衞生防護中心
Centre for Health Protection

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Scientific Committee on Enteric Infections and Foodborne Diseases

Epidemiology, Prevention and Control of Shiga toxin-producing *Escherichia coli* Infection

Purpose

This paper provides an overview on the epidemiology of shiga toxin-producing *Escherichia coli* (STEC) infection and its prevention and control strategies.

The Pathogen and the Disease

The bacteria

2. *Escherichia coli (E. coli)* are Gram negative bacteria. They normally live in the intestines of people and animals. Most *E. coli* are harmless and actually are important normal flora of a healthy human intestinal tract. However, some are pathogenic and cause illness, either diarrhoea or illness outside of the gastrointestinal tract. The types of *E. coli* that can cause diarrhoea can be transmitted through contaminated water or food, or through direct contact with animals or persons.[1]

3. STEC is an important group of *E. coli* that can cause severe diarrhoea and many foodborne outbreaks worldwide. The serotype of a STEC is based on the O antigen determined by the polysaccharide portion of cell wall lipopolysaccharide and the H antigen by the flagella protein. They may be referred to as verocytotoxin-producing *E. coli* (VTEC) or enterohaemorrhagic *E. coli* (EHEC). They can cause haemorrhagic colitis through the production of cytotoxins called Shiga

toxins which are similar to the toxins produced by *Shigella dysenteriae*. The most important serotype is *E. coli* O157:H7 while other *E. coli* serogroups are called "non-O157 STECs" and include O26, O111, and O103 etc.[1]

4. STEC can grow in temperatures ranging from 7°C to 50°C, with an optimum temperature of 37°C. Some can grow in acidic foods, down to a pH of 4.4. It will be destroyed by thorough cooking until the core temperature reaches 70°C or higher.[2]

5. Healthy dairy and beef cattle are a major reservoir of STEC.[3] *E. coli* O157:H7 has been detected in cattle faeces. Contamination of meat with the bacteria can occur during slaughtering. Ground beef possesses higher risk than intact meat because it can be contaminated during the grinding process.[4] Besides, food and water can be contaminated by cattle manure. STEC have also been isolated from other ruminants such as sheep, goats and deer. Other mammals like pigs, horses, rabbits, dogs, cats and birds are occasionally infected.[2, 3]

Disease Transmission

6. STEC infection is transmitted by faecal-oral route through contaminated food and water, or direct contact with STEC carrying animals. Apart from meat (ground beef, steak, beef products), there is a wide variety of food involved in STEC infection worldwide, e.g. unpasteurized milk, unpasteurised apple cider, fresh vegetables and sprouts, salami, etc.[5] Infection also occurred after visits to petting zoos and farms where there is direct contact with animals or their contaminated surroundings.[5] Exposure to recreational water sources like swimming in contaminated water is also a route of infection.[5] The very low infectious dose (<100 organisms) was accounted for the person-to-person transmission in children's day care centres, and in institutions providing care for the disables or elderly.[5, 6]

Clinical presentation

7. The incubation period for STEC is two to 10 days, usually three to four days.[1] Though STEC infection may be asymptomatic, it typically begins with watery diarrhoea associated with abdominal pain, and occasionally with nausea and vomiting. Fever is not a prominent symptom. The watery diarrhoea may or may not progress to bloody diarrhoea. A serious

complication, haemolytic uraemic syndrome (HUS), occurs in two to 15% of STEC infection cases.[7] HUS is more common in extreme of ages with children under five years most frequently affected.[7] Among STEC, *E. coli* O157:H7 has the strongest aetiological association with HUS before the occurrence of 2011 outbreak of STEC O104:H4 in Europe.[8] HUS tends to occur on average seven days after the onset of diarrhoea when the diarrhoea is improving.[1] It is characterized by acute onset of microangiopathic haemolytic anaemia, renal injury and low platelet count. HUS is the most common cause of acute renal failure in young children.[2] Neurological complications such as stroke, seizures and coma occur in about 25 % of HUS patients. They are the most sinister and are important determinants of morbidity and mortality.[8] Intestinal complications during acute HUS consist of perforation and necrosis.[8] About half of HUS survivors will continue to suffer from mild chronic renal sequelae after recovery.[2] The case fatality rate of HUS ranges from 3% to 5%.[2]

