

### Key Findings and Public Health Messages

- The California Department of Public Health (CDPH) received reports of 2,067 cases of *E. coli* O157:H7 infection with estimated onset dates from 2001 through 2008. This corresponds to an average annual incidence rate of 0.7 cases per 100,000 Californians.
- Average annual *E. coli* O157:H7 incidence rates for the surveillance period were higher among children 1 to 4 years of age (3.30 per 100,000), and 5 to 14 years of age (1.29 per 100,000). During the surveillance period, 179 *E. coli* O157:H7 infections progressed to hemolytic uremic syndrome (HUS) and 10 cases died with their infections.
- CDPH received reports of 336 cases of HUS with estimated symptom onset dates from 2001 through 2008. This corresponds to an average annual HUS incidence rate of 0.11 cases per 100,000 Californians.
- Average annual HUS incidence rates were higher among children 1 to 4 years of age (1.04 per 100,000), and 5 to 14 years of age (0.21 per 100,000). During the surveillance period, 11 cases were reported to have died with HUS and 179 cases were accompanied by a laboratory-confirmed *E. coli* O157:H7 infection.
- From 2001 through 2008, CDPH received reports of 22 confirmed and 2 suspected foodborne outbreaks of STEC in California involving 501 case-patients.
- Despite advances in food safety, STEC infections have remained level in California.

### Background

Shiga toxin-producing *Escherichia coli* (STEC) are important enteric bacterial pathogens in the United States (US), causing an estimated 110,000 infections, 3300 hospitalizations, and 91 deaths each year<sup>1</sup>. These diarrhea-causing *E. coli* are named for the potent cytotoxins (Shiga toxins 1 and 2) they produce. Among the many STEC serotypes, *E. coli* O157:H7 is the most frequently reported. Handling or consuming food contaminated by infected animals, especially cattle, are the leading sources of STEC infections. Direct exposure to infected persons or infected animals and their environments can also result in infection. The national *Healthy People 2010* target objective for *E. coli* O157:H7 is fewer than 1 new case per 100,000 population.

Acute illness, usually gastroenteritis, occurs after an incubation period of 3 to 4 days. About 8 percent of infections progress to hemolytic uremic syndrome (HUS). HUS is a delayed, life-threatening complication and is a leading cause of acute renal failure in US children. Approximately 85 percent of childhood HUS is preceded by an STEC infection. The fraction of HUS cases attributable to an antecedent STEC infection is large and onset of HUS may be delayed until after the STEC infection has cleared. Therefore, for surveillance purposes, post-diarrheal HUS cases without laboratory evidence of an STEC infection are presumed to be related to an undetected STEC infection.

We describe here the epidemiology of *E. coli* O157:H7 and HUS in California from 2001 through 2008. We also describe the numbers of cases in California in 2008 that were infections of non-O157:H7 STEC serogroups or were Shiga toxin fecal screening test positive with no further laboratory confirmation. Data for 2008 are provisional and may differ from data in future publications. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to Technical Notes<sup>2</sup>.

### California reporting requirements and surveillance case definitions

California Code of Regulations, Title 17, requires health care providers to report suspected cases of *E. coli* O157:H7 and HUS to their local health department immediately by telephone. Laboratories are also required to notify the local health

department within one working day after the health care provider has been notified that laboratory testing yielded evidence suggestive of *E. coli* O157:H7.

California regulations were expanded in late 2006 to require reporting of non-O157 STEC infections and cases in which Shiga toxin was detected in feces without further culture confirmation or serogroup identification. This latter requirement, which was considered fully implemented in 2008, was added because some commercial laboratories now test for Shiga toxin without subsequently confirming identification by culture or other means.

