Escherichia coli O157:H7

Important: CDC encourages consumers to check the labels on frozen steak products

Frequently Asked Questions

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- What can you do to prevent E. coli O157:H7 infection?

Escherichia coli O157:H7 is an emerging cause of foodborne illness. An estimated 73,000 cases of infection and 61 deaths occur in the United States each year. Infection often leads to bloody diarrhea, and occasionally to kidney failure. Most illness has been associated with eating undercooked, contaminated ground beef. Person-to-person contact in families and child care centers is also an important mode of transmission. Infection can also occur after drinking raw milk and after swimming in or drinking sewage-contaminated water.

Consumers can prevent E. coli O157:H7 infection by thoroughly cooking ground beef, avoiding unpasteurized milk, and washing hands carefully. Because the organism lives in the intestines of healthy cattle, preventive measures on cattle farms and during meat processing are being investigated.
What is *Escherichia coli* O157:H7?

*E. coli* O157:H7 is one of hundreds of strains of the bacterium *Escherichia coli*. Although most strains are harmless and live in the intestines of healthy humans and animals, this strain produces a powerful toxin and can cause severe illness.

*E. coli* O157:H7 was first recognized as a cause of illness in 1982 during an outbreak of severe bloody diarrhea; the outbreak was traced to contaminated hamburgers. Since then, most infections have come from eating undercooked ground beef.

The combination of letters and numbers in the name of the bacterium refers to the specific markers found on its surface and distinguishes it from other types of *E. coli*.

How is *E. coli* O157:H7 spread?

The organism can be found on a small number of cattle farms and can live in the intestines of healthy cattle. Meat can become contaminated during slaughter, and organisms can be thoroughly mixed into beef when it is ground. Bacteria present on the cow’s udders or on equipment may get into raw milk.

Eating meat, especially ground beef, that has not been cooked sufficiently to kill *E. coli* O157:H7 can cause infection. Contaminated meat looks and smells normal. Although the number of organisms required to cause disease is not known, it is suspected to be very small.

Among other known sources of infection are consumption of sprouts, lettuce, salami, unpasteurized milk and juice, and swimming in or drinking sewage-contaminated water.

Bacteria in diarrheal stools of infected persons can be passed from one person to another if hygiene or handwashing habits are inadequate. This is particularly likely among toddlers who are not toilet trained. Family members and playmates of these children are at high risk of becoming infected.

Young children typically shed the organism in their feces for a week or two after their illness resolves. Older children rarely carry the organism without symptoms.

What illness does *E. coli* O157:H7 cause?

*E. coli* O157:H7 infection often causes severe bloody diarrhea and abdominal cramps; sometimes the infection causes nonbloody diarrhea or no symptoms. Usually little or no fever is present, and the illness resolves in 5 to 10 days.

In some persons, particularly children under 5 years of age and the elderly, the infection can also cause a complication called hemolytic uremic syndrome, in which the red blood cells are destroyed and the kidneys fail. About 2%-7% of infections lead to this complication. In the United States, hemolytic uremic syndrome is the principal cause of acute kidney failure in children, and most cases
of hemolytic uremic syndrome are caused by *E. coli* O157:H7.

**How is *E. coli* O157:H7 infection diagnosed?**

Infection with *E. coli* O157:H7 is diagnosed by detecting the bacterium in the stool. Most laboratories that culture stool do not test for *E. coli* O157:H7, so it is important to request that the stool specimen be tested on sorbitol-MacConkey (SMAC) agar for this organism. All persons who suddenly have diarrhea with blood should get their stool tested for *E. coli* O157:H7.

**How is the illness treated?**

Most persons recover without antibiotics or other specific treatment in 5-10 days. There is no evidence that antibiotics improve the course of disease, and it is thought that treatment with some antibiotics may precipitate kidney complications. Antidiarrheal agents, such as loperamide (Imodium), should also be avoided.

Hemolytic uremic syndrome is a life-threatening condition usually treated in an intensive care unit. Blood transfusions and kidney dialysis are often required. With intensive care, the death rate for hemolytic uremic syndrome is 3%-5%.