8. Adult could excrete the bacteria one week after infection while for children, one-third of them excrete the bacteria up to three weeks. However, prolonged carriage of the bacteria is uncommon.[9]

Laboratory Diagnosis

9. Diagnosis can be confirmed by laboratory investigations on stool specimens for culture of STEC O157, serological testing for *E. coli* O157:H7 antigen, and an assay that detects Shiga toxins, which has low sensitivity, or the genes encoding these toxins.[10]

Patient Management and Infection Control

10. Patients with STEC infection are advised to stay in hospital for management and to monitor for the development of HUS. The treatment is largely supportive in nature with intravenous rehydration and maintenance fluid to provide optimum nephroprotection. Drugs such as antibiotics, antimotility agents, narcotic opioids, or non-steroidal anti-inflammatory drugs should not be given in general because they may increase the risk of developing HUS.[8]

11. For infection control, enteric precautions should be reinforced during the acute illness. Patients and their caregivers should be educated regarding effective hand washing, particularly after using toilet, changing diapers, and

before preparing or eating food. The importance of proper hygiene must be stressed, as excretion of the organism may persist for several weeks. Children should be excluded from playgroup, day-care/preschool nursery or child care centre/kindergarten until free from symptoms for at least 48 hours and two successive negative stool cultures taken not less than 48 hours apart, after recovery. Food handlers should refrain from food handling duties until become asymptomatic and have two negative stool specimens. Advices on suspension from work duties for infected child care attendants and healthcare workers should be given until they have two stool specimens showing negative results. The stool specimens should be collected 24 hours apart and not sooner than 48 hours after the last dose of antibiotics, if given. Infected persons may continue to be infectious for several weeks after diarrhoea resolves and should be cautioned accordingly especially with regards to hand washing. They should also refrain from recreational water venues (e.g. swimming pool, water parks) for two weeks after symptoms resolve.[7, 9]

12. The patients' close contacts with symptoms compatible with STEC infection should be referred for clinical assessment and laboratory testing. In case there are close contacts who work as a food handler, healthcare worker, child care worker or attend child care, testing for STEC should also be considered even if they are asymptomatic. All contacts should be educated about transmission routes, symptoms, and effective hand washing, particularly after using toilet, changing diapers, and before preparing or eating food.[7, 9]

Epidemiology

Global Situation

13. STEC is known to be associated with large scale outbreaks affecting hundreds of people reported over the past two decades.[11-15] As for the complication of HUS, the incidence is low worldwide.[16] The following paragraphs describe the epidemiology in developed countries including the United States (US), European Union (EU) countries, Australia, New Zealand and Canada. As the surveillance programme varies between countries, caution is required when interpreting STEC incidence rates. In particular, the focus of testing in most countries has been put on the detection of *E. coli* O157 strains and some countries will not perform test for STEC non-O157.

Incidence

14. In the US, STEC O157 has been put under surveillance since 1996. The reported incidence was on a decreasing trend and ranged from 0.91 to 2.62 per 100,000 population from 1996 to 2012 with the highest rate reported in 1996 and the latest preliminary figure in 2012 was 1.12 per 100,000 population.[17] On the other hand, the incidence for STEC non-O157 continues to rise since it was put under surveillance in 2000. The reported rates ranged from 0.16 to 1.16 per 100,000 population. The incidence of STEC infections generally peaked in summer.[18]

15. During 2006 to 2010, the incidence of STEC infection in EU countries was on an increasing trend from 2006 to 2009 and remained to stable in 2010. The reported rates ranged from 0.77 to 0.96 per 100,000 population. In 2010, Ireland reported the highest incidence rate, 4.41 per 100,000 population, followed by Sweden and Denmark, whose incidences were 3.58 and 3.22 per 100,000 population respectively. Similar to US, more cases were reported in summer.[19]

