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National Institute of Infectious Diseases and
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Control Division,
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Symptoms associated with EHEC infection, by serotype, 2012 125
EHEC O157 food poisoning caused by lightly pickled Chinese cabbage–Sapporo City 126
Large scale EHEC O157:H7 food poisoning outbreak in Hokkaido in August 2012; IS-printing analysis of the isolates obtained outside of Hokkaido 127
On revision of hygienic standards of pickled vegetables in response to several food poisoning incidents related to lightly pickled vegetables 128
Epidemiology of EHEC O157 food poisoning in 2011-2012; possible influence of the tightened hygienic regulation of marketed beef and cattle liver for eating raw 129
Food poisoning caused by VT1&2- producing strain of EHEC O157:H7 in a restaurant–Aomori 130
EHEC O26 VT1 outbreak in a nursery school–Osaka City..... 131
EHEC O26 VT1 outbreak, which was attributed to contaminated water of a padding pool–Nagano..... 132
EHEC O26:H11 VT1 outbreaks in nursery schools–Kurashiki City... 134
EHEC outbreak in a nursery school caused by serogroups O103 and O111–Niigata City..... 135
EHEC O145 VT2 outbreak in a nursery school–Fukuoka City 135
EHEC O157:H- VT2 outbreak in a nursery school–Aomori 136
Multiple EHEC cases among participants in a Beijing sightseeing tour..... 137
Cluster analysis of the PFGE patterns exhibited by O157 and O26 isolated in various places in Japan, 2012 139
Hemolytic uremic syndrome that appeared in NESID: trends in 2012..... 140
Antigenic and drug-resistance types of the epidemic influenza viruses in Japan in 2012/13 season (progress report)..... 141
Toxin-producing *Corynebacterium ulcerancs* isolated from a patient with diphtheria symptoms; the first report in Shiga Prefecture..... 143
CLSI's modified criteria for evaluating clinical efficacy of fluoroquinolone antibiotics in terms of MIC for *Salmonella* Typhi and parenteral isolates of *Salmonella* 143

<THE TOPIC OF THIS MONTH>
Enterohemorrhagic *Escherichia coli* infection in Japan as of April 2013

Enterohemorrhagic *Escherichia coli* (EHEC) infection is a category III notifiable infectious disease in the National Epidemiological Surveillance of Infectious Diseases (NESID) under the Law Concerning the Prevention of Infectious Diseases and Medical Care for Patients of Infections (Infectious Diseases Control Law). All the cases must be notified by a physician who has made the diagnosis (http://www.nih.go.jp/niid/en/iasr-sp/2251-related-articles/related-articles-399/3534-de3991.html). When an EHEC infection is notified as food poisoning by physicians or judged as such by the director of the health center, the local government investigates the incident and submits the report to the Ministry of Health, Labour and Welfare (MHLW) in compliance with the Food Sanitation Law. Accordingly, there are two related but independent systems of notification, the one in compliance with the Infectious Diseases Control Law and the other in compliance with the Food Sanitation Law.

Prefectural and municipal public health institutes (PHIs) conduct isolation of EHEC, serotyping, and verotoxin (VT) typing and report the result to Infectious Disease Surveillance Center (IDSC) in National Institute of Infectious Diseases (NIID). The Department of Bacteriology I, NIID conducts molecular epidemiological analysis, whose result is made available through the PulseNet Japan (see p. 139 of this issue).

Cases notified under NESID: In 2012 (January-December), total 3,768 EHEC infections, 2,362 symptomatic and 1,406 asymptomatic, were reported (Table 1). Asymptomatic infections are detected during the active surveillance of outbreaks or regular stool test of cooks. As in previous years, a large peak of epidemics occurred in summer (see weekly reports summarized in Fig. 1). The incidence (cases per 100,000 population) was highest in Saga Prefecture (9.21) followed by Okayama (8.71) and Iwate Prefecture (8.14) (Fig. 2, left). As in previous years, incidence of EHEC infection was highest among the age group of 0-4 years followed by 5-9 year age group (Fig. 3). When prefectures were compared for the EHEC incidence (cases per 100,000 population) among 0-4 year age group, Okayama, Kagoshima and Miyazaki Prefectures were the highest (Fig. 2, right). Symptomatic cases were relatively high in young and aged groups and relatively low in population in their 30's, 40's and 50's (Fig. 3). Total 94 hemolytic uremic syndrome (HUS) cases, corresponding to 4.0% of symptomatic cases, were reported in 2012 (see p. 140 of this issue). Among 94 HUS cases, EHEC were isolated from 70 cases (the remaining 24 cases were EHEC isolation negative but LPS antibody positive or VT positive). Among the 70 cases, there were 58 O157, four O111, two O26, two O145 and one each for O25, O165, O174 and O183. Sixty-six isolates among 70 were positive for VT2 or VT1&2 (94%). Fifteen fatal cases were reported, among which three were HUS and two EHEC-related encephalopathy.

