

Symptoms associated with EHEC infection, by serotype in Japan, 2013.....	119	Detection of geographically widely dispersed EHEC O157 and O26 with the same PFGE pattern in Japan, 2013.....	128
EHEC food poisoning outbreak in Japan, 2013–MHLW.....	120	Molecular classification of EHEC in Japan.....	129
EHEC O157 food poisoning outbreak at a beef barbecue restaurant, September–October, 2013–Kawasaki City.....	120	Hemolytic uremic syndrome cases among EHEC infections in Japan, 2013–NESID.....	130
An EHEC O157 outbreak at an athletic training camp, August 2013 –Hyogo Prefecture.....	121	Detection of measles virus genotype D9 from a traveler returning from the Philippines, February 2014–Fukuoka City.....	132
An EHEC O111 outbreak in a nursery school, July 2013 –Fukuoka City.....	123	Epidemiology of syphilis in Tokyo, 2007–2013.....	132
An outbreak of EHEC O103 and O26 in a nursery school, August 2013–Tokyo.....	124	Food poisoning due to <i>Vibrio cholerae</i> non-O1 & non-O139, September & October 2013–Oita Prefecture.....	134
A mixed outbreak of EHEC O26 VT1 and O103 VT1 infections in a nursery school, August 2013–Miyazaki City.....	126	Food poisoning due to <i>Vibrio cholerae</i> non-O1 & non-O139, September 2013–Ishikawa Prefecture.....	135
An EHEC O26:H11 VT2 outbreak in a nursery school, September 2013–Tokyo.....	127	<i>Vibrio cholerae</i> non-O1 & non-O139 isolation from food poisoning cases, September–October 2013.....	136

## &lt;THE TOPIC OF THIS MONTH&gt;

Enterohemorrhagic *Escherichia coli* infection in Japan as of April 2014

Enterohemorrhagic *Escherichia coli* (EHEC) infection is a category III notifiable infectious disease under the Law Concerning the Prevention of Infectious Diseases and Medical Care for Patients of Infections (Infectious Diseases Control Law). All cases must be notified by the physician who makes the diagnosis (<http://www.nih.go.jp/niid/en/iasr-sp/2251-related-articles/related-articles-399/3534-de3991.html>). If an EHEC infection is notified as food poisoning by the physician or judged as such by the director of the health center, the local government investigates the incident and submits a report to the Ministry of Health, Labour and Welfare (MHLW) in compliance with the Food Sanitation Law.

Prefectural and municipal public health institutes (PHIs) conduct isolation of EHEC, serotyping, and toxin [vero-/Shigatoxin: (VT)/(Stx)] typing and report the result to the National Epidemiological Surveillance of Infectious Diseases (NESID) system (see p. 119 of this issue). When necessary, the Department of Bacteriology I, National Institute of Infectious Diseases (NIID), conducts confirmatory tests for sero- and toxin-typing and also conducts multiple-locus variable-number tandem repeat analysis (MLVA), pulsed-field gel electrophoresis (PFGE) and other molecular epidemiological analysis to analyze outbreaks (including sporadic cases part of diffuse outbreaks). These results are informed back to PHIs and made available through the National Epidemiological Surveillance of Foodborne Disease (NESFD) system (see p. 128 of this issue).

**Cases notified under NESID:** During January to December 2013, a total 4,046 EHEC infections, composed of 2,624 symptomatic and 1,422 asymptomatic (detected during active surveillance of outbreaks or routine stool testing of food preparation staff) cases, were reported (Table 1). The number of symptomatic infections remained stable from 2009 to 2012 (2,602, 2,719, 2,659 and 2,363, respectively). As in previous years, a large peak occurred in summer (Fig. 1). Reported number of cases (including asymptomatic cases) was the highest in Tokyo (382), followed by Fukuoka (271), Kanagawa (218), Aichi (211), and Hokkaido (207). Incidence (cases per 100,000 populations) was the highest in Miyazaki Prefecture (8.35) followed by Saga Prefecture (8.19) and Toyama Prefecture (7.95) (Fig. 2, left). Among those 0–4 years of age, more cases were reported from Miyazaki, Nagasaki and Shimane Prefectures (Fig. 2, right). The young (<30 years of age) and the elderly (≥60 years of age) had a greater proportion of reported cases that were symptomatic relative to those in their 30's, 40's and 50's (Fig. 3).

