

Air-/Droplet-  
Borne  
Diseases

Vector-Borne/  
Zoonotic  
Diseases

Food-/Water-  
Borne  
Diseases

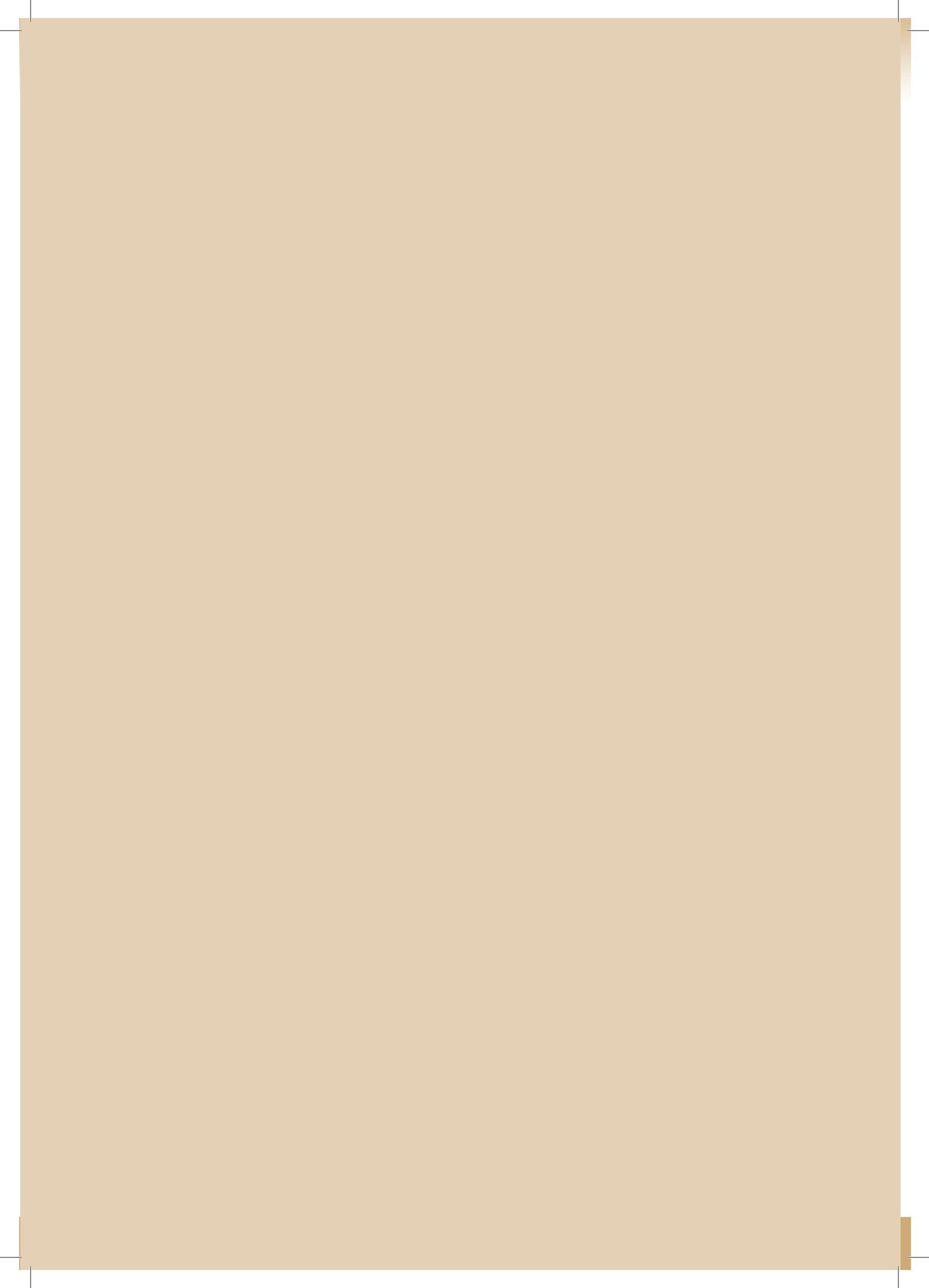
Blood-Borne  
Diseases

Environment-  
Related  
Diseases

HIV/AIDS, STIs,  
Tuberculosis  
& Leprosy

Childhood  
Immunisation

- Acute Diarrhoeal Illnesses
- Campylobacteriosis
- Cholera
- Enteric Fevers (Typhoid and Paratyphoid)
- Hepatitis A and E
- Listeriosis
- Salmonellosis
- Shigellosis
- Food Poisoning



### III FOOD-/WATER-BORNE DISEASES

Food-borne diseases are caused by the ingestion of foodstuffs or water contaminated by toxins associated with bacterial growth in the food, bacterial, viral or para-

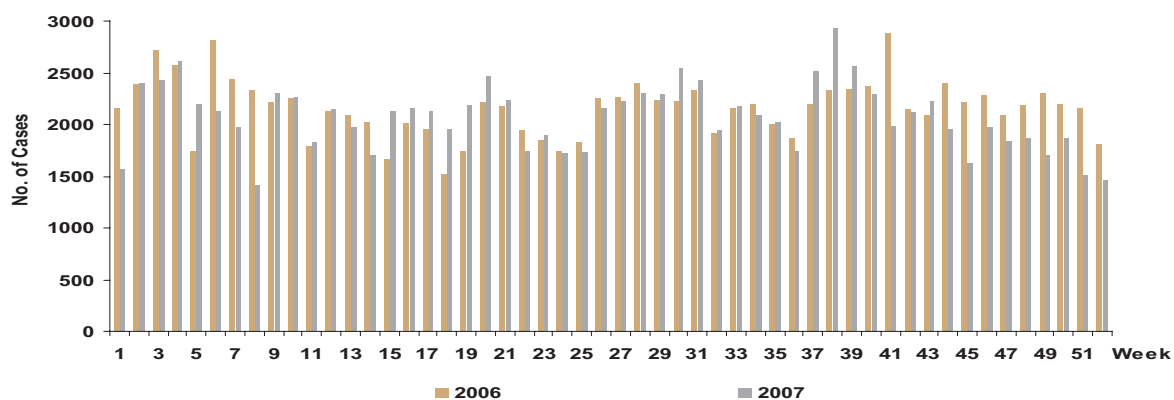
sitic agents, toxins produced by harmful algal species or present in specific fish species or heavy metals and other organic compounds.

#### ACUTE DIARRHOEAL ILLNESS

There were a total of 107,789 attendances at polyclinics for acute diarrhoeal illness in 2007 - a decrease of 4% over the 112,241 seen in 2006. Weekly surveillance of

acute diarrhoeal attendances showed a similar pattern to that of previous year (Figure 3.1).

Figure 3.1  
Weekly attendances of diarrhoeal illness at polyclinics, 2006 – 2007



#### 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 organisms in undercooked chicken and pork, contaminated food and water or unpasteurised milk.

A total of 170 cases of *Campylobacter* enteritis were reported in 2007, a decrease of 28% in comparison to 236 cases reported in 2006. *Campylobacter jejuni* was

isolated in majority of the cases (Table 3.1). Of the 170 reported cases, 168 were local residents comprising 15 imported cases and 153 indigenous cases. The other two cases were foreigners who came to Singapore seeking medical treatment for infections acquired overseas.

