Escherichia coli O157 and other Shiga toxin-producing *Escherichia coli* (STEC) infections

Escherichia coli O157 (O157) is one of the most dreaded causes of infectious gastroenteritis. Bloody diarrhea is a hallmark of this pathogen, but the real danger is post-diarrheal hemolytic uremic syndrome (HUS). Oregon has been the setting for many O157 outbreaks, and the investigations of those outbreaks, combined with the analysis of other surveillance data, have contributed greatly to our understanding of this pathogen. Spread by the fecal-oral route, O157 has a number of animal reservoirs, the most important of which are ruminants: cattle, goats, sheep, deer, elk, etc. Transmission often occurs from consumption of contaminated food or water, as well as direct person-to-person spread and environmental exposures. Mid-to-late summer is the peak season for O157 infections.

With increasing deployment of diagnostic kits that identify Shiga toxin-producing *E. coli* (rather than O157 per se) comes an appreciation of the significant role that other STEC play as human pathogens. In the U.S. (and in Oregon), O26, O45, O103, O111, O121 and O145 are the most common "other" serogroups of the enterohemorrhagic *E. coli* making up about half of the reported cases. O157 infections are much more likely to result in HUS than is infection by STEC.

Over the past 10 years, the number of O157 cases reported statewide has ranged between 61 and 149 annually. After being relatively steady during 2008–2011, the number increased to 111 in 2012 but has regressed back to the mean with 74 cases reported in 2014.

As for the non-O157 serogroups, those case counts have increased steadily from single digits in 2007 and 2008 to 89 confirmed cases in 2014. Of the 163 confirmed STECs serotyped in 2014, 74 were O157, 89 were non-O157, including O26 (38), O103 (13), O121 (18) and 15 other serogroups.
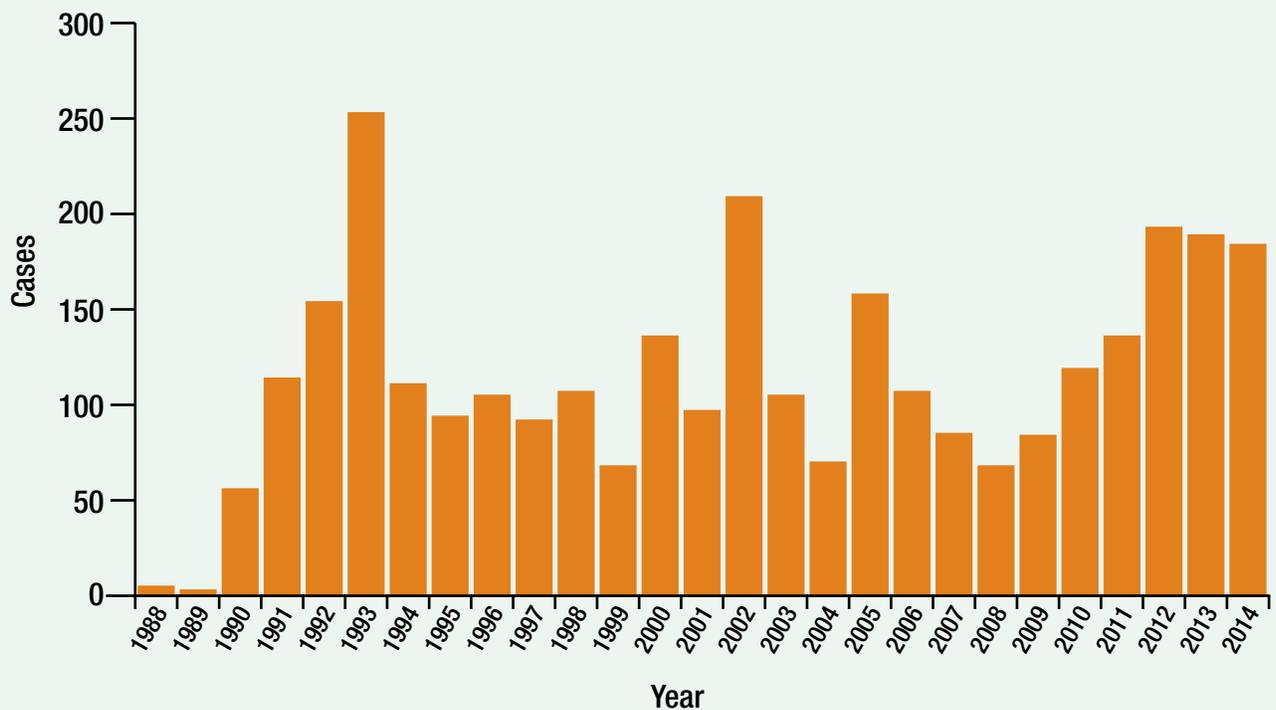
Several STEC outbreaks were investigated in 2014; single outbreaks were associated with swimming in a river, eating packaged salad greens, a petting zoo, a daycare and an indeterminate exposure. No source was confirmed for the outbreak, although environmental exposure to farm animals was likely the cause.