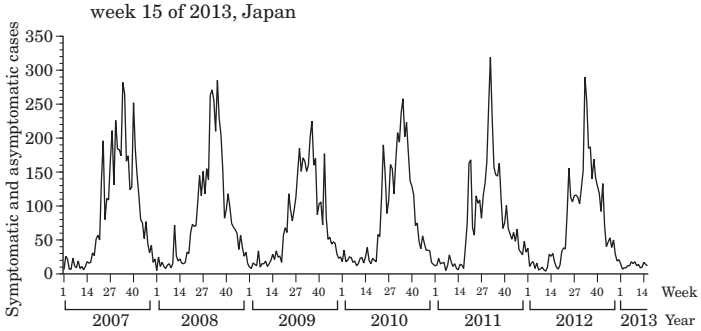
EHEC isolated in PHIs: In 2012, number of EHEC isolates that PHIs reported to the IDSC, NIID, was 1,957, which was far less than the reported number of EHEC infection cases, 3,768 (Table 1). This discrepancy is due to the current situation where isolates in clinical or commercial settings are not always sent to PHIs. The most frequent O-serogroup was O157 (53%), followed by O26 (27%) and O103 (5.2%) (see Table on p. 125 of this issue). Among the O157 isolates double positives for VT1 and

Table 1. Notified cases of EHEC infection

Year	Period	Cases
1999	Apr. 1 – Dec. 31	3,115
2000	Jan. 1 – Dec. 31	3,652
2001	Jan. 1 – Dec. 31	4,436
2002	Jan. 1 – Dec. 31	3,186
2003	Jan. 1 – Dec. 31	2,998
2004	Jan. 1 – Dec. 31	3,760
2005	Jan. 1 – Dec. 31	3,594
2006	Jan. 1 – Dec. 31	3,922
2007	Jan. 1 – Dec. 31	4,617
2008	Jan. 1 – Dec. 31	4,329
2009	Jan. 1 – Dec. 31	3,879
2010	Jan. 1 – Dec. 31	4,135
2011	Jan. 1 – Dec. 31	3,939
2012	Jan. 1 – Dec. 31	3,768
2013	Jan. 1 – Apr. 14	188

Including symptomatic and asymptomatic cases
National Epidemiological Surveillance of Infectious Diseases
Data based on the reports as of April 17, 2013

Figure 1. Weekly incidence of EHEC infection from week 1 of 2007 to week 15 of 2013, Japan

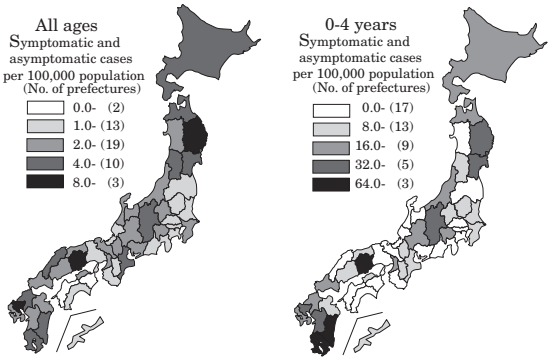


Week of diagnosis
(National Epidemiological Surveillance of Infectious Diseases: Data based on the reports received before April 17, 2013)

(Continued on page 124′)