**What are the long-term consequences of infection?**

Persons who only have diarrhea usually recover completely.

About one-third of persons with hemolytic uremic syndrome have abnormal kidney function many years later, and a few require long-term dialysis. Another 8% of persons with hemolytic uremic syndrome have other lifelong complications, such as high blood pressure, seizures, blindness, paralysis, and the effects of having part of their bowel removed.

**What can be done to prevent the infection?**

*E. coli* O157:H7 will continue to be an important public health concern as long as it contaminates meat. Preventive measures may reduce the number of cattle that carry it and the contamination of meat during slaughter and grinding. Research into such prevention measures is just beginning.

**What can you do to prevent *E. coli* O157:H7 infection?**

Cook all ground beef and hamburger thoroughly. Because ground beef can turn brown before disease-causing bacteria are killed, use a digital instant-read meat thermometer to ensure thorough cooking. Ground beef should be cooked until a thermometer inserted into several parts of the patty, including the thickest part, reads at least 160°F. Persons who cook ground beef without using a thermometer can decrease their risk of illness by not eating ground beef patties that are still pink in the middle.

If you are served an undercooked hamburger or other ground beef product in a restaurant, send it back for further cooking. You may want to ask for a new bun
and a clean plate, too.

Avoid spreading harmful bacteria in your kitchen. Keep raw meat separate from ready-to-eat foods. Wash hands, counters, and utensils with hot soapy water after they touch raw meat. Never place cooked hamburgers or ground beef on the unwashed plate that held raw patties. Wash meat thermometers in between tests of patties that require further cooking.

Drink only pasteurized milk, juice, or cider. Commercial juice with an extended shelf-life that is sold at room temperature (e.g. juice in cardboard boxes, vacuum sealed juice in glass containers) has been pasteurized, although this is generally not indicated on the label. Juice concentrates are also heated sufficiently to kill pathogens.

Wash fruits and vegetables thoroughly, especially those that will not be cooked. Children under 5 years of age, immunocompromised persons, and the elderly should avoid eating alfalfa sprouts until their safety can be assured. Methods to decontaminate alfalfa seeds and sprouts are being investigated.

Drink municipal water that has been treated with chlorine or other effective disinfectants.

Avoid swallowing lake or pool water while swimming. See more information about this.

Make sure that persons with diarrhea, especially children, wash their hands carefully with soap after bowel movements to reduce the risk of spreading infection, and that persons wash hands after changing soiled diapers. Anyone with a diarrheal illness should avoid swimming in public pools or lakes, sharing baths with others, and preparing food for others.

For more information about reducing your risk of foodborne illness, visit the US Department of Agriculture’s Food Safety and Inspection Service website at: http://www.fsis.usda.gov or the Partnership for Food Safety Education at: For more advice on cooking ground beef, visit the U.S. Department of Agriculture web site at: http://www.fsis.usda.gov/OA/topics/gb.htm
### Escherichia coli O157:H7

