

## 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.<sup>1, 2</sup> In 2018, the overall incidence rate of vibriosis in the U.S. was 0.9 cases per 100,000 population.<sup>3</sup> 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.<sup>4</sup>

*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.<sup>5, 6, 7</sup> Exposing wounds to seawater or contaminated raw shellfish harvested from such waters can also cause skin or soft tissue *Vibrio* infection.<sup>8</sup>

In the U.S., the most common species causing vibriosis are *V. parahaemolyticus*, *V. alginolyticus*, and *V. vulnificus*.<sup>1</sup> 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.<sup>9</sup> *V. alginolyticus* primarily causes soft tissue infections, including those involving the eye and ear.<sup>9, 10</sup> *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.<sup>9, 11</sup>

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*.<sup>12</sup> 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*.<sup>13, 14</sup>

## 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.<sup>15</sup> 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.<sup>16</sup>

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.<sup>17</sup>

## 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].

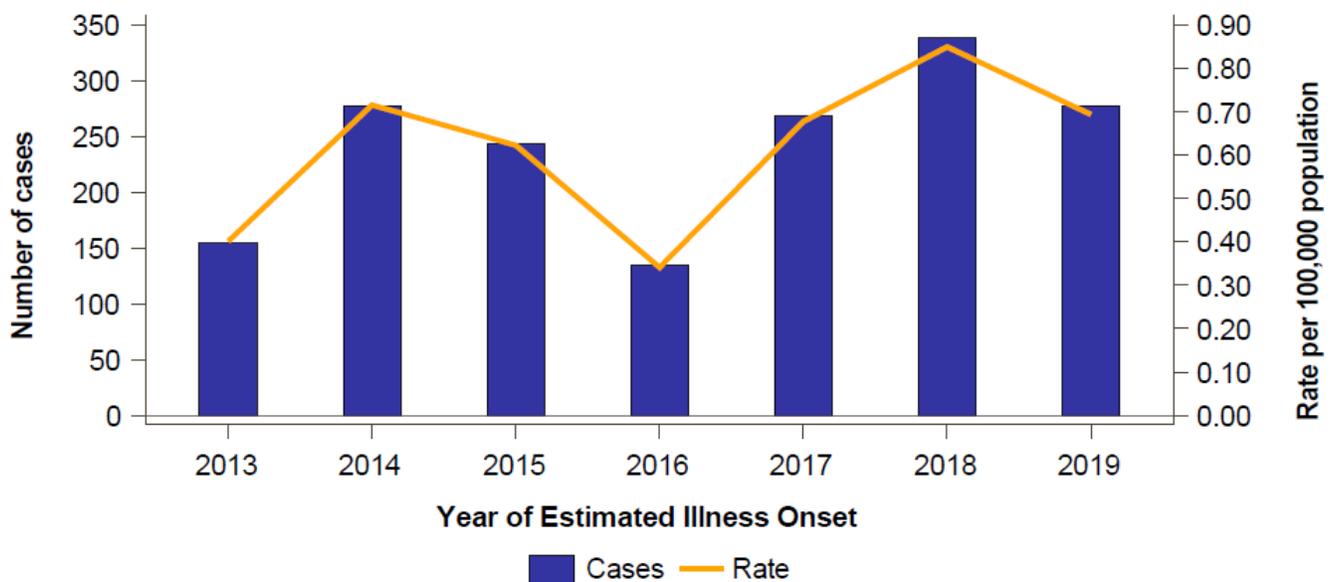
For vibriosis cases with complete race/ethnicity information (see *Technical Notes*), the highest percentage of cases was among those who reported non-Hispanic White race/ethnicity (59.6%). The percentage of cases among those who reported non-Hispanic White race/ethnicity is disproportionately higher 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].