California regulations require local health officers to report to CDPH cases of STEC-related infections. California officially counted cases that satisfied the Centers for Disease Control and Prevention (CDC) surveillance case definition with minor modifications. CDC defined a confirmed case as one with isolation of STEC from a clinical specimen. CDC assumed serotype O157:H7 isolates were Shiga toxin-producing. For all other serotypes, CDC required evidence of toxin production or the presence of Shiga toxin genes. Although CDC also included a probable classification for case reporting, in practice, CDPH only counted confirmed cases. Although not included in the CDC case definition, CDPH began counting cases with Shiga toxin present in stool (in the absence of culture confirmation) to comply with regulatory changes in California. The CDC defined a confirmed case of HUS as one with anemia with microangiopathic changes or renal injury evidenced by either hematuria, proteinuria,

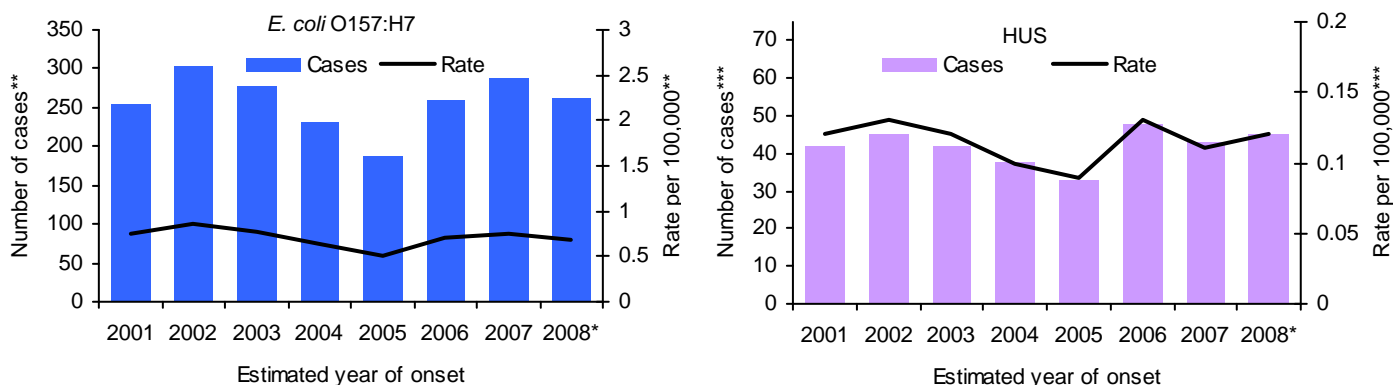
or elevated creatinine levels that began within three weeks of onset of acute or bloody diarrhea. A probable case was one with laboratory evidence of HUS but an unclear history of diarrhea or one that met all criteria for a confirmed case but did not have confirmed microangiopathic changes. CDPH counted both confirmed and probable HUS cases.

#### *Epidemiology of E. coli O157:H7*

CDPH received reports of 2,067 cases of *E. coli* O157:H7 infection with estimated onset dates from 2001 through 2008. This corresponds to an average annual incidence rate of 0.71 cases per 100,000 Californians. Incidence rates remained stable during the surveillance period (range: 0.51 to 0.86 per 100,000) [Figure 1]. A total of 179 infections progressed to HUS (8.7 percent) at the time of report [Figure 2] and 10 (0.5 percent) cases died with their infections. *E. coli* O157:H7 average annual incidence rates during the surveillance period were higher among children 1 to 4 years of age (3.30 per 100,000), and 5 to 14 years of age (1.29 per 100,000) [Figure 3]. The ratio of male to female cases was 0.9:1.0. Incidence rates by race/ethnicity were not calculated due to the substantial portion of missing data (22.8 percent). However, *E. coli* O157:H7 cases with complete data reported White, non-Hispanic race/ethnicity more frequently than would be expected based on the demographic profile of California [Figure 4].

Twenty-eight (48.3 percent) of 58 counties had an *E. coli* O157:H7 average annual incidence rate for the surveillance period that was above the national *Healthy People 2010* target [Figure 5]. Average

Figure 1. California *E. coli* O157:H7 and hemolytic uremic syndrome (HUS) case counts and incidence rates



annual incidence rates were 3.2 times higher in Northern California (1.16 per 100,000) than in Southern California (0.36 per 100,000). The Sierra (2.35 per 100,000), San Joaquin Valley (1.31 per 100,000) and Bay Area (1.18 per 100,000) regions reported the highest average incidence rates during the surveillance period.

From 2001 through 2008, CDPH received reports of 24 (22 confirmed, 2 suspected) foodborne outbreaks of STEC involving 501 cases. Only 1 outbreak was suspected to have been caused by a non-O157:H7 STEC. While the majority of outbreaks involved a single county, 6 (25.0 percent) involved exposures and residents in multiple counties and an additional 4 (16.7 percent) involved exposures and residents in multiple states. Among 13 (54.2 percent) confirmed outbreaks with a confirmed vehicle, the most common types of foods implicated were meats (7, 53.9 percent) and fruits and vegetables (4, 30.8 percent). The largest confirmed outbreak occurred in 2007, and involved 124 cases of *E. coli* O157:H7 infection associated with beef tri-tip.

