

# FOOD-BORNE DISEASES



Food-borne diseases are a result of ingestion of food or water contaminated with microorganisms (bacteria, virus or parasite), toxins produced by harmful algal and bacterial species or present in specific fish species, or chemicals. Affected individuals commonly present with gastrointestinal symptoms. Contamination of food may occur at any stage in the process, from food production to consumption.

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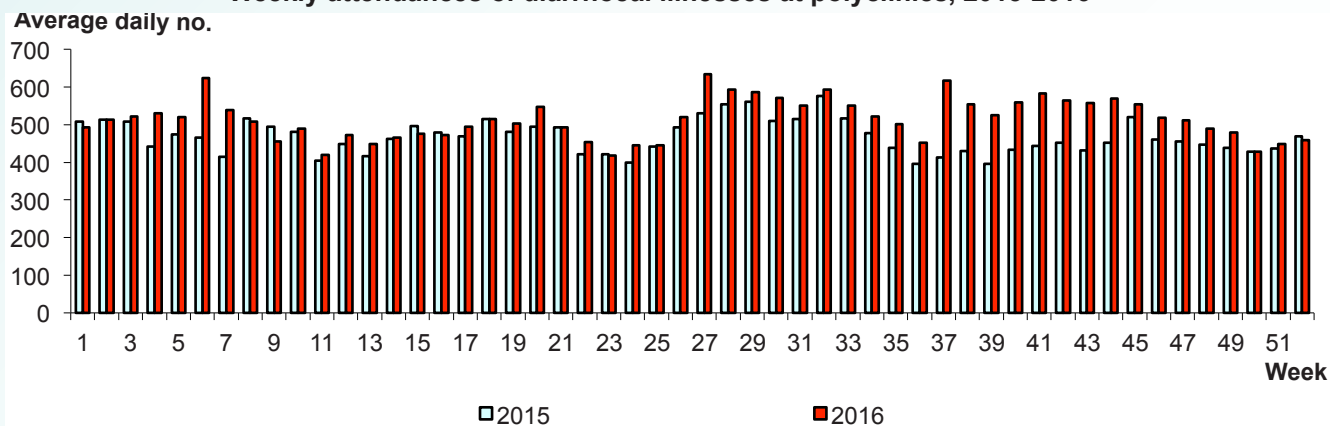
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**FOOD  
POISONING**

## ACUTE DIARRHOEAL ILLNESS

There were a total of 142,004 attendances at polyclinics for acute diarrhoeal illness in 2016, an increase of 11.7% compared to the 127,150 seen in 2015. The weekly surveillance of acute diarrhoeal illness attendances showed a similar pattern to that of the previous year (Figure 4.1).

**Figure 4.1**  
Weekly attendances of diarrhoeal illnesses at polyclinics, 2015-2016



## CAMPYLOBACTERIOSIS

*Campylobacter* enteritis is an acute bacterial enteric disease of variable severity characterised by diarrhoea, abdominal pain, malaise, fever, nausea and vomiting. *Campylobacter jejuni* and less commonly, *Campylobacter coli* are the usual causes of *Campylobacter* enteritis in humans. The mode of transmission is by ingestion of the organism in undercooked chicken or pork, contaminated food, water or unpasteurised milk.

A total of 442 cases of *Campylobacter* enteritis were reported in 2016, an increase of 5.2% compared to 420 cases reported in 2015. *Campylobacter jejuni* was isolated in the majority of the cases (Table 4.1). Of the 442 reported cases, 18 were imported cases and 406 indigenous cases (Table 4.2). The remaining 18 cases comprised 12 tourists and six foreigners who travelled to Singapore to seek medical treatment.

The incidence among indigenous cases was highest in the 0-4 years age group, with an overall male to female ratio of 1.1:1 (Table 4.3). Among the three major ethnic groups, Malays had the highest incidence rate followed by Chinese (Table 4.4).

**Table 4.1**  
Incidence rates of reported *Campylobacter* enteritis cases, 2012-2016

Year	No. of cases caused by					Incidence rates per 100,000 population*
	<i>C. jejuni</i>	<i>C. coli</i>	<i>C. laridis</i>	Other species	Total	
2012	388#	12	1#	43	443	8.3
2013	335	14	0	48	397	7.4
2014	370	18	0	45	435	8.0
2015	334	31	0	55	420	7.6
2016	364^	33^	0	45	442	7.6

#One case had a concurrent infection of both *C. jejuni* and *C. laridis*.

\*Rates are based on annual estimated mid-year population.

(Source: Singapore Department of Statistics).

**Table 4.2**  
**Total number of notifications\* received for *Campylobacter* enteritis, 2012-2016**

Age group	2012		2013		2014		2015		2016	
	Local	Imported	Local	Imported	Local	Imported	Local	Imported	Local	Imported
0-4	180	8	166	13	154	9	168	6	149	1
5-14	105	14	75	8	90	11	88	6	100	5
15-24	14	2	14	1	7	21	21	6	20	5
25-34	13	3	15	6	2	23	23	3	28	1
35-44	9	6	9	0	6	10	10	1	6	3
45-54	13	4	10	1	4	15	15	0	21	1
55+	53	4	68	6	1	63	63	4	82	2
<b>Total</b>	<b>387</b>	<b>41</b>	<b>357</b>	<b>35</b>	<b>370</b>	<b>40</b>	<b>388</b>	<b>26</b>	<b>406</b>	<b>18</b>

\*Excluded tourists and foreigners who travelled to Singapore to seek medical treatment.

**Table 4.3**  
**Age-gender distribution and age-specific incidence rates of reported *Campylobacter* enteritis cases<sup>^</sup>, 2016**

Age group	Male	Female	Total	%	Incidence rates per 100,000 population*
0-4	76	74	150	35.4	64.4
5-14	61	44	105	24.8	22.6
15-24	18	7	25	5.9	3.4
25-34	16	13	29	6.8	2.3
35-44	4	5	9	2.1	0.9
45-54	13	9	22	5.2	2.9
55+	37	47	84	19.8	7.4
<b>Total</b>	<b>225</b>	<b>199</b>	<b>424</b>	<b>100</b>	<b>7.6</b>

<sup>^</sup>Excluded 12 tourists and six foreigners seeking medical treatment in Singapore.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics).

**Table 4.4**  
**Ethnic-gender distribution and ethnic-specific incidence rates of reported *Campylobacter* enteritis cases<sup>^</sup>, 2016**

	Male	Female	Total	%	Incidence rates per 100,000 population*
Singapore residents					
Chinese	120	106	226	53.3	7.7
Malay	28	33	61	14.4	11.6
Indian	13	13	26	6.1	7.3
Others	18	11	29	6.8	22.7
Foreigners	46	36	82	19.4	4.9
<b>Total</b>	<b>225</b>	<b>199</b>	<b>424</b>	<b>100</b>	<b>7.6</b>

<sup>^</sup>Excluded 12 tourists and six foreigners seeking medical treatment in Singapore.