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<th><strong>Clinical Features</strong></th>
<th>Acute bloody diarrhea and abdominal cramps with little or no fever; usually lasts 1 week.</th>
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<tr>
<td><strong>Etiologic Agent</strong></td>
<td><em>Escherichia coli</em> serotype O157:H7. Gram-negative rod-shaped bacterium producing Shiga toxin(s).</td>
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<td><strong>Incidence</strong></td>
<td>An estimated 73,000 cases occur annually in the United States. Uncommonly reported in patients in less industrialized countries.</td>
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<td><strong>Sequelae</strong></td>
<td>Hemolytic uremic syndrome (HUS): Persons with this illness have kidney failure and often require dialysis and transfusions. Some develop chronic kidney failure or neurologic impairment (e.g., seizures or stroke). Some have surgery to remove part of the bowel. Estimated 61 fatal cases annually; 3-5% with HUS die.</td>
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<td><strong>Costs</strong></td>
<td>Estimated 2,100 hospitalizations annually in the United States. The illness is often misdiagnosed; therefore, expensive and invasive diagnostic procedures may be performed. Patients who develop HUS often require prolonged hospitalization, dialysis, and long-term follow-up.</td>
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<td><strong>Transmission</strong></td>
<td>Major source is ground beef; other sources include consumption of unpasteurized milk and juice, sprouts, lettuce, and salami, and contact with cattle. Waterborne transmission occurs through swimming in contaminated lakes, pools, or drinking inadequately chlorinated water. Organism is easily transmitted from person to person and has been difficult to control in child day-care centers.</td>
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<tr>
<td><strong>Risk Groups</strong></td>
<td>All persons. Children &lt;5 years old and the elderly are more likely to develop serious complications.</td>
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<td><strong>Surveillance</strong></td>
<td><em>E. coli</em> O157:H7 infection is nationally reportable and is reportable in most U.S. states. HUS is also reportable in most states.</td>
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Trends
Since the first description of this illness in 1982, infections have been reported from >30 countries on six continents. The use of subtyping by pulsed-field gel electrophoresis and comparison of patterns by PulseNet has increased the ability to identify outbreaks.

Challenges
Developing farm and slaughterhouse-based methods to decrease contamination of meat; encouraging use of irradiation to increase the safety of ground beef; identifying ways to prevent contamination of foods eaten raw (e.g., produce); educating the U.S. public to cook ground beef thoroughly, preferably using a digital instant-read thermometer; convincing clinical laboratories to screen for \textit{E. coli} O157:H7 in stools from persons with bloody diarrhea; conducting population-based surveillance for HUS and determining which serotype of Shiga toxin-producing \textit{E. coli} was responsible for illness; identifying other vehicles of transmission; developing an international network for subtyping and communicating about outbreaks.

Opportunities
Learning more about the ecology of this organism in cattle and other ruminants may help in devising methods to decrease its prevalence in food animals. Learning how this pathogen contaminates produce items could lead to measures that would increase their safety. Decreasing the incidence of these infections would decrease HUS, the major cause of kidney failure in children in the United States. Transmission in day-care centers highlights need for better infection-control practices.

December 2000
Surveillance

CDC currently has six surveillance systems for obtaining information about *E. coli* O157:H7. They serve different purposes and provide information on various features of the organism's epidemiology.

- **Public Health Laboratory Information System (PHLIS)**
  PHLIS is a passive, laboratory-based surveillance system that collects data about many infections, including *E. coli* O157:H7. Reporting is limited to illnesses that are confirmed by culture and verified at the state public health laboratory. After verification, information about the infection is reported electronically to CDC by the state [http://www.cdc.gov/ncidod/dbmd/phlisdata](http://www.cdc.gov/ncidod/dbmd/phlisdata).

- **National Electronic Telecommunications System for Surveillance (NETSS)**
  NETSS is a passive, physician-based surveillance system that captures both laboratory-confirmed and clinically suspected cases of all nationally notifiable diseases, including *E. coli* O157:H7. The number of illnesses reported through NETSS tends to be higher than the number reported through PHLIS because NETSS does not require confirmation by the state public health laboratory. More information on NETSS can be found at [http://www.cdc.gov/epo/dphsi/netss.htm](http://www.cdc.gov/epo/dphsi/netss.htm).

  *E. coli* O157:H7 infections and other surveillance data collected by NETSS is published weekly in the CDC Morbidity and Mortality Report (MMWR) and can be found at [http://www2.cdc.gov/mmwr](http://www2.cdc.gov/mmwr).

The MMWR also publishes an annual summary of the NETSS *E. coli* O157:H7 surveillance data; this information can be found at [http://www2.cdc.gov/mmwr/summary.html](http://www2.cdc.gov/mmwr/summary.html).