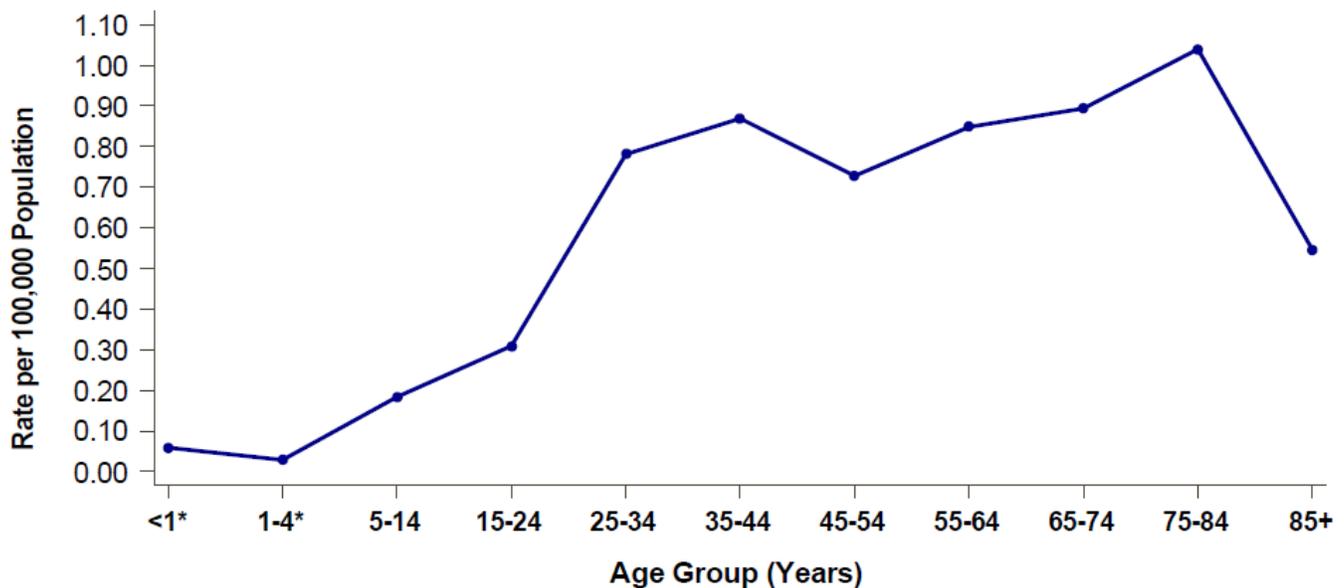
From 2013 through 2019, there were eight foodborne outbreaks of vibriosis involving 26 California case-patients. The greatest number of outbreaks occurred in 2019 (four outbreaks). Four outbreaks involved patients exposed in multiple states. For all eight outbreaks, *V. parahaemolyticus* was the identified species. One multi-state outbreak in 2019 involving multiple pathogens also identified non-toxigenic *V. cholerae*.<sup>18</sup> The implicated food source for all outbreaks was oysters from oyster beds outside of California.<sup>19</sup>

**Figure 1. Vibriosis (Non-Cholera) Cases and Incidence Rates by Year of Estimated Illness Onset, California, 2013-2019**