\*Rates are based on 2016 estimated mid-year population.

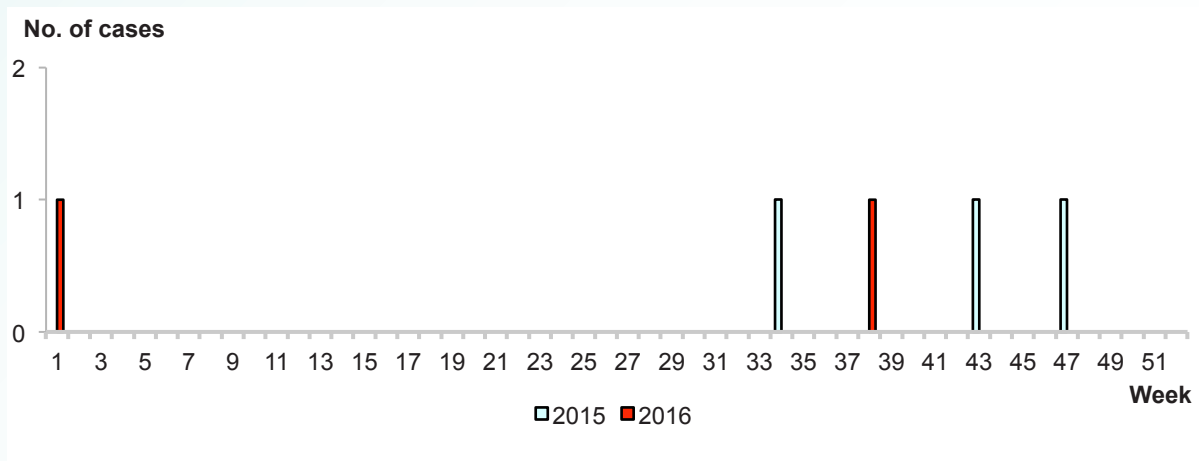
(Source: Singapore Department of Statistics).

## CHOLERA

Cholera is an acute bacterial enteric disease characterised in its severe form by sudden onset, profuse painless watery stools, nausea and vomiting. Untreated cases proceed rapidly to dehydration, acidosis, hypoglycaemia, circulatory collapse and renal failure. The usual causative agent in Singapore is *Vibrio cholerae* serogroup O1 which includes two biotypes, Classical and El Tor. Each of these biotypes can be further classified into serotypes Inaba, Ogawa and Hikojima. Other serogroups in addition to O1 are O139 and Non O. The mode of transmission is through ingestion of food or water contaminated with faeces or vomitus of infected persons.

In 2016, two imported cases of cholera were reported (Figure 4.2) and they were tourists. The overall incidence rate was hence zero per 100,000 population (Table 4.5 and 4.6).

**Figure 4.2**  
Weekly distribution of reported cholera cases, 2015-2016



**Table 4.5**  
Age-gender distribution and age-specific incidence rates of reported cholera cases<sup>^</sup>, 2016

Age group	Male	Female	Total	%	Incidence rates per 100,000 population*
0-4	0	0	0	0	0
5-14	0	0	0	0	0
15-24	0	0	0	0	0
25-34	0	0	0	0	0
35-44	0	0	0	0	0
45-54	0	0	0	0	0
55-64	0	0	0	0	0
65+	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

<sup>^</sup>Excluded two tourists.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)



**Table 4.6**  
**Ethnic-gender distribution and ethnic-specific incidence rates of reported cholera cases<sup>^</sup>, 2016**

	Male	Female	Total	%	Incidence rates per 100,000 population*
Singapore residents					
Chinese	0	0	0	0	0
Malay	0	0	0	0	0
Indian	0	0	0	0	0
Others	0	0	0	0	0
Foreigners	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

<sup>^</sup>Excluded two tourists.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

**Table 4.7**  
**Total number of notifications\* received for reported cholera cases, 2012-2016**

Age group	2012		2013		2014		2015		2016	
	Local	Imported	Local	Imported	Local	Imported	Local	Imported	Local	Imported
0-4	0	0	0	0	0	1	0	0	0	0
5-14	0	0	0	0	0	0	0	0	0	0
15-24	0	0	0	0	0	0	0	0	0	0
25-34	0	0	0	0	0	1	0	0	0	0
35-44	0	1	0	2	0	0	0	2	0	0
45-54	0	0	0	0	0	0	0	0	0	0
55-64	0	0	0	0	0	0	1	0	0	0
65+	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>

\*Excluded tourists and foreigners seeking medical treatment in Singapore.

## ENTERIC FEVERS

Enteric fevers (typhoid, paratyphoid) are systemic, bacterial diseases characterised by insidious onset of sustained fever, severe headache, malaise, anorexia. Other features may include a relative bradycardia, splenomegaly and non-productive cough (in the early stage of the illness). Constipation is more common than diarrhoea in adults. Causative organisms for the enteric fevers are *Salmonella typhi* and *Salmonella paratyphi* (types A or B) and infections are usually associated with travel to countries where these diseases are endemic. It is important to appreciate the difference between enteric fevers and non-typhoidal salmonellosis.

During the period 2012 to 2016, a total of 471 cases of enteric fever were reported, of which 326 (69.2%) cases were typhoid and 145 (30.8%) cases were paratyphoid. The majority (89.0%) were imported cases (Table 4.8).