**Hemolytic uremic syndrome (HUS):** A total of 87 hemolytic uremic syndrome (HUS) cases (3.3% of symptomatic cases), were reported in 2013 (see p. 130 of this issue). EHEC was isolated from 55 cases, among which 48 were O157, three were O26, and one each of O76, O111, O121 and O165. Among the 55 isolates, 54 were positive for VT2 or VT1 & 2 (98%). One isolate was unknown for VT type. Four fatal cases were reported, among which one had HUS complication (5 years of age) and the others were elderly (one in her 70's and two in their 90's).

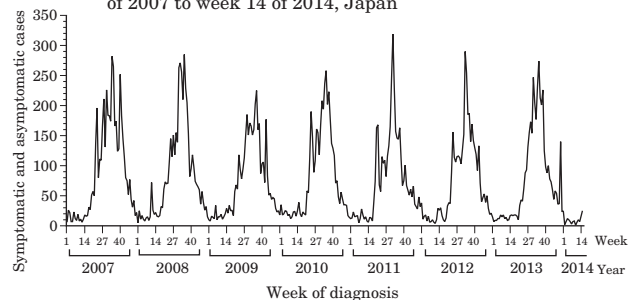
**EHEC isolated by PHIs:** In 2013, number of EHEC isolated by PHIs was 2,086 (see p. 119 of this issue), which was far less than the reported number of 4,046 EHEC cases (Table 1). This discrepancy is due to the current situation where clinical or commercial laboratories do not always send specimens to PHIs. The most frequent O-serogroup was O157 (52%), followed by O26 (25%) and O111 (7.2%). Among O157 isolates, those positive for both VT1 and VT2 genes were predominant (63%) as in previous years. Of the O26 isolates, 95.7% were positive only for VT1 and 78.1% of O111 were positive for both VT1 and VT2. Signs and

Table 1. Notified cases of EHEC infection

Year of diagnosis	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	3,770
2013	Jan. 1 - Dec. 31	4,046
2014	Jan. 1 - Apr. 6	120

Including symptomatic and asymptomatic cases  
National Epidemiological Surveillance of Infectious Diseases  
(Data based on reports as of April 9, 2014)

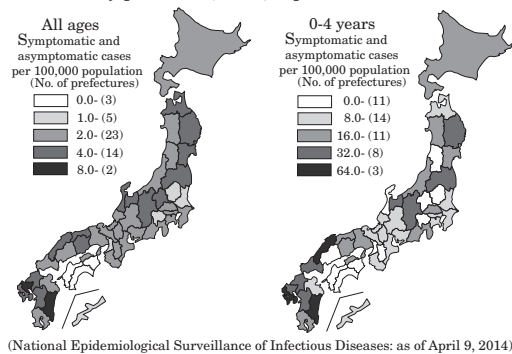
Figure 1. Weekly number of reported EHEC infection cases, week 1 of 2007 to week 14 of 2014, Japan



(National Epidemiological Surveillance of Infectious Diseases: as of April 9, 2014)

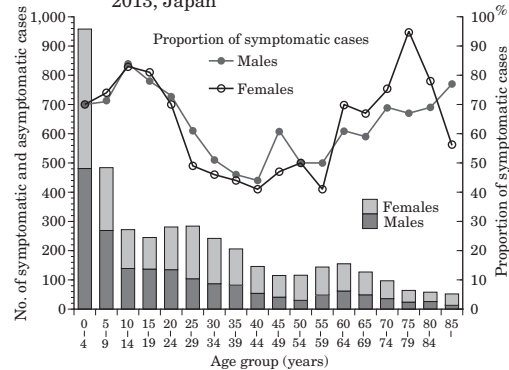
(THE TOPIC OF THIS MONTH-Continued)

