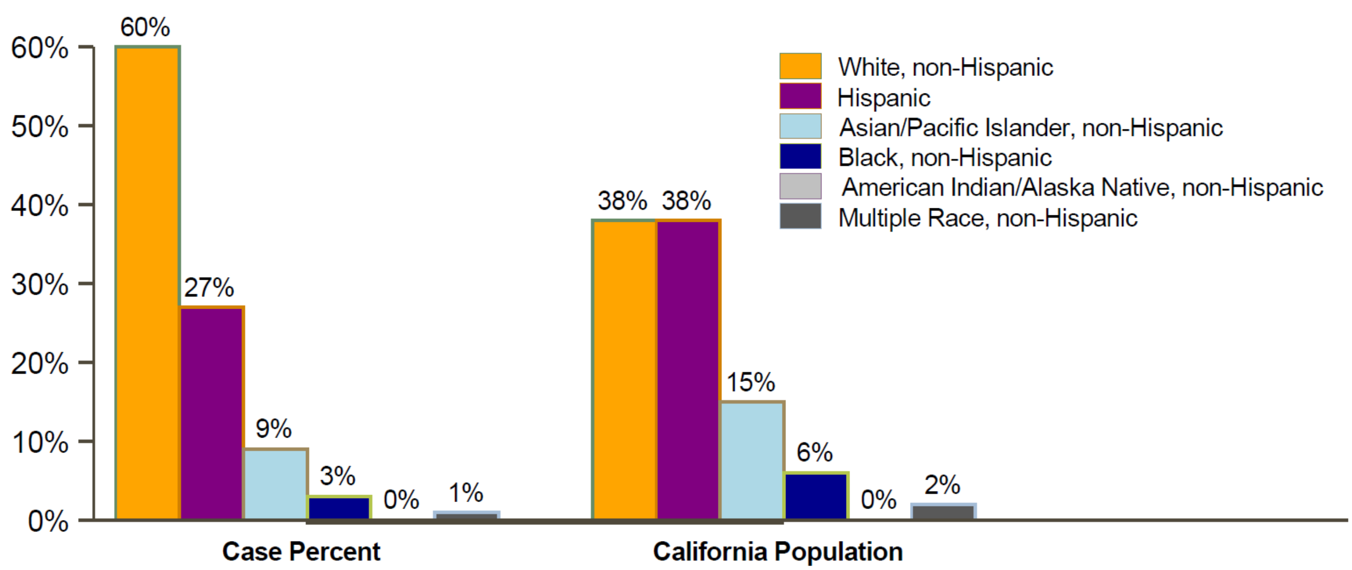


Figure 3. Vibriosis (Non-Cholera) Average Annual Incidence Rates by Age Group, California, 2013-2019



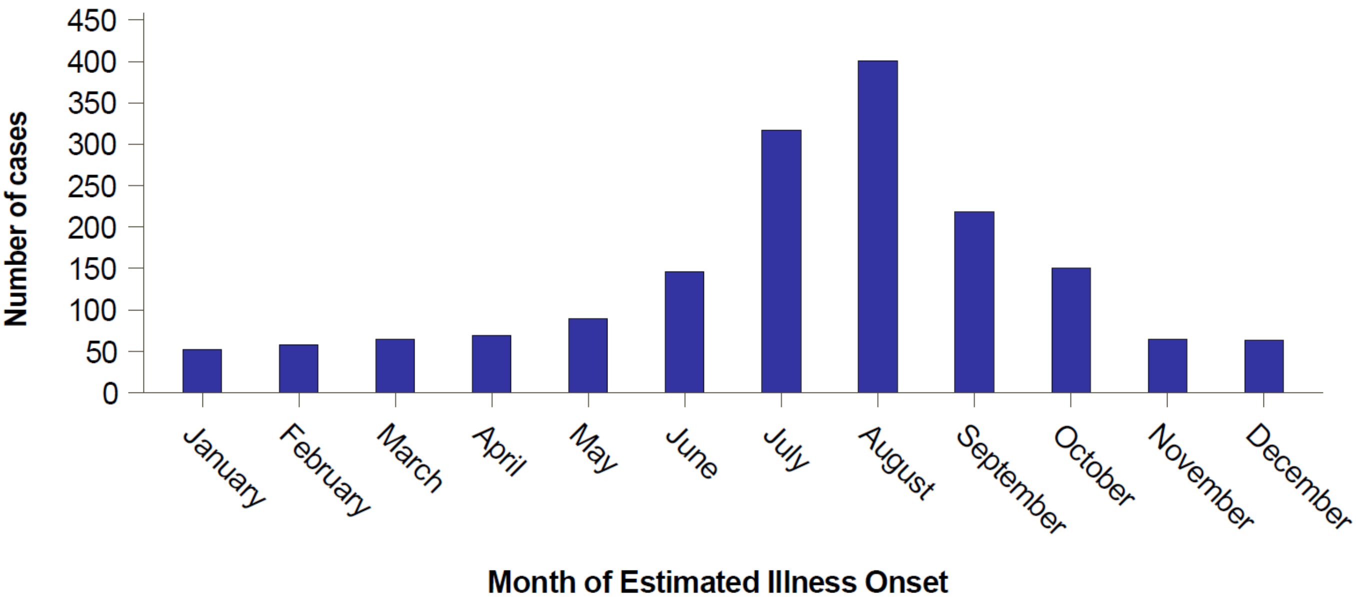
*Potentially unreliable rate: relative standard error 23 percent or more.

Figure 4. Vibriosis (Non-Cholera) Cases and Population by Race/Ethnicity, California, 2013-2019



18.3% (n=310) of reported incidents of Vibriosis (non-Cholera) did not identify race/ethnicity and 2.5% (n=43) 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.

Figure 5. Vibriosis (Non-Cholera) Cases by Month of Estimated Illness Onset, California, 2013-2019



Comments

Overall, average annual incidence of vibriosis in California increased during the 2013-2019 surveillance period (0.6 cases per 100,000 population) compared to the 2009-2012 surveillance period (0.4 cases per 100,000 population).[14] The peak rate of the 2013-2019 surveillance period was in 2018 (0.9 per 100,000 population), which was similar to the overall incidence rate in the U.S in 2018.[3] However, California's incidence rates were lower than the annual incidence rates of other coastal states, such as Washington (range: 0.9 to 2.9 per 100,000 population) and Florida (range: 0.8 to 1.3 per 100,000 population).[20, 21] The increase of reported vibriosis in recent years may be due in part to the increased use of CIDT and a more inclusive probable case definition.[22, 23] In addition, the increase may also be due to climatic and environmental factors, such as warmer sea temperatures, that favor the growth of *Vibrio* species.[24]

It is estimated that for every vibriosis case reported, there are 142 cases that are undiagnosed; therefore, the true rates are likely to be much higher.[1] *Vibrio* infections are often underdiagnosed, partly due to laboratories not routinely using media that are selective for *Vibrio* spp.[25] Unlike for other pathogens, there are no state regulations that require clinical laboratories to submit specimens that are positive for *Vibrio* by CIDT to a public health laboratory for culture confirmation.[16] Clinicians should maintain a high index of suspicion for vibriosis in persons with gastroenteritis or sepsis and a history of raw shellfish consumption or seawater exposure (swimming, surfing, etc.). Clinicians suspecting vibriosis should also notify the laboratory of their suspicions so that the appropriate selective culture medium can be used to isolate the organism. Specimens that test positive for *Vibrio* by CIDT should undergo reflex culture or be forwarded to a public health laboratory for confirmation and speciation.