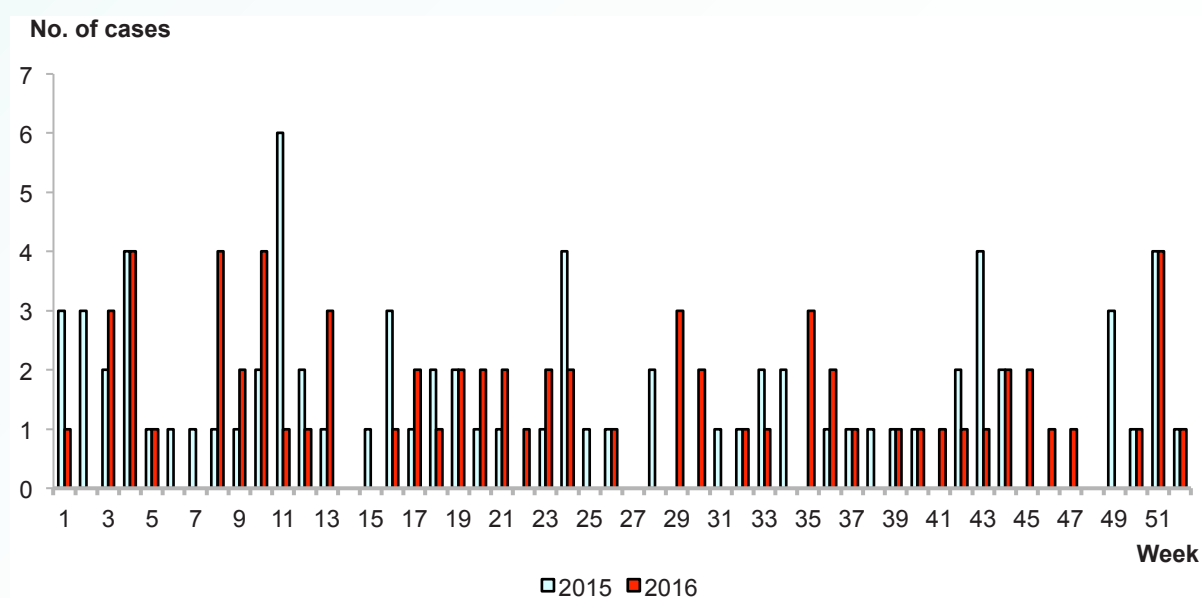
**Table 4.8**  
**Classification of reported enteric fever cases, 2012-2016**

Year	Typhoid	Paratyphoid		Total
		A	B	
2012	84 (82)	57 (46)	0 (0)	141 (128)
2013	84 (75)	23 (23)	0 (0)	107 (98)
2014	58 (52)	18 (17)	1 (0)	77 (69)
2015	49 (44)	25 (24)	2 (0)	76 (68)
2016	51 (39)	19 (17)	0 (0)	70 (56)
<b>Total</b>	<b>326 (292)</b>	<b>142 (127)</b>	<b>3 (0)</b>	<b>471 (419)</b>

( ) imported cases

In 2016, there were a total of 70 cases of enteric fevers comprising 51 cases of typhoid and 19 cases of paratyphoid A, a decrease of 7.9% compared to 76 cases reported in 2015 (Figure 4.3).

**Figure 4.3**  
**Weekly distribution of reported enteric fever cases, 2015-2016**



## Typhoid

There were 51 reported cases of typhoid in 2016. 18 cases were Singapore residents, three were foreigners seeking medical treatment in Singapore and three were tourists. The remaining 27 cases comprised 20 foreigners working in Singapore, three dependent pass holders and four student pass holders (Table 4.9). During the period 2012 to 2016, majority of the cases of typhoid were imported and in the 25-34 age group (Table 4.10). The overall incidence rate of typhoid among local residents was 0.8 per 100,000 population. Incidence was highest in the 25-34 years age group in 2016 (Table 4.11).

**Table 4.9**  
**Classification of reported typhoid and paratyphoid cases, 2016**

Population Group	Typhoid		Paratyphoid	
	No.	%	No.	%
Singapore residents	18	37.0	10	52.6
Foreigners seeking medical treatment in Singapore	3	5.6	1	5.3
Tourists	3	5.6	0	0
Other categories of foreigners	27	52.8	8	42.1
<b>Total</b>	<b>51</b>	<b>100</b>	<b>19</b>	<b>100</b>

**Table 4.10**  
**Total number of notifications\* received for reported typhoid cases, 2012-2016**

Age group	2012		2013		2014		2015		2016	
	Local	Imported	Local	Imported	Local	Imported	Local	Imported	Local	Imported
0-4	0	7	0	5	0	7	1	1	0	2
5-14	0	11	0	10	0	11	0	3	0	5
15-24	0	9	0	10	0	9	1	9	1	5
25-34	1	27	1	22	1	27	1	17	2	15
35-44	1	15	0	10	1	15	1	8	1	10
45-54	0	2	0	1	0	2	0	0	1	1
55-64	0	3	0	0	0	3	0	1	0	0
65+	0	3	1	1	0	3	0	0	1	1
<b>Total</b>	<b>2</b>	<b>77</b>	<b>2</b>	<b>59</b>	<b>2</b>	<b>77</b>	<b>4</b>	<b>39</b>	<b>6</b>	<b>39</b>

\*Excluded tourists and foreigners seeking medical treatment in Singapore.

**Table 4.11**  
**Age-gender distribution and age-specific incidence rates of reported typhoid cases<sup>^</sup>, 2016**

Age group	Male	Female	Total	%	Incidence rates per 100,000 population*
0-4	0	2	2	4.4	0.9
5-14	4	1	5	11.1	1.1
15-24	3	3	6	13.4	0.8
25-34	11	6	17	37.8	1.3
35-44	6	5	11	24.5	1.1
45-54	2	0	2	4.4	0.3
55-64	0	0	0	0	0
65+	2	0	2	4.4	0.4
<b>Total</b>	<b>28</b>	<b>17</b>	<b>45</b>	<b>100</b>	<b>0.8</b>

<sup>^</sup> Excluded three foreigners seeking medical treatment in Singapore and three tourists.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

Among the three major ethnic groups, Indians had the highest incidence rate (Table 4.12).

**Table 4.12**  
**Ethnic-gender distribution and ethnic-specific incidence rates of reported typhoid cases<sup>^</sup>, 2016**

	Male	Female	Total	%	Incidence rates per 100,000 population*
Singapore residents					
Chinese	4	3	7	15.6	0.2
Malay	2	2	4	8.9	0.8
Indian	5	0	5	11.1	1.4
Others	0	2	2	4.4	3.1
Foreigners	17	10	27	60.0	1.6
<b>Total</b>	<b>28</b>	<b>17</b>	<b>45</b>	<b>100</b>	<b>0.8</b>

<sup>^</sup> Excluded three foreigners seeking medical treatment in Singapore and three tourists.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

The majority of the cases acquired the infection from South Asia (53.9%) and Southeast Asia (46.1%) (Table 4.13). Most Singapore residents acquired the disease while overseas on vacation (85.7%) (Table 4.14).