#### Epidemiology of HUS

CDPH received reports of 336 cases of HUS with estimated symptom onset dates from 2001 through 2008. The average annual HUS incidence rate was 0.11 cases per 100,000 Californians and rates remained stable from 2001 to 2008 (range: 0.09 to 0.13 per 100,000) [Figure 1]. During the surveillance period, 11 (3.3 percent) cases were reported to have died with HUS and 179 (53.3 percent) cases were accompanied by a laboratory-confirmed *E. coli* O157:H7 infection [Figure 2]. Average annual HUS incidence rates were higher among children 1 to 4 years of age (1.04 per 100,000), and 5 to 14 years of age (0.21 per 100,000) [Figure 3]. The ratio of male to female cases was 0.8:1.0. Incidence rates by race/ethnicity were not calculated due to missing data (15.7 percent). However, HUS cases reported White non-Hispanic race/ethnicity more frequently than would be expected based on the demographic profile of California [Figure 4].

Similar to *E. coli* O157:H7 rates, the average annual incidence rate for HUS for the surveillance period was 3.0 times higher in Northern California (0.18 per 100,000) than in Southern California (0.06 per 100,000) [Figure 4]. From 2001 to 2008, incidence rates increased by 17.6 percent in Northern California (from 0.17 to 0.20 per 100,000) but decreased by 33.3 percent in Southern

Figure 2. Venn diagram of California *E. coli* O157:H7 and HUS cases 2001 - 2008\*

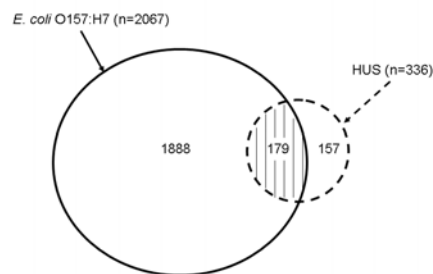


Figure 3. California *E. coli* O157:H7 and HUS incidence rates by age 2001-2008\*

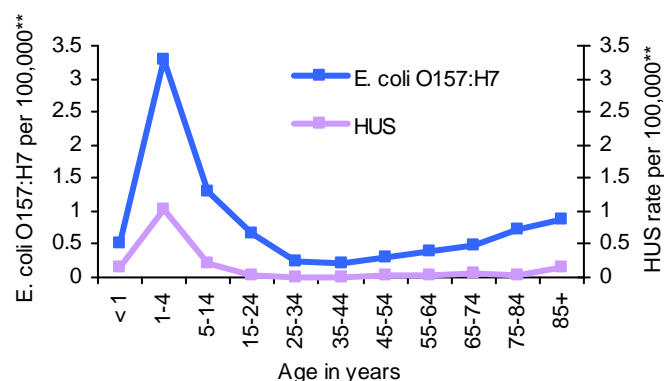
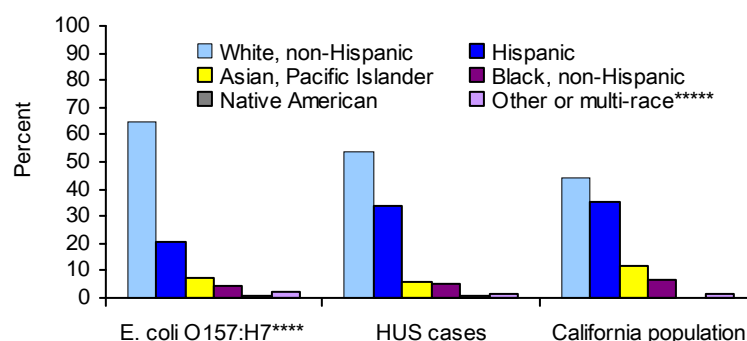


Figure 4. California *E. coli* O157:H7 and HUS cases and population by race/ethnicity 2001-2008\*