To prevent vibriosis, seafood, including oysters and other shellfish, should be thoroughly cooked before eating. Proper handwashing and adherence to food safety guidelines when handling or preparing raw shellfish can also help mitigate infection. Persons with a skin wound or recent tattoo or piercing should avoid contact with seawater until the skin heals. Ensuring shellfish beds are routinely monitored for the presence of enteric pathogens, ensuring shellfish are handled safely during and after harvest, and educating consumers about the risks of consuming raw or undercooked shellfish and about potential exposure from open-wound contact with seawater are important for reducing vibriosis. However, these efforts may not be enough. A 2003 California regulation restricting the sale of raw oysters harvested from the Gulf of Mexico during the summer months, unless the oysters have been processed, led to a marked decrease in the number of reported cases of *V. vulnificus* cases among California residents during 2003-2010.[26] Thus, post-harvest measures to decrease contamination of oysters may need to be implemented more widely.[27] When vibriosis cases or outbreaks are reported, complete epidemiologic and seafood traceback information collected in a timely manner will enable CDPH to identify the likely source of infection, identify specific shellfish growing regions where contamination could have occurred, and implement potential regulatory action to prevent additional illnesses.[28]

Prepared by Alyssa Nguyen, Yanyi Djamba, Vi Peralta, Akiko Kimura, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, September 2021

References

[1] Scallan E, Hoekstra RM, Angulo FJ, et al. Foodborne illness acquired in the United States—Major pathogens. *Emerg Infect Dis*. 2011;17 (1):7-15.

[2] *Vibrio* Species Causing Vibriosis Illness. U.S. Centers for Disease Control and Prevention website. Updated March 5, 2019. Accessed December 31, 2020. http://www.cdc.gov/vibrio/

[3] National Notifiable Diseases Surveillance System. *2016-2018 Annual Tables of Infectious Disease Data*. Atlanta, GA: U.S. Centers for Disease Control and Prevention, Division of Health Informatics and Surveillance; 2019. Accessed February 3, 2021. https://wwwn.cdc.gov/nndss/data-and-statistics.html

[4] *Healthy People 2020* Food Safety Objectives. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion website. Updated October 8, 2020. Accessed February 3, 2021. https://www.healthypeople.gov/2020/topics-objectives/topic/food-safety/objectives

[5] Altekruse SF, Bishop RD, Baldy LM, et al. Vibrio gastroenteritis in the US Gulf of Mexico region: the role of raw oysters. Epidemiol Infect 2000;124:489-95.

[6] CDC. Vibrio parahaemolyticus infections associated with consumption of raw shellfish three states, 2006. MMWR 2006;55:854-6.

[7] Newton AE, Garrett N, Stroika SG, et al. Increase in Vibrio parahaemolyticus infections associated with consumption of Atlantic Coast shellfish--2013. MMWR Morb Mortal Wkly Rep. 2014 Apr 18;63 (15):335-6.

[8] Dechet AM1, Yu PA, Koram N, Painter J. Nonfoodborne Vibrio infections: an important cause of morbidity and mortality in the United States, 1997-2006. Clin Infect Dis. 2008 Apr 1;46(7):970-6. doi: 10.1086/529148.

[9] Horseman M, Bray R, Lujan-Francis B, et al. Infections Caused by Vibrionaceae: A Review of the Epidemiology, Pathogenesis, Clinical Presentations, and Treatment. Infect Dis Clin Pract. 2013;21(4):222-232.

[10] Jacobs Slifka KM, Newton AE, Mahon BE. Vibrio alginolyticus infections in the USA, 1988-2012. Epidemiol Infect. 2017 May;145(7):1491-1499. doi: 10.1017/S0950268817000140

[11] Horseman MA, Surani S. A comprehensive review of Vibrio vulnificus: an important cause of severe sepsis and skin and soft-tissue infection. Int J Infect Dis. 2011 Mar;15(3):e157-66.

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

[13] State of California, Department of Public Health. Vibriosis (non-cholera). In: *Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008*. Sacramento, CA; 2009. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA2001-2008.pdf

[14] State of California, Department of Public Health. Vibriosis (non-cholera). In*: Epidemiologic Summaries of Selected General Communicable Diseases in California, 2009-2012*. Sacramento, CA; 2015. Accessed October 18, 2020. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesofSelectedCommDiseasesinCA09-12.pdf

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

[16] Reportable Conditions: Notification by Laboratories, 17 CCR § 2505 (2021). https://govt.westlaw.com/calregs/Document/I1947D280662411E384928538D6692020

[17] Vibriosis (any species of the family *Vibrionaceae*, other than toxigenic *Vibrio cholerae* O1 or O139) Case Definitions, 2012 & 2017. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention. Accessed August 6, 2021. https://ndc.services.cdc.gov/case-definitions/vibriosis-2012/ https://ndc.services.cdc.gov/case-definitions/vibriosis-2017/

[18] Multistate Outbreak of Gastrointestinal Illnesses Linked to Oysters Imported from Mexico (Final Update). U.S. Centers for Disease Control and Prevention website. Updated June 21, 2019. Accessed February 12, 2021. https://www.cdc.gov/vibrio/investigations/rawoysters-05-19/index.html

[19] National Outbreak Reporting System (NORS). U.S. Centers for Disease Control and Prevention website. Updated November 4, 2019. Data extracted on December 16, 2020. https://www.cdc.gov/nors/index.html

[20] Washington State Department of Health. 2018 Communicable Disease Report. Shoreline, WA; November 2019. Accessed February 4, 2021. https://www.doh.wa.gov/Portals/1/Documents/5100/420-004-CDAnnualReport2018.pdf

[21] FLHealthCHARTS Community Health Assessment Resource Tool Set. Florida Department of Health website. Accessed February 4, 2021. http://www.flhealthcharts.com/charts/CommunicableDiseases/default.aspx

[22] Iwamoto M, Huang JY, Cronquist AB, et al. Bacterial enteric infections detected by culture-independent diagnostic tests--FoodNet, United States, 2012-2014.

[23] Tack DM, Marder EP, Griffin PM, et al. Preliminary incidence and trends of infections with pathogens transmitted commonly through food – Foodborne Diseases Active Surveillance Network, 10 U.S. Sites, 2015-2018. MMWR Morb Mortal Wkly Rep 2019:68;369-373.

[24] Vezzulli L, Brettar I, Pezzati E, et al. Long-term effects of ocean warming on the prokaryotic community: evidence from the vibrios. *ISME J*. 2012;6(1):21-30. doi:10.1038/ismej.2011.89

[25] Voetsch AC, Angulo FJ, Rabatsky-Ehr T, et al. Laboratory practices for stool-specimen culture for bacterial pathogens, including Escherichia coli O157:H7, in the FoodNet sites, 1995-2000. Clin Infect Dis. 2004 Apr 15;38 Suppl 3:S190-7.

[26] Vugia D, Tabnak F, Newton A, Hernandez M, Griffin P. Impact of 2003 state regulation on raw oyster-associated Vibrio vulnificus illnesses and deaths, California, USA. Emerg Infect Dis. 2013; 19 (8):1276-1280.

[27] Newton A, Kendall M, Vugia DJ, Henao OL, Mahon BE. Increasing rates of vibriosis in the United States, 1996-2010: review of surveillance data from 2 systems. *Clin Infect Dis*. 2012;54 Suppl 5(0 5):S391-S395. doi:10.1093/cid/cis243

[28] State of California, Department of Public Health. Non-cholera *Vibrio* infections. In: *CDPH IDB Guidance for Managing Select Communicable Diseases*. Sacramento, CA; 2020. Accessed February 5, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/IDBGuidanceforCALHJs-Vibriosis.pdf

Epidemiologic Summary of Yersiniosis in California, 2013 - 2019

Key Findings

Yersiniosis is an infection caused by *Yersinia enterocolitica* or *Yersinia pseudotuberculosis*, which are types of bacteria that live naturally in many animals, especially pigs. People with yersiniosis may have diarrhea, fever, and severe stomach pain. People usually get yersiniosis by eating contaminated food, especially raw or undercooked pork, or by having contact with someone that touched contaminated food or prepared a pork product, such as pig intestines. People can also get infected by drinking contaminated milk or untreated water, or by having contact with infected animals or their feces (poop).

Yersiniosis in California from 2013 through 2019

Total Cases: There were a total of 1,362 new yersiniosis cases from 2013 through 2019. This is an average of 195 cases each year.

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

- **By County**: Of the counties that reported at least 1 case per year during 2013-2019, the average rate was highest in Ventura County (about 2 cases per 100,000 people) and San Mateo County (1 case per 100,000 people).

- **By Sex:** The average rate was similar in females and males, but each group had less than 1 case per 100,000 people.

- **By Age Group**: The average rates were highest in children aged less than 1 year and adults aged 85 years and older (both groups with less than 2 cases 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 (55%).