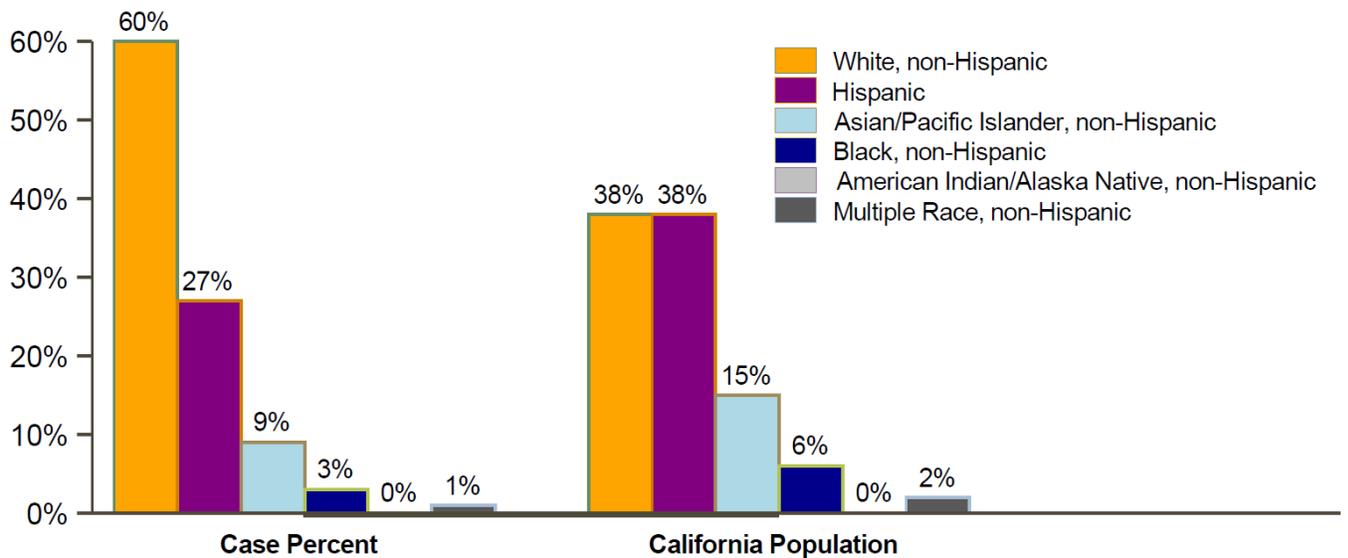


**Figure 3. Vibriosis (Non-Cholera) Average Annual Incidence Rates by Age Group, California, 2013-2019**



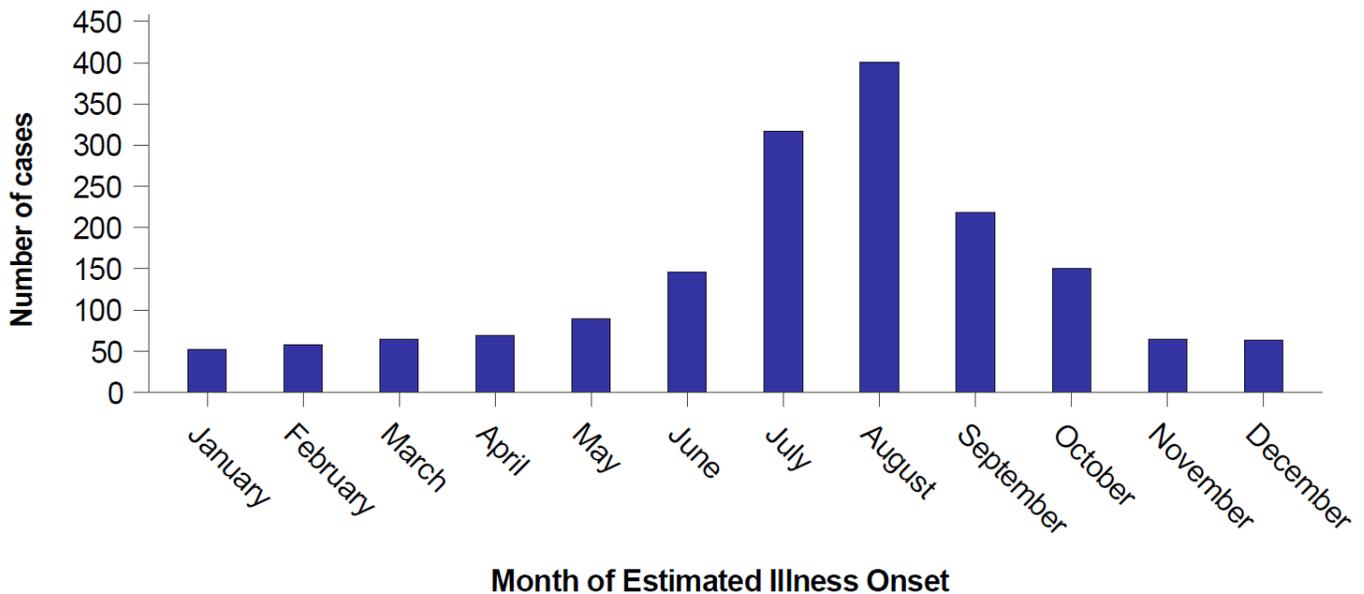
\*Potentially unreliable rate: relative standard error 23 percent or more.

**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).<sup>14</sup> 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.<sup>3</sup> 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).<sup>20, 21</sup> 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.<sup>22, 23</sup> 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.<sup>24</sup>

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.<sup>1</sup> *Vibrio* infections are often underdiagnosed, partly due to laboratories not routinely using media that are selective for *Vibrio* spp.<sup>25</sup> 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.<sup>16</sup> 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.<sup>26</sup> Thus, post-harvest measures to decrease contamination of oysters may need to be implemented more widely.<sup>27</sup> 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.<sup>28</sup>

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