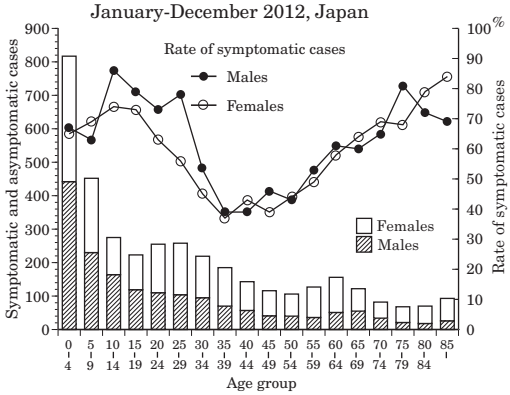
(THE TOPIC OF THIS MONTH-Continued)

Figure 2. Incidence of EHEC infection by prefecture, 2012, Japan



(National Epidemiological Surveillance of Infectious Diseases: Data based on the reports received before April 17, 2013)

Figure 3. Age distribution of cases of EHEC infection, January-December 2012, Japan



(National Epidemiological Surveillance of Infectious Diseases: Data based on the reports received before April 17, 2013)

VT2 genes were predominant (68%) as in previous years (53-78% in 1997-2011). Among O26 and O103, 94% and 97%, respectively, were single positive for VT1. Information on clinical symptoms were available for 973 cases among 1,040 cases of O157. Major symptoms were abdominal pain (64% of the cases), diarrhea (62%), bloody diarrhea (46%), and fever (21%) (see Table on p. 125 of this issue).

Outbreaks: In 2012, PHIs reported to IDSC twenty-three EHEC outbreaks, including six outbreaks caused by O157. Sixteen outbreaks involving ten or more EHEC-positive cases are shown in Table 2. Five outbreaks were suspected to be food-borne, and ten were suspected for person-to-person transmission. In 2012, prefectures reported 17 EHEC incidents with 398 symptomatic patients (isolation negative cases included) in compliance with the Food Sanitation Law (25 incidents and 714 patients in 2011).

In 2012, there was an EHEC O157 outbreak caused by lightly pickled vegetables (see pp. 126 & 127 of this issue). The outbreak mainly affected an elderly facility in Sapporo City, but as the product was distributed to supermarkets, hotels and restaurants as many as 169 persons fell ill and eight died.

Prevention an measures to be implemented: The basics for preventing EHEC infections are to observe the principles of food poisoning prevention and to avoid consumption of raw or undercooked beef. In response to persistent food poisonings caused by raw beef, MHLW revised the standards of the beef marketed for eating raw and put it into operation by issuing the MHLW notice No. 321 on October 2011. Further, upon the detection of EHEC O157 in the inner part of cattle livers, MHLW banned marketing of the cattle liver for eating raw (notice No. 404 in July 2012). As a consequence, the incidence of O157 cases related to consumption of raw beef or raw cattle liver significantly decreased in one year from 2011 to 2012 (see p. 129 of this issue).

In response to O157 outbreaks caused by pickled vegetables, MHLW modified the hygiene standards of pickled vegetables (Shoku-An-Kan-Hatsu 1012 No.1, 12 October 2012) (see p. 128 of this issue).

Like dysentery bacilli, EHEC establishes infection even at minute doses and can spread from person to person rather easily. The year 2012 experienced several EHEC outbreaks in nursery schools (Table 2). Preventing such outbreaks needs appropriate hygienic practice, such as routine hand washing and sanitary use of children's padding pools during summer (see "Infection Control Guidelines for Nurseries" revised in November 2012 that recommends confirmation of appropriate concentration of chloride ions and disinfection of water used for swimming baths).

To prevent spread of EHEC within patients' families, the health center should give full instructions to the families concerning prevention of secondary infections.

Update 2013: In 1-15 weeks of 2013, 188 EHEC infections have been reported (Table 1). As EHEC infection increases in summer season, increased level of vigilance is necessary.

Table 2. Outbreaks of EHEC infection, 2012 (Data based on the reports from public health institutes received before March 25, 2013 and references in IASR)