More labs are testing for the presence of Shiga toxin rather than just O157. Unfortunately, at the same time, many labs are dropping culture-based methods, leaving clinicians (and epidemiologists) in the dark as to the specifics of the
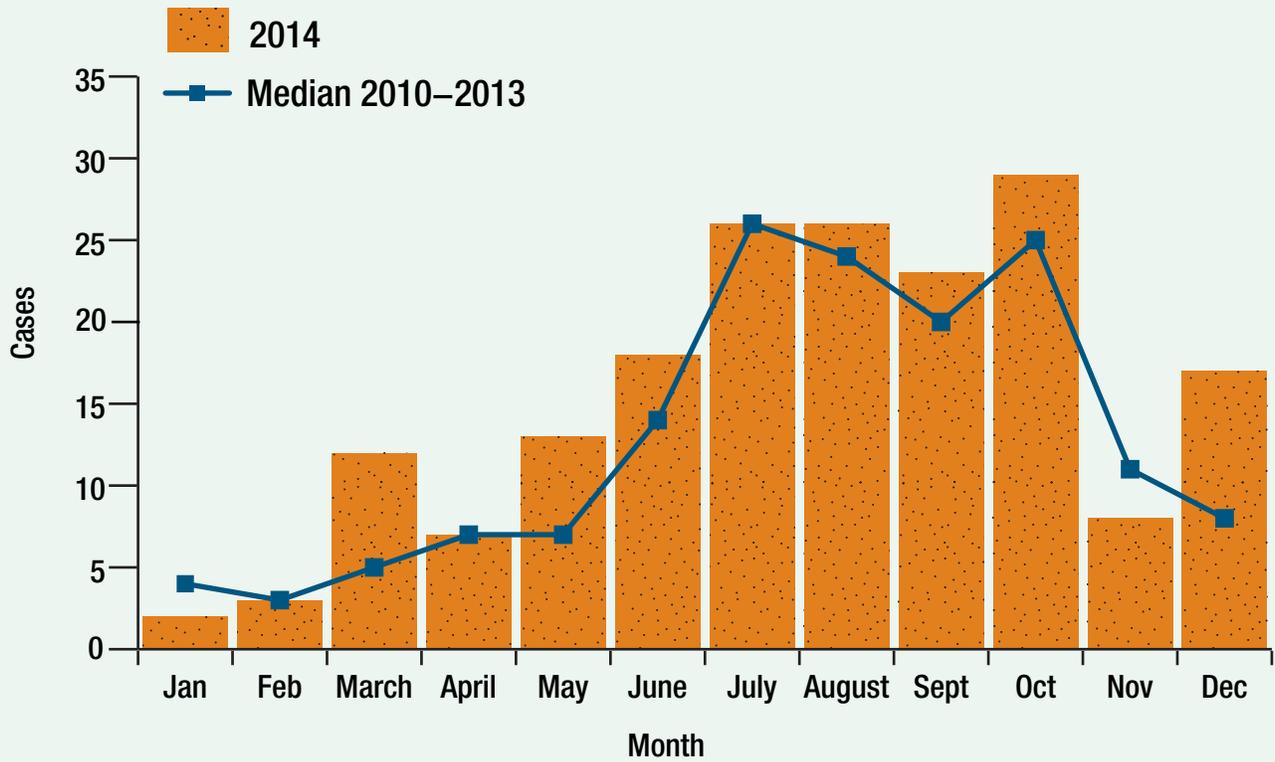
etiologic agent, and putting more of the diagnostic burden on the public health reference lab.