The incidence rate among indigenous cases was highest in the 0 – 4 years age group, with an overall male to female ratio of 1.2:1 (Table 3.2). Among the three major ethnic groups, Malays had the highest incidence followed by Indians and Chinese (Table 3.3).

**Table 3.1**  
Incidence of reported *Campylobacter* enteritis, 1997 – 2007

Year	No. of cases caused by					Incidence rate per 100,000 population*
	<i>C. jejuni</i>	<i>C. coli</i>	<i>C. laridis</i>	Other species	Total	
1997	118	3	0	0	121	3.2
1998	254	0	4	11	269	6.9
1999	323	0	3	17	343	8.7
2000	226	0	1	4	231	5.8
2001	105	0	0	0	105	2.5
2002	50	0	0	0	50	1.2
2003	140	1	0	3	144	3.4
2004	122	2	0	7	131	3.1
2005	241	0	0	0	241	5.5
2006	227	0	0	9	236	5.3
2007	161 <sup>^</sup>	1 <sup>^</sup>	0	9	170	3.7

<sup>^</sup> One case has a concurrent infection of both *C.jejuni* and *C.coli*  
\*Rates are based on 2007 estimated mid-year population.  
(Source: Singapore Department of Statistics)

**Table 3.2**  
Age-gender distribution and age-specific incidence rates of reported *Campylobacter* enteritis<sup>^</sup>, 2007

Age (Yrs)	Male	Female	Total (%)	Incidence rate per 100,000 population*
0 – 4	44	42	86 (51.1)	41.3
5 – 14	24	15	39 (23.2)	7.5
15 – 24	5	2	7 ( 4.2)	1.0
25 – 34	4	3	7 ( 4.2)	0.7
35 – 44	3	2	5 ( 3.0)	0.6
45 – 54	1	2	3 ( 1.8)	0.5
55+	9	12	21 (12.5)	2.9
Total	90	78	168 ( 100)	3.7

<sup>^</sup> Excluding two tourists seeking medical treatment in Singapore  
\*Rates are based on 2007 estimated mid-year population.  
(Source: Singapore Department of Statistics)

**Table 3.3**  
Ethnic-gender distribution and ethnic-specific incidence rates of reported *Campylobacter* enteritis<sup>^</sup>, 2007

	Male	Female	Total (%)	Incidence rate per 100,000 population*
Singapore Resident				
Chinese	59	44	103 (61.3)	3.8
Malay	17	16	33 (19.6)	6.7
Indian	8	9	17 (10.1)	5.4
Others	4	2	6 ( 3.6)	6.5
Foreigner	2	7	9 ( 5.4)	0.9
<b>Total</b>	<b>90</b>	<b>78</b>	<b>168 ( 100)</b>	<b>3.7</b>

<sup>^</sup> Excluding two tourists seeking medical treatment in Singapore

\* Rates are based on 2007 estimated mid-year population

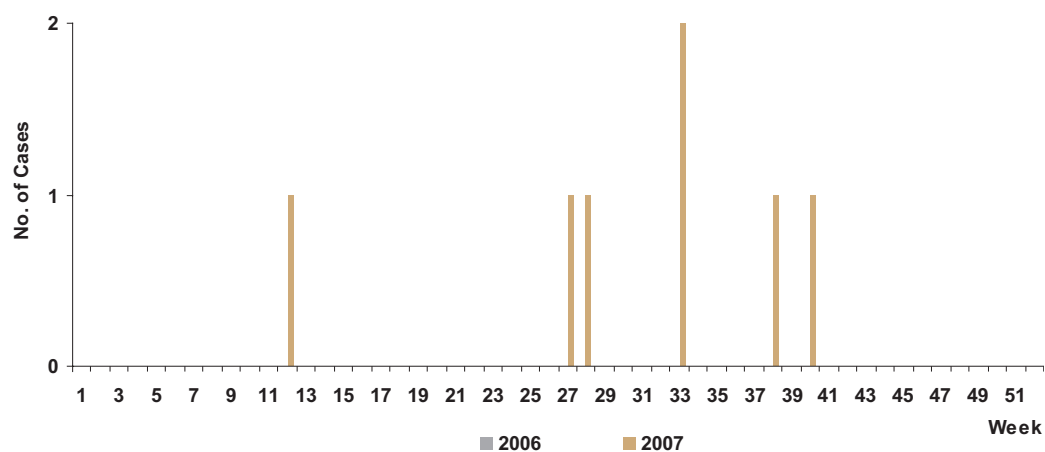
(Source: Singapore Department of Statistics)

## 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 but these have not been seen in Singapore. The mode of transmission is through ingestion of food or water contaminated with faeces or vomitus of infected persons.

In 2007, five imported isolated cases of cholera and two local cases of cholera were reported (Figure 3.2). Five imported cases involved four local residents who contracted infection overseas and one foreigner who was employed locally. Two local cases were reported in September and October involving a 40-year-old technician and a 69-year-old housewife with no travel history. Stool cultures showed *V.cholerae* O1, serotype E1 for biotype Ogawa. The overall incidence rate was 0.2 per 100,000 population (Table 3.4 and 3.5).

**Figure 3.2**  
E-weekly distribution of reported cholera cases in Singapore, 2006-2007



**Table 3.4**  
Age-gender distribution and age-specific incidence rates of reported cholera cases, 2007

Age (Yrs)	Male	Female	Total (%)	Incidence rate per 100,000 population*
0 – 4	0	0	0 ( 0.0)	0.0
5 – 14	0	0	0 ( 0.0)	0.0
15 – 24	1	0	1 (14.3)	0.1
25 – 34	1	2	3 (42.8)	0.3
35 – 44	1	0	1 (14.3)	0.1
45 – 54	0	0	0 ( 0.0)	0.0
55 +	0	2	2 (28.6)	0.3
<b>Total</b>	<b>3</b>	<b>4</b>	<b>7 (100.0)</b>	<b>0.2</b>

\*Rates are based on 2007 estimated mid-year population.  
(Source: Singapore Department of Statistics)

**Table 3.5**  
Ethnic-gender distribution and ethnic-specific incidence rates of reported cholera cases, 2007

	Male	Female	Total (%)	Incidence rate per 100,000 population*
Singapore Resident				
Chinese	1	3	4 ( 57.1)	0.1
Malay	0	0	0 ( 0.0)	0.0
Indian	0	0	0 ( 0.0)	0.0
Others	1	1	2 ( 28.6)	2.2
Foreigner	1	0	1 ( 14.3)	0.1
<b>Total</b>	<b>3</b>	<b>4</b>	<b>7 (100.0)</b>	<b>0.2</b>

\*Rates are based on 2007 estimated mid year population  
(Source: Singapore Department of Statistics)

## ENTERIC FEVERS

Enteric fevers 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. It is important to appreciate the difference between Salmonellosis food poisoning, and typhoid or paratyphoid fever, commonly known as enteric fevers. Causative organisms for the

enteric fevers are *Salmonella typhi* and *Salmonella paratyphi* (types A, B or C) and infections are usually associated with travel to countries where these diseases are endemic.

During the period 2003 to 2007, a total of 403 cases of enteric fever were reported, of which 280 (69.5%) cases were typhoid and 123 (30.5%) cases were paratyphoid. The majority (91.1%) were imported cases (Table 3.6).

