



## What is *E.coli*?

“*E.coli*”, or to give it its full name “*Escherichia coli*”, is a common bacterium. Many types of bacteria live harmlessly in the digestive systems of people and animals. *E.coli* is one of them. The average human gut contains approximately 10 million million bacteria. They weigh about one kilogram. The body needs these intestinal bacteria, because among other benefits, they synthesise vitamins and metabolise food components.

“*Escherichia*” is named after **Theodor Escherich**, a paediatrician. He discovered *E.coli* in 1885 when studying the intestinal bacteria of newborn babies. He was the first to investigate in detail the harmless bacteria of humans; a very appropriate study because the vast majority of the hundred billion billion *E.coli* living in the world at any one time are in the intestines of healthy humans and animals. But among the very large number of genetic types of *E.coli* are a few that cause disease. The most virulent are the Verocytotoxin producing *E.coli* (“VTEC”). Another widely used designation for VTEC is “EHEC”, which is short for “*Enterohaemorrhagic E.coli*”.

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VTEC produce toxins that are lethal for cultured African green monkey (Vero) cells. They are also called “Shiga toxins” because of their close relationship to toxins produced by a bacterium that causes severe dysentery “*Shigella dysenteriae*”. VTEC also have special genes whose products enable the bacteria to stick very firmly to the inner surface of the intestine. The commonest VTEC is *E.coli* O157:H7.



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*E.coli* O157 is called an “emerging pathogen” because it is relatively new and because it is evolving quickly. It first came to notice abruptly and dramatically in 1982 in the USA, when it caused two outbreaks of bloody diarrhoea linked to the hamburgers from a chain of fast food restaurants. The first recorded outbreak in England and Wales was in 1983.

There have been increasing reports of *E.coli* O157 infection worldwide. This may be due in part to improved surveillance and methods of detection but it is generally accepted that the increase is real as opposed to being simply the result of increased awareness and assessment.

*E.coli* O157 is a particularly nasty organism because:

- (i) It is highly virulent; ingesting only very few organisms can cause illness.
- (ii) It can survive for quite long periods on steel e.g. knives, and other surfaces.
- (iii) It can survive refrigeration and is quite tolerant of acid, salt and dry conditions.
- (iv) Although the effects of *E.coli* O157 toxins on some people can be mild, the impact on others can be very serious and sometimes fatal. Even after recovery from infection, some cases are left with permanent kidney or brain damage. The young (notably the under 5’s) and the elderly (notably the over 75’s) are particularly vulnerable.
- (v) Apart from good supportive care, including monitoring and close attention to hydration, there is no specific treatment for *E.coli* O157 infection. Once an infection has started, it is not possible to prevent the onset of complications.

*E.coli* O157 is highly infectious. A very small number of organisms, possibly between 10 and 100, can cause people to become ill.

The source of *E.coli* O157 extends back to the farm. It has been found in a range of wild animals, farm animals and domestic animals, and even in birds, mainly gulls. The main source is the intestines of cattle and sheep. It is more prevalent



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in cattle, although both can be a significant source of possible infection for people.

Approximately 9% of cattle may carry the organism. Infected animals do not show any clinical symptoms of *E.coli* O157 infection and do not appear to suffer any adverse effects, save perhaps for transient diarrhoea in very young animals. This means that it isn't possible for farmers to identify animals that are infected and there is no pressing reason for them to do so.

*E.coli* O157 can survive for months in, or on the surface of, animal faeces, in soil and in freshwater. So anyone who comes into contact with infected faeces risks becoming a physical carrier and a potential source of infection for others, either directly or by contaminating other surfaces.

### **How can People become Infected?**

People can become infected through food and other sources. For both, infection is through a person's mouth. This may occur by swallowing contaminated food or drink or by contact between the mouth and hands, which may have become infected through contact with other surfaces.

*E.coli* O157 spread through food is usually the result of well-recognised lapses in food handling, notably a failure to achieve adequate cooking temperatures or through cross-contamination of ready-to-eat products. Products made from minced beef, like burgers, have presented particular problems in the USA where consumers like them rare – in other words cooked too lightly to kill the organisms throughout the burger.

Cross-contamination can occur when raw meat carrying *E.coli* O157 is allowed to contaminate other foods directly or via knives, other equipment or work surfaces.



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Because *E.coli* O157 can also be transmitted between people, good personal hygiene is vital, as is meticulous attention to procedures designed to prevent cross-infection. This is particularly important for elderly people in residential care homes, for children and young people mixing in schools or places where pre-school children gather, and for people in hospital. Poor hygiene practices that allow faecal-oral contact result in person-to-person spread.