Figure 2. Annual incidence of EHEC infection by prefecture, 2013, Japan



(National Epidemiological Surveillance of Infectious Diseases: as of April 9, 2014)

Figure 3. Age distribution of EHEC infection cases, 2013, Japan



(National Epidemiological Surveillance of Infectious Diseases: as of April 9, 2014)

symptoms frequent among the O157-isolated symptomatic cases (n=1,044), were abdominal pain (60%), diarrhea (60%), bloody diarrhea (50%), and fever (22%).

**Outbreaks:** In 2013, PHIs reported to NESID 34 EHEC outbreaks. Outbreaks involving ten or more EHEC-positive cases are shown in Table 2. Several outbreaks were believed to have occurred via human to human transmissions at nursery schools (pp. 123, 124, 126 and 127 of this issue). In 2013, prefectures reported a total of 13 EHEC incidents involving 105 symptomatic patients (cases that were negative for isolation included) in compliance with the Food Sanitation Law (25 incidents and 714 patients in 2011; 16 incidents and 392 patients in 2012) (see p. 120 of this issue). Although epidemiological linkage was not demonstrated, Department of Bacteriology I, NIID reported that EHEC cases showing the same PFGE pattern was isolated from sporadic cases that occurred diffusely and widely (see p. 128 of this issue).

**Prevention and measures to be implemented:** In response to persistent food poisonings caused by raw beef, MHLW revised the standards of beef marketed for raw consumption and issued the MHLW notice No. 321 in October 2011. Further, upon the detection of EHEC O157 in the inner part of beef liver, MHLW banned marketing of beef liver for raw consumption (notice No. 404 in July 2012) (IASR 34: 123-124, 2013). As a consequence, the incidence of O157 cases related to consumption of raw beef or raw beef liver decreased considerably in one year from 2011 and that level has been maintained through 2013. In response to O157 outbreaks caused by pickled vegetables, MHLW further modified the hygiene standards of pickled vegetables (Shoku-An-Kan-Hatsu 1012 No.1, 12 October 2012). The basics for preventing EHEC infections are to observe the principles of food poisoning prevention and to avoid consumption of raw or undercooked beef (<http://www.gov-online.go.jp/useful/article/201005/4.html>). Although Japan experienced no large-scale food poisoning events in 2013, food safety measures, including the assurance of personal hygiene of food handlers, should be further strengthened.

Similar to dysentery bacilli, EHEC establishes infection even at minute doses and can spread from person to person rather easily. The year 2013 experienced many EHEC outbreaks in nursery schools (Table 2, pp. 123, 124, 126 and 127 of this issue). Preventing such outbreaks needs appropriate hygienic practice, such as routine hand washing and sanitary use of children's pools during summer (see "Infection Control Guidelines for Nurseries" revised in 2012). To prevent the spread of EHEC within patients' families and to the wider community, health centers should provide instructions on prevention to relevant persons.