**Table 3.6**  
**Classification of reported enteric fever cases, 2003 – 2007**

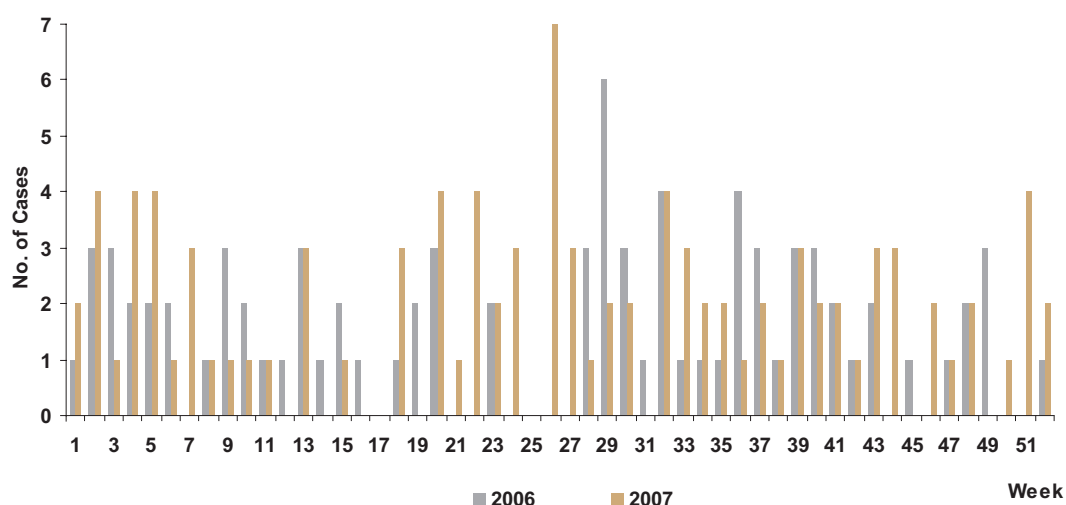
Year	Typhoid	Paratyphoid			Total
		A	B	C	
2003	32 (31)	9 ( 9)	0	0	41 (40)
2004	52 (45)	29 (26)	3 (0)	0	84 (71)
2005	69 (64)	24 (23)	2 (1)	0	95 (88)
2006	60 (55)	23 (23)	0	0	83 (78)
2007	67 (63)	28 (25)	5 (2)	0	100 (90)
<b>Total</b>	<b>280 (258)</b>	<b>113 (106)</b>	<b>10 (3)</b>	<b>0</b>	<b>403 (367)</b>

( ) imported cases

In 2007, a total of 100 cases of enteric fevers, comprising 67 cases of typhoid, and 28 cases of paratyphoid A and five cases of paratyphoid B were reported, an

increase from 83 cases of enteric fever reported in 2006 (Figure 3.3).

**Figure 3.3**  
**E-weekly distribution of reported enteric fever cases, 2006 – 2007**



**Table 3.7**  
**Classification of reported typhoid and paratyphoid cases, 2007**

Population Group	Typhoid No. (%)	Paratyphoid No. (%)
Local residents	53 (79.1)	26 (78.8)
Foreigners seeking medical treatment in Singapore	11 (16.4)	7 (21.2)
Tourists	3 ( 4.5)	0 ( 0.0)
Other categories of foreigners	0 ( 0.0)	0 ( 0.0)
<b>Total</b>	<b>67 (100.0)</b>	<b>33 (100.0)</b>

## Typhoid Fever

Of the 67 reported cases of typhoid, 53 were local residents comprising 49 imported and four indigenous cases. Of the 49 imported cases, 16 were Singapore residents, 28 were work permit or employment pass holders, four were student pass holders and one child of an employment pass holder. The remaining 14 were foreigners not residing in Singapore and who had acquired the infection overseas, the majority (78.6%) of whom

had come to Singapore seeking treatment (Table 3.7). Overall the incidence rate of typhoid fever among local residents was 1.2 per 100,000 population (Table 3.8).

The incidence rate among local residents was highest in the 15 – 24 years age group, followed by the 25 – 34 years age group.

**Table 3.8**  
Age-gender distribution and age-specific incidence rates of reported typhoid cases<sup>^</sup>, 2007

Age (Yrs)	Male	Female	Total (%)	Incidence rate per 100,000 population*
0 – 4	2	1	3 ( 5.7)	1.4
5 – 14	3	4	7 ( 13.2)	1.4
15 – 24	12	9	21 ( 39.6)	2.9
25 – 34	8	6	14 ( 26.4)	1.5
35 – 44	6	0	6 ( 11.3)	0.7
45 – 54	0	0	0 ( 0.0)	0.0
55 +	0	2	2 ( 3.8)	0.3
<b>Total</b>	<b>31</b>	<b>22</b>	<b>53 (100.0)</b>	<b>1.2</b>

<sup>^</sup> Excluding 11 foreigners seeking medical treatment in Singapore and 3 tourists  
\*Rates are based on 2007 estimated mid-year population.  
(Source: Singapore Department of Statistics)

Among the three major ethnic groups, Chinese had the highest incidence rate followed by Indian (Table 3.9).

Foreigners comprised 66.0% of the cases involving local residents.

**Table 3.9**  
Ethnic-gender distribution and ethnic-specific incidence rates of reported typhoid cases<sup>^</sup>, 2007

	Male	Female	Total (%)	Incidence rate per 100,000 population*
Singapore Resident				
Chinese	3	2	5 ( 9.4)	1.6
Malay	2	1	3 ( 5.7)	0.6
Indian	4	3	7 (13.2)	1.4
Others	0	3	3 ( 5.7)	0.6
Foreigner	22	13	35 (66.0)	3.5
<b>Total</b>	<b>31</b>	<b>22</b>	<b>53 (100.0)</b>	<b>1.2</b>

<sup>^</sup> Excluding 11 foreigners seeking medical treatment in Singapore and 3 tourists  
\*Rates are based on 2007 estimated mid year population  
(Source: Singapore Department of Statistics)

Of the 16 Singapore residents who acquired the infection overseas, the majority contracted the disease

from Indian sub-continent and Indonesia (Table 3.10). Most cases were overseas on vacation (75.0%) (Table 3.11).



**Table 3.10**  
Singapore residents who contracted typhoid overseas by country of origin,  
2003 – 2007

Classification	2003	2004	2005	2006	2007
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Country visited					
Australia	0 ( 0.0)	1 ( 6.7)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)
Bangladesh	0 ( 0.0)	0 ( 0.0)	1 ( 3.8)	1 ( 8.3)	1 ( 6.3)
Cambodia	0 ( 0.0)	0 ( 0.0)	1 ( 3.8)	0 ( 0.0)	0 ( 0.0)
China	0 ( 0.0)	1 ( 6.7)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)
India	5 ( 45.5)	4 ( 26.7)	13 (50.0)	6 (50.0)	8 (50.0)
Indonesia	6 ( 54.5)	8 ( 53.2)	6 (23.1)	4 (33.4)	4 (25.0)
Malaysia	0 ( 0.0)	0 ( 0.0)	3 (11.5)	1 ( 8.3)	2 (12.4)
Myanmar	0 ( 0.0)	1 ( 6.7)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)
Nepal	0 ( 0.0)	0 ( 0.0)	1 ( 3.8)	0 ( 0.0)	0 ( 0.0)
Pakistan	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)
Philippines	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)
Thailand	0 ( 0.0)	0 ( 0.0)	1 ( 3.8)	0 ( 0.0)	1 ( 6.3)
<b>Total</b>	<b>11 (100.0)</b>	<b>15 (100.0)</b>	<b>26 (100.0)</b>	<b>12 (100.0)</b>	<b>16 (100.0)</b>