16. In Australia, STEC infections have remained fairly steady since 2000. In 2010, there were 80 STEC notifications in Australia giving an incidence of 0.4 cases per 100,000 population.[20] Overall, the incidence of disease due to STEC in Australia appears comparable or lower than other developed countries. The distribution of STEC case was also seasonal with a larger proportion of reported cases occurring in the summer months and lower numbers in winter.[13]

17. The incidence of STEC infection in New Zealand showed a gradual increasing trend with a small peak in 2003 since 2002 and the rate in 2011 was the highest. In 2011, the incidence was 3.5 cases per 100,000 population. Seasonality of STEC infections in New Zealand follows those in the US, EU countries and Australia.[21]

18. In Canada, the incidence of STEC O157 showed a significant decline from 2002 to 2012 with the incidence decreased from 3.80 to 1.39 per 100,000 population.[22]

Complication rate and mortality

19. In the US, nearly half of STEC O157 cases (43.4%) required hospitalization. The corresponding rate in STEC non-O157 was much lower (18.0%). In 2010, 71 cases of HUS were related to STEC giving a complication rate of 7.9%. The mortality rate of STEC infection in the US was low and death cases occurred exclusively in older age group (over 80 years). The case fatality rates in 2011 were 0.43% and 0.19 % for STEC O157 and STEC non-O157 respectively.[18] In EU countries, 6.3% (230/3656 cases) of confirmed STEC infections developed HUS with 66% of them being children aged 0 to four years old.[19] Among the 80 notifications in Australia in 2010, only one developed HUS with a complication rate of 1.3%.[20]

Large scale outbreaks

20. Several large outbreaks of STEC O157 infection were recorded in various countries in the past two decades. In early 1990s, an outbreak of more than 700 cases and three deaths took place in western US which was linked to consumption of undercooked hamburger meat (ground beef) at a fast food chain.[11] Then a massive O157:H7 outbreak took place in Japan (Sakai city) in 1996. More than 10,000 people were affected after white radish sprouts had been served at school canteens and resulted in 12 deaths.[11] Also in 1996, another outbreak of STEC O157:H7 occurred in Scotland involving 512 people and 17 deaths. The source of this outbreak was identified to be due to contaminated meat products.[11] In 1999 to 2000, two waves of large outbreaks of *E. coli* O157:H7 infection took place in China in three neighboring provinces, Jiangsu, Anhui and Henan. It was estimated that it caused thousands of cases resulting in 208 deaths.[12] Based on the available information, no incriminated food or other sources causing the outbreak was reported. In US, another outbreak of STEC O157 related to contaminated meat products happened in Wisconsin in 2000. A total of 788 people were infected with one fatal case.[11]

21. In addition to the foodborne transmission route, there have been three large STEC O157 waterborne outbreaks (tap water, well water and drinking water) in 1995, 1999 and 2000 in Scotland, New York and Canada (Walkerton) affecting 633, more than 1000 and 2300 people respectively.[11]

22. Compared with STEC O157, there were relatively few outbreaks of STEC non-O157 recorded worldwide. The 2011 outbreak of STEC O104:H4 in Europe was the most significant one with higher rate of HUS caused by STEC non-O157 and a major proportion of middle-aged people being infected. It took place in Germany and 15 other countries with more than 4,000 cases and 50 deaths.[13] The causative agent was a rare strain *E. coli* O104:H4. Fenugreek sprouts was believed to be the most likely causative agent in that outbreak. Contrary to the common belief that *E. coli* O157:H7 was the serotype in the vast majority of HUS cases, there were 909 HUS cases reported in the 2011 outbreak. The incidence rate (22 %) was higher than those caused by *E. coli* O157:H7 (2% – 15%). Besides, the majority of patients were adults, predominantly middle-aged and otherwise healthy women.[23]