To help prevent yersiniosis, do not eat raw or undercooked pork. In addition, drink and eat only milk or dairy products that have been pasteurized. It is also important to follow food safety guidelines when preparing food, especially by keeping raw pork away from ready-to-eat foods and cooking food to the right temperature. To prevent the spread of *Yersinia,* wash hands with soap and water before preparing food, immediately after handling any raw pork or meat, and after touching animals (especially pigs and other farm animals) or being in areas where animals live. Keep children away from areas where raw pork is being handled or prepared to keep children from getting sick.

For more information about yersiniosis, please visit the U.S. Centers for Disease Control and Prevention Yersiniosis webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Yersiniosis is a gastrointestinal illness most often caused by *Yersinia enterocolitica* bacteria, less commonly by *Y. pseudotuberculosis* bacteria. The U.S. Centers for Disease Control and Prevention (CDC) estimates that *Y. enterocolitica* causes 117,000 illnesses, 640 hospitalizations, and 35 deaths in the U.S. every year.[1] The national *Healthy People 2020* target objective for yersiniosis was to have an incidence rate lower than 0.3 cases per 100,000 population.[2]

Y. enterocolitica are naturally carried in the intestines and oral cavities of pigs. However, other farm animals, rodents, dogs and cats can also carry strains that cause human illness.[3, 4] Infection occurs most commonly in young children and in the elderly. Consuming or handling contaminated raw or undercooked pork is the leading cause of yersiniosis; illness, especially among infants and young children, can also occur after direct or indirect contact with people who have handled contaminated food or prepared a pork product (such as pig intestines). Yersiniosis may also occur after consuming unpasteurized milk and milk products, drinking untreated water, or exposure to infected animals or their feces. Rarely, infection can occur through person-to-person contact or through transfusion with contaminated blood.[3]

Symptoms of yersiniosis usually begin within 4-7 days after exposure and last 1-3 weeks or longer. Symptoms in young children usually include fever, abdominal pain, and diarrhea that may be bloody.[1, 5] In older children and adults, abdominal pain may localize to the right side of the abdomen, which may be mistaken for appendicitis. Post-infectious complications, including reactive arthritis and painful skin lesions called erythema nodosum, can rarely occur.[5, 6] Most illness is self-limited, and treatment with antibiotics should be reserved for severe cases.[6]

This report describes the epidemiology of confirmed and probable yersiniosis cases in California from 2013 through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes*.[7]

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 yersiniosis to their local health department within one working day of identification or immediately by telephone if an outbreak is suspected.[8] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of non-pestis *Yersinia* 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.[9]

California regulations require cases of yersiniosis to be reported to the California Department of Public Health (CDPH). Prior to 2019, no standard national case definition existed. Beginning in 2019, the Council of State and Territorial Epidemiologists (CSTE) defined a confirmed case of yersiniosis as an infection in which *Y. enterocolitica or Y. pseudotuberculosis* was isolated from a clinical specimen. A probable case was defined as an infection in which any *Yersinia* species other than *Y. pestis* was detected in a clinical specimen using a nucleic acid amplification culture-independent diagnostic test (CIDT) or as an infection with an established epidemiologic link to either a laboratory-confirmed or CIDT-positive case.[10] During the 2013-

2019 surveillance period, CDPH counted cases that were classified as confirmed or probable by local health departments or satisfied the CSTE surveillance case definition.

Although yersiniosis is reportable in California, it is not a nationally reportable condition. However, the Foodborne Diseases Active Surveillance Network (FoodNet), a collaboration of CDC and other government entities with 10 state health departments in the U.S. (including Alameda, Berkeley, San Francisco, and Contra Costa health departments in California), conducts active, population-based surveillance of yersiniosis.[11]

Epidemiology of Yersiniosis in California, 2013-2019

CDPH received reports of 1,362 total cases of yersiniosis with estimated symptom onset dates from 2013 through 2019. This corresponds to an average of 195 cases per year and an average annual incidence rate of 0.5 cases per 100,000 population. Incidence rates increased 300% during this surveillance period, from 0.2 per 100,000 (78 cases) in 2013 to 0.8 per 100,000 (326 cases) in 2019 [Figure 1]. Deaths were reported among 10 (0.7%) case-patients at the time of case report. Case fatality rates were greatest among case-patients aged 75 years and older (less than 0.1%).

There were 14 counties in which at least one case of yersiniosis occurred each year during 2013-2019: Alameda, Fresno, Los Angeles, Marin, Orange, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Luis Obispo, San Mateo, Santa Clara, and Ventura. Of these counties, Ventura (1.6 per 100,000; 97 cases) and San Mateo (1.0 per 100,000; 53 cases) had the highest average annual rates [Figure 2]. Overall, Los Angeles County had the highest number of cases (298 cases; 0.4 per 100,000). Of the 58 California counties, 34 (58.6%) had an average annual incidence rate that was above the national *Healthy People 2020* target rate for yersiniosis of 0.3 cases per 100,000 population.[2] By region (see *Technical Notes*), the Central Coast (0.9 per 100,000; 89 cases) and San Diego (0.8 per 100,000; 200 cases) regions had the highest average annual incidence rates.

During 2013-2019, the average annual incidence rate of yersiniosis was similar among females (0.5 per 100,000; 701 cases) and males (0.5 per 100,000; 652 cases); 51.8% of yersiniosis case-patients were female and 48.2% were male.

Average annual yersiniosis incidence rates during the surveillance period were highest among children aged less than 1 year (1.5 per 100,000; 52 cases) and adults aged 85 years and older (1.5 per 100,000; 78 cases), followed by adults aged 75 to 84 years (1.2 per 100,000; 132 cases) [Figure 3].

For yersiniosis cases with complete race/ethnicity information (see *Technical Notes*), the highest percentages of cases were among those who reported non-Hispanic White race/ethnicity (55.0%), which was disproportionately higher than the percentage of the non-Hispanic White racial/ethnic population in California during the same time period (55.0% vs. 38.0%, respectively) [Figure 4].

There were no foodborne outbreaks of yersiniosis during the surveillance period.

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

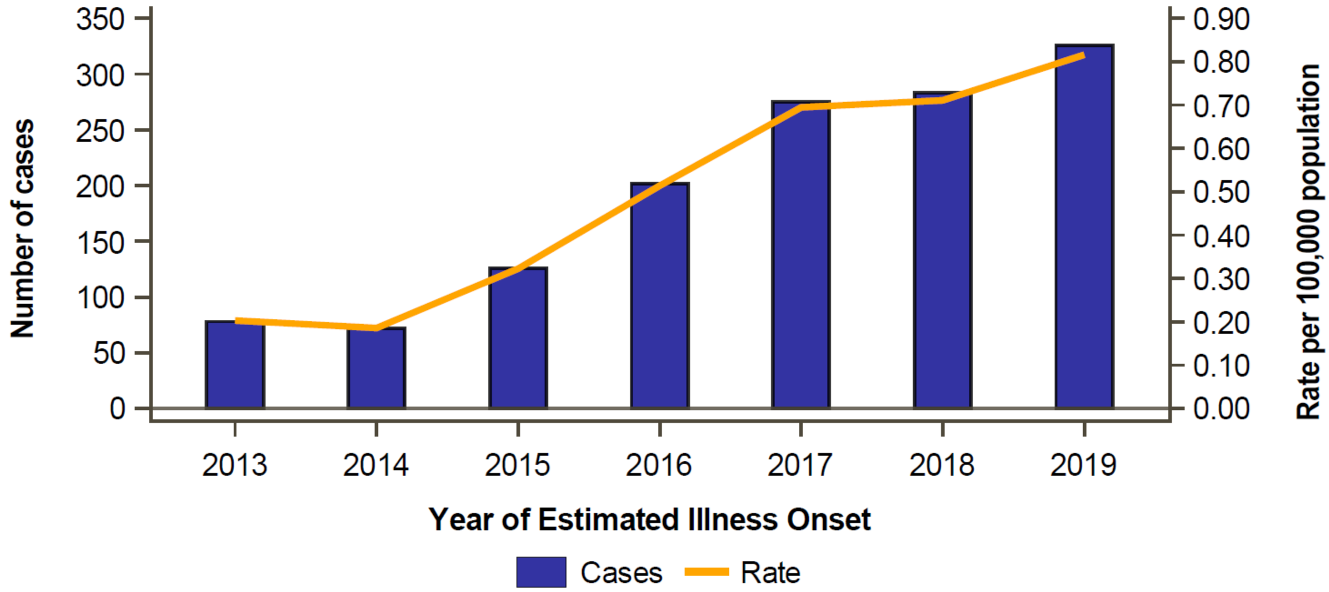


Figure 2. Yersiniosis Average Annual Incidence Rates by County, California, 2013-2019