No.	Prefecture /City	Period	Suspected route of infection	Setting of outbreak	Serotype	VT type	Symptomatic cases	Consumers	Positives /examined	Familial infection	Reference in IASR
1	Saga P.	May 23-Jun. 6	Person to person	Welfare facility	O103:H2	VT1	3	⋯	10 / 620	Yes	
2	Osaka C.	May 24-	Foodborne*1	Nursery school	O26:H-	VT1	68	159	115 / 404	Yes	p .131 of this issue
3	Iwate P.	May 28-Jun. 1	Foodborne	Hotel	O121:H19	VT2	8	N.D.	12 / 57	Yes	
4	Chiba P.	May 17-29	Person to person	Nursery school	O157:HNT	VT1&2	9	⋯	12 / 117	Yes	
5	Fukuoka C.	Jul. 10-19	Foodborne*2	Luncher	O157:H-	VT1&2	8	N.D.	10 / 142	No	
6	Gifu P.	Jul. 16-Aug. 5	Person to person	Day nursery	O111:H-	VT1	5	⋯	17 / 123	Yes	
7	Saga P.	Jul. 23-Aug. 5	Person to person	Nursery school	O26:H11	VT1	1	⋯	26 / 210	Yes	
8	Kurashiki C.	Jul. 31-Aug. 24	Unknown	Three nursery schools	O26:H11	VT1	66	N.D.	105 / 533	Yes	p. 134 of this issue
9	Hokkaido P.&O*	Aug. 2-	Foodborne*3	Welfare facility**	O157:H7	VT1&2	169	N.D.	73 / 165	Yes	p. 126 of this issue
10	Fukuoka C.	Aug. 10-Sep. 14	Person to person	Nursery school	O145:H-	VT2	11	⋯	14 / 382	Yes	p. 135 of this issue
11	Nagano P.	Aug. 10-28	Person to person*4	Nursery school	O26:H11	VT1, VT(-)	62	⋯	61 / 330	Yes	p. 132 of this issue
12	Aomori P.	Aug. 15-30	Foodborne	Restaurant	O157:H7	VT1&2	14	N.D.	14 / 40	Yes	p. 130 of this issue
13	Niigata P.	Aug. 30-Oct. 10	Person to person	Nursery school	O103:H-	VT1	9	⋯	29 / 94	Yes	p. 135 of this issue
					O111:H-	VT1			2 / 94		
14	Aomori P.	Oct. 3-16	Person to person	Kindergarten	O157:H-	VT2	36	⋯	29 / 286	Yes	p. 136 of this issue
15	Chiba P.	Oct. 27-Feb. 28	Person to person	Nursery school	O26:HNT	VT1	3	⋯	19 / 132	Yes	
16	Saitama C.	Oct. 29-Dec. 2	Person to person	Nursery school	O121:H19	VT2	5	⋯	17 / 598	Yes	

Including 10 or more EHEC-positives, P.: Prefecture, C.: City, NT: Not typed, N.D.: No data, ⋯ No information was entered because person-to-person infection was suspected.
*Other prefectures, **for the elderly, *1 School lunch, *2 Catered lunch, *3 Lightly pickled Chinese cabbage, *4 Pool water

The statistics in this report are based on 1) the data concerning patients and laboratory findings obtained by the National Epidemiological Surveillance of Infectious Diseases undertaken in compliance with the Law Concerning the Prevention of Infectious Diseases and Medical Care for Patients of Infections, and 2) other data covering various aspects of infectious diseases. The prefectural and municipal health centers and public health institutes (PHIs), the Department of Food Safety, the Ministry of Health, Labour and Welfare, and quarantine stations, have provided the above data.

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＜特集関連資料＞ 腸管出血性大腸菌検出例の血清型別臨床症状，2012年

Symptoms associated with EHEC infection, by serotype, 2012　(病原微生物検出情報：2013年4月11日現在報告数)