Table 2. Outbreaks of EHEC infection, 2013

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	Hyogo P.	Jun. 11-29	Person to person	Nursery school	O157:H-	VT1&VT2	3	...	13 / 82	Yes	
2	Fukuoka C.	Jun. 29-Jul. 30	Person to person	Nursery school	O111:H-	VT1&VT2	46	...	79 / 671	Yes	p. 123 of this issue
3	Saitama P.	Jul. 3-14	Person to person	Nursery school	O157:H7	VT1&VT2	7	...	12 / 299	Yes (3)	
4	Saga P.	Jul. 8-17	Person to person	Welfare facility**	O157:H7	VT1	1	...	20 / >100	No	
5	Miyazaki P.	Jul. 12-29	Person to person	Nursery school	O26:H11	VT1	8	...	11 / 81	Yes	
6	Saitama C.	Aug. 1-12	Person to person	Nursery school	O26:H11	VT1	6	...	18 / 186	Yes	
7	Tokyo	Aug. 1-15	Person to person	Nursery school	O26:H-	VT1	3	...	9 / 150	Yes	p. 124 of this issue
					O103:H2	VT1	5	...	11 / 150		
8	Fukuoka P.	Aug. 4-Oct. 17	Person to person	Nursery school	O26:H11	VT1	24	...	36 / 259	Yes	
9	Saitama P.	Aug. 9-15	Person to person	Nursery school	O26:H11	VT1	9	...	23 / 136	Yes (6)	
10	Kawasaki C.	Aug. 10-Oct. 17	Person to person	Nursery school	O145:HNT	VT1	17	...	23 / 226	Yes	
11	Sendai C.	Aug. 19-Sep. 5	Person to person	Nursery school	O111:H8	VT1&VT2	21	...	20 / 154	Yes	
12	Fukushima P.	Aug. 22	Person to person	Nursery school	O26:H11	VT1	17	...	33 / 164	Yes (7)	
13	Fukushima P.	Aug. 22-Oct. 25	Person to person	Nursery school	O26:H11	VT1	24	...	65 / 480	Yes (17)	
14	Hyogo P., Aichi P. & Fukui P.	Aug. 27-Sep. 14	Unknown	Athletic training camp	O157:H7	VT1&VT2	20	...	20 / 101	Yes	p. 121 of this issue
15	Tokyo	Aug. 30-Sep. 30	Person to person	Nursery school	O26:H11	VT2	7	...	25 / 113	Yes	p. 127 of this issue
16	Miyazaki P.	Aug. 31-Sep. 11	Person to person	Nursery school	O26:H11	VT1	7	...	28 / 288	Yes	p. 126 of this issue
					O103:H2	VT1	1	...	18 / 288		
17	Fukushima P.	Sep. 5	Person to person	Nursery school	O26:H11	VT1	2	...	17 / 166	Yes (5)	
18	Kawasaki C.	Sep. 27-Oct. 13	Foodborne	Restaurant***	O157:HNT	VT2	29	77	24 / 58	Yes	p. 120 of this issue
19	Fukuoka C.	Sep. 27-Nov. 19	Person to person	Nursery school	O103:H11	VT1	7	...	10 / 228	Yes	
20	Fukushima P.	Oct. 18	Person to person	Nursery school	O26:H11	VT1	5	...	15 / 150	Yes (5)	
21	Toyama P.	Nov. 30-Jan. 7	Person to person	Nursery school	O26:H11	VT1	15	...	47 / 297	Yes	
22	Nagano C.	Dec. 5	Person to person	Nursery school	O26:H11	VT1	22	...	48 / 164	Yes	

Including 10 or more EHEC-positives, P.: Prefecture, C.: City, NT: Not typed, ...: No information was entered because person-to-person infection was suspected.

\*Secondary transmission within family. Number in ( ) refer to infections from secondary transmission. \*\*for the elderly, \*\*\*beef barbecue restaurant

(Data based on the reports from public health institutes received before April 1, 2014 and references in IASR)

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, 2013年

Symptoms associated with EHEC infection, by serotype, 2013

(病原微生物検出情報: 2014年4月1日現在報告数)