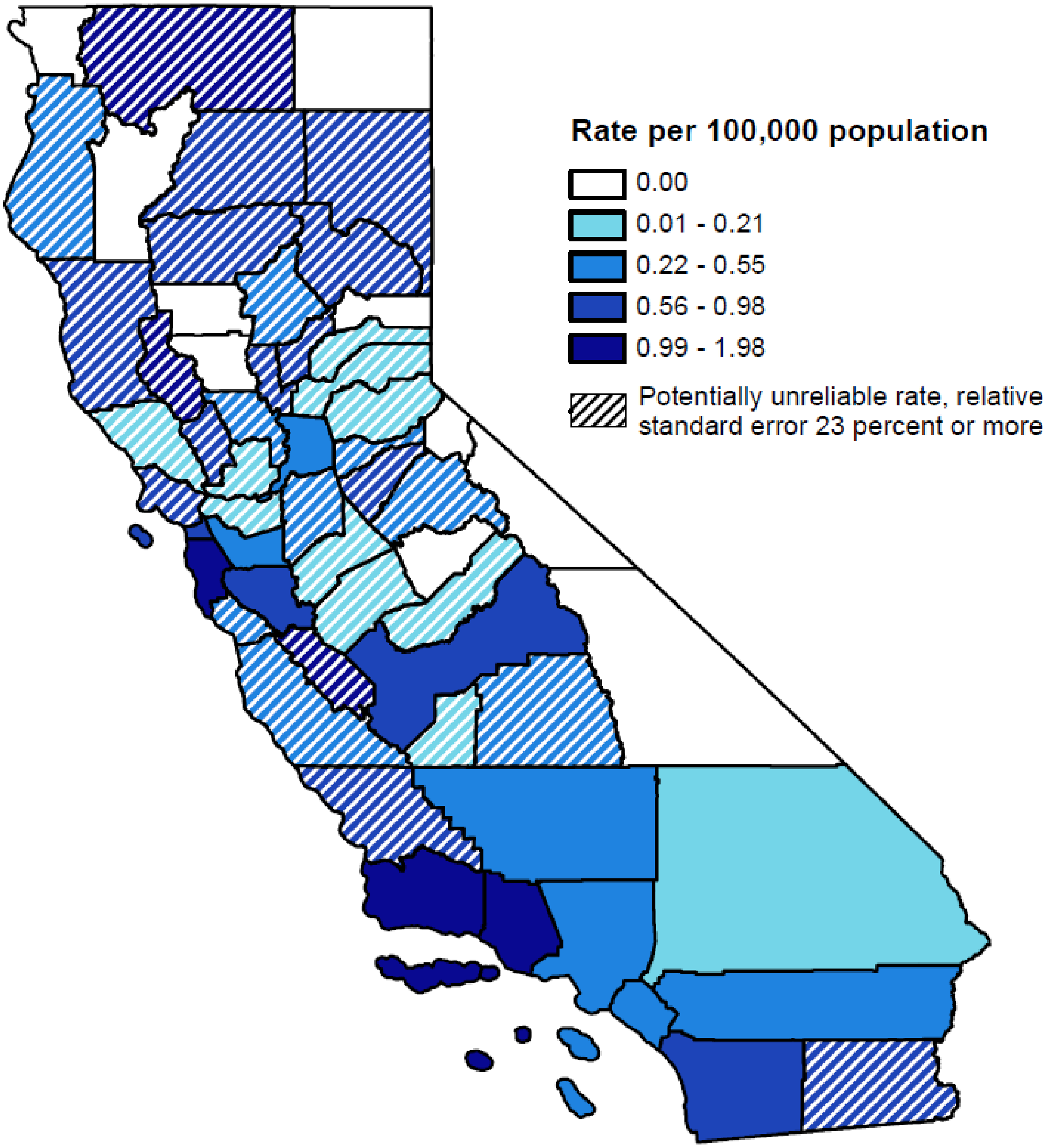


Figure 3. Yersiniosis Average Annual Incidence Rates by Age Group, California, 2013-2019

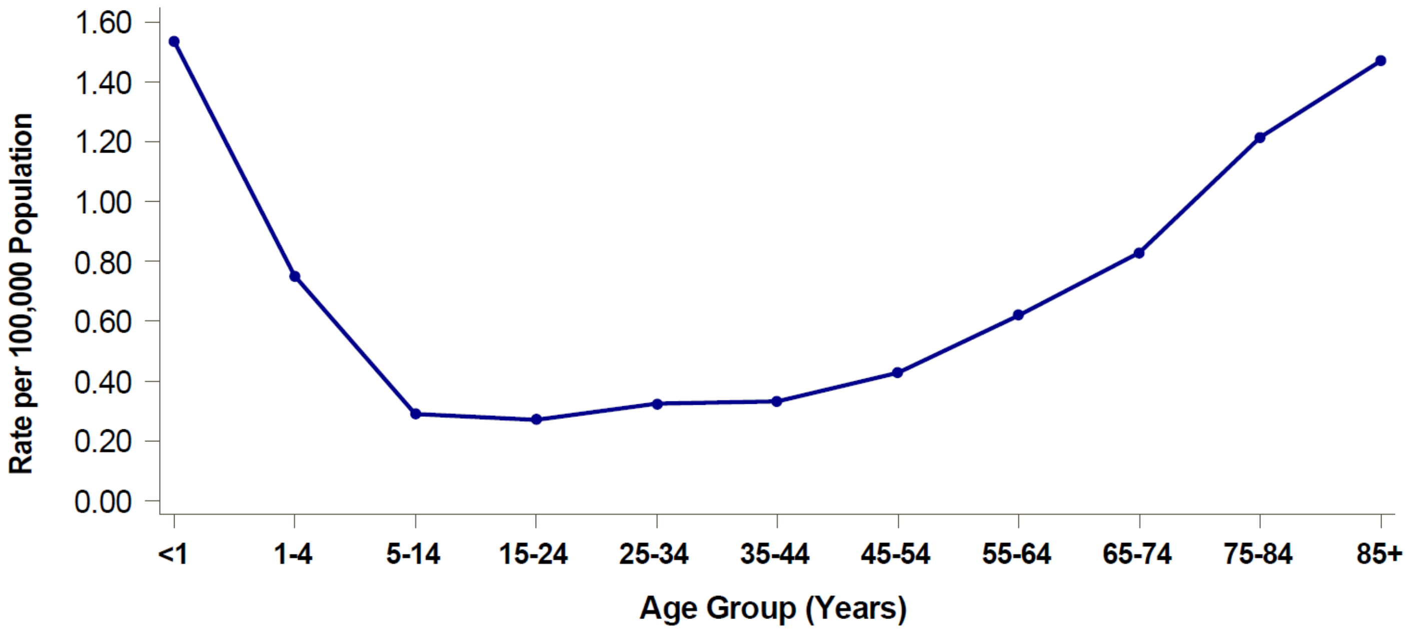
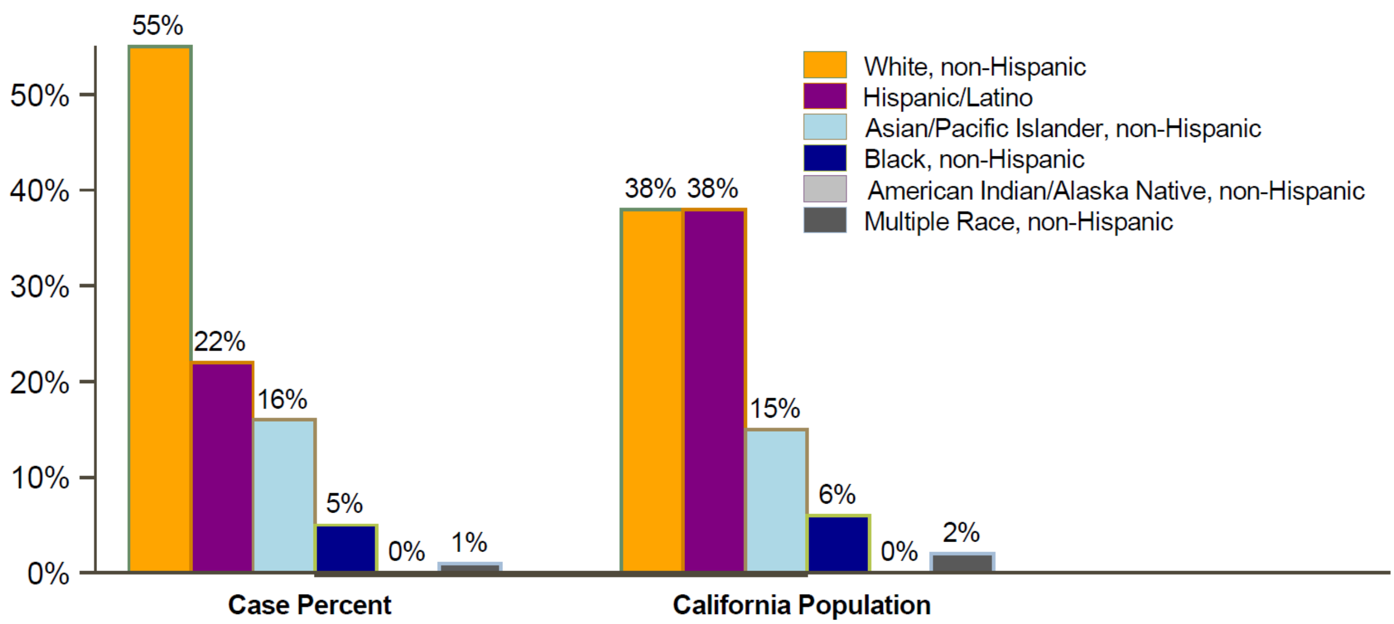