**Table 3.11**  
Singapore residents who contracted typhoid overseas by purpose of travel  
2003 – 2007

Classification	2003	2004	2005	2006	2007
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Purpose of travel					
Vacation	7 (63.6)	9 (60.0)	22 (84.6)	8 (66.8)	12 (75.0)
Business/Employment	3 (27.3)	5 (33.3)	3 (11.5)	2 (16.6)	3 (18.7)
Pilgrimage	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)
Others	1 ( 9.1)	1 ( 6.7)	1 ( 3.9)	2 (16.6)	1 ( 6.3)
<b>Total</b>	<b>11 (100.0)</b>	<b>15 (100.0)</b>	<b>26 (100.0)</b>	<b>12 (100.0)</b>	<b>16 (100.0)</b>

### Paratyphoid Fever

Of the 33 reported cases of paratyphoid, 27 are imported cases and six are indigenous cases. Of the 27 imported cases, nine were Singapore residents, four were work permit holders and seven were student pass holders. The remaining seven were foreigners not residing in

Singapore, and seeking treatment in Singapore. The overall incidence rate of paratyphoid fever among local residents was 0.6 per 100,000 population (Table 3.12).

The incidence rate among local residents was highest in the 35 – 44 years age group (Table 3.12).

**Table 3.12**  
**Age-gender distribution and age-specific incidence rates of reported paratyphoid cases<sup>^</sup>, 2007**

Age (Yrs)	Male	Female	Total (%)	Incidence rate per 100,000 population*
0 – 4	0	0	0 (0.0)	0.0
5 – 14	1	0	1 (3.8)	0.2
15 – 24	2	2	4 (15.4)	0.6
25 – 34	3	2	5 (19.2)	0.5
35 – 44	8	1	9 (34.7)	1.1
45 – 54	1	3	4 (15.4)	0.6
55 +	3	0	3 (11.5)	0.4
<b>Total</b>	<b>18</b>	<b>8</b>	<b>26 (100.0)</b>	<b>0.6</b>

<sup>^</sup> Excluding seven foreigners seeking medical treatment in Singapore  
 \*Rates are based on 2007 estimated mid-year population.  
 (Source: Singapore Department of Statistics)

Among the three major ethnic groups, others had the highest incidence rate (1.1 per 100,000 population) in

2007 (Table 3.13). Foreigners comprised 50% of the cases.

**Table 3.13**  
**Ethnic-gender distribution and ethnic-specific incidence rates of reported paratyphoid cases<sup>^</sup>, 2007**

	Male	Female	Total (%)	Incidence rate per 100,000 population*
<b>Singapore Resident</b>				
Chinese	5	2	7 (27.0)	0.3
Malay	2	1	3 (11.5)	0.6
Indian	2	0	2 (7.7)	0.6
Others	0	1	1 (3.8)	1.1
<b>Foreigner</b>	<b>9</b>	<b>4</b>	<b>13 (50.0)</b>	<b>1.3</b>
<b>Total</b>	<b>18</b>	<b>8</b>	<b>26 (100.0)</b>	<b>0.6</b>

<sup>^</sup> Excluding seven foreigners seeking medical treatment in Singapore  
 \*Rates are based on 2007 estimated mid year population  
 (Source: Singapore Department of Statistics)

Of the nine Singapore residents who acquired the infection overseas, the majority contracted the disease from India (4), Malaysia (2), Bangladesh (1), Myanmar (1) and

Thailand (1) (Table 3.14). Most cases were travelling on vacation (66.7%) (Table 3.15).

**Table 3.14**  
Singapore residents who contracted paratyphoid overseas by country of origin, 2003 – 2007

Classification	2003	2004	2005	2006	2007
	No. (%)	No. (%)	No. (%)	No (%)	No (%)
Country visited					
Australia	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	1 (20.0)	0 ( 0.0)
Bangladesh	1 (20.0)	1 ( 6.7)	0 ( 0.0)	0 ( 0.0)	1 ( 0.0)
Cambodia	0 ( 0.0)	1 ( 6.7)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)
Hong Kong	0 ( 0.0)	0 ( 0.0)	1 (14.3)	0 ( 0.0)	0 ( 0.0)
India	1 (20.0)	7 (46.7)	2 (28.6)	2 (40.0)	4 (55.6)
Indonesia	1 (20.0)	5 (33.3)	2 (28.6)	1 (20.0)	0 ( 0.0)
Malaysia	0 ( 0.0)	0 ( 0.0)	2 (28.6)	0 ( 0.0)	2 (22.2)
Myanmar	1 (20.0)	0 ( 0.0)	0 ( 0.0)	1 (20.0)	1 (11.1)
Switzerland	1 (20.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)
Taiwan	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)
Thailand	0 ( 0.0)	1 ( 6.7)	0 ( 0.0)	0 ( 0.0)	1 (11.1)
<b>Total</b>	<b>5 (100.0)</b>	<b>15 (100.0)</b>	<b>7 (100.0)</b>	<b>5 (100.0)</b>	<b>9 (100.0)</b>

**Table 3.15**  
Singapore residents who contracted paratyphoid overseas by purposes of travel, 2003 – 2007

Classification	2003	2004	2005	2006	2007
	No. (%)	No. (%)	No. (%)	No (%)	No (%)
Purpose of travel					
Vacation	2 (40.0)	10 (66.7)	6 (85.7)	4 (80.0)	6 (66.7)
Business/Employment	3 (60.0)	4 (26.7)	1 (14.3)	1 (20.0)	2 (22.2)
Military training	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)	0 ( 0.0)
Seminar	0 ( 0.0)	1 ( 6.6)	0 ( 0.0)	0 ( 0.0)	1 (11.1)
<b>Total</b>	<b>5 (100.0)</b>	<b>15 (100.0)</b>	<b>7 (100.0)</b>	<b>5 (100.0)</b>	<b>9 (100.0)</b>

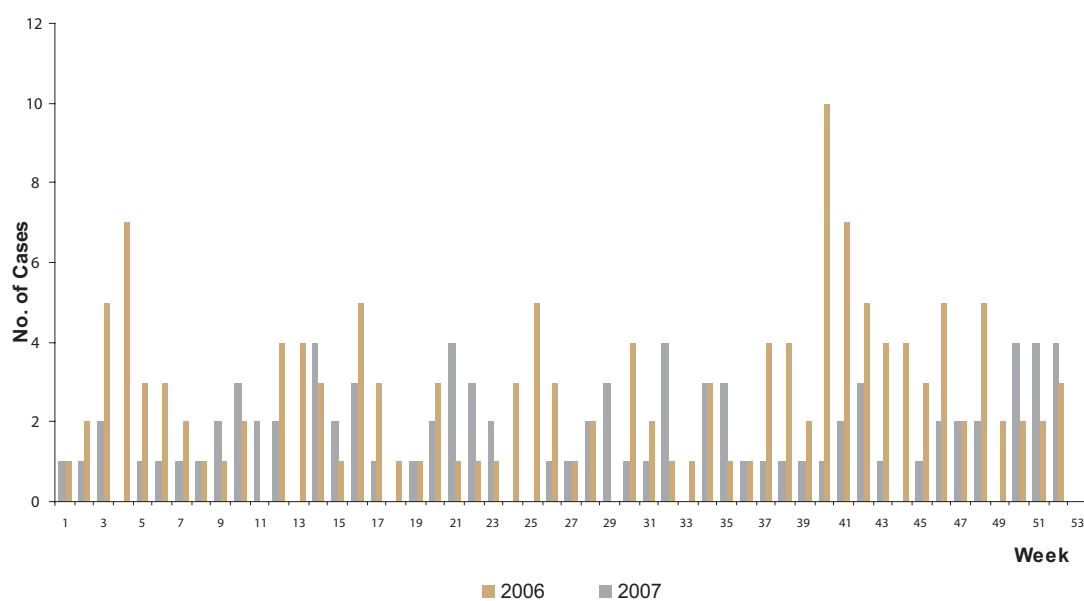
### HEPATITIS A AND E

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.