**Table 4.13**  
**Imported typhoid cases by country of origin, 2015-2016**

Country of origin	2015	2016
	No. (%)	No. (%)
<b>Southeast Asia</b>		
Cambodia	1 (2.5)	0
Indonesia	5 (12.5)	6 (15.4)
Malaysia	2 (5.0)	3 (7.7)
Myanmar	3 (7.5)	8 (20.5)
Philippines	1 (2.5)	1 (2.5)
Thailand	0	0
Vietnam	1 (2.5)	0
<b>South Asia</b>		
Bangladesh	14 (35.0)	9 (23.1)
India	11 (27.5)	12 (30.8)
Nepal	0	0
<b>Others</b>		
People's Republic of China, Hong Kong	2 (5.0)	0
Republic of Korea	0	0
Taiwan	0	0
<b>Total</b>	<b>40 (100)</b>	<b>39 (100)</b>

**Table 4.14**  
**Singapore residents who contracted typhoid overseas, 2012-2016**

Purpose of travel	2012		2013		2014		2015		2016	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Vacation	26	92.9	23	95.8	14	77.8	13	92.9	12	85.7
Business/employment	2	7.1	1	4.2	2	11.1	1	7.1	2	14.3
Others	0	0	0	0	2	11.1	0	0	0	0
<b>Total</b>	<b>28</b>	<b>100</b>	<b>24</b>	<b>100</b>	<b>18</b>	<b>100</b>	<b>14</b>	<b>100</b>	<b>14</b>	<b>100</b>

## Paratyphoid

Of the 19 reported cases of paratyphoid, 10 were Singapore residents, one was a foreigner seeking medical treatment in Singapore, seven were foreigners working in Singapore, and one was a student pass holder (Table 4.9). During the period 2012 to 2016, majority of the cases of paratyphoid were imported and in the 25-34 age group (Table 4.15). The overall incidence rate of paratyphoid among local residents was 0.3 per 100,000 population and was highest in the 25-34 age group in 2016 (Table 4.16).



**Table 4.15**  
**Total number of notifications\* received for reported paratyphoid cases, 2012-2016**

Age group	2012		2013		2014		2015		2016	
	Local	Imported	Local	Imported	Local	Imported	Local	Imported	Local	Imported
0-4	0	0	0	0	0	0	0	1	0	1
5-14	0	4	0	3	0	1	0	2	0	2
15-24	2	5	0	2	0	5	0	3	0	2
25-34	6	16	0	6	1	7	1	7	1	7
35-44	1	9	0	2	0	0	0	4	0	4
45-54	0	5	0	3	0	1	0	3	0	0
55-64	2	0	0	1	0	1	0	1	0	0
65+	0	1	0	0	1	0	2	0	1	0
<b>Total</b>	<b>11</b>	<b>40</b>	<b>0</b>	<b>17</b>	<b>2</b>	<b>15</b>	<b>3</b>	<b>21</b>	<b>2</b>	<b>16</b>

\*Excluded tourists and foreigners seeking medical treatment in Singapore.

**Table 4.16**  
**Age-gender distribution and age-specific incidence rates of reported paratyphoid cases<sup>^</sup>, 2016**

Age group	Male	Female	Total	%	Incidence rates per 100,000 population*
0-4	1	0	1	5.6	0.4
5-14	1	1	2	11.1	0.4
15-24	1	1	2	11.1	0.3
25-34	8	0	8	44.4	0.6
35-44	3	1	4	22.2	0.4
45-54	0	0	0	0	0
55-64	0	0	0	0	0
65+	0	1	1	5.6	0.2
<b>Total</b>	<b>14</b>	<b>4</b>	<b>18</b>	<b>100</b>	<b>0.3</b>

<sup>^</sup> Excluded one foreigner seeking medical treatment in Singapore.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

Among the three major ethnic groups, Indians had the highest incidence rate (Table 4.17).

**Table 4.17**  
**Ethnic-gender distribution and ethnic-specific incidence rates of reported paratyphoid cases<sup>^</sup>, 2016**

	Male	Female	Total	%	Incidence rates per 100,000 population*
Singapore residents					
Chinese	4	2	6	33.3	0.2
Malay	0	0	0	0	0.0
Indian	1	0	1	5.6	0.3
Others	2	1	3	16.7	2.4
Foreigners	7	1	8	44.4	0.5
<b>Total</b>	<b>14</b>	<b>4</b>	<b>18</b>	<b>100</b>	<b>0.3</b>

<sup>^</sup> Excluded one foreigner seeking medical treatment in Singapore.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

The 17 cases acquired the infection from Southeast Asia (41.2%), East Asia (5.9%) and South Asia (52.9%) (Table 4.18). Most Singapore residents acquired the disease while overseas on vacation (66.7%) (Table 4.19).

**Table 4.18**  
Imported paratyphoid cases by country of origin, 2015-2016

Country of Origin	2015	2016
	No. (%)	No. (%)
<b>East Asia</b>		
China	0	1 ( 5.9)
<b>Southeast Asia</b>		
Cambodia	1 (4.8)	0
Indonesia	2 (9.5)	1 (5.9)
Myanmar	10 (47.6)	6 (35.3)
Philippines	1 (4.8)	0
Vietnam	0	0
<b>South Asia</b>		
Bangladesh	3 (14.3)	3 (17.6)
India	4 (19.0)	5 (29.4)
Pakistan	0	1 (5.9)
<b>Total</b>	<b>21 (100)</b>	<b>17 (100)</b>

**Table 4.19**  
Singapore residents who contracted paratyphoid overseas, 2012-2016

Purpose of travel	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Vacation	18 (64.3)	6 (54.6)	8 (88.9)	10 (83.3)	6 (66.7)
Business/employment	10 (35.7)	5 (45.4)	1 (11.1)	2 (16.7)	3 (33.3)
<b>Total</b>	<b>28 (100)</b>	<b>11 (100)</b>	<b>9 (100)</b>	<b>12 (100)</b>	<b>9 (100)</b>