Figure 4. Yersiniosis Cases and Population by Race/Ethnicity, California, 2013-2019



30.8% (n=419) of reported incidents of Yersiniosis did not identify race/ethnicity and 2.8% (n=38) 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

Although there was a 3-fold increase in yersiniosis incidence rates in California from 2013 through 2019, yersiniosis remains relatively uncommon in California; the peak rate in 2019 was less than 1 case per 100,000 population. However, it is estimated that only 1 of every 123 people who are infected with *Yersinia* seek medical care and are diagnosed with yersiniosis; therefore, the true infection rates are likely to be much higher.[12] For each year in California beginning in 2015, the state-wide incidence rate was above the national *Healthy People 2020* target rate for yersiniosis of 0.3 cases per 100,000 population.

The overall yersiniosis incidence rate in 2019 for FoodNet sites in the U.S. was 1.4 per 100,000 population, which was a 2.6-fold increase since 2013, comparable to the increase in California.[13] Also, the age distribution of yersiniosis case-patients living in FoodNet sites and California was similar; incidence rates were highest among very young children and older adults.[14] Similar to FoodNet sites, the increase in incidence in California may be due in part to the increased use of CIDT methods and a more inclusive probable case definition of yersiniosis.[13]

To reduce the risk of yersiniosis, persons should be educated regarding the risks of consuming raw and undercooked pork. In addition, proper handwashing after contact with raw pork products, pigs, and environments where pigs are present is key to preventing the transmission of *Yersinia*. Persons handling any raw pork product should not have contact with children while preparing the food, and follow food safety guidelines when preparing food, especially by keeping raw pork away from ready-to-eat foods and cooking food to the right temperature. In addition, persons should drink and eat only pasteurized milk or dairy products and avoid drinking untreated water.[15] Animal feces should be disposed of in a sanitary manner.

Prepared by Kirsten Knutson, Yanyi Djamba, Akiko Kimura, Vi Peralta, Jeff Higa, Allyx Nicolici, and Duc Vugia — Infectious Diseases Branch, December 2021

References

[1] U.S. Centers for Disease Control and Prevention. *CDC Yellow Book 2020: Health Information for International Travel.* Chapter 4: Travel-related Infectious Diseases: Yersiniosis. New York: Oxford University Press; 2017. https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/yersiniosis

[2] *Healthy People 2020* Food Safety Objectives. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion website. Updated October 8, 2020. Accessed May 6, 2021. https://www.healthypeople.gov/2020/topics-objectives/topic/food-safety/objectives

[3] *Yersinia enterocolitica* (Yersiniosis), Questions and Answers. U.S. Centers for Disease Control and Prevention website. Updated August 1, 2019. Accessed May 6, 2021. https://www.cdc.gov/yersinia/faq.html

[4] Schaake J, Kronshage M, Uliczka F et al. Human and animal isolates of *Yersinia enterocolitica* show significant serotype-specific colonization and host-specific immune defense properties. Infect Immun. 2013 Nov;81(11):4013-25.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3811832/

[5] *Yersinia enterocolitica* (Yersiniosis), Symptoms. U.S. Centers for Disease Control and Prevention website. Updated May 26, 2016. Accessed May 11, 2021. https://www.cdc.gov/yersinia/symptoms.html

[6] *Yersinia enterocolitica* (Yersiniosis), Information for Health & Lab Professionals. U.S. Centers for Disease Control and Prevention website. Updated May 25, 2016. Accessed May 15, 2021. https://www.cdc.gov/yersinia/healthcare.html

[7] State of California, Department of Public Health. Technical notes. In*: Epidemiologic Summaries of Selected Communicable Diseases in California, 2013-2019.* Sacramento, CA; 2021. Accessed December 30, 2021.

https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/EpiSummariesTechnicalNotes2013-2019.pdf

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

[9] Reportable Diseases and Conditions: Notification by Laboratories, 17 CCR § 2505 (2021).

https://govt.westlaw.com/calregs/Document/I1947D280662411E384928538D6692020

[10] Council of State and Territorial Epidemiologists. Case Definition for Non-pestis Yersiniosis (18-ID-02). Accessed October 8, 2021. https://cdn.ymaws.com/www.cste.org/resource/resmgr/2018_position_statements/18-ID-02.pdf

[11] Foodborne Diseases Active Surveillance Network (FoodNet): About FoodNet. U.S. Centers for Disease Control and Prevention website. Updated August 12, 2015. Accessed June 11, 2021. https://www.cdc.gov/foodnet/about.html

[12] Scallan E, Hoekstra RM, Angulo FJ et al. Foodborne illness acquired in the United States—major pathogens. *Emerg Infect Dis*. 2011 Jan; 17(1):7-15.

[13] FoodNet Fast (depicting Pathogen Surveillance – *Yersinia*). Foodborne Diseases Active Surveillance Network (FoodNet), U.S. Centers for Disease Control and Prevention website. Updated September 23, 2021. Accessed October 26, 2021. https://wwwn.cdc.gov/foodnetfast/

[14] U.S. Centers for Disease Control and Prevention. Foodborne Diseases Active Surveillance Network (FoodNet): FoodNet 2015 Surveillance Report (Final Data). Atlanta, Georgia: U.S. Department of Health and Human Services, CDC. 2017. https://www.cdc.gov/foodnet/pdfs/FoodNet-Annual-Report-2015-508c.pdf

[15] *Yersinia enterocolitica* (Yersiniosis), Prevention. U.S. Centers for Disease Control and Prevention website. Updated May 25, 2016. Accessed May 11, 2021. https://www.cdc.gov/yersinia/prevention.html

Key Findings

Zika is an infectious disease caused by a virus that spreads to people mainly through bites of infected mosquitoes. Zika is also spread through sex with an infected partner, or from a pregnant woman to her developing baby. Zika virus infection during pregnancy can cause serious birth defects. Zika occurs in many tropical and subtropical areas of the world, including Africa, Asia, and Central and South America. The mosquitoes that can spread the Zika virus, *Aedes aegypti* and *Aedes albopictus*, have invaded many areas of California. To date, *Aedes* mosquitoes in California are not known to be infected with Zika, and locally acquired cases of Zika have not been reported.