Much of the heavy lifting for prevention must be done upstream, with plans to minimize contamination of crops and processing equipment. Hazard Analysis and Critical Control Points (HACCP) practices focus on documenting and controlling risks during food processing and commercial food preparation, as well as efforts to control water and other potential environmental sources of infection.
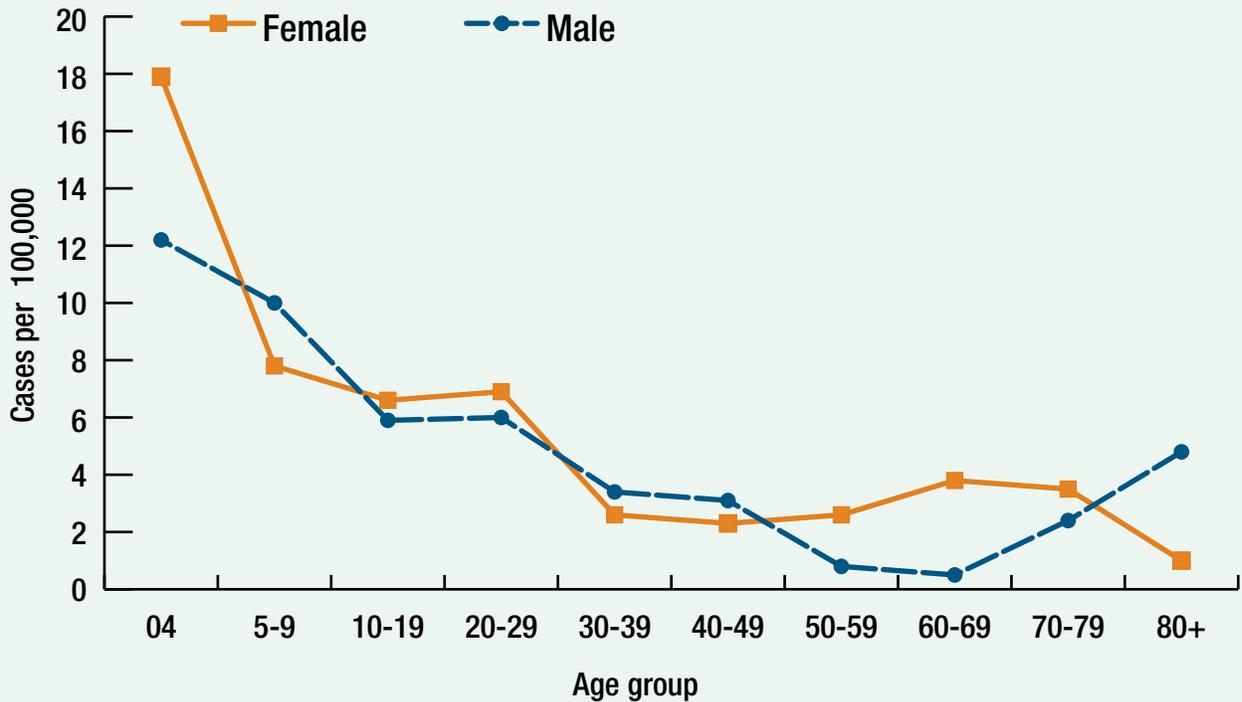
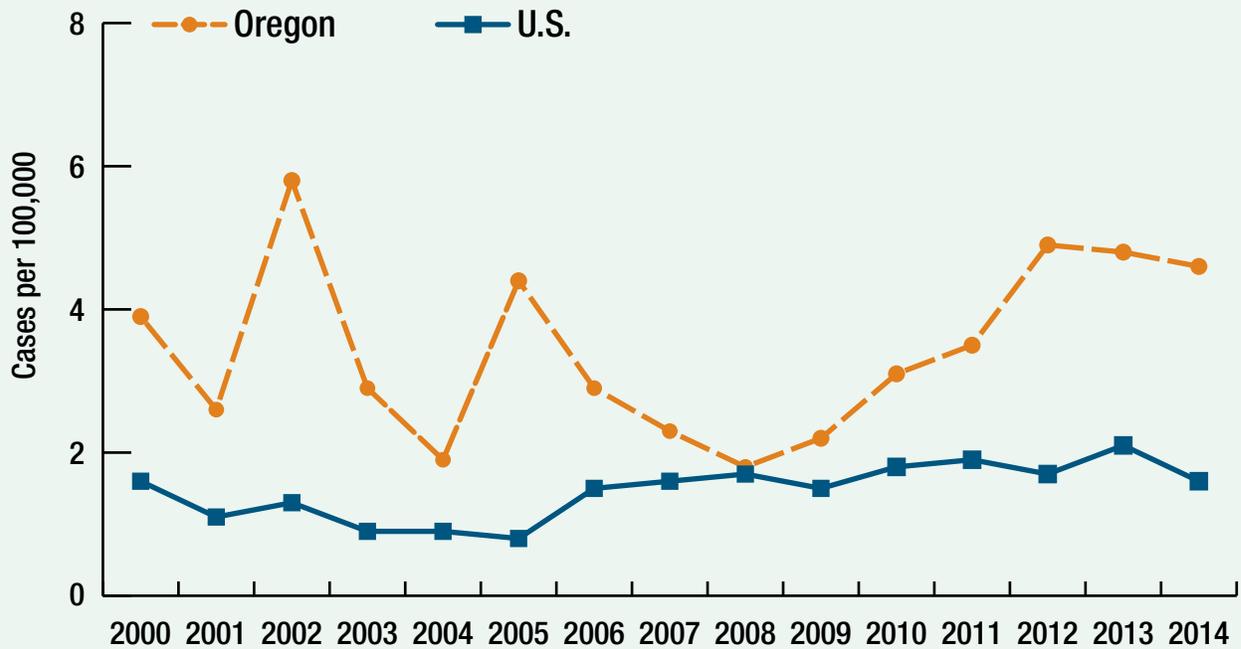## STEC infection (including *E. coli* O157) by year: Oregon, 1988–2014