23. In August 2008, a large outbreak of STEC O111:NM (non-motile) infections associated with a buffet-style restaurant in rural Oklahoma was identified. Out of 341 cases with gastroenteritis, 70 patients required hospitalization, 25 (7.3%) developed HUS and one died. The epidemiological evidence suggested it resulted from cross-contamination of restaurant food from food preparation equipment or surfaces, or from an unidentified infected food handler.[14]

Sources of outbreaks

24. Besides undercooked meat and contaminated vegetables were reported to be associated with large scale outbreaks as mentioned above, there were also reports of smaller scale STEC outbreaks found to be related to other food products such as raw or inadequately pasteurized dairy products (e.g., milk, yogurt and cheese), in-shell hazelnuts,[15] raw refrigerated prepackaged cookie dough,[15] rice cake,[24] apple juice and cider, alfalfa sprouts, and fresh produce, namely lettuce, spinach, romaine lettuce, salad, cucumber and mesclun.[11] Contamination of these food products may be due to contact with animal faeces at some stage during cultivation or handling. Animal-to-person transmission of STEC was also documented by contact with farm animals and visiting petting zoos in US, Canada, Netherlands, China and United Kingdom.[11] Outbreaks occurring in nursery, day care centre and geriatric hospital were suggestive of possible person-to-person transmission.[11]

Local Situation

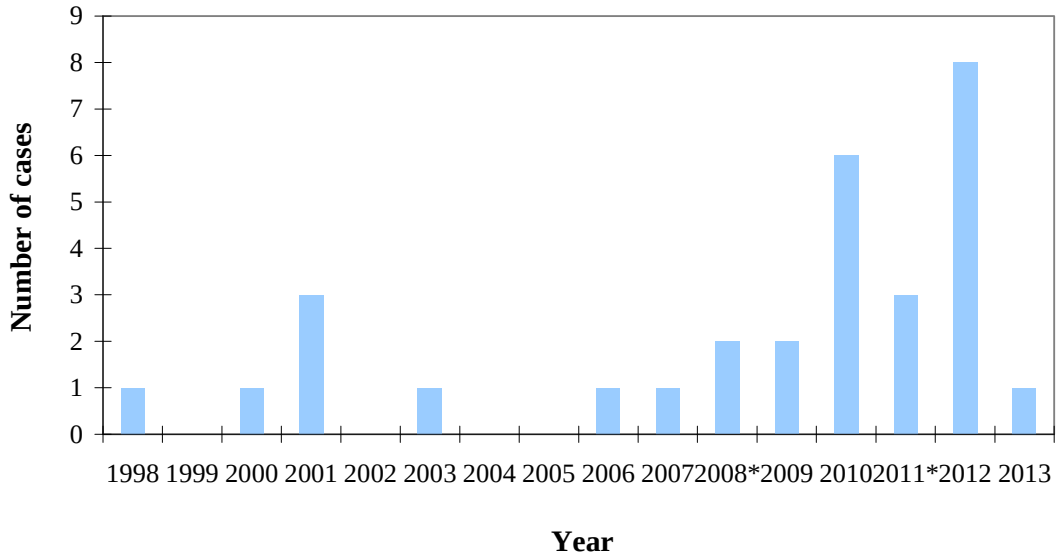
25. *E. coli* O157:H7 infection became a statutory notifiable disease in July 2008 but before that, there had been reporting of *E. coli* O157:H7 on voluntary basis. In addition, in the light of the occurrence of large scale non-O157 STEC outbreaks in Germany in 2011, the Centre for Health Protection (CHP) of the Department of Health (DH) has stepped up the surveillance to include all STEC infections to the list of statutory notifiable diseases since 10 June 2011. From 1998 to 2013 (as of June 30), CHP of DH has recorded 30 cases of STEC infections including nine cases reported on a voluntary basis prior to July 2008. The annual number of cases ranged from 0 to eight (Figure 1) while the incidence using mid-year population of the corresponding years ranged from 0 to 0.11 per 100,000 populations from 1998 to 2013 (as of June 30). The incidence in Hong Kong is much lower compared with EU countries, US, Australia, New Zealand and Canada (Table 1).