血清型 Serotype	臨床症状* Symptoms*											例数 Cases
	不詳[1]	無症状[2]	発熱[3]	下痢[4]	嘔気嘔吐[5]	血便[6]	腹痛[7]	意識障害[8]	脳症[9]	HUS[10]	腎機能障害[11]	
検出報告総数　Total	81	697	333	937	191	564	860	1	3	21	17	1, 957
O157:H7:VT1	−	1	2	4	2	5	5	−	−	−	−	6
O157:H7:VT2	1	57	47	107	28	92	117	−	−	4	4	196
O157:H7:VT1&VT2	1	93	103	294	67	243	320	−	−	6	5	459
O157:H17:VT2	−	−	1	1	−	−	1	−	−	−	−	1
O157:H-:VT1	−	3	−	2	−	−	2	−	−	−	−	5
O157:H-:VT2	−	14	13	36	6	24	32	−	1	2	4	59
O157:H-:VT1&VT2	1	22	16	50	9	28	50	−	−	−	−	80
O157:HUT:VT2	−	1	−	−	−	−	−	−	−	−	−	1
O157:HUT:VT1&VT2	−	2	−	2	−	3	3	−	−	−	−	5
O157:HNT:VT1	1	2	1	4	−	2	4	−	−	−	−	8
O157:HNT:VT2	2	26	4	31	5	13	27	−	−	5	1	60
O157:HNT:VT1&VT2	61	23	19	69	11	37	61	−	1	−	1	159
O157**	−	−	1	1	−	−	−	−	−	1	−	1
O157 小計　Subtotal	67	244	207	601	128	447	622	−	2	18	15	1, 040
O26:H2:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O26:H11:VT1	−	130	33	98	9	29	43	−	−	−	−	248
O26:H11:VT2	−	6	2	4	1	1	1	−	−	−	−	10
O26:H11:VT1&VT2	−	3	4	9	3	8	10	−	−	−	−	14
O26:H51:VT1	−	1	−	1	−	2	2	−	−	−	−	5
O26:H-:VT1	−	51	23	43	5	5	33	−	−	−	−	134
O26:H-:VT2	−	1	−	1	1	−	−	−	−	1	−	2
O26:H-:VT1&VT2	−	3	−	2	−	1	2	−	−	−	−	5
O26:HUT:VT1	−	1	−	1	1	−	−	−	−	−	−	2
O26:HNT:VT1	4	73	8	22	8	6	17	−	−	−	−	106
O26:HNT:VT1&VT2	1	−	−	−	−	−	−	−	−	−	−	1
O26 小計　Subtotal	5	270	70	181	28	52	108	−	−	1	−	528
O103:H2:VT1	−	19	6	10	2	5	8	−	−	−	−	34
O103:H-:VT1	−	20	4	10	−	1	4	−	−	−	−	32
O103:HUT:VT1	−	9	1	5	1	2	3	−	−	−	−	16
O103:HNT:VT1	1	13	1	3	−	2	3	−	−	−	−	17
O103:HNT:VT1&VT2	−	2	−	1	−	1	1	−	−	−	−	3
O103 小計　Subtotal	1	63	12	29	3	11	19	−	−	−	−	102
O111:H21:VT1	−	−	1	1	−	−	−	−	−	−	−	1
O111:H-:VT1	−	14	4	19	3	4	11	−	−	−	−	34
O111:H-:VT1&VT2	1	5	4	8	−	2	7	−	−	−	−	14
O111:HUT:VT1	−	4	1	5	1	1	4	−	−	−	−	11
O111:HUT:VT1&VT2	−	5	−	2	−	−	−	−	−	−	−	7
O111:HNT:VT1	1	1	1	2	−	1	2	−	−	−	−	4
O111:HNT:VT1&VT2	−	−	−	2	−	2	2	−	−	−	−	2
O111 小計　Subtotal	2	29	11	39	4	10	26	−	−	−	−	73
O121:H19:VT2	−	19	7	20	5	13	25	−	−	−	−	48
O121:HUT:VT2	−	−	−	1	−	1	−	−	−	−	−	1
O121:HNT:VT2	1	3	2	7	2	3	7	−	−	−	−	12
O121 小計　Subtotal	1	22	9	28	7	17	32	−	−	−	−	61
O145:H41:VT2	−	1	−	1	−	1	1	−	−	−	−	2
O145:H-:VT1	−	1	1	2	2	2	2	−	−	−	−	5
O145:H-:VT2	−	3	8	17	7	8	12	1	1	2	2	25
O145:HNT:VT2	−	3	4	6	1	4	5	−	−	−	−	12
O145:HNT:VT1&VT2	−	−	1	1	1	−	1	−	−	−	−	1
O145 小計　Subtotal	−	8	14	27	11	15	21	1	1	2	2	45
O91:H14:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O91:H26:VT1&VT2	−	1	−	−	−	−	−	−	−	−	−	1
O91:H-:VT1	1	3	−	1	1	−	1	−	−	−	−	5
O91:H-:VT1&VT2	−	4	−	−	−	−	−	−	−	−	−	4
O91:HUT:VT1	−	7	1	2	−	−	1	−	−	−	−	9
O91:HNT:VT1	1	3	−	−	−	−	−	−	−	−	−	5
