

SPORADIC CASES OF HEMORRHAGIC ESCHERICHIOSIS

ESCHERICHIA COLI O157:H7 (“O157”) is an important cause of bloody and non-bloody diarrhea, as well as the major cause of pediatric and perhaps adult hemolytic uremic syndrome (HUS). This issue reviews O157 infections in Oregon and the U.S. and new data about sporadic infections.

O157 infections became reportable in Oregon in mid-1990, and the number of cases reported annually since 1991 has ranged from 90–244 (median, 105; see graph). O157 reporting in Oregon is relatively “mature” compared to many of the United States, reflecting the longer history of reporting, generally better physician awareness, and relatively sensitive laboratory practices. Thus, Oregon’s case rate (~3.3/100,000/year) is probably closer to reality than rates derived from national tallies. (2,741 cases were reported to CDC in 1996.) Even in Oregon, though, reported case totals underestimate the true burden of illness. Many persons suffer without seeking medical care; many physicians do not obtain cultures; many laboratories do not look for the pathogen; blah, blah, blah. (A 1996 survey of Oregon laboratories that do stool cultures showed that 74% routinely culture for O157; an additional 22% routinely culture all bloody diarrhea for O157.) The true national incidence has been guesstimated at 10,000–20,000 cases per year (and let’s not ignore asymptomatic infections, which are common).

Since 1982, many outbreaks of O157 infection have been described in the literature. While undercooked hamburger has been repeatedly implicated,^{1,2} raw milk, apple cider, venison, salad bar fixings, lettuce, and alfalfa sprouts have also been identified as vehicles in food-borne outbreaks.³⁻⁷ Outbreaks have also been linked to person-to-person transmission: in day-care centers, from swimming in contaminated lake water, and by consumption of sewage-contaminated drinking water.⁸⁻¹⁰

The vast majority of O157 infections are “sporadic,” however, with no identified link to any other case; only 224 (25%) of the 891 cases reported in Oregon from 1991–97 were outbreak-associated. Almost by definition, the specific exposures responsible for sporadic infections are rarely confirmable.

SURVEY METHODS

To identify risky foods and practices associated with sporadic O157 infection, the FoodNet project, which is part of the Emerging Infections Program, recently completed a case-control study in FoodNet surveillance areas.* A case was defined as a person with culture-confirmed O157 infection with specimen collection date occurring between March 27, 1996, and March 26, 1997, inclusive. Cases were excluded if they:

- lived outside of Oregon;
- were not reachable by phone;
- did not speak English;
- were unable to answer questions;
- had no history of diarrhea or were unable to provide a diarrhea onset date;
- had onset of diarrhea more than 10 days before the specimen collection date;
- had onset of diarrhea within 28 days of another culture-confirmed case of O157 infection within the same household (i.e., were secondary cases); or
- were part of an outbreak where the source was clearly identified.

Cases and controls were interrogated over the telephone by trained personnel using a standardized questionnaire. Cases were interviewed within 21 days of the date of the fateful specimen collection. Two age- and phone prefix-matched controls were found for each case.

Controls were excluded if they:

- resided outside of Oregon;
- did not speak English;
- were unable to answer questions;

- had diarrhea within 28 days of the matched case’s onset; or
- had a household member with culture-confirmed O157 infection within 28 days of the matched case’s onset.

We asked about food consumption in the 5 days prior to illness, food handling practices, medication use, contact with animals, and travel outside the country.

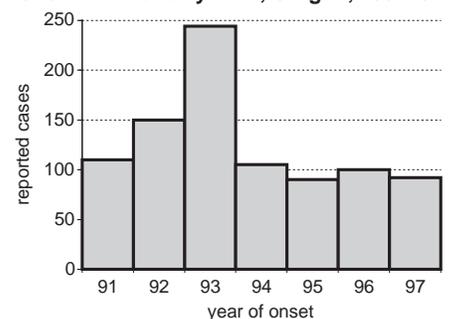
An exposure was considered to be a risk factor if the matched odds ratio (OR) was significantly greater than one. Similarly, an exposure was considered to be “protective” if the OR was significantly less than one.

RESULTS

Seventy-four cases of culture-confirmed O157 infection were reported in Oregon during the one-year period. Twenty-three (31%) of the cases were hospitalized, and one died. Sixteen cases did not meet the inclusion criteria and were excluded from the study. Fifty-eight cases were enrolled in the study, each with two age-matched controls. Cases and controls did not differ significantly with regard to age, sex, race, education or income.

Only two potential exposures from a long list were associated with an increased risk: visiting or living on a farm (OR=2.8; 95% CI, 1.2-7.0) and, more specifically, visiting or living on a farm where there are cows (OR=3.5; 95% CI, 1.1-13.0). Only a minority of cases had these risks, however, making the population “attributable risk” low.

O157 Infections by Year, Oregon, 1991–97



*Oregon, Minnesota, and parts of California, Connecticut, and Georgia

Neither eating hamburger, eating in restaurants or fast-food outlets, nor spending time in day-care facilities was associated with sporadic infections. Consumption of several foods (lettuce at home, raw carrots, celery, cantaloupe, and honeydew melon) was found to be protective—i.e., associated with a *reduced* risk of infection.