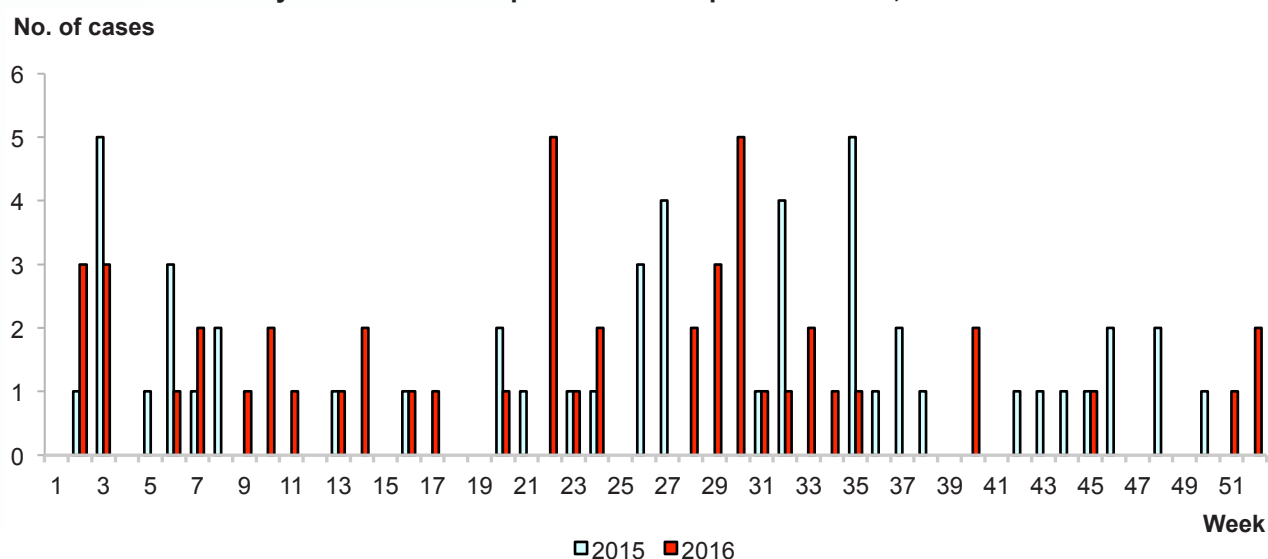
## HEPATITIS A

Hepatitis A is a viral infection spread from person to person by the faecal-oral route. Foods that are eaten raw or partially cooked, prepared with contaminated water or by an infected food handler, are common sources of infection. Clinical features include jaundice, fever, nausea and vomiting, loss of appetite, abdominal pain and tenderness, dark urine and pale stools.

There were 48 cases of laboratory confirmed acute hepatitis A in 2016 as compared to 50 cases in 2015 (Figure 4.4). 30 were imported and eight were indigenous cases. The remaining ten cases involved four tourists and six foreigners seeking medical treatment in Singapore. (Table 4.20).

Among local residents, the incidence of acute hepatitis A was highest in the 25-34 years age group. The overall male to female ratio was 1.8:1 (Table 4.21). Among the three major ethnic groups, Malays had the highest incidence rate (Table 4.22).

**Figure 4.4**  
Weekly distribution of reported acute hepatitis A cases, 2015-2016



**Table 4.20**  
**Classification of reported acute hepatitis A cases, 2016**

Population group	No. of cases (%)
Singapore residents	21 (43.8)
Work permit holders/other foreigners	17 (35.4)
Foreigners seeking medical treatment in Singapore	6 (12.5)
Tourists	4 (8.3)
<b>Total</b>	<b>48 (100)</b>

**Table 4.21**  
**Age-gender distribution and age-specific incidence rates of acute hepatitis A cases<sup>^</sup>, 2016**

Age group	Male	Female	Total	%	Incidence rates per 100,000 population*
0-4	0	0	0	0	0
5-14	3	0	3	7.9	0.6
15-24	5	1	6	15.8	0.8
25-34	10	4	14	36.8	1.1
35-44	2	4	6	15.8	0.6
45-54	3	1	4	10.5	0.5
55-64	1	0	1	2.7	0.2
65+	1	3	4	10.5	0.7
<b>Total</b>	<b>25</b>	<b>13</b>	<b>38</b>	<b>100</b>	<b>0.7</b>

<sup>^</sup>Excluded four tourists and six foreigners seeking medical treatment in Singapore.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

**Table 4.22**  
**Ethnic-gender distribution and ethnic-specific incidence rates of acute hepatitis A cases<sup>^</sup>, 2016**

	Male	Female	Total	%	Incidence rates per 100,000 population*
Singapore residents					
Chinese	10	6	16	42.1	0.5
Malay	1	2	3	7.9	0.6
Indian	1	0	1	2.6	0.3
Others	1	0	1	2.6	0.8
Foreigners	12	5	17	44.8	1.0
<b>Total</b>	<b>25</b>	<b>13</b>	<b>38</b>	<b>100</b>	<b>0.7</b>

<sup>^</sup>Excluded four tourists and six foreigners seeking medical treatment in Singapore.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

### Imported acute hepatitis A

Of the 48 cases of acute hepatitis A, 40 (81.6%) cases acquired the infection overseas (Table 4.23). The majority of the cases acquired the infection from Southeast Asia (57.5%) and India (12.5%) (Table 4.24).

**Table 4.23**  
**Classification of imported acute hepatitis A cases, 2016**

Population group	No. of cases (%)
Local residents	
Residents who contracted the disease overseas	14 (35.0)
Work permit/employment/dependent pass holders	16 (40.0)
Foreigners seeking medical treatment	6 (15.0)
Tourists	4 (10.0)
<b>Total</b>	<b>40 (100)</b>

**Table 4.24**  
**Imported acute hepatitis A cases by country of origin, 2016**

Country of origin	No. of cases (%)
<b>Southeast Asia</b>	
Indonesia	8 (20.0)
Myanmar	4 (10.0)
Philippines	4 (10.0)
Cambodia	2 (5.0)
Vietnam	2(5.0)
Malaysia	1 (2.5)
Timor Leste	1 (2.5)
Thailand	1(2.5)
<b>South Asia</b>	
India	5 (12.5)
Sri Lanka	1(2.5)
<b>Others</b>	
Republic of China, Taiwan	4 (10.0)
Japan	2 (5.0)
France	1(2.5)
Georgia	1 (2.5)
Italy	1 (2.5)
Mexico	1 (2.5)
Republic of Korea	1(2.5)
<b>Total</b>	<b>40 (100)</b>

**Table 4.25**  
**Total number of notifications\* received for acute hepatitis A, 2012–2016**

Age group	2012		2013		2014		2015		2016	
	Local	Imported	Local	Imported	Local	Imported	Local	Imported	Local	Imported
0-4	0	1	0	0	0	1	0	0	0	0
5-14	1	1	1	6	0	4	0	4	0	3
15-24	3	12	2	7	3	8	5	7	1	5
25-34	8	15	4	15	7	17	2	11	1	13
35-44	12	14	10	5	2	8	4	5	1	5
45-54	14	4	7	9	0	7	2	1	2	2
55-64	4	2	2	5	1	1	1	1	1	0
65+	4	1	4	0	8	0	2	0	2	2
<b>Total</b>	<b>46</b>	<b>50</b>	<b>30</b>	<b>47</b>	<b>21</b>	<b>46</b>	<b>16</b>	<b>29</b>	<b>8</b>	<b>30</b>

\*Excluded tourists and foreigners seeking medical treatment in Singapore.