血清型 Serotype	臨床症状* Symptoms*											例数 Cases
	不詳 <sup>1)</sup>	無症状 <sup>2)</sup>	発熱 <sup>3)</sup>	下痢 <sup>4)</sup>	嘔気嘔吐 <sup>5)</sup>	血便 <sup>6)</sup>	腹痛 <sup>7)</sup>	意識障害 <sup>8)</sup>	脳症 <sup>9)</sup>	HUS <sup>10)</sup>	腎機能障害 <sup>11)</sup>	
検出報告総数 Total	61	762	339	1,037	192	698	887	-	1	27	15	2,086
O157:H7:VT1	-	28	3	6	1	5	5	-	-	-	-	36
O157:H7:VT2	2	68	40	134	28	111	130	-	-	7	3	240
O157:H7:VT1&VT2	-	112	132	316	85	281	335	-	1	11	4	494
O157:H:VT1	-	-	-	4	1	1	3	-	-	-	-	5
O157:H:VT2	-	2	9	15	5	18	20	-	-	3	3	25
O157:H:VT1&VT2	1	25	9	40	5	28	36	-	-	1	-	71
O157:HNT:VT1	-	2	-	5	1	4	3	-	-	-	-	7
O157:HNT:VT2	3	23	17	48	12	33	41	-	-	3	2	83
O157:HNT:VT1&VT2	27	20	15	59	7	45	56	-	-	-	1	116
O157 小計 Subtotal	33	280	225	627	145	526	629	-	1	25	13	1,077
O26:H7:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O26:H11:VT1	-	175	38	161	15	61	87	-	-	-	-	370
O26:H11:VT2	-	4	2	5	1	5	3	-	-	-	-	10
O26:H11:VT1&VT2	-	5	3	2	2	4	5	-	-	2	1	10
O26:H:VT1	-	9	1	9	1	7	9	-	-	-	-	20
O26:HUT:VT1	-	-	1	-	-	1	-	-	-	-	-	1
O26:HUT:VT2	-	1	-	1	-	-	1	-	-	-	-	2
O26:HNT:VT1	3	77	4	32	2	9	16	-	-	-	-	114
O26:HNT:VT2	-	-	-	1	-	1	1	-	-	-	-	1
O26 小計 Subtotal	3	272	49	211	19	88	122	-	-	2	1	529
O111:H8:VT1	-	-	1	1	-	-	1	-	-	-	-	1
O111:H8:VT1&VT2	-	6	3	12	2	5	9	-	-	-	-	19
O111:H21:VT1	-	-	-	1	-	-	1	-	-	-	-	1
O111:H:VT1	-	-	3	4	1	3	4	-	-	-	-	5
O111:H:VT1&VT2	19	33	1	26	1	5	9	-	-	-	-	87
O111:HUT:VT1	-	12	3	5	-	-	3	-	-	-	-	21
O111:HUT:VT1&VT2	-	4	1	5	1	2	4	-	-	-	-	10
O111:HNT:VT1	-	2	-	3	-	-	2	-	-	-	-	5
O111:HNT:VT1&VT2	-	-	1	1	-	2	2	-	-	-	-	2
O111 小計 Subtotal	19	57	13	58	5	17	35	-	-	-	-	151
O103:H2:VT1	-	32	5	11	2	5	7	-	-	-	-	46
O103:H11:VT1	-	5	3	7	-	2	3	-	-	-	-	19
O103:H18:VT1	-	-	1	1	-	-	-	-	-	-	-	1
O103:H51:VT1	-	-	1	2	-	-	2	-	-	-	-	2
O103:H:VT1	-	2	-	-	-	-	-	-	-	-	-	2
O103:HUT:VT1	-	3	5	7	2	2	6	-	-	-	-	11
O103:HNT:VT1	1	6	5	10	2	3	6	-	-	-	-	17
O103 小計 Subtotal	1	48	20	38	6	12	24	-	-	-	-	98
O121:H6:VT2	-	1	-	1	-	-	-	-	-	-	-	2
O121:H19:VT2	-	21	12	33	6	26	36	-	-	-	-	61
O121:H19:VT1&VT2	-	-	1	3	1	1	4	-	-	-	-	4
O121:H21:VT2	-	-	-	1	-	1	1	-	-	-	-	1
O121:H:VT2	-	-	-	1	-	-	1	-	-	-	-	1
O121:HUT:VT2	-	1	1	7	1	4	3	-	-	-	-	8
O121:HNT:VT2	-	5	2	7	1	4	5	-	-	-	-	13
O121:HNT:VT1&VT2	-	1	-	-	-	-	-	-	-	-	-	1
O121 小計 Subtotal	-	29	16	53	9	36	50	-	-	-	-	91
O145:H:VT1	-	8	1	6	1	3	2	-	-	-	-	15
O145:H:VT2	-	-	-	5	2	4	4	-	-	-	-	5