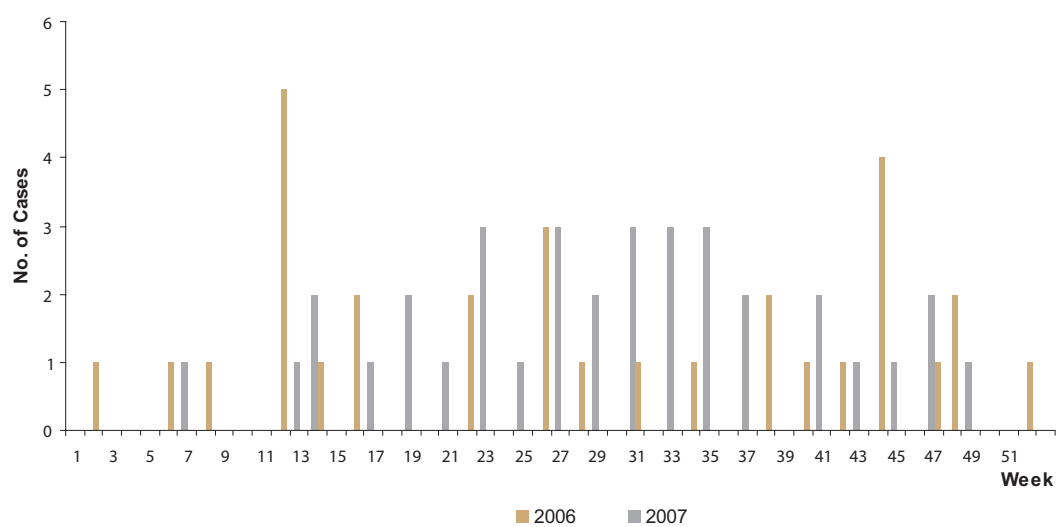
For viral hepatitis E, the mode of transmission is the same as viral hepatitis A. The most common documented mechanism of transmission is via faecal contaminated drinking water.

There were 88 cases of serologically confirmed viral hepatitis A and 35 cases of viral hepatitis E reported as compared to 146 cases and 31 cases respectively in 2006 (Figures 3.4 and 3.5). Of the total reported, 25 cases of viral hepatitis A and five cases of viral hepatitis E involved patients seeking medical treatment in Singapore (Table 3.16).

**Figure 3.4**  
E-weekly distribution of reported hepatitis A cases, 2006– 2007



**Figure 3.5**  
E-weekly distribution of reported hepatitis E cases, 2006 – 2007



**Table 3.16**  
Classification of reported acute viral hepatitis A & E cases, 2007

Population Group	No. of cases	
	Hepatitis A (%)	Hepatitis E (%)
Local residents	63 ( 71.6)	30 ( 85.7)
Foreigners seeking medical treatment in Singapore	25 ( 28.4)	5 (14.3)
<b>Total</b>	<b>88 (100.0)</b>	<b>35 (100.0)</b>

Among local residents, the age-specific incidence rate of acute hepatitis A (2.0 per 100,000 population) and Hepatitis E (1.4 per 100,000 population) was highest

in the 25 - 34 years age group. The overall male to female ratio was 2.3:1 for acute hepatitis A and 3.4:1 for acute hepatitis E (Table 3.17).

**Table 3.17**  
Age-gender distribution and age-specific incidence rates of acute hepatitis A & E<sup>^</sup>, 2007

Age (Yrs)	Hepatitis A				Hepatitis E			
	Male	Female	Total (%)	Incidence rate per 100,000 population*	Male	Female	Total (%)	Incidence rate per 100,000 population*
0 - 4	0	0	0 ( 0.0)	0.0	0	0	0 ( 0.0)	0.0
5 - 14	3	1	4 ( 6.3)	0.8	2	0	2 ( 6.7)	0.4
15 - 24	7	4	11 (17.5)	1.5	5	2	7 (23.3)	1.0
25 - 34	16	3	19 (30.1)	2.0	11	2	13 (43.3)	1.4
35 - 44	5	5	10 (15.9)	1.2	3	2	5 (16.7)	0.6
45 - 54	6	4	10 (15.9)	1.5	1	0	1 ( 3.3)	0.2
55+	7	2	9 (14.3)	1.2	1	1	2 ( 6.7)	0.3
<b>Total</b>	<b>44</b>	<b>19</b>	<b>63 (100.0)</b>	<b>1.4</b>	<b>23</b>	<b>7</b>	<b>30 (100.0)</b>	<b>0.7</b>

<sup>^</sup>Excluding 22 cases of foreigners and three tourists seeking medical treatment in Singapore (hepatitis A) and four cases of foreigners and one tourist seeking medical treatment in Singapore (hepatitis E)

\*Rates are based on 2007 estimated mid-year population.  
(Source: Singapore Department of Statistics)

Of the three main ethnic groups, Indians had the highest incidence rate of hepatitis A while Chinese has the highest incidence of hepatitis E. The ethnic and

gender distribution of Hepatitis A and E are shown in Table 3.18.

**Table 3.18**  
Ethnic-gender distribution and ethnic-specific incidence rates of acute hepatitis A & E<sup>^</sup>, 2007

	Hepatitis A				Hepatitis E			
	Male	Female	Total (%)	Incidence rate per 100,000 population*	Male	Female	Total (%)	Incidence rate per 100,000 population*
Singapore Resident								
Chinese	22	8	30 (47.6)	1.1	5	5	10 (33.3)	0.4
Malay	3	1	4 ( 6.3)	0.8	0	0	0 ( 0.0)	0.0
Indian	3	2	5 ( 7.8)	1.6	0	0	0 ( 0.0)	0.0
Others	5	4	9 (14.3)	9.8	1	1	2 ( 6.7)	2.2
Foreigner	11	4	15 (23.8)	1.5	17	1	18 (60.0)	1.8
<b>Total</b>	<b>44</b>	<b>19</b>	<b>63 (100.0)</b>	<b>1.4</b>	<b>23</b>	<b>7</b>	<b>30 (100.0)</b>	<b>0.7</b>

<sup>^</sup>Excluding 22 cases of foreigners and three tourists seeking medical treatment in Singapore (hepatitis A) and four cases of foreigners and one tourist seeking medical treatment in Singapore (hepatitis E)

\*Rates are based on 2007 estimated mid-year population.  
(Source: Singapore Department of Statistics)

### Overseas-acquired viral hepatitis

Of the 88 cases of hepatitis A and 35 cases of hepatitis E, 66 (75.0%) and 21 (60.0%) cases respectively were acquired overseas (Table 3.19). The majority of cases

acquired the infection from Southeast Asia (51.6%) and the Indian subcontinent (43.9%) (Table 3.20).