Table 1. Incidence of STEC infection in Hong Kong and other countries

Place	Year	Incidence rate (per 100,000 population)
Hong Kong	1998 – 2013^	0 - 0.11^
United States	1996 - 2012	STEC O157: 0.91 – 2.62
	2000 - 2012	STEC non-O157: 0.16 – 1.16
European Union countries	2006 - 2010	0.77 – 0.96
Australia	2010	0.4
New Zealand	2011	3.5
Canada	2002 - 2012	STEC O157: 1.18 – 3.80

^ Data of 2013 are preliminary as of June 30

Figure 1. Number of reported confirmed STEC infection from 1998 to 2013^



^Provisional data as of June 30, 2013
*This disease has been made notifiable since 14 July 2008. The figures of STEC infection represent *E. coli* O157:H7 infection before 10 June 2011.

26. For the 30 cases recorded, four were imported cases and the other 26 patients acquired the infection locally. All reported cases were sporadic except two children, who were cousins aged 10 and 26 months respectively and were living in the same flat. More than half (60%) of the affected person had symptom onset in summer from May to August (Figure 2). The male to female ratio was 16:14. Patients aged six months to 80 years with a median of 17 months (Figure 3). Majority of the cases (24 cases, 80%) were children under six years old with good past health (22/24 cases, 92%). The rest were adults above 46 years old with four being elderly aged 71 to 80 years. All of the elderly had underlying medical illnesses, such as hypertension, diabetes, hyperlipidaemia, malignancy, bronchiectasis. In contrast, only two children had pre-existing medical conditions, namely atrial septal defect and epilepsy respectively.

Figure 2. Number of reported confirmed cases of STEC infection by month of symptoms onset from 1998 to 2013

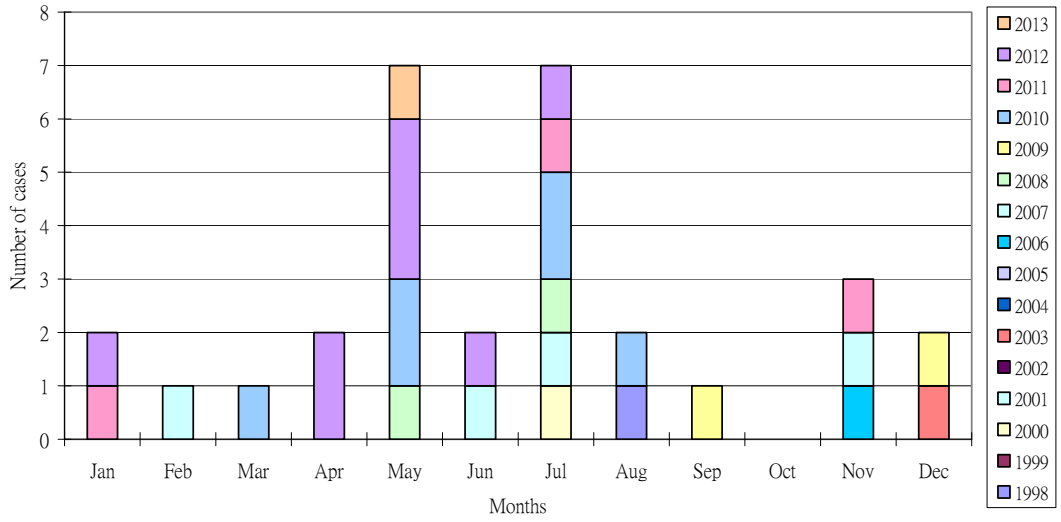
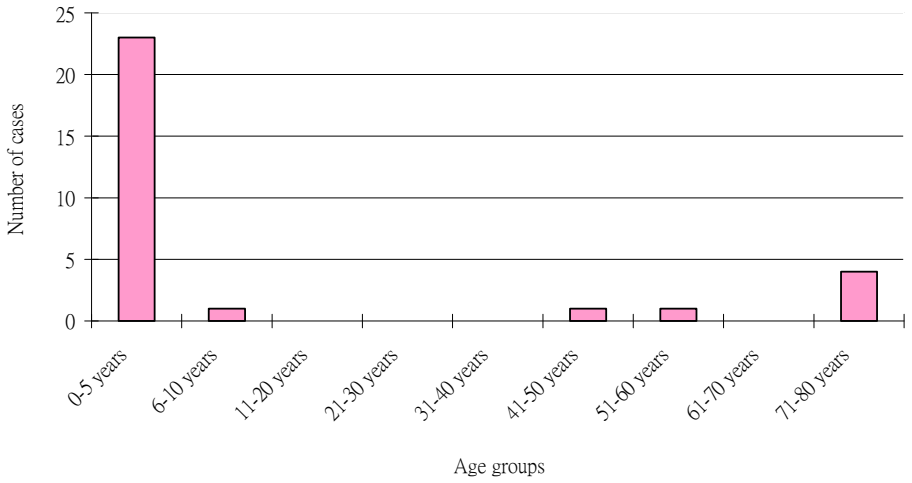


