

E.COLI O157

INFORMATION AND GUIDANCE

2019



1. Key <i>E. coli</i> O157 and other Shiga toxin-producing <i>E. coli</i> (STEC) Information	2
2. Shiga toxin-producing <i>Escherichia coli</i> (STEC).....	3
3. Growth and survival characteristics	3
4. Sources and routes of transmission.....	3
5. Human disease symptoms.....	4
Human disease incidence	4
6. Foodborne outbreaks	5
7. Legislation	5
8. Control in the food chain.....	5
9. Relevant guidance for food businesses	6
10. References	7

1. Key *E. coli* O157 and other Shiga toxin-producing *E. coli* (STEC) Information

Common sources	Raw/undercooked Beef, raw/undercooked lamb, fresh produce, unpasteurised dairy products, untreated water or private water supplies that have not been adequately treated
Transmission mode	Mainly through ingestion of contaminated foods, but also by direct or indirect contact with animals, contaminated water and person to person spread
Occurrence	Anyone can become ill from STEC however infection rates are highest in children
Reservoir	Mainly ruminants such as cattle, sheep and goats including calves, lambs and kids. Some wild animals have also been found to harbour STEC including deer.
Incidence of disease in Scotland	Most years there are about 250 laboratory confirmed cases of STEC reported in Scotland, and an incidence rate of about 4.5 per 100,000. This incidence in Scotland is the highest in the UK.
Symptoms	Watery or bloody diarrhoea, abdominal pain, fever and vomiting, in severe cases HUS or death
Time between catching an infection and symptoms appearing	1-10 days
Duration of illness	Average of 5-7 days
Infection control	Even if not handling food as their job, symptomatic individuals should not, if possible, prepare food for others until 48 hours after symptoms cease.
Prevention tips	<ul style="list-style-type: none"> • Wash hands properly (i.e. before handling food, after toileting, contact with animals and handling raw meat) • Cooking properly kills any harmful bacteria • Ensure food is thoroughly cooked (cook through till 75°C reached) • Use separate chopping boards and utensils, when preparing raw and ready-to-eat foods or wash thoroughly between uses • Store raw meats in sealed containers at bottom of fridge

2. Shiga toxin-producing *Escherichia coli* (STEC)

E. coli is a bacterium that is commonly found in the gut of humans and warm-blooded animals. Most strains of *E. coli* are harmless and able to live in host intestines without causing any problems, however there are some like Shiga toxin-producing *E. coli* (STEC)¹ that are able to cause illness.

STEC are gram negative, rod-shaped bacteria and are characterised by the production of Shiga (Stx) toxins. There are estimated to be over 100 different STEC serotypes associated with human illness².

The predominant STEC strain that causes serious illness in the UK is *E. coli* O157:H7, however there are many other non-O157 STEC that can cause illness.

3. Growth and survival characteristics

STEC have been demonstrated to survive a wide range of growth parameters.

Parameter	Optimum	Range
Temperature (°C)	37°C [∧]	7-50°C [∞]
Atmosphere		Can grow in presence or absence of O ₂ [∧]
Water activity (a _w)	0.995 [∧]	0.95-0.98 [∞]
pH	6-7 [∧]	4-9 ^{†∞}
NaCl (%)	0.5% [†]	0.5-5.0% [∞]

(*Doyle and Schoeni 1984, [†]Miller and Kaspar 1994, [∞]WHO 2016, [∧]New Zealand Ministry of Health, 2001, [∞]Buchanan and Doyle 1997, [†]Abdulkarim et al., 2009)

4. Sources and routes of transmission

Ruminants, such as cattle, sheep, and goats, are considered the main reservoirs of STEC. STEC can also be found in the environment and can colonise the gastrointestinal tract of other farmed animals as well as wild and domesticated animals and birds. STEC usually does not show any clinical signs in their animal hosts, however can cause severe clinical disease in humans.