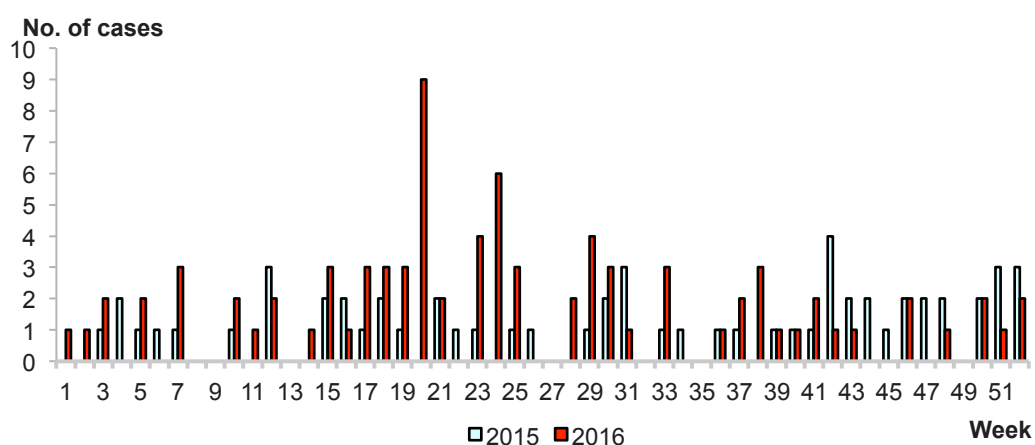
## HEPATITIS E

Similar to hepatitis A, hepatitis E is also a viral infection spread from person to person by the faecal-oral route. The most common documented medium of transmission is faecal-contaminated drinking water. Clinical features include jaundice, fever, nausea and vomiting, loss of appetite, abdominal pain and tenderness, dark urine and pale stools.

There were 74<sup>1</sup> reported cases of serologically confirmed acute hepatitis E in 2016, compared to 59 cases in 2015 (Figure 4.5). They comprised 62 Singapore residents, 10 work permit holders/others and two foreigners seeking medical treatment in Singapore (Table 4.26). In the first two categories, 56 were local and 16 were imported cases.

Among local residents, the incidence of acute hepatitis E was highest in the 55-64 and 65+ years age groups (3.5 per 100,000 population). The overall male to female ratio was 3.5:1 (Table 4.27). Of the three main ethnic groups, Chinese had the highest incidence (Table 4.28).

**Figure 4.5**  
Weekly distribution of reported acute hepatitis E cases, 2015-2016



**Table 4.26**  
Classification of reported acute hepatitis E cases, 2016

Population group	No. of cases (%)
Singapore residents	62 (80.5)
Work permit holders/other foreigners	10 (15.9)
Foreigners seeking medical treatment in Singapore	2 ( 3.6)
<b>Total</b>	<b>74 (100)</b>

**Table 4.27**  
Age-gender distribution and age-specific incidence rates of acute hepatitis E cases<sup>^</sup>, 2016

Age group	Male	Female	Total	%	Incidence rates per 100,000 population*
0-4	0	0	0	0	0
5-14	1	0	1	1.4	0.2
15-24	3	0	3	4.2	0.4
25-34	6	4	10	13.9	0.8
35-44	5	2	7	9.7	0.7
45-54	9	2	11	15.3	1.5
55-64	15	6	21	29.2	3.5
65+	17	2	19	26.3	3.5
<b>Total</b>	<b>56</b>	<b>16</b>	<b>72</b>	<b>100</b>	<b>1.3</b>

<sup>^</sup> Excluded two foreigners seeking medical treatment in Singapore.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

<sup>1</sup> Case definition for an acute Hepatitis E was updated in October 2016.



**Table 4.28**  
**Ethnic-gender distribution and ethnic-specific incidence rates of acute hepatitis E cases<sup>^</sup>, 2016**

	Male	Female	Total	%	Incidence rates per 100,000 population*
Singapore residents					
Chinese	41	14	55	76.3	1.9
Malay	1	0	1	1.4	0.2
Indian	3	0	3	4.2	0.8
Others	2	1	3	4.2	2.4
Foreigners	9	1	10	13.9	0.6
<b>Total</b>	<b>56</b>	<b>16</b>	<b>72</b>	<b>100</b>	<b>1.3</b>

<sup>^</sup> Excluded two foreigners seeking medical treatment in Singapore.

\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

### Imported acute hepatitis E

Of the 74 cases of hepatitis E, 18 (24.3%) cases acquired the infection overseas (Table 4.29). The majority of the cases acquired the infection from the Southeast Asia (52.0%) and South Asia (32.0%) (Table 4.30).

**Table 4.29**  
**Imported acute hepatitis E cases by population group, 2016**

Population group	No. of cases (%)
Local Residents	
Residents who contracted the disease overseas	10 (55.6)
Work permit/employment/dependent pass holders	6 (33.3)
Foreigners seeking medical treatment	2 (11.1)
<b>Total</b>	<b>18 (100.0)</b>

**Table 4.30**  
**Imported acute hepatitis E cases by country of origin, 2016**

Country of origin	No. of cases (%)
<b>Southeast Asia</b>	
Malaysia	4 (19.0)
Myanmar	1 (4.8)
Indonesia	3 (14.3)
Philippines	1 (4.8)
Thailand	1 (4.8)
<b>South Asia</b>	
Bangladesh	2 (9.5)
India	4 (19.0)
<b>Other Countries</b>	
Australia	2 (9.5)
People's Republic of China, Hong Kong	1 (4.8)
Japan	1 (4.8)
Republic of China, Taiwan	1 (4.8)
<b>Total</b>	<b>21 (100)</b>

After excluding foreigners seeking medical treatment in Singapore, the annual number of acute hepatitis E notifications in the past five years has ranged from 18-56 for local cases and 16-52 for imported cases (Table 4.31).

**Table 4.31**  
**Total number of notifications\* received for acute hepatitis E cases, 2012–2016**

Age group	2012		2013		2014		2015		2016	
	Local	Imported	Local	Imported	Local	Imported	Local	Imported	Local	Imported
0-4	0	0	0	0	0	0	0	0	0	0
5-14	0	0	0	0	0	0	0	0	1	0
15-24	5	15	0	8	0	1	0	5	0	0
25-34	8	25	2	9	3	5	1	3	0	4
35-44	7	6	3	5	1	8	2	1	6	2
45-54	7	5	2	2	6	2	9	0	9	2
55-64	11	1	4	6	17	3	17	6	17	6
65+	9	0	7	5	15	2	13	1	23	2
<b>Total</b>	<b>47</b>	<b>52</b>	<b>18</b>	<b>35</b>	<b>42</b>	<b>21</b>	<b>42</b>	<b>16</b>	<b>56</b>	<b>16</b>

\*Excluded tourists and foreigners seeking medical treatment in Singapore.