Figure 3. Number of reported confirmed cases of STEC infection by age groups from 1998 to 2013



27. Most of them (27 cases, 90%) presented with diarrhoea with seven (23%) of them presented with bloody diarrhoea. About half (53%) of the patients were febrile on presentation. Twenty-five patients (83%) required in-hospital management for the infection. The hospital stay ranged from one day to 27 days with a median of four days. Among these 30 cases, there was only one 4-year-old boy presented with HUS as complication. He developed HUS at around eight days after onset of symptoms and required more than two weeks of peritoneal dialysis. The other 29 cases did not have complications. No fatal cases were ever reported since there is record from 1998.

28. For the epidemiological-linked cases involving two cousins living in the same flat, the source of infection was undetermined. Investigations showed that the cousins did not have common meals, did not use same toilets and had different caregivers. However, they shared common cooking and dining utensils, and toys, and there were physical contacts between them.

29. There was one case, a 2-year-old boy with history of epilepsy, who might had contracted the disease during hospital stay. He was admitted to the hospital for management of breakthrough seizures and started to develop fever, vomiting and diarrhea only 11 days after admission. As he had been staying in the hospital during the entire incubation period, it was likely a hospital-acquired infection. Epidemiological investigation found that the patient had consumed food provided by the hospital only. Contact tracing revealed two ward staff and four patients in the same ward reported gastrointestinal symptoms. However, all the environmental swabs, food samples and stool from contacts were tested negative for STEC and the source of infection of this hospital-acquired case was undetermined.

30. Although the sources of infection of most cases could not be ascertained by epidemiological investigations, there were cases reported to have had consumption of high risk foods during the incubation period. They included consumption of unpasteurized milk in an overseas farm, undercooked minced beef congee, congee contaminated by raw beef and rare steak. There were also two children who had history of visiting farms and had been in close contact with sheep, goats and rabbits.

31. Epidemiological investigations also revealed that family members of six cases had asymptomatic STEC infection with positive stool culture. This could be due to individual susceptibility to manifest the disease after having infection by STEC. Alternatively, the asymptomatic family members could be the source of infection and spread the disease to the household contact through person-to-person transmission.

32. Regarding the serogroups, 23 and seven cases were associated with *E. coli* O157:H7 and STEC non-O157 respectively, but bear in mind that STEC non-O157 infections have been put under surveillance only since June 2011. The non-O157 groups consisted of O124:H9 (one case), O8:H19 (one case), O26:H11 (one case), O (ungroupable):H7 (one case), untypable (one case) and

ungroupable (two cases). Concomittent infection with other bacteria and viruses are not uncommon (23%). In addition to STEC, pathogenic bacteria and viruses were detected in stool specimens of two and five patients respectively. The bacteria were *Campylobacter species* and *Vibro parahaemolyticus* while the viruses were rotavirus and norovirus.