**Table 3.19**  
Overseas-acquired acute hepatitis A & E by population group, 2007

Population Group	No. of cases		Total (%)
	Hepatitis A	Hepatitis E	
<b>Local Residents</b>			
Residents who contracted the disease overseas	31	2	33 (37.9)
Work permit/Employment pass holders	7	13	20 (23.0)
Student pass holders	3	1	4 ( 4.6)
Foreigners seeking medical treatment	25	5	30 (34.5)
<b>Total</b>	<b>66</b>	<b>21</b>	<b>87 (100.0)</b>

**Table 3.20**  
Overseas-acquired acute hepatitis A & E by country of origin, 2007

Country visited	No. of cases		Total (%)
	Hepatitis A	Hepatitis E	
<b>Southeast Asia</b>			
Indonesia	30	1	31 (35.7)
Vietnam	1	0	1 ( 1.1)
Malaysia	10	0	10 (11.5)
Philippines	1	0	1 ( 1.1)
Myanmar	1	0	1 ( 1.1)
Thailand	0	0	0 ( 0.0)
<b>Indian Subcontinent</b>			
Bangladesh	3	11	14 (16.2)
India	14	4	18 (20.7)
Nepal	2	3	5 ( 5.8)
Sri Lanka	1	1	2 ( 2.3)
<b>Other Countries</b>			
Chile	0	1	1 ( 1.1)
China	1	0	1 ( 1.1)
Hong Kong SAR	2	0	2 ( 2.3)
<b>Total</b>	<b>66</b>	<b>21</b>	<b>87 (100.0)</b>

## LISTERIOSIS

The causative agent, *Listeria monocytogenes*, is a gram-positive rod shaped bacterium found in soil, water, mud and silage. The mode of transmission is via ingestion of raw or contaminated milk, soft cheeses, vegetables and ready-to-eat meats such as pâté.

There were six cases of laboratory confirmed *Listeria monocytogenes* in 2007 compared to nine cases in 2006. One was imported from Malaysia and the remaining five were indigenous cases. Four cases were adults with ages ranging from 54 to 69 years, including two

immunocompromised patients. The remaining case is a 21-day-old infant who is fully on breast feeding. *Listeria monocytogenes* was isolated from blood cultures from these cases. The normal host who acquires listeriosis may experience only an acute mild febrile illness but in pregnant women, the infection can be transmitted to the foetus and result in abortion or severe illness in the newborn. In newborns and some adults, listeriosis may manifest as meningoenzephalitis and/or septicaemia. In others such as the immunocompromised or elderly, the infection may be subacute.

## SALMONELLOSIS

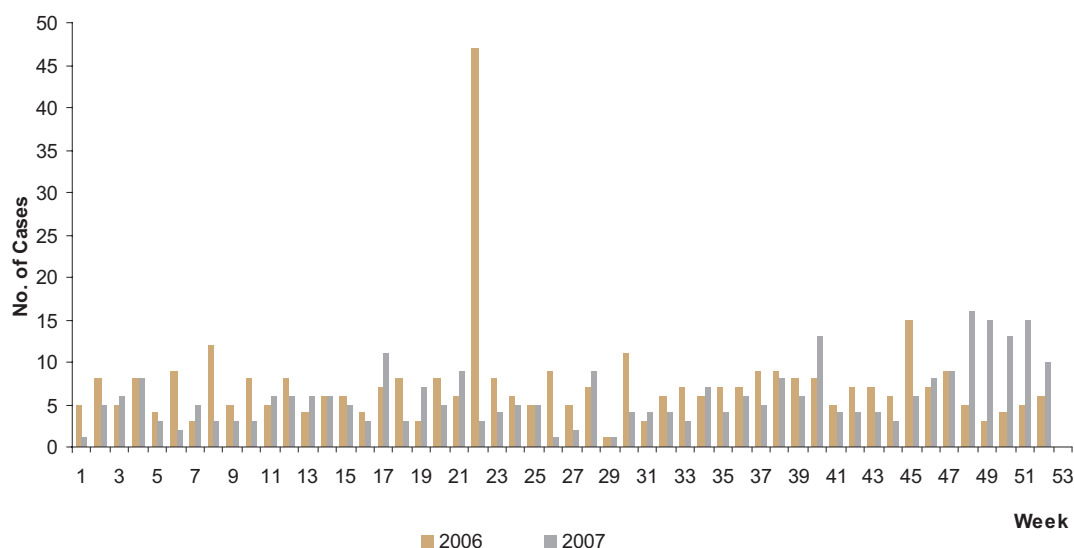
Salmonellosis is a bacterial disease commonly presenting as acute enterocolitis, with sudden onset of fever, headache, abdominal pain, diarrhoea, nausea and sometimes vomiting. Dehydration occurs commonly in infants and the elderly. The causative pathogen, *Salmonella* is a genus of gram-negative, facultative 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 (59%) 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 includes

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 307 laboratory-confirmed cases of non-typhoidal salmonellosis were reported in 2007, a decrease of 19.2% from 380 cases reported in 2006 (Figure 3.6). Of these, 191 cases were caused by *S. Enteritidis* (Table 3.21).

**Figure 3.6**  
E-weekly distribution of reported Salmonellosis cases, 2006 – 2007



**Table 3.21**  
Incidence of reported non-typhoidal salmonellosis, 2007

Salmonella serotypes	No. of cases (%)	Incidence rate per 100,000 population*
Group A	0 ( 0.0)	0.0
Group B		
Typhimurium	6 ( 2.0)	0.1
Untyped	23 ( 7.5)	0.5
Group C	28 ( 9.1)	0.6
Group D		
Enteritidis	191 (62.2)	4.2
Untyped	27 ( 8.8)	0.6
Group E	24 ( 7.8)	0.5
Untyped	8 ( 2.6)	0.2
<b>Total</b>	<b>307 (100.0)</b>	<b>6.7</b>

\*Rates are based on 2007 estimated mid-year population.  
(Source: Singapore Department of Statistics)

### S. Enteritidis

Of the 191 cases reported in 2007, 162 were local residents comprising two imported and 160 indigenous cases. Two cases of S. Enteritidis were foreigners seeking medical treatment in Singapore.

The notifications of S. Enteritidis among local residents had decreased by 3.0 % as compared to the 167 cases in 2006. The incidence rate was highest for the age group 0 – 4 years (Table 3.22).

**Table 3.22**  
Age-gender distribution and age-specific incidence rates of reported S. Enteritidis<sup>^</sup>, 2007

Age (Yrs)	Male	Female	Total (%)	Incidence rate per 100,000 population*
0 – 4	12	17	29 (15.4)	13.9
5 – 14	1	0	1 ( 0.5)	0.2
15 – 24	7	5	12 ( 6.4)	1.7
25 – 34	20	12	32 (16.9)	3.4
35 – 44	21	10	31 (16.4)	3.8
45 – 54	15	6	21 (11.1)	3.2
55 +	36	27	63 (33.3)	8.6
<b>Total</b>	<b>112</b>	<b>77</b>	<b>189 (100.0)</b>	<b>4.1</b>

<sup>^</sup> Excluding two foreigners seeking medical treatment in Singapore  
\*Rates are based on 2007 estimated mid-year population.  
(Source: Singapore Department of Statistics)

Among the three major ethnic groups, Malays had the highest incidence rate of S. Enteritidis followed by Indians

and Chinese (Table 3.23).