#### Notes for Figures 1-5

\*2008 data are provisional

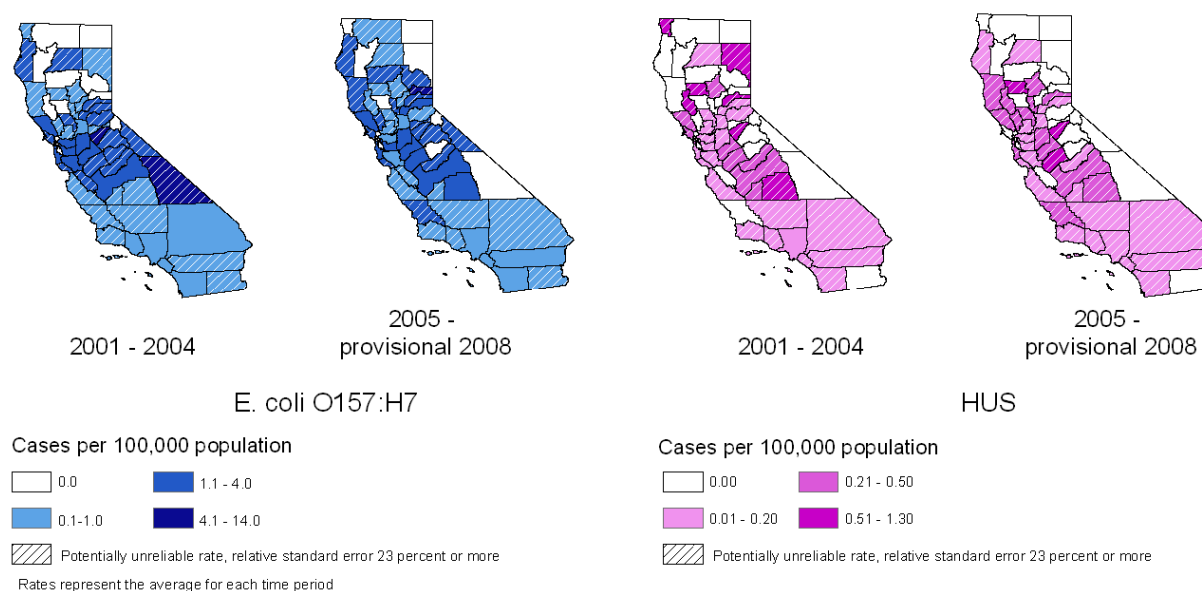
\*\* Includes cases accompanied by HUS

\*\*\* Includes cases with laboratory evidence of STEC

\*\*\*\* Unknowns were excluded

\*\*\*\*\* Includes cases who identified 'other' as their race and Californians ('population') who identified more than one race

Figure 5. California county-specific *E. coli* O157:H7 and HUS incidence rates



California (from 0.09 to 0.06 per 100,000).

#### *Non-O157:H7 STEC cases 2008*

CDPH received reports of 350 cases of STEC related infections and illnesses with estimated symptom onset dates in 2008. Of these cases, 36 (10.3 percent) were culture-confirmed as non-O157:H7 serogroups, 35 (10.0 percent) were Shiga toxin fecal screening test positive without further culture confirmation or identification, 263 (75.1 percent) were *E. coli* O157:H7 including 29 cases that were accompanied by HUS, and 16 (4.6 percent) were HUS without further laboratory evidence of STEC infection.

#### **Comment**

During the surveillance period, average annual incidence rates of *E. coli* O157:H7 infection and HUS were stable with only modest fluctuations. The statewide average annual incidence rate of *E. coli* O157:H7 infection for the surveillance period was just below the national *Healthy People 2010* target objective of 1 case per 100,000. However, many counties in Northern California reported average incidence rates above that threshold.

Despite advances in food safety, STEC infections have remained level during the surveillance period

in California. Preventing 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-related infections and illnesses.

#### **References and resources**

<sup>1</sup>Mead PS, Slutsker L, Dietz V et al. Food-related illness and death in the United States. *Emerg Infect Dis* 1999;5:607-25.

<http://www.cdc.gov/ncidod/eid/Vol5no5/pdf/mead.pdf>

<sup>2</sup>Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008: Technical Notes

<http://www.cdph.ca.gov/data/statistics/Documents/technicalnotes-episummary-aug2409.pdf>

California Department of Public Health information web page

<http://www.cdph.ca.gov/HealthInfo/discond/Pages/EscherichiacoliO157H7.aspx>

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