A variety of foods have been implicated in past outbreaks, including milk, cooked meats, salads, meat pies, dry cured salami, faecally-contaminated raw vegetables, cheese, yoghurt, apple juice, and water.

Infection can also occur through direct contact with infected animals and by contact with land contaminated with animal faeces. People whose job brings them into contact with farm animals are at increased risk. There are also risks associated with visitors, especially children, to farm centres.

## What Happens when someone becomes Infected?

The incubation period for infection with *E.coli* O157; that is, the period between infection with the organism and the onset of symptoms such as diarrhoea, is usually between 2 - 12 days and most commonly about three days.

Symptoms of infection include diarrhoea, headaches, abdominal pain, nausea and vomiting. *The infection can cause:*

- (i) Mild diarrhoea.
- (ii) Haemorrhagic colitis, which is caused by inflammation of the large bowel, with bloody diarrhoea.
- (iii) Haemolytic uraemic syndrome (“HUS”), which usually occurs in children and which is thought to be the major cause of kidney failure.
- (iv) Thrombotic thrombocytopenic purpura (“TTP”).



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Typically, infection causes 1-3 days of non-bloody diarrhoea after which in many cases diarrhoea becomes bloody. It is generally the appearance of blood in diarrhoea that prompts a person or family to seek medical help.

In most people, the symptoms last about a week and resolve themselves without any long-term problems. Research suggests that between 2-7% of people with *E.coli* O157 will develop HUS, which is a severe, potentially life-threatening complication. The incidence of this is higher in children than adults[4]. The risk that a child under the age of ten will develop HUS is about 15%.

HUS is a complex syndrome. Its characteristics include haemolytic anaemia, which is the destruction of red blood cells, and thrombocytopenia, which indicates the destruction of the cells (platelets) that are responsible for the clotting of blood, and acute kidney failure. HUS typically develops 5-13 days after the onset of diarrhoea.

### **How Common is *E.coli* O157?**

*E.coli* O157 infection is still relatively rare but because the illnesses it can cause can be severe and even fatal, it is a serious public health issue. The fact that it is rare is no reason at all for complacency. In 2008 there were 948 cases in England and Wales.

The largest outbreaks in the UK have been those in Central Scotland in 2006 (279 confirmed cases, 17 deaths) and in South Wales in 2005 (118 confirmed cases, 1 death). Both were associated with butchers.



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### Previous Outbreaks of Note

Between November 1992 and February 1993, the American “Jack-in-the-Box” outbreak (burgers) resulted in 477 confirmed cases of *E.coli* O157 or Haemolytic Uraemic Syndrome (“HUS”), and four deaths, in four States; Washington, Idaho, California, and Nevada. This stimulated the US Department of Agriculture Food Safety and Inspection Service to declare *E.coli* O157 an adulterant in raw beef and it began a sampling programme to test for it in Federally inspected establishments and retail stores.

To date, the largest ever outbreak of *E.coli* O157 occurred in Sakai City, Osaka, Japan in July 1996, just before the outbreak in Scotland. There were 2,764 microbiologically confirmed cases but many more people had symptoms of infection. Of the confirmed cases, 2,345 were school children in 47 schools. There were 121 cases of HUS and three deaths. The source was traced to radish sprouts served at school meals.

In May 2000, an outbreak in Walkerton, Ontario, Canada, which was also the subject of a public inquiry, was traced to a contaminated public water supply. More than 2,300 people fell ill, of which 163 cases were confirmed microbiologically. Twenty-seven people had HUS. Four people died from the infection and it contributed to the death of three others.

Outbreaks in the UK are nearly all local whereas many in the USA have been continent wide. For example, the 2006 spinach outbreak originated in produce from the Salinas Valley in California but affected 205 people in 26 States. Thirty-five people contracted HUS and there were three deaths.



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It is reasonable to suppose that the distribution of outbreaks in the UK reflect the small to medium size of the businesses that were responsible for them. This is also the case for outbreaks caused by milk. The largest milk outbreak in the UK was in North Cumbria in 1996 with 114 cases. Eighty-eight were confirmed microbiologically and three people developed HUS[10]. The source was a two-man farm that pasteurised approximately 1,920 pints of their own milk each week.

More than 80% of cases of *E.coli* O157 in England and Wales are sporadic; that is, cases that are not apparently linked to other cases. In Wales, around 30 sporadic cases are confirmed every year. In just over half, the source is never identified.

Most cases tend to occur between July and September of each year. This is consistent with research that has shown that animals shed higher concentrations of the bacteria in summer months. However, *E.coli* O157 is a year-round threat that requires continual attention to hygiene procedures.

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