STEC infection by onset month: Oregon, 2014

Legend: ▨ 2014; ■— Median 2010–2013

Y-axis: Cases (0–35)
X-axis: Month (Jan, Feb, March, April, May, June, July, August, Sept, Oct, Nov, Dec)

Incidence of STEC infection by age and sex: Oregon, 2014

Legend: ■— Female; ●-- Male

Y-axis: Cases per 100,000 (0–20)
X-axis: Age group (04, 5-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+)

Incidence of STEC infection: Oregon vs. U.S., 2000–2014

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Oregon	3.9	2.6	5.8	2.9	1.9	4.4	2.9	2.3	1.8	2.2	3.1	3.5	4.9	4.8	4.6
U.S.	1.6	1.1	1.3	0.9	0.9	0.8	1.5	1.6	1.7	1.5	1.8	1.9	1.7	2.1	1.6

Incidence of STEC infection, O157 vs non-O157 type: Oregon, 2004–2014
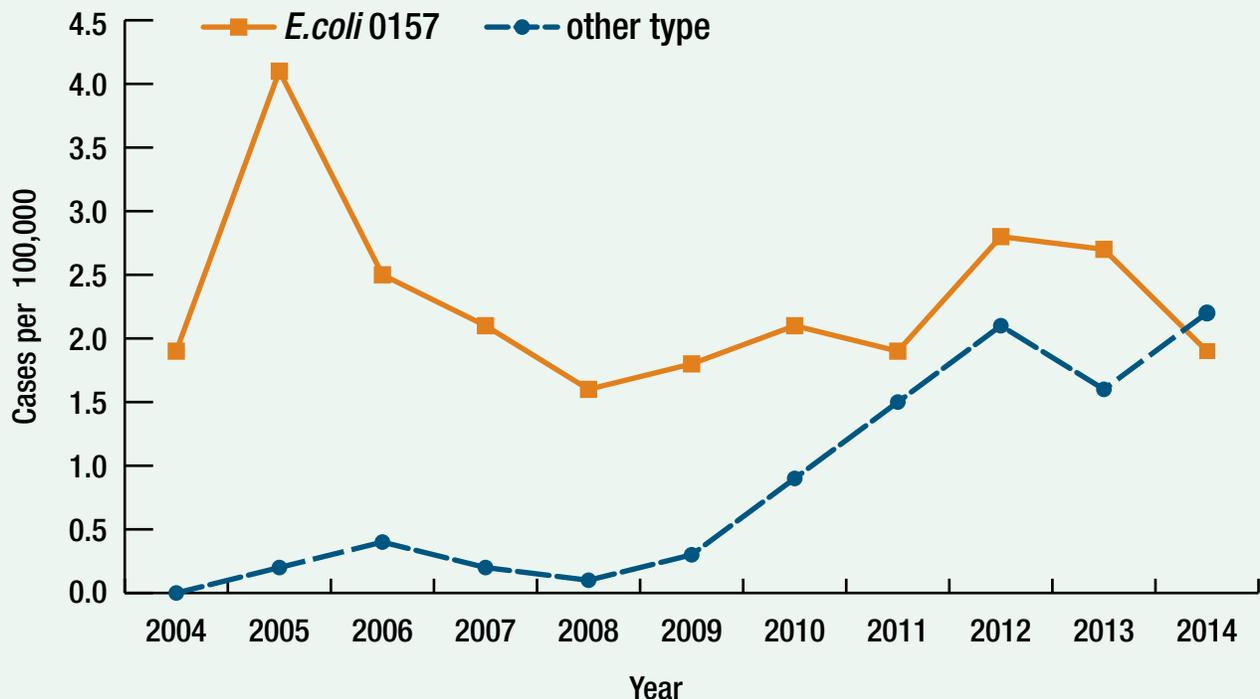
Incidence of STEC infection by county of residence: Oregon, 2005–2014