Zika in California from 2017 through 2019

Total Cases: There were a total of 236 new Zika cases from 2017 through 2019. Required reporting for this disease in California began in mid-2016.

Rate: The average annual rate of new Zika cases during 2017-2019 was less than 1 case per 100,000 people in California.

- **By County**: The average rate was highest in San Francisco County (about 1 case per 100,000 people) and Sonoma County (less than 1 case per 100,000 people).
- **By Sex**: The average rates for both males and females were less than 1 case per 100,000 people, but females made up more than 75% of all new cases.
- **By Age Group**: The average rates were highest in children aged less than 1 year and adults aged 25 to 34 years (both with 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 Hispanic/Latino race/ethnicity (about 56%).

To prevent Zika, pregnant women should avoid traveling to areas where Zika is occurring. Anyone traveling in areas with Zika should prevent mosquito bites by using mosquito repellent on clothes and exposed skin, sleeping under a mosquito bed net, and keeping mosquitoes out of living spaces by using window and door screens. Because Zika can also spread through sex, it is important to use condoms, practice safe sex, and delay pregnancy if a person or their sexual partner has recently been in areas with Zika. Men should practice safe sex and delay pregnancy for 3 months, and women should practice safe sex and delay pregnancy for 2 months. Women planning pregnancy with a man who has recently been in areas with Zika should wait 3 months before trying to get pregnant. After returning from an area where Zika occurs, people should continue to use mosquito repellent for three weeks to prevent spreading Zika to mosquitoes around their home.

For more information about Zika in California, please visit the CDPH Zika webpage. For details about key infectious diseases in California, please visit the CDPH Surveillance and Statistics Section webpage.

Background

Zika virus disease is caused by a virus that is transmitted to people primarily through bites from infected mosquitoes, specifically *Aedes aegypti* and *Aedes albopictus*. Mosquitoes become infected when they bite and feed on a person who is already infected with the virus. Because the virus can be present in the semen and vaginal fluids of an infected person, as well as in blood and other tissue, transmission can also occur via unprotected sex, blood transfusion, or notably, from an infected pregnant woman to her fetus during pregnancy or around the time of birth.[1]

Many people infected with Zika virus are asymptomatic. Those who do have symptoms may develop fever, maculopapular rash, joint pain, and/or conjunctivitis about 3-7 days after exposure to the virus. Illness is usually mild and lasts up to 7 days. Death due to Zika is very rare.[2]

Pregnant women and their developing fetuses have the greatest risk of serious complications caused by Zika virus infection. In utero transmission of Zika virus can cause congenital abnormalities, including microcephaly, which is a birth defect that results in an abnormally small head and brain. Prenatal infection can also result in miscarriage, stillbirth, and premature birth.[3] Additionally, Guillain-Barré syndrome, an autoimmune disorder of the nervous system that causes muscle weakness and can result in paralysis, is associated rarely with Zika.[4]

There is no specific therapy for Zika. General treatment includes symptom management, rest, and hydration. For pain, acetaminophen should be taken instead of aspirin or non-steroidal anti-inflammatory drugs.[5] Pregnant women with Zika, as well as mothers exposed to Zika but without laboratory evidence of the virus, should be monitored by a healthcare provider during pregnancy to evaluate fetal development.[3] Currently, there is no vaccine that prevents Zika.[5]

Prior to 2015, Zika occurred primarily in areas of Africa, Southeast Asia, and the Pacific Islands. In May 2015, cases were detected for the first time in Brazil; the virus then spread rapidly and caused outbreaks in Mexico, the Caribbean, and countries throughout Central and South America.[6] Zika soon became widespread in the U.S. territories of Puerto Rico and U.S. Virgin Islands. The first cases identified in mainland U.S., including the first known case of Zika in California, were in 2015 among people who traveled outside of the U.S. to an area affected by Zika.[7] By 2016, Florida and Texas began reporting locally transmitted cases.[8] The *Aedes* mosquitoes that can spread the Zika virus have invaded many areas of California, but to date, there has been no known local mosquito-borne transmission of Zika in California.[9, 10] Required reporting of California Zika cases to the California Department of Public Health (CDPH) began on June 1, 2016; prior to this date, cases were reported under the general category of “unusual” diseases and were summarized by CDPH to describe travel-associated cases and assess the potential threat of local Zika virus transmission in California.[11, 12]

This report describes the epidemiology of confirmed and probable Zika cases, including symptomatic and asymptomatic cases, in California from 2017 (the first year case data were available for the full year) through 2019. Due to multiple factors that can contribute to underreporting, data in this report are likely underestimates of actual disease incidence. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes*.[13]

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 Zika to their local health department within one working day of identification or immediately by telephone if an outbreak is suspected.[14] Per CCR, Title 17, Section 2505, laboratories are required to report laboratory testing results suggestive of Zika virus 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.[15]

California regulations require cases of Zika to be reported to CDPH. CDPH counted cases that satisfied the U.S. Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists surveillance case definition of a confirmed or probable case. During the surveillance period (2017-2019), a confirmed case of Zika was defined as either an asymptomatic infection or an infection that meets clinical criteria for disease (clinically compatible illness, complication of pregnancy, or Guillain-Barré syndrome or other neurologic manifestations not explained by another etiology) that also has laboratory evidence of recent Zika virus infection by detection of Zika virus by culture, viral antigen or RNA in serum, cerebrospinal fluid (CSF), tissue, or other specimen, or has a positive Zika virus IgM antibody test of serum or CSF along with positive Zika virus neutralizing antibody titers and negative neutralizing antibody titers against dengue or other flaviviruses endemic to the region where exposure occurred. A probable case was defined as either an asymptomatic infection or an infection that meets clinical criteria for disease that also has laboratory evidence of recent Zika virus infection by positive Zika virus IgM antibody test of serum or CSF with either positive Zika virus neutralizing antibody titers against Zika virus, dengue virus, or other flaviviruses endemic to the region of exposure or a negative dengue IgM antibody test in the absence of a neutralizing antibody test.[16]

Epidemiology of Zika in California, 2017-2019

CDPH received reports of 236 total cases of Zika with estimated symptom onset dates from 2017 through 2019. The overall average annual incidence of Zika was 0.2 per 100,000 population. Zika incidence rates decreased 66.7% from 2017 (0.3 per 100,000; 133 cases) to 2019 (0.1 per 100,000; 35 cases) [Figure 1]. Of the 236 total cases, 127 (53.8%) were asymptomatic. At the time of infection, 124 (52.5%) case-patients were pregnant. No case-patients were reported to have died with Zika, and no pregnancy losses due to Zika-related birth defects were reported.

Fifteen (6.4%) case-patients were infants born with congenital infections; 9 (60.0%) of the 15 infants were born with Zika-related birth defects, including either microcephaly, intracranial calcifications, an abnormal hearing screen or eye exam, or an abnormal brain imaging or eye exam finding.

Of the 221 case-patients with non-congenital Zika, 200 (90.5%) case-patients reported traveling outside of the U.S. during the incubation period, and 21 (9.5%) case-patients either traveled outside the incubation period or provided insufficient travel-related information. Nine (4.1%) cases were sexually transmitted.

From 2017 through 2019, there were 9 California counties in which at least one Zika case occurred each year. Cases from these 9 counties accounted for 81.8% of the total Zika cases:

Los Angeles (47 cases), San Diego (37 cases), Santa Clara (24 cases), San Francisco (22 cases), Alameda (19 cases), Orange (19 cases), Sonoma (9 cases), San Mateo (9 cases), and Riverside (7 cases). Of these counties, San Francisco County (0.8 per 100,000) and Sonoma County (0.6 per 100,000) had the highest average annual incidence rates. By region (see *Technical Notes*), the Bay Area (0.4 per 100,000; 94 cases) and San Diego (0.4 per 100,000; 38 cases) regions had the highest average annual incidence rates [Figure 2].

The average annual incidence rate during the surveillance period was higher among females (0.3 per 100,000; 183 cases) than among males (0.1 per 100,000; 53 cases); 77.5% of Zika case-patients were female and 22.5% were male.