O91:HNT:VT1&VT2	−	1	−	−	−	−	−	−	−	−	−	1
O91 小計　Subtotal	2	20	1	3	1	−	2	−	−	−	−	26
O5:H-:VT1	−	−	−	−	−	−	1	−	−	−	−	1
O8:H19:VT1&VT2	−	−	1	1	1	1	1	−	−	−	−	1
O8:HUT:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O8:HUT:VT2	−	−	1	1	1	−	1	−	−	−	−	1
O8:HNT:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O8:HNT:VT1&VT2	−	−	−	−	−	−	−	−	−	−	−	1
O25:H12:VT1	−	−	−	1	−	−	1	−	−	−	−	1
O25:H28:VT Others	−	−	−	1	−	1	1	−	−	−	−	1
O28ac:HUT:VT2	−	1	−	−	−	−	−	−	−	−	−	1
O39:H49:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O40:HUT:VT2	−	1	−	1	−	−	−	−	−	−	−	2
O40:HNT:VT2	−	−	−	−	1	1	1	−	−	−	−	1
O63:HNT:VT1&VT2	1	−	−	−	−	−	−	−	−	−	−	1
O74:H20:VT2	−	1	−	−	−	−	−	−	−	−	−	1
O88:H25:VT1&VT2	−	−	1	1	−	1	1	−	−	−	−	1
O96:H19:VT1&VT2	−	1	−	−	−	−	−	−	−	−	−	1
O98:HNT:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O105:H7:VT2	−	1	−	−	−	−	−	−	−	−	−	1
O112ac:H16:VT1&VT2	−	2	−	−	−	−	−	−	−	−	−	2
O113:H-:VT2	−	−	1	1	−	1	−	−	−	−	−	1
O115:H10:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O115:HNT:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O115:HNT:VT2	1	−	−	−	−	−	−	−	−	−	−	1
O118:H16:VT1	−	1	−	1	−	1	1	−	−	−	−	2
O119:H4:VT1	−	−	−	1	−	1	−	−	−	−	−	1
O119:HNT:VT1	−	−	−	−	−	−	1	−	−	−	−	1
O128:H2:VT2	−	−	1	1	−	−	1	−	−	−	−	2
O128:H2:VT1&VT2	−	2	−	−	−	−	−	−	−	−	−	2
O128:H-:VT1&VT2	−	1	−	−	−	−	−	−	−	−	−	1
O130:H11:VT2	−	1	−	−	−	−	−	−	−	−	−	1
O141:H-:VT2	−	−	−	1	−	1	1	−	−	−	−	1
O146:H-:VT1&VT2	−	2	−	−	−	−	−	−	−	−	−	2
O148:H18:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O148:HNT:VT1	−	−	−	1	1	−	1	−	−	−	−	1
O153:HUT:VT2	−	−	−	1	−	−	−	−	−	−	−	1
O165:H-:VT2	−	−	−	1	−	1	2	−	−	−	−	2
O165:H-:VT1&VT2	−	−	1	2	1	1	3	−	−	−	−	3
O165:HNT:VT2	−	−	−	−	−	−	−	−	−	−	−	1
O165:HNT:VT1&VT2	−	−	−	2	−	1	2	−	−	−	−	2
O169:H9:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O174:H21:VT2	−	1	−	−	−	−	−	−	−	−	−	1
O174:H-:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O183:H18:VT1	−	1	−	−	−	−	−	−	−	−	−	1
O186:H-:VT1	−	−	1	5	2	−	6	−	−	−	−	6
O untypable	1	16	2	6	2	1	5	−	−	−	−	23

UT: Untypable, NT: Not typed, *2つ以上の臨床症状が報告された例を含む。　地方衛生研究所からの「病原体個票」の報告による。

*Including cases for which two or more symptoms were reported, **serodiagnosed by O157-antibody, 1) no data, 2) no symptoms, 3) fever, 4) diarrhea, 5) nausea/vomiting, 6) bloody diarrhea, 7) abdominal pain, 8) disturbance of consciousness, 9) encephalopathy, 10) hemolytic uremic syndrome, 11) renal failure

(Infectious Agents Surveillance Report: Data based on the reports from public health institutes received before April 11, 2013)