### Hepatitis E virus genotypes

In 2016, 34 laboratory-confirmed acute hepatitis E samples were forwarded to the National Public Health Laboratory for genotyping. 27 of 34 samples were PCR positive and the remaining seven samples were positive by serology only.

Among the 27 PCR positive samples, 22 were indigenous cases and five were imported cases. Of the 22 indigenous cases, 10 (45.5%) were genotype 3, two (9.1%) were genotype 1 and the genotypes for remaining samples were indeterminate. Of the five imported cases, two (40.0%) were genotype 3 and the genotypes for remaining samples were indeterminate.

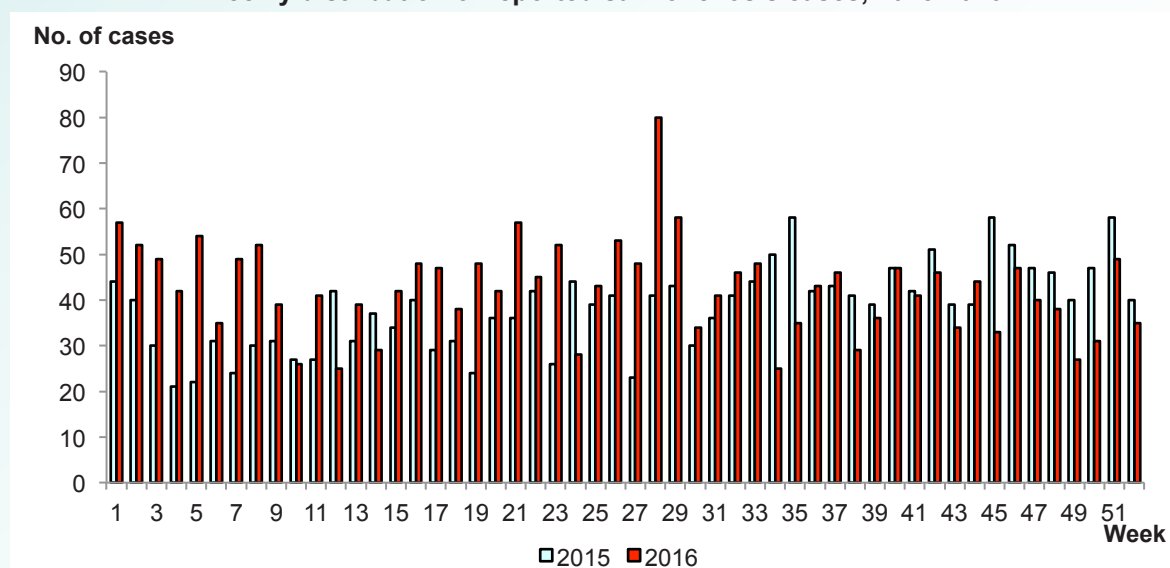
## SALMONELLOSIS

Salmonellosis is a bacterial disease commonly presenting as acute enterocolitis, with sudden onset of fever, headache, abdominal pain, diarrhoea, nausea and sometimes vomiting. Dehydration, especially among infants or in the elderly, may be severe. The causative pathogen, *Salmonella* is a genus of gram-negative, facultative anaerobic motile rod-shape bacteria. It is divided into two species, *Salmonella enterica* and *Salmonella bongori*. *Salmonella enterica* is further subdivided into subspecies and serotypes based on biochemical and antigenic reactions. The majority of *Salmonella* serotypes belong to *S. enterica* subsp. *enterica*. Within *S. enterica* subsp. *enterica*, the most common O-antigen serogroups identified are from A to E. Numerous serotypes of *Salmonella* are pathogenic for both animals and human; that include the most commonly reported *Salmonella enterica* serovar Typhimurium (*S. Typhimurium*) and *Salmonella enterica* serovar Enteritidis (*S. Enteritidis*).

Poultry is the commonest source of human salmonellosis. Consumption of contaminated meat and eggs is also a frequent cause. A wide range of domestic and wild animals including poultry, swine, cattle, rodents and pets may act as reservoirs for salmonellosis.

A total of 2,212 laboratory-confirmed cases of non-typhoidal salmonellosis were reported in 2016, an increase of 11.3% compared to 1,988 cases reported in 2015 (Figure 4.6). *Salmonella* Group D was the predominant serogroup identified in 2016 (Table 4.32). Of these Group D cases, 310 cases were caused by *S. Enteritidis*.

**Figure 4.6**  
Weekly distribution of reported salmonellosis cases, 2015-2016



**Table 4.32**  
Reported salmonellosis cases by serogroups, 2016

Salmonella serogroups	No. of cases	Incidence rates per 100,000 population*
Enterica-D	901	16.1
Enterica-B	485	8.6
Enterica-C	265	4.7
Enterica-E	99	1.8
Enterica-E/G	21	0.4
Enterica-G	6	0.1
Enterica-A	1	0.0
Enterica-Unspecified	434	7.7
<b>Total</b>	<b>2,212</b>	<b>39.4</b>

\*Rates are based on 2016 estimated mid-year population.  
(Source: Singapore Department of Statistics)

### Salmonella Enteritidis

Of the 310 cases reported in 2016, 307 were local residents comprising 302 indigenous and five imported cases. The remaining three cases involved two foreigners seeking medical treatment in Singapore and one tourist.

The notifications of *S. Enteritidis* among local residents had decreased by 5.5% as compared to 324 cases in 2015. The incidence rate was highest in the 65+ years age group (Table 4.33).

**Table 4.33**  
Total number of notifications\* received for reported *S. Enteritidis* cases, 2012-2016

Age group	2012		2013		2014		2015		2016	
	Local	Imported	Local	Imported	Local	Imported	Local	Imported	Local	Imported
0-4	81	1	124	3	71	0	34	0	21	1
5-14	18	0	36	0	15	1	16	1	7	0
15-24	18	0	22	0	20	0	12	1	19	1
25-34	35	2	80	1	35	1	34	0	40	2
35-44	28	0	29	2	28	0	34	0	30	0
45-54	30	1	30	3	36	1	35	0	42	0
55-64	36	1	55	4	61	2	54	2	40	1
65+	101	0	137	4	116	1	101	0	103	0
<b>Total</b>	<b>342</b>	<b>5</b>	<b>513</b>	<b>17</b>	<b>382</b>	<b>6</b>	<b>320</b>	<b>4</b>	<b>302</b>	<b>5</b>

\*Excluded tourists and foreigners seeking medical treatment in Singapore.