By age group, average annual Zika incidence was highest among children aged less than 1 year (0.4 per 100,000; 15 cases), followed by case-patients aged 25 to 34 years (0.2 per 100,000; 89 cases), and patients aged 15 to 24 years and 35 to 44 years (both 0.1 per 100,000; 49 cases).

For Zika cases with complete race/ethnicity information, the highest percentage of cases was in people who reported Hispanic/Latino race/ethnicity. Cases reported Hispanic/Latino race/ethnicity (55.6%) and non-Hispanic Asian/Pacific Islander race/ethnicity (29.2%) more frequently than would be expected compared to the percentage of these groups in California during the 2017-2019 time period (38.7% and 15.4%, respectively) [Figure 3].

Figure 1. Zika Cases and Incidence Rates by Year of Estimated Illness Onset, California, 2017-2019

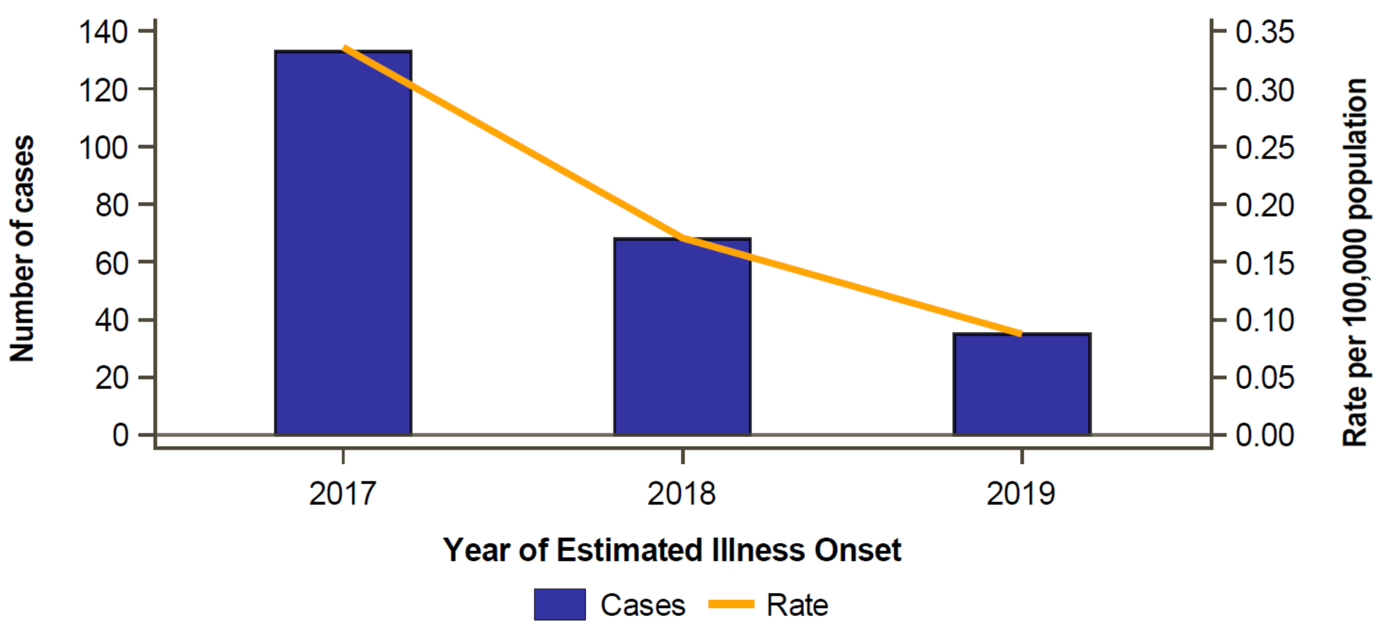


Figure 2. Zika Average Annual Incidence Rates by County, California, 2017-2019

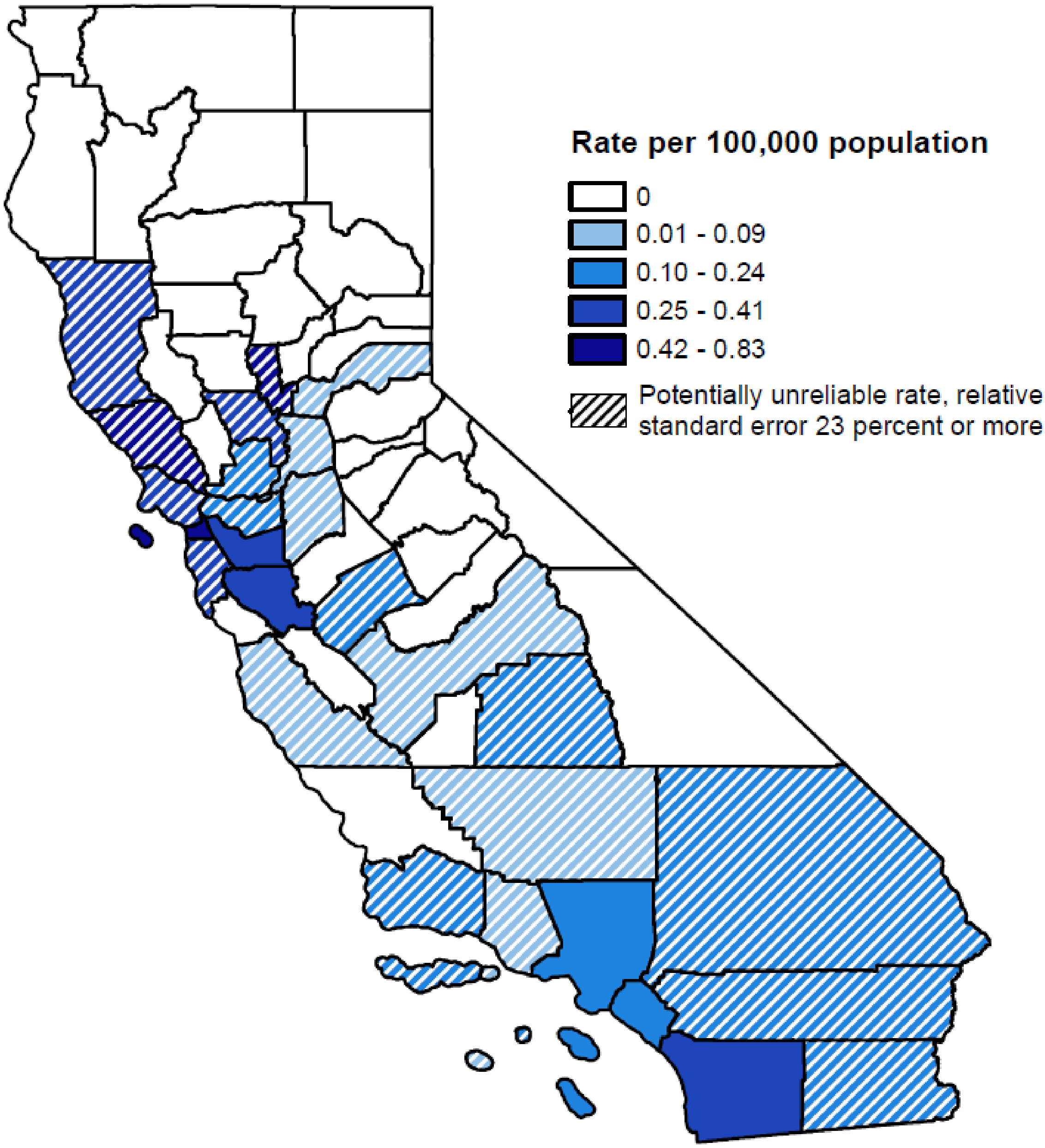
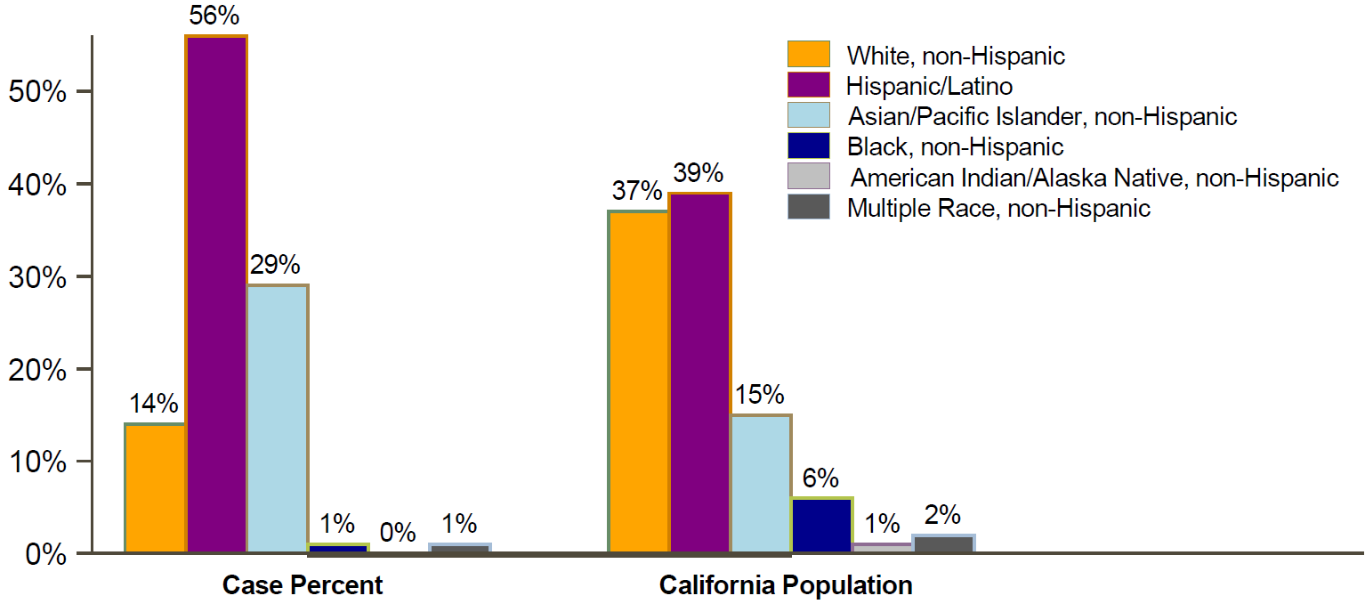