Cases per 100,000

	0.0
	0.1 - 3.1
	3.2 - 5.3
	5.4 - 7.2
	7.3 - 13.1
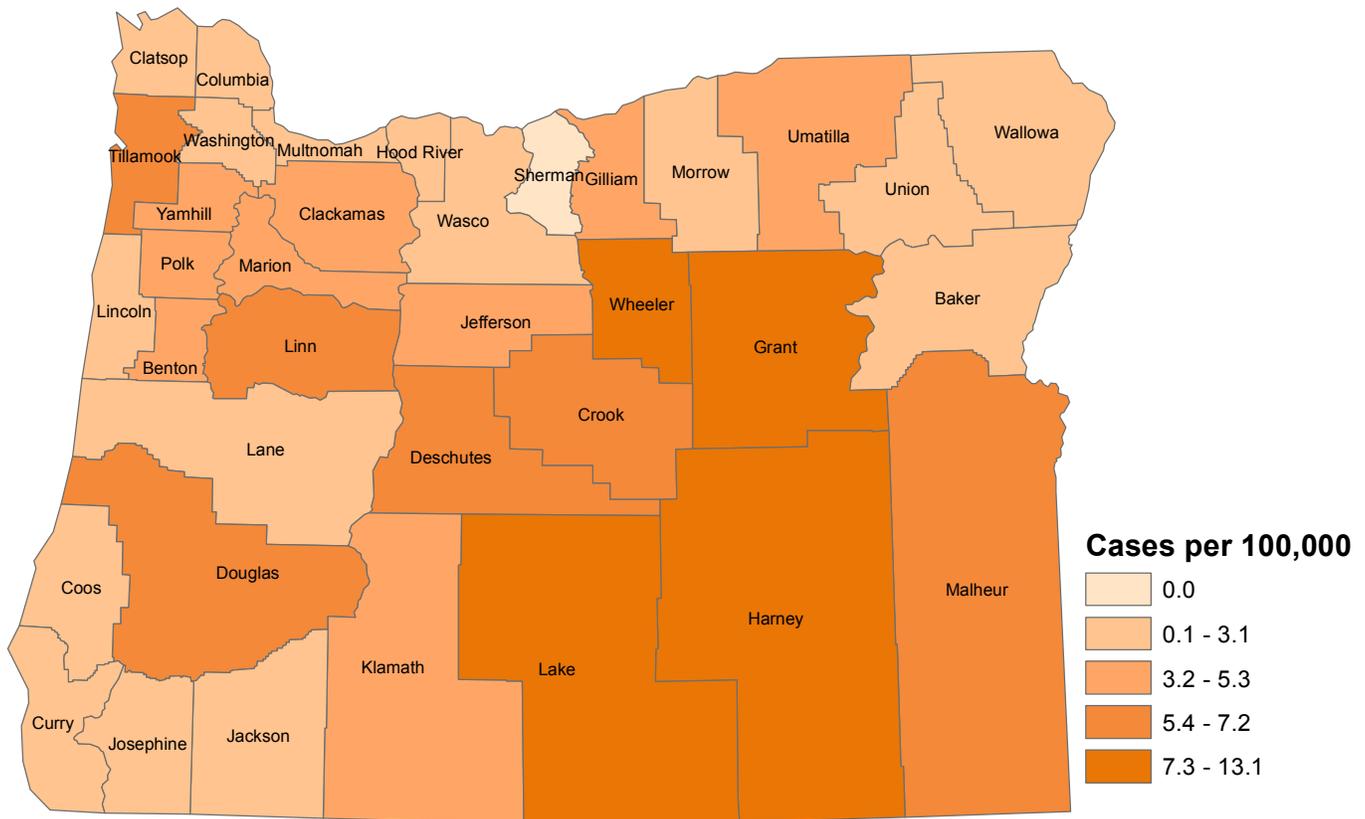
Prevention

- Wash hands with soap carefully and frequently, especially after going to the bathroom, after changing diapers or after touching livestock. Supervise hand washing of toddlers and small children after they use the toilet.

- Do not work or attend daycare, serve or prepare food, or work in health care while ill with diarrhea.

- Practice safe food handling. Rinse raw produce thoroughly under running tap water; separate uncooked meats from vegetables, cooked foods and ready-to-eat foods; and cook meat to the proper temperatures.

- Do not drink raw milk and do not eat foods that have unpasteurized milk in them.