- **FoodNet**
  The Foodborne Diseases Active Surveillance Network (FoodNet) is an active surveillance system for identifying and characterizing culture-confirmed infections that may be foodborne, including *E. coli* O157:H7. FoodNet workers regularly contact more than 300 laboratories for confirmed cases of foodborne infections in several states encompassing a population of more than 25 million persons. In addition to monitoring the number of *E. coli* O157:H7 infections, investigators monitor laboratory techniques for isolation of bacteria, perform case-control studies of ill persons to determine foods associated with illness, and
administer questionnaires to people living in FoodNet sites to better understand trends in the eating habits of Americans. Annual FoodNet reports that include data about E. coli O157:H7 can be found at http://www.cdc.gov/foodnet/annuals.htm.

More information on FoodNet can be found at http://www.cdc.gov/foodnet.

- **National Molecular Subtyping Network for Foodborne Diseases Surveillance (PulseNet)**
  PulseNet is a national network of public health laboratories that perform pulsed-field gel electrophoresis (PFGE), a type of DNA "fingerprinting", on certain foodborne bacteria, including E. coli O157:H7. PFGE "fingerprint" patterns are submitted electronically to CDC and can be compared rapidly with others in a large database. This system can help determine if individual infections are related or if an outbreak is occurring. PulseNet is not a surveillance system itself but a laboratory subtyping method used in surveillance. More information on PulseNet can be found at http://www.cdc.gov/pulsenet

- **National Antimicrobial Resistance Monitoring System (NARMS)**
  NARMS is a passive surveillance system that monitors antimicrobial resistance of E. coli O157:H7 and selected other bacteria that cause human illness. NARMS is a collaboration between CDC, 16 state and local health departments, the Food and Drug Administration (FDA), and the United States Agricultural Department (USDA). More information on NARMS can be found at http://www.cdc.gov/narms.

- **Foodborne Outbreak Detection Unit**
  CDC monitors outbreaks of foodborne disease, including outbreaks caused by Shigella. Each year, state and territorial epidemiologists voluntarily (passively) report the results of outbreak investigations to CDC. While outbreaks account for a small percentage of the total number of illnesses that occur each year, these investigations provide valuable information about sources of foodborne infection and often highlight important prevention opportunities. The latest summaries of foodborne outbreaks can be found at http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/ss4901a1.htm.

Annual summaries of E. coli O157:H7 outbreaks are reported to the Council of State and Territorial Epidemiologists. The most recent annual reports can be found at the following links:

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<th>pdf files - will open in a new browser window</th>
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<td>Surveillance for Outbreaks of <em>Escherichia coli</em> O157:H7 Infection; Summary of 1999 Data</td>
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MMWR Articles
Outbreaks of *Escherichia coli* O157:H7 Infections Among Children Associated With Farm Visits --- Pennsylvania and Washington, 2000 MMWR April 20, 2001 / Vol. 50 / No. 15
Outbreak of *Escherichia coli* O157:H7 and Campylobacter Among Attendees of the Washington County Fair --- New York, 1999 MMWR September 17, 1999/ Vol. 48 / No. 36
Outbreaks of *Escherichia coli* O157:H7 Infection and Cryptosporidiosis Associated with Drinking Unpasteurized Apple Cider - Connecticut and New York, October 1996 MMWR January 10, 1997 / Vol. 46 / No. 1
Outbreak of *E. coli* O157:H7 Infections Associated with Drinking Unpasteurized Commercial Apple Juice - October 1996 MMWR November 9, 1996 / Vol. 45 / No. 44
Outbreak of Acute Gastroenteritis Attributable to *Escherichia coli* Serotype O104:H21 - Helena, Montana, 1994 MMWR July 14, 1995 / Vol. 44 / No. 27

*Escherichia coli* O157:H7 Outbreak at a Summer Camp - Virginia, 1994 MMWR June 9, 1995 / Vol. 44 / No. 22

Links
FoodNet
PulseNet
*E. coli* Index

References
Mahon BE, Griffin PM, Mead PS, Tauxe RV. Hemolytic uremic syndrome surveillance to monitor trends in infection with *Escherichia coli* O157:H7 and other shiga toxin-producing *E. coli*. Emerg Infect Dis 1997; 3:409-12.