Figure 3. Zika Cases and Population by Race/Ethnicity, California, 2017-2019



35.6% (n=84) of reported incidents of Zika did not identify race/ethnicity and 3.4% (n=8) 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

Required reporting of Zika virus infection in California began on June 1, 2016. Therefore, this epidemiologic summary only covers the period of 2017 through 2019 for which case data were available for the full year. Descriptions of Zika virus cases in California in 2016 can be found in the CDPH *Vector-Borne Disease Section Annual Report, 2016*.[12]

Zika is currently rare in California; there were only 35 cases reported to CDPH in 2019. By 2019, the incidence of Zika cases worldwide had decreased substantially. While there were still outbreaks in isolated areas, the global pandemic was controlled. The decreasing incidence of Zika cases in California during the surveillance period (2017-2019) aligns with the decreasing global incidence and what would be expected of a travel-related illness.

The risk of serious complications caused by Zika virus infection to pregnant women and their developing fetuses may have biased Zika incidence in California. Due to the profound risk of birth defects, including microcephaly, from Zika infection during pregnancy, it was recommended that pregnant women be screened during their prenatal visits and tested for Zika if they or their partner had traveled to a region with ongoing Zika transmission. Also of note, although children aged less than 1 year had the highest average annual Zika incidence of all age groups during the surveillance period, all such case-patients were newborns who were exposed during pregnancy or around the time of birth to the Zika virus via their infected mother.

As *Aedes* mosquitoes have become established in cities throughout California in recent years, there is a potential for them to continue to spread to other areas of California.[9] The presence of

Aedes mosquitoes in California presents the risk that Zika virus could be transmitted locally from returned infected travelers. Although there have been no Zika virus-positive mosquitoes collected in California and no known locally acquired Zika cases detected in California to date, transmission is an ongoing concern in areas with *Aedes* mosquitoes as travelers return and visitors come from areas with Zika.[9, 10]

To prevent Zika, pregnant women should avoid traveling to areas where Zika is occurring. All individuals traveling in areas with Zika should prevent mosquito bites by using mosquito repellent on clothes and exposed skin, sleeping under a mosquito bed net, and keeping mosquitoes out of living spaces by using window and door screens. To prevent sexual transmission of Zika, sexual partners should use condoms and practice safe sex while in areas with Zika or if a sexual partner has recently traveled in areas with Zika. Individuals who have possible exposure to Zika through sex or travel should also delay pregnancy. Males who have traveled should practice safe sex and wait at least 3 months after return from travel or start of symptoms before trying to conceive. Females who have traveled should practice safe sex and wait at least 2 months after return from travel or start of symptoms before trying to conceive. Females planning pregnancy with a male who has possible exposure to Zika should wait at least 3 months after the male's return from travel or start of symptoms before trying to conceive. All persons with possible exposure to Zika through travel should use mosquito repellent for three weeks after returning from travel to prevent mosquitoes in local areas from becoming infected with Zika virus.

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References

[1] Zika Transmission. U.S. Centers for Disease Control and Prevention website. Updated July 24, 2019. Accessed March 5, 2021. https://www.cdc.gov/zika/prevention/transmission-methods.html

[2] Zika Virus Clinical Evaluation & Disease. U.S. Centers for Disease Control and Prevention website. Updated January 28, 2019. Accessed May 4, 2021. https://www.cdc.gov/zika/hc-providers/preparing-for-zika/clinicalevaluationdisease.html

[3] State of California, Department of Public Health. *Comprehensive Zika Virus Information for Healthcare Providers, January 2020.* Sacramento, CA; 2020. Accessed March 22, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/ZikaVirusInformationforHCPs.pdf

[4] Zika and Guillian-Barré Syndrome. U.S. Centers for Disease Control and Prevention website. Updated May 14, 2019. Accessed May 4, 2021. https://www.cdc.gov/zika/healtheffects/gbs-qa.html

[5] Zika Virus Treatment. U.S. Centers for Disease Control and Prevention website. Updated May 21, 2019. Accessed May 4, 2021. https://www.cdc.gov/zika/symptoms/treatment.html

[6] State of California, Department of Public Health. *Guidance for Surveillance of and Response to Invasive Aedes Mosquitoes and Dengue, Chikungunya, and Zika and California.* Sacramento, CA; 2020. Accessed March 22, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/InvasiveAedesSurveillanceandResponseinCA.pdf

[7] Porse CC, Messenger S, Vugia DJ, et al. Travel-Associated Zika Cases and Threat of Local Transmission during Global Outbreak, California, USA. *Emerg Infect Dis*. 2018;24(9):1626-1632. doi:10.3201/eid2409.180203

[8] Zika Virus, Statistics and Maps. U.S. Centers for Disease Control and Prevention website. Updated March 3, 2021. Accessed March 6, 2021. https://www.cdc.gov/zika/reporting/index.html

[9] *Aedes aegypti* and *Aedes albopictus* Mosquitoes. California Department of Public Health website. Updated April 19, 2021. Accessed May 4, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Aedes-aegypti-and-Aedes-albopictus-mosquitoes.aspx

[10] Zika. California Department of Public Health website. Updated February 7, 2021. Accessed March 22, 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Zika.aspx

[11] Porse C, Messenger S, Vugia DJ, et al. Travel-Associated Zika Cases and Threat of Local Transmission during Global Outbreak, California, USA. Emerging Infectious Diseases. 2018;24(9):1626-1632. doi:10.3201/eid2409.180203.

[12] Feiszli T, Wong J, Porse C and Metzger, M. Chapter 4: Mosquito-borne diseases. In: *Vector-Borne Disease Section Annual Report, 2016.* California Department of Public Health, Sacramento, California, 2017. pp 14-21. Accessed January 12, 2022. https://westnile.ca.gov/pdfs/VBDSAnnualReport16.pdf

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

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

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

[16] Zika Virus Disease and Zika Virus Infection 2016 Case Definition, Approved June 2016. National Notifiable Diseases Surveillance System, U.S. Centers for Disease Control and Prevention website. Accessed March 5, 2021. https://ndc.services.cdc.gov/case-definitions/zika-virus-disease-and-zika-virus-infection-2016-06-01/

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