Laboratory studies on prevalence of STEC infection

33. During November 2009 to December 2012, the Public Health Laboratory Services Branch (PHLSB) of CHP has conducted a study on the prevalence of STEC infection among out-patients. In the first 22-month period, stool specimens of patients with diarrhoea were selected while in the following 16-month period, only stool specimens of patients with "bloody" or similar wording indicated in the request form or presence of blood in stool samples detected by microscopy were selected. Among the 4,432 stool samples tested, the isolation rate of STEC was 0.11%. There was another study collecting stool specimens from patients under 5 years in three public hospitals for testing of STEC from January 2009 to June 2011. None of the 227 specimens tested yielded growth of STEC.

Prevention and Control Strategy

34. Effective surveillance and epidemiological investigation systems, together with food safety control measures at all stages of the food chain are the basis for prevention and control for foodborne diseases like STEC infection.[2, 25] In Hong Kong, there are established disease surveillance and epidemiological investigation systems on human STEC infection, food surveillance programme and food incidents surveillance. There are also various statutory requirements and health promotional initiatives in safeguarding and promoting food safety along all stages of food chain.

Disease Surveillance

35. *E. coli* O157:H7 had been made statutory notifiable under Cap. 599 since July 2008 and cases were reported to CHP on a voluntary basis before this time. Moreover, with effect from June 2011, the CHP has enhanced the surveillance on STEC by extending the requirement of statutory notification of *E. coli* O157:H7 to STEC. Suspected cases of STEC infection must be

reported to the CHP. Once a notification is received, the CHP will initiate epidemiological investigation and implement control measures. Food history including the epidemiological information of the food collaterals and, other risk factors such as animal or case contact would be explored in order to identify source of the infection.

36. If food premises are suspected to be the source of infection, the case will be referred to the Food and Environmental Hygiene Department (FEHD) for further investigation. FEHD will conduct field investigation and collect samples of food, from the environment and food handlers for laboratory analysis. Giving health advice on food safety practices and enforcement on environmental and food hygiene will be carried out as appropriate. If there is suspected contaminated food potentially available in the market, FEHD will trace its source and distribution, and take actions to stop the import or sales of the affected products if necessary. Food handlers with STEC infection will be ordered to suspend from food handling work.

37. At laboratory level, PHLSB will provide support for microbiological analysis including typing of isolates as necessary for epidemiological investigations.

38. In addition to local disease surveillance, CHP monitors the global situations of STEC infection and outbreaks. In response to the 2011 Germany STEC O104:H4 outbreak, the CHP issued press release to inform the public the outbreak situation and remind them to be vigilant against STEC infection. Along with the enhancement of disease surveillance on STEC infection, CHP sent letters to doctors to alert them the latest development of the outbreak and require them to report cases to CHP for investigations according to the statutory notification system.

<u>Food surveillance and control</u>

39. The Centre for Food Safety (CFS) of FEHD conducts food surveillance for prevention and control of food risk to the public. Food samples are taken at import, wholesale and retail levels for microbiological and chemical laboratory testing. *E. coli* O157 is included in food surveillance programme in assessing the condition of microbiological contamination in ready-to-eat food. In 2012, 150 samples were collected and none of them were tested positive for *E. coli* O157.

Food incidents surveillance

40. The CFS also monitors globally occurring food incidents, assesses the potential local impacts and takes appropriate control actions. From 2010 to 2013 (as of June 13), CFS has identified three food incidents associated with STEC contaminated food. Prompt risk assessment and risk management actions have been carried out. There is no local occurrence of human STEC infection associated with these food incidents reported in the corresponding period.