**Table 3.23**  
Ethnic-gender distribution and ethnic-specific incidence rates of reported *S. Enteritidis*<sup>^</sup>, 2007

	Male	Female	Total (%)	Incidence rate per 100,000 population*
Singapore Resident				
Chinese	65	49	114 (60.3)	4.2
Malay	13	12	25 (13.2)	5.0
Indian	10	4	14 ( 7.4)	4.5
Others	3	4	7 ( 3.7)	7.6
Foreigner	24	5	29 (15.4)	2.9
<b>Total</b>	<b>115</b>	<b>74</b>	<b>189 (100.0)</b>	<b>4.1</b>

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

\*Rates are based on 2007 estimated mid-year population.

(Source: Singapore Department of Statistics)

## SHIGELLOSIS

Shigellosis is an acute bacterial disease involving the large and distal small intestines, characterised by fever, diarrhoea, nausea and sometimes vomiting, cramps and tenesmus. The causative agent is genus *Shigella* comprising four species or serogroups namely Group A, *S. dysenteriae*; Group B, *S. flexneri*; Group C, *S. boydii*; and Group D, *S. sonnei*. Groups A, B and C are further divided into 12, 14, and 18 serotypes and subtypes, respectively. The mode of transmission is mainly by direct or indirect faecal oral transmission from a symptomatic patient or a short-term asymptomatic carrier. It could also be transmitted via water and milk due to direct faecal contamination.

A total of 13 sporadic cases of shigellosis were reported in 2007, as compared to 19 cases in 2006. The serotypes

involved were *Shigella sonnei* (53.8%), *Shigella flexneri* (30.8%), *Shigella boydii* (7.7%), and *Shigella dysenteriae* (7.7%). Of the reported cases, eight were local residents comprising three indigenous and five imported cases. There were two non-residents that acquired the infection locally. The remaining three cases were foreigners seeking medical treatment in Singapore. The five imported cases acquired the infection from Indonesia (3), India (1) and China (1). Majority of *Shigella* isolates were from stool specimens. The age-gender distribution and age-specific incidence rates are shown in Table 3.24. The ethnic-gender distribution and ethnic-specific incidence rates are detailed in Table 3.25.

**Table 3.24**  
Age-gender distribution and age-specific incidence rates of reported shigellosis<sup>^</sup>, 2007

Age (Yrs)	Male	Female	Total (%)	Incidence rate per 100,000 population*
0-4	1	1	2 (20.0)	1.0
5-14	2	4	6 (60.0)	1.2
15-24	0	1	1 (10.0)	0.1
25-34	0	0	0 ( 0.0)	0.0
35-44	1	0	1 (10.0)	0.1
45-54	0	0	0 ( 0.0)	0.0
55+	0	0	0 ( 0.0)	0.0
<b>Total</b>	<b>4</b>	<b>6</b>	<b>10 (100.0)</b>	<b>0.2</b>

<sup>^</sup> Excluding three foreigners seeking medical treatment in Singapore

\*Rates are based on 2007 estimated mid-year population.

(Source: Singapore Department of Statistics)

**Table 3.25**  
**Ethnic-gender distribution and ethnic-specific incidence rates of reported shigellosis<sup>^</sup>, 2007**

	Male	Female	Cases (%)	Incidence rate per 100,000 population*
Singapore Resident				
Chinese	2	4	6 (60.0)	0.2
Malay	0	1	1 (10.0)	0.2
Indian	1	0	1 (10.0)	0.3
Others	1	1	2 (20.0)	2.1
<b>Total</b>	<b>4</b>	<b>6</b>	<b>10 (100.0)</b>	<b>0.2</b>

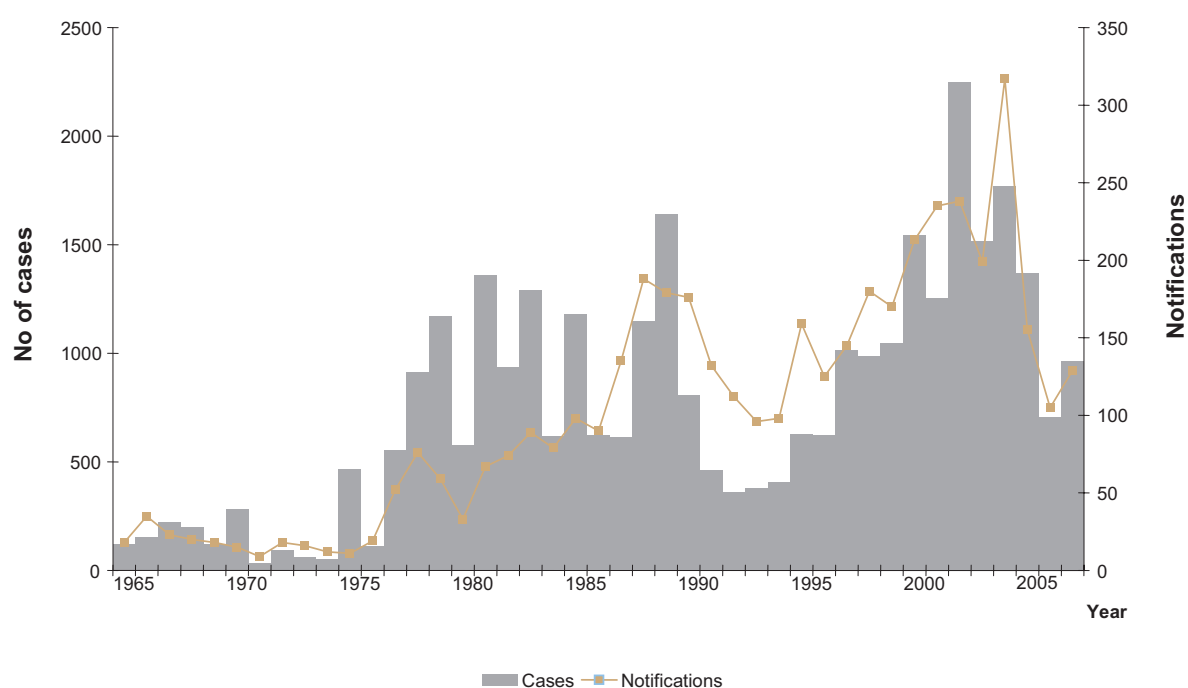
<sup>^</sup> Excluding three foreigners seeking medical treatment in Singapore  
 \*Rates are based on 2007 estimated mid-year population.  
 (Source: Singapore Department of Statistics)

### FOOD POISONING

There were 129 notifications of food poisoning involving 965 cases, compared with 105 notifications involving 707 cases in 2006 (Figure 3.7). Of these, 124 notifica-

tions were classified as outbreaks involving two or more cases epidemiologically linked to a common source, as compared to 99 notifications in 2006.

**Figure 3.7**  
**Notifications of food poisoning in Singapore, 1965-2007**



Majority (46.8%) of the outbreaks occurred in restaurants and eating houses (Table 3.26).