Transmission pathways can be foodborne, waterborne, environmental, person to person (secondary spread) or direct contact with animals and their faeces (by the faecal-oral route). Transmission to humans can occur through the ingestion of contaminated food, for example, by raw or undercooked meat products, unpasteurised dairy products or fresh produce (e.g. salad and vegetables). Cross-contamination can also be a factor in the transmission of STEC via food, for example during the preparation of raw foods, any STEC present can contaminate surfaces, utensils and ready-to-eat-foods. Environmental transmission can infect humans by contact with infected animals or accidental ingestion of STEC via the faecal-oral route by touching places that their faeces may have been such as grazing land,

¹ STEC can be used interchangeably with VTEC (verocytotoxigenic *E. coli*)

² WHO/CSR/APH (1998) Zoonotic non-O157 Shiga toxin-producing *Escherichia coli* (STEC). Report of a WHO Scientific Working Group Meeting, 23-26 June, Berlin, Germany

fences/gates, footwear/clothing worn on farms. STEC can also be acquired through drinking untreated or inadequately treated water. Poor personal hygiene may contribute to environmental transmission or to person to person transmission (known as secondary cases). Person to person transmission has been reported in family households, nurseries and care homes where there is close personal contact with a patient (i.e. the person who has contracted STEC via the faecal-oral route) and often where there have been reported issues with hygiene.

5. Human disease symptoms

Symptoms of STEC infection range from asymptomatic infection, to mild non-bloody diarrhoea, through to bloody diarrhoea (around half of people infected will have bloody diarrhoea), abdominal pain and occasionally fever. Some people may go on to develop very serious complications such as haemolytic uraemic syndrome (HUS) (this is a complication in which the toxins attack the kidneys), and in a small number of cases infection may prove fatal. HUS causes renal failure, large bowel inflammation, destruction of red blood cells, low platelet count, intravascular haemolysis and thrombocytopenia, which may result in serious disability. Approximately, 10-15% of people infected with STEC go on to develop HUS. Children are the group most at risk of developing severe complications. The incubation period for diarrhoeal illness caused by STEC O157 infection is usually three to four days, with a range of one day to ten days, but has been occasionally recorded as long as 14 days. However, even longer incubation periods have also been noted.

Most patients with non-severe symptoms recover within 5-7 days, but the bacteria can still be present in the faeces for longer. The infective dose of *E. coli* O157 is estimated to be very low, and as few as 10-100 organisms can cause infection³.

Human disease incidence

STEC can affect any age group across a population but most often a higher incidence of disease is reported in children. In Scotland there were 158 reported cases of *E. coli* O157 and 59 non-O157 STEC in 2017. The incidence of STEC in Scotland in 2017 was 4.1 cases per 100,000 people⁴.

This data is collated and published by HPS and can be accessed by this link: <https://hps-beta.azurewebsites.net/web-resources-container/stec-in-scotland-2017-enhanced-surveillance-and-reference-laboratory-data/>

³Teunis PFM, Ogden ID & Strachan NJC. (2008). Hierarchical dose response of *E. coli* O157:H7 from human outbreaks incorporating heterogeneity in exposure. *Epidemiology and infection*, **136**(6), 761-770.

⁴ Gastrointestinal and Zoonoses Team and Scottish *E. coli* O157/STEC Reference Laboratory. (2018). STEC in Scotland 2017: enhanced surveillance and reference laboratory data.

6. Foodborne outbreaks

The majority of STEC cases tend to be sporadic but outbreaks can occur. Foods that have been implicated in foodborne outbreaks include: raw or undercooked minced beef and beef products, unpasteurised dairy products and water sources (i.e. inadequately treated private water supplies and recreational waters). In recent years there has been an increasing number of outbreaks associated with fresh produce e.g. spinach, sprouted seeds or lettuce. It is likely these outbreaks are due to contamination of soil or irrigation water by STEC from farmed or wild animals.

In Scotland, although the majority of cases are sporadic, outbreaks can occur. In Scotland during 2017 there were three outbreaks of STEC reported⁴, one each of O157, O145 and O26. Health Protection Scotland monitor and report foodborne outbreaks and more information can be found through their [website](#).