Other surveys

41. There is also other survey providing information on surveillance for the prevention and control of the disease. A local survey was conducted on the prevalence of STEC in cattle and pigs in a slaughterhouse between August 1996 and December 1998. Both rectal and carcass swabs were collected from 986 adult cattle and 487 adult pigs to determine the carriage rate of STEC in cattle and pigs. The carriage rate of STEC is higher in cattle (409/986, 41.5%) compared with pigs (10/487, 2.1%). Moreover, *E. coli* O157:H7 was isolated from samples taken from cattle only. In Hong Kong, the volume of consumption of freshly slaughtered pigs is much higher than cattle. In 2011, 1,556,571 pigs were processed in local slaughterhouses while only 28,591 cattle were processed in the same year.[26] Despite the high volume of consumption, the low STEC carriage in pigs may explain the low incidence of human STEC disease in Hong Kong.[27] The risk will be further reduced by thorough cooking of meat.

Food safety control measures

42. Currently there are statutory requirements for food being imposed for public health reasons. For example, certain high risk imported food like milk and meat are governed by subsidiary legislation of the Public Health and Municipal Services Ordinance (Cap. 132). Import of meat is confined to sources recognized by the FEHD. In Hong Kong, milk and milk beverages available in the market are pasteurized or effectively sterilized to prevent known related foodborne diseases like STEC infection.

Health promotion

43. Promulgated by the World Health Organization, CFS promotes "Five Keys to Food Safety" to prevent foodborne diseases. There are also food safety trainings, health education and health promotional activities for the food trade, food handlers and general public.

44. CHP and FEHD have prepared a variety of health education materials such as factsheets on STEC, pamphlets and posters on hand hygiene, food and water safety, and ways to prevent foodborne diseases, to raise awareness of the general public and food trade. Furthermore, the website of Travel Health Service of DH is uploaded with the most updated news on STEC outbreaks around the world with relevant health tips for the travellers.

Recommendations

45. Further enhancement in health promotion such as specific education materials for cases and their contacts is recommended to prevent secondary spread of the disease. As enteric precautions and refrain from food handling duties and recreational water activities are important for the infected persons, and/or their caregivers and close contacts to prevent spreading of the disease, specific health education materials such as handy information leaflets can be made available and along with case investigation, provide to these groups of people.

46. Besides, there can be more health education materials available at venues where are known to be at risk of the disease transmission. Examples are petting zoo, animal farm, swimming pool and water park. In essence, visitors are advised not to put hands on faces or fingers in mouths while petting animals or walking around the farm. They should not kiss farm animals nor to put their faces close to the animals. If the shoes and boots are soiled, these should be cleaned and then wash hands thoroughly with soap and water. After touching animals, fences or any surfaces in animal areas, visitors should also wash hands with water and soap. Caregivers should supervise young children in maintaining hand hygiene during their visit. However, gels and wipes are not recommended to replace hand washing with soaps as they do not remove *E. coli* O157 in dirt. Besides, eating and drinking should be confined in picnic areas and cafes.[28]

47. In view of the occurrence of sprouts in causing large scale outbreaks and the increasing incidence of STEC non-O157 infection in other countries, the CFS of FEHD could also consider a targeted food surveillance programme on STEC non-O157 in high risk food such as sprouts, in order to assess their food risk in Hong Kong.

Conclusion

48. STEC infection is a foodborne disease that causes both sporadic diseases and large scale outbreaks worldwide. It will result in a serious complication, HUS, particularly in children group. In Hong Kong, STEC associated morbidity and mortality are much lower compared with the overseas countries.

49. In Hong Kong, systems and measures are in place for the prevention and control of the disease. CHP has been keeping surveillance on human STEC infection to closely monitor the local and global situations for prompt control actions deemed necessary. CHP and FEHD have also been working closely in communicating information on disease surveillance, food surveillance and food incidents surveillance for keeping review and improvement on the most effective strategies in combating the disease. Besides, CHP is in close collaborations with other stakeholders to implement series of health promotional activities in empowering the food trade, childcare workers, institutions, food handlers and the general public to practice safe food and appropriate hand hygiene practices to prevent the disease. Strengthened public education and targeted food surveillance in high risk food are recommended to enhance prevention of the disease.

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