**Table 3.26**  
**Food poisoning notifications by type of food establishment, 2007**

Type of food establishments	No. of notifications	Notification classified as outbreak*	No. of cases
<b>General outlets</b>			
<b>Restaurant</b>			
In hotels	5	5	22
Others	41	38	294
Eating house	16	15	48
Hawker centre	0	0	0
Private food court	3	3	6
Fast food outlets	4	4	12
Other food outlets	4	3	10
<b>Canteens</b>			
Factory/office/staff/construction site	2	2	10
School	3	3	175
Supermarket/market shops	1	1	3
Catering (licensed)	4	4	66
Catering (unlicensed)	0	0	0
Food factory	40	40	290
Sub-total (General outlets)	123	118	936
<b>Institution</b>			
<b>In house kitchen</b>			
Nursing homes	2	2	10
Foreign workers dormitories	1	1	9
Others	3	3	10
Sub-total (Institution)	6	6	29
<b>Total</b>	<b>129</b>	<b>124</b>	<b>965</b>

\*two or more epidemiologically linked cases involved

Microbiological investigations of 159 food samples and 21 environmental swabs were conducted, of which two were positive for *Staphylococcus aureus*, three for *Escherichia coli* and 15 for *Salmonella*. Of 618 food

handlers sent for screening, 20 were found to be positive for *Salmonella*, one for rotavirus, two for norovirus and one for *Shigella*.

One case study is discussed below.

### Case Study 1: An outbreak of food poisoning involving students who attended an adventure camp

#### **Notification**

On 1 March 07, MOH was informed of an outbreak of food poisoning among students from a secondary school after attending a outdoor adventure camp. Epidemio-

logical investigations were conducted to determine the extent of the outbreak, source of infection and mode of transmission.

### Epidemiological findings

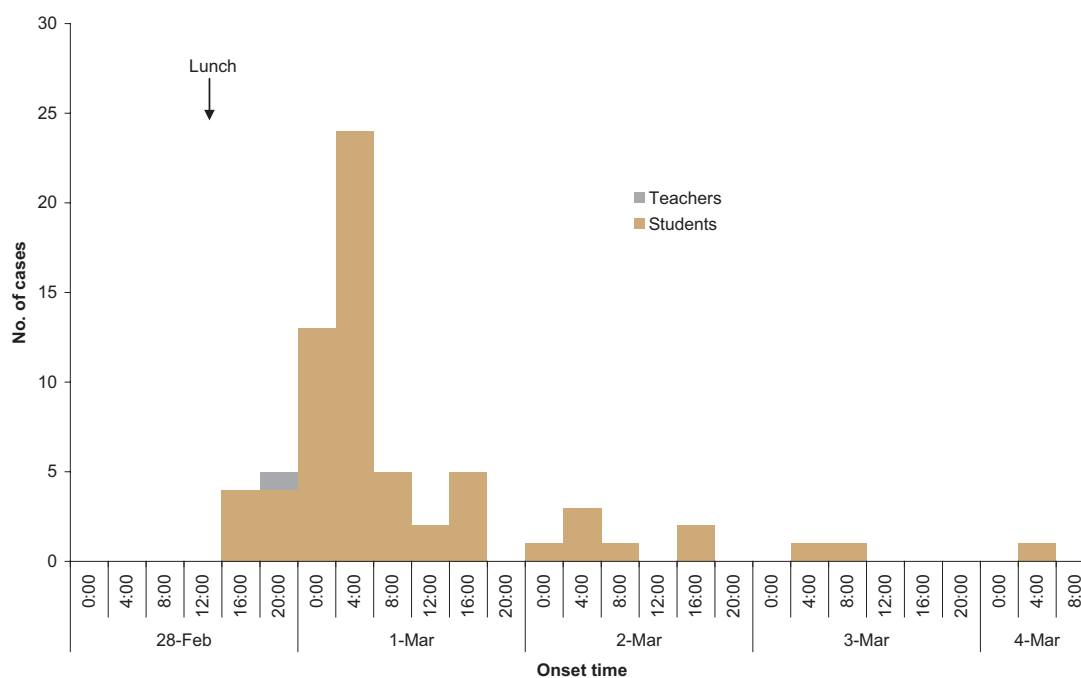
The outdoor adventure camp was an annual event for Secondary 3 students and held in an Adventure Centre in Pasir Panjang Road. A total of 301 Secondary 3 students from 10 classes, 36 student leaders from Secondary 4, 30 instructors from Secondary 3, 2 photographers and 2 youths from National Youth Achievement Award Council attended the camp. The food was prepared by the student leaders and a food caterer.

A total of 68 gastroenteritis cases comprising 67 students and one teacher were identified. The clinical symptoms were abdominal pain (100.0%), diarrhoea

(76.5%), headache (48.5%), nausea (47.1%), fever (13.2%) and vomiting (10.3%). 49 received outpatient treatment while 19 self-medicated. Affected students were distributed across all classes in the Secondary 3 level except Secondary 3P with attack rates ranging from 1.5-19.1%. Among the ethnic groups, cases involved Chinese (80.9%), Indians (10.3%), Malays (7.4%) and others (1.5%). The mean and median incubation periods are 22.5 hours and 17.5 hours, respectively.

The epidemic curve is shown in Figure 3.8.

**Figure 3.8**  
Time distribution of 68 cases of gastroenteritis in a secondary school camp, 28 Feb - 4 Mar 07



Analysis of the food-specific attack rates based on the food items consumed prior to onset of illness involving 68 cases and 203 controls did not implicate any meal. No one specific food item was established as the vehicle of transmission.

The observations made at the campsite included the absence of soap in toilets and handling of food by the student leaders without hand gloves.

The caterer for lunch and dinner was licensed by NEA. A joint inspection with NWRO (NEA) officers carried out on 2 March 07 at the food factory revealed that the premise was dirty. In addition, there was double stacking of food items inside the freezer and utensils and paraphernalia

### Comments

The exact causative agent in the outbreak was undetermined. Based on the predominant clinical presentations of abdominal pain, diarrhoea, headache, nausea, fever and vomiting and the incubation period of 22.5 hours, the causative agent is likely to be of bacterial nature such as *Salmonella* organisms. Transmission could have occurred through the consumption of a batch of contaminated food, likely to be the lunch on 28 February 07 which was the first common meal of the camp. Contributing factors to the outbreak included the absence of soap for handwashing and the inadequate food hygiene practices of the students.

were placed beside the toilet on the floor. A dirty chopping board used for food preparation was discarded.

Of the three food samples taken, one was positive for food poisoning pathogens. The sample of cut fruits supplies by the caterer was positive for non-enterotoxigenic *S.aureus*. Summons action was taken by NEA against the caterer for possessing food for sale which was unclean.

Stool samples from three symptomatic students were sent for microbial testing but turned out negative for pathogens. All six food handlers referred to CDC for medical screening on 5 and 12 March 07 were tested negative for food poisoning pathogens.

Following the incident, the food handlers and management of the restaurant was instructed to immediately correct the lapses observed and maintain proper hygiene standards at all times. MOE has also been briefed on the protocols to follow in the event of an outbreak (i.e. carry out active case detection, promptly isolate the cases and seek medical treatment if necessary) to minimise involvement of students in mass food preparation, and ensure provision of soap and other toilet facilities in their campsites.