7. Legislation

Food businesses must comply with food law and the following regulations listed here apply to STEC:

- [Regulation \(EC\) No 2073/2005](#) on microbiological criteria for foodstuffs
- [Regulation \(EC\) No 852/2004](#) on the hygiene of foodstuffs
- [Regulation \(EC\) No 853/2004](#) laying down specific hygiene rules for food of animal origin

8. Control in the food chain

Key behaviours that food handlers should carry out, whether in a domestic or commercial kitchen:

- wash hands thoroughly and frequently using soap and warm water, before handling food, after toileting and especially after handling raw meat
- cook food thoroughly as this will kill STEC (cook until the internal temperature reaches 75°C)
- keep kitchen areas clean
- prevent cross-contamination by keeping raw and cooked foods separate, e.g. using separate chopping boards and utensils, and keeping stored food covered
- keep raw meat on the bottom shelf, in a sealable container or covered so it can't drip onto other food
- keep unwashed and raw fruit and vegetables separate from ready-to-eat food
- when washing raw vegetables (that may be covered in soil) avoid cross-contamination by rubbing them in a bowl of water to avoid splashing. Clean the vegetables thoroughly.

See the [CookSafe guide](#) for more information on the processes.

Cases with STEC infection and their contacts, who are more likely to pass on the infection, such as food handlers will be required to stay away from work until they are tested to ensure they are clear of infection. Public/Environmental health will advise.

All cases, even if not in a high risk group, should be advised to refrain from attending work or educational establishments until 48 hours after diarrhoea and/ or vomiting have resolved.

9. Relevant guidance for food businesses

Cross-contamination guidance

This is [guidance](#) produced for food business to help clarify the steps needed to take control, avoid food becoming contaminated with *E. coli* O157 and other STEC and to protect customers from food poisoning.

Manure guidance for growers

This is [guidance](#) that provides advice on good practices for fresh produce growers and especially of ready-to-eat crops as it explains how to manage farm manures to reduce the risk of microbiological contamination.

Fresh produce tool

This is a [free resource](#) that can help with the food safety management and manage microbiological contamination risk in your business if you grow fresh produce.

Other useful links

[HPS public information leaflet](#)

[PHE STEC information leaflet for cases](#)

10. References

- Abdulkarim, S.M. and Fatimah, A.B. and Anderson, J.G. (2009) Effect of salt concentrations on the growth of heat-stressed and unstressed escherichia coli. *Journal of Food Agriculture and Environment*, 7 (3-4). pp. 51-54.
- Buchanan RL and Doyle MP. (1997). Foodborne Disease Significance of Escherichia coli O157:H7 and other Enterohemorrhagic E. coli. *Institute of Food Technologists – Food Technology Magazine*, 51(10): 69-76
- Corrigan JJ and Boineau FG. (2001) Hemolytic-Uremic Syndrome. *Pediatrics in Review*, 22 (11), 365-369.
- Doyle MP, & Schoeni JL. (1984). Survival and growth characteristics of Escherichia coli associated with hemorrhagic colitis. *Applied and Environmental Microbiology*, 48(4), 855-856.
- Kintz E, Brainard J, Hooper L, & Hunter P. (2017). Transmission pathways for sporadic Shiga-toxin producing E. coli infections: A systematic review and meta-analysis. *International journal of hygiene and environmental health*, 220(1), 57-67.
- Miller LG, & Kaspar CW. (1994). Escherichia coli O157: H7 acid tolerance and survival in apple cider. *Journal of Food Protection*, 57(6), 460-464.
- New Zealand Ministry of Health data sheet, Escherichia Coli O157:H7 (2001)
http://www.foodsafety.govt.nz/elibrary/industry/Escherichia_Coli-Organism_Invades.pdf
Accessed 21 August 2017
- Teunis PFM, Ogden ID & Strachan NJC. (2008). Hierarchical dose response of E. coli O157:H7 from human outbreaks incorporating heterogeneity in exposure. *Epidemiology and infection*, 136(6), 761-770.
- WHO E. coli factsheet (2016)
<http://www.who.int/mediacentre/factsheets/fs125/en/>
Accessed 21 August 2017