O145:H:VT1&VT2	-	-	1	1	-	1	1	-	-	-	-	1
O145:HNT:VT1	-	6	8	17	-	-	2	-	-	-	-	23
O145:HNT:VT2	-	2	-	3	-	1	3	-	-	-	-	5
O145 小計 Subtotal	-	16	10	32	3	9	12	-	-	-	-	49
O91:H2:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O91:H14:VT1	-	3	-	-	-	-	-	-	-	-	-	3
O91:H21:VT2	-	1	-	-	-	-	-	-	-	-	-	1
O91:H51:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O91:H:VT1	-	2	1	1	-	1	1	-	-	-	-	4
O91:H:VT1&VT2	-	1	-	-	-	-	-	-	-	-	-	1
O91:HUT:VT1	-	2	-	-	-	-	1	-	-	-	-	3
O91:HUT:VT2	-	1	-	-	-	-	-	-	-	-	-	1
O91:HNT:VT1	-	7	-	1	1	-	1	-	-	-	-	8
O91 小計 Subtotal	-	19	1	2	1	1	3	-	-	-	-	23
O6:HNT:VT1&VT2	1	-	-	-	-	-	-	-	-	-	-	1
O8:H19:VT2	-	-	-	-	-	-	-	-	-	-	-	1
O15:H2:VT1	-	-	-	1	-	1	-	-	-	-	-	1
O18:H2:VT2	-	1	-	-	-	-	-	-	-	-	-	1
O19:H11:VT1	-	-	-	-	-	-	-	-	-	-	-	1
O25:HNT:VT2	1	-	-	-	-	-	-	-	-	-	-	1
O28ac:HUT:VT2	-	1	-	-	-	-	-	-	-	-	-	1
O55:H12:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O55:H7:VT1	-	2	1	3	-	3	3	-	-	-	-	6
O76:H7:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O98:H:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O101:H:VT1	-	-	1	1	1	-	-	-	-	-	-	1
O113:H21:VT2	-	1	-	-	-	-	-	-	-	-	-	1
O113:H4:VT1&VT2	-	-	-	-	-	-	1	-	-	-	-	1
O115:H10:VT1	-	3	-	-	-	-	-	-	-	-	-	3
O115:HNT:VT1	1	-	-	-	-	-	-	-	-	-	-	1
O115:HNT:VT2	-	1	-	-	-	-	-	-	-	-	-	1
O119:HNT:VT2	-	-	-	1	-	1	-	-	-	-	-	1
O128:H:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O128:H2:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O128:H2:VT1&VT2	-	1	-	-	-	-	-	-	-	-	-	1
O128:HUT:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O136:H12:VT2	-	1	-	-	-	-	-	-	-	-	-	1
O136:HUT:VT1	-	1	-	1	1	-	-	-	-	-	-	2
O146:H:VT2	-	2	-	-	-	-	-	-	-	-	-	2
O146:H21:VT1	-	2	-	-	-	-	-	-	-	-	-	2
O146:HNT:VT2	-	1	-	-	-	-	-	-	-	-	-	1
O156:H25:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O159:H19:VT2	-	1	-	-	-	-	-	-	-	-	-	1
O165:H:VT1&VT2	-	1	-	1	-	-	1	-	-	-	-	2
O165:H:VT2	-	-	-	1	-	-	1	-	-	-	-	1
O165:H25:VT1&VT2	-	1	-	2	-	1	-	-	-	-	-	3
O165:HNT:VT2	1	-	-	-	-	-	-	-	-	-	-	1
O168:H19:VT1	-	1	-	-	-	-	-	-	-	-	-	1
O181:H16:VT2	-	1	-	-	-	-	-	-	-	-	-	1
O183:H:VT1&VT2	-	1	-	-	-	-	-	-	-	-	-	1
O untypable	1	11	3	5	2	3	6	-	-	-	1	19

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「病原体概要」の報告による  
 \*Including cases for which two or more symptoms were reported, 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 1, 2014)