DISCUSSION

Data from many studies suggest that cattle feces in one guise or another are the most common source of human infections, although it is now clear that they are not the only source. The relative importance of domesticated and wild animals in the maintenance and distribution of O157 is much less clear, however, as is the potential role of environmental “reservoirs” such as water, soil, or animal feeds. Our finding that farm exposure (particularly when cows are present) is associated with risk of infection is certainly consistent with the importance of animal contact, but obviously leaves many questions unanswered.

In this study, hamburger consumption per se was not associated with sporadic illness. Why not? One possibility is that times have changed. We would like to believe that the steady drumbeat of publicity about the hazards of rare or raw ground beef—particularly since the Jack-in-the-Box outbreak in 1993—has translated into more people cooking their burgers well done, and there is some evidence to support this. In addition, changes in meat processing may well have translated into a reduced likelihood of meat being contaminated in the first place. Still, a recent telephone survey

found that 20% of Oregonians prefer their burgers pink, although we don't know how often this blood lust is satisfied. The small numbers of cases in this study may have precluded our finding a significant association. No association with hamburger consumption *sensu lato* was seen when Oregon data were aggregated with other FoodNet sites, but in that analysis consumption of *pink* hamburgers or *pink* ground beef (OR=3.5; 95% CI, 1.7-7.3) was a risk factor,¹¹ consistent with several older studies.

Despite growing concern about the risk of foodborne illness arising from contaminated produce, we identified no such risks in this study. The statistical “power” of this kind of study to detect genuine but low risk exposures is limited, of course, or it could be that sporadic infections are rarely attributable to contaminated veggies. While not terribly profound, it is also plausible that persons who eat lots of produce are less likely to eat lots of meat. So if consumption of flesh is associated with increased risk, vegetable eaters would tend to be at reduced risk.

Persons who dine out were not at a greater risk for sporadic O157 infection than those who eat at home. Although many of us have the tendency to impute our gastrointestinal woes to the last meal that was prepared by somebody else, it appears that home cookin' may not be appreciably safer than commercial stuff. Certainly it is easier to detect restaurant-associated outbreaks, which can affect dozens or thousands of persons, than two or three cases in a household caused by similar mishandling.

CONCLUSION

The O157 story is more complicated than just rare burgers, and the source of most sporadic infections remains obscure. In the meantime, we ask you to encourage your patients to wash their hands, cook their meat well, and enjoy (but don't cross-contaminate) their fruits and vegetables.

REFERENCES

1. Riley LW, Remis RS, Helgerson SD, et al. Hemorrhagic colitis associated with a rare *Escherichia coli* serotype. *N Engl J Med* 1983; 308:681-685.
2. Bell BP, Goldoft M, Griffin PM, et al. A multistate outbreak of *Escherichia coli* O157:H7-associated bloody diarrhea and hemolytic uremic syndrome from hamburgers: the Washington experience. *JAMA* 1994; 272:1349-1353.
3. Keene WE, Hedberg K, Herriott DE, et al. A prolonged outbreak of *Escherichia coli* O157:H7 infections caused by commercially distributed raw milk. *J Infect Dis* 1997; 176:815-818.
4. Besser RE, Lett SM, Weber JT, et al. An outbreak of diarrhea and hemolytic uremic syndrome from *Escherichia coli* O157:H7 in fresh-pressed apple cider. *JAMA* 1993; 269:2217-2220.
5. Keene WE, Sazie E, Kok J, et al. An outbreak of *Escherichia coli* O157:H7 infections traced to jerky made from deer meat. *JAMA* 1997; 27:1229-1231.
6. Ackers M, Mahon E, Leahy E, et al. An outbreak of *Escherichia coli* O157:H7 infections associated with leaf lettuce consumption, Western Montana [abstract K43]. In: *Abstracts of the 36th ICAAC*. Washington: ASM, 1996; 257.
7. CDC. Outbreaks of *Escherichia coli* O157:H7 infection associated with eating alfalfa sprouts—Michigan and Virginia, June-July 1997. *MMWR* 1997; 46:741-744.
8. Spika JS, Parsons JE, Nordenberg D, et al. Hemolytic uremic syndrome and diarrhea associated with *Escherichia coli* O157:H7 in a day care center. *J Pediatr* 1986; 109:287-291.
9. Keene WE, McNulty JM, Hoesly FC, et al. A swimming-associated outbreak of hemorrhagic colitis caused by *Escherichia coli* O157:H7 and *Shigella sonnei*. *N Engl J Med* 1994; 331:579-584.
10. Swerdlow DL, Woodruff BA, Brady RC, et al. A waterborne outbreak in Missouri of *Escherichia coli* O157:H7 associated with bloody diarrhea and death. *Ann. Intern. Med.* 1992; 117:812-819.
11. Kassenborg H, Hedberg C, Evans M, et al. Case-control study of sporadic *Escherichia coli* O157:H7 infections in 5 FoodNet sites. In: *Programs and Abstracts of the International Conference on Emerging Infectious Diseases*. Washington: ASM, 1998; 50.