**Table 4.34**  
**Age-gender distribution and age-specific incidence rates of reported S. Enteritidis cases<sup>^</sup>, 2016**

Age group	Male	Female	Total	%	Incidence rates per 100,000 population*
0-4	12	10	22	7.2	9.4
5-14	5	2	7	2.3	1.5
15-24	16	4	20	6.5	2.7
25-34	20	22	42	13.7	3.3
35-44	17	13	30	9.8	3.0
45-54	26	16	42	13.7	5.5
55-64	28	13	41	13.3	6.8
65+	68	35	103	33.5	19.2
<b>Total</b>	<b>192</b>	<b>115</b>	<b>307</b>	<b>100</b>	<b>5.5</b>

\*Excluded one tourist and two foreigners seeking medical treatment in Singapore.

\*\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

Among the three major ethnic groups, Malays had the highest incidence rate, followed by Chinese and Indians (Table 4.35).

**Table 4.35**  
**Ethnic-gender distribution and ethnic-specific incidence rates of reported S. Enteritidis cases<sup>^</sup>, 2016**

	Male	Female	Total	%	Incidence rates per 100,000 population*
Singapore residents					
Chinese	104	65	169	55.0	5.8
Malay	38	21	59	19.2	11.2
Indian	13	6	19	6.2	5.3
Others	5	2	7	2.3	5.5
Foreigners	32	21	53	17.3	3.2
<b>Total</b>	<b>192</b>	<b>115</b>	<b>307</b>	<b>100</b>	<b>5.5</b>

\*Excluded one tourist and two foreigners seeking medical treatment in Singapore.

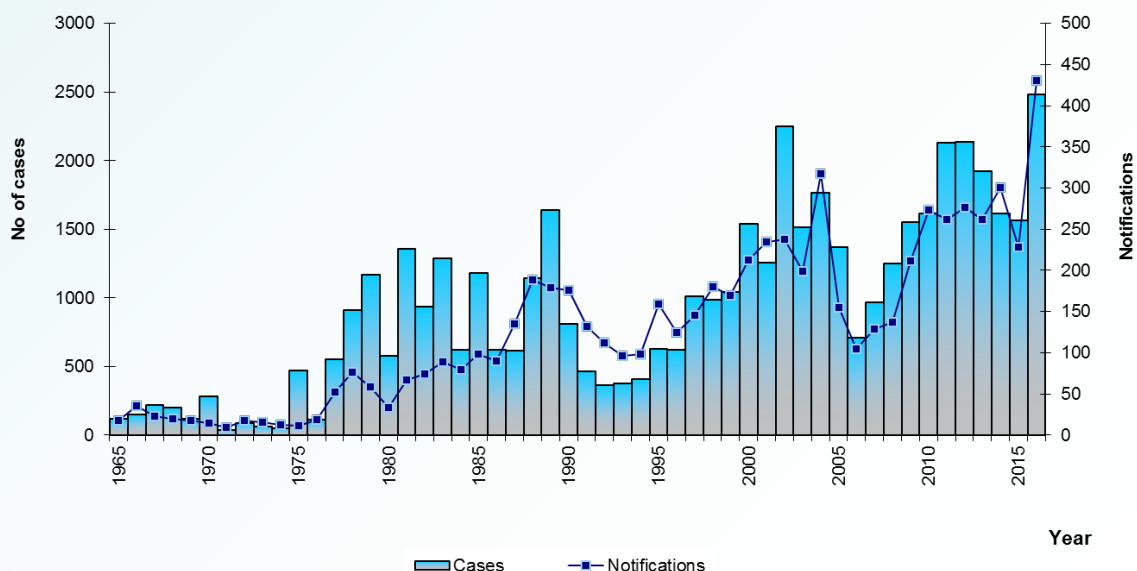
\*\*Rates are based on 2016 estimated mid-year population.

(Source: Singapore Department of Statistics)

## FOOD POISONING

There were 431 notifications of food poisoning involving 2,502 cases in 2016, compared with 228 notifications with 1,567 cases in 2015 (Figure 4.7). Of these, 192 notifications were classified as outbreaks involving two or more cases epidemiologically linked to a common source, as compared to 214 such notifications in 2015.

**Figure 4.7**  
Notifications of food poisoning in Singapore, 1965-2016



**Table 4.36**  
Food poisoning notifications by type of food establishments, 2016

Type of food establishments	No. of notifications	Notification classified as outbreak*	No. of food establishments involved	No. of cases
General outlets				
Bakery	15	0	15	45
Canteens				
School	4	1	4	89
Tertiary Institution	1	1	1	13
Others	5	2	4	89
Caterer (licensed)	28	17	15	685
Eating house	36	4	35	106
Fair(food fair)	0	0	0	0
Fair (others)	0	0	0	0
Food court	32	4	31	71
Foodshop (takeaway)	7	0	7	19
Hawker centre	13	3	13	60
Other licensed premises	1	0	1	4
Restaurants				
In Hotel	52	41	17	369
Fast Food	15	6	15	52
Others	199	104	131	617
Supermarket	6	0	6	26
Snackbar	7	2	7	33
Food factory	0	0	0	0
<b>Sub-total (General outlets)</b>	<b>421</b>	<b>186</b>	<b>302</b>	<b>2,278</b>



**Table 4.36**  
**Food poisoning notifications by type of food establishments, 2016 (cont'd)**

<b>In house kitchens</b>				
Army	1	1	1	80
Childcare centre	3	3	3	14
Hotel	0	0	0	0
Nursing home	0	0	0	0
Police	1	0	1	20
Prison	0	0	0	0
School	1	0	1	60
Workers dormitory	1	0	1	3
Others	2	1	2	8
Unlicensed premises	1	1	1	39
<b>Sub-total (Others)</b>	<b>10</b>	<b>6</b>	<b>10</b>	<b>224</b>
<b>Total</b>	<b>431</b>	<b>192</b>	<b>312</b>	<b>2,502</b>

\*Two or more epidemiologically linked cases involved.

In the course of epidemiological investigation into food poisoning incidents, a total of 302 food samples and 130 environment swabs were taken and sent for microbiological analysis.

Of the food samples, 12 were positive for *Escherichia coli*, 12 for *Bacillus cereus*, seven for *Salmonella* species, three for *Staphylococcus aureus*, two for *Salmonella* Enteritidis and *Clostridium perfringens*, and one each for *Campylobacter jejuni*, *Salmonella* Javiana and norovirus.

Of the environment swabs, one each was tested positive for *Salmonella* species, *Escherichia coli*, and *Staphylococcus aureus*. Of 375 food handlers sent for screening, 14 were positive for norovirus, eight for *Salmonella* species, four for rotavirus, two for *Salmonella* species, and one each for *Salmonella* Group B, *Escherichia coli*, and *Plesiomonas shigelloides*.

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