

ISSN: 1176-3485

**ANNUAL SUMMARY OF OUTBREAKS  
IN NEW ZEALAND 2006**

Prepared as part of a Ministry of Health  
Contract for scientific services

by

Population and Environmental Health Group  
Institute of Environmental Science and Research Limited

April 2007

Client Report  
FW 0741

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## **ACKNOWLEDGMENTS**

This report has been prepared by the Population and Environmental Health (PEH) Group of the Institute of Environmental Science and Research Ltd. In particular, Tati Corpuz, Kerry Sexton, Liza Lopez and Ruth Pirie have contributed to the analysis and reporting of outbreak data for this report.

This report could not have been produced without the continued support of staff in the Public Health Services who provide us with data from their regions. The authors would also like to thank Dr Alison Roberts at the Ministry of Health for her peer review of the draft report and helpful feedback provided.

This report is available on the Internet at [www.surv.esr.cri.nz](http://www.surv.esr.cri.nz)

## CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>I</b>
<b>1. INTRODUCTION .....</b>	<b>1</b>
<b>2. METHODS .....</b>	<b>1</b>
2.1. Outbreak definition .....	1
2.2. Data source .....	2
2.3. Data analysis .....	2
2.4. Data limitations .....	2
<b>3. RESULTS .....</b>	<b>4</b>
3.1. Characteristics of outbreaks .....	4
3.2. Distribution of outbreaks by PHU .....	4
3.3. Type of outbreak .....	5
3.4. Causal agents .....	6
3.5. Morbidity and mortality .....	8
3.6. Outbreak setting .....	9
3.7. Mode of transmission .....	10
3.8. Foodborne outbreaks .....	12
3.9. Person-to-person outbreaks .....	14
3.10. Waterborne outbreaks .....	15
3.11. Environmental outbreaks .....	16
3.12. Zoonotic outbreaks .....	17
3.13. Outbreaks with overseas transmission .....	18
3.14. Outbreak recognition, investigation and control .....	18
3.15. Summary of trends .....	21
<b>GLOSSARY .....</b>	<b>24</b>

## LIST OF TABLES

Table 1: Outbreaks and associated cases by PHU, 2006.....	5
Table 2: Outbreaks and associated cases by type of outbreak, 2006 .....	6
Table 3: Outbreaks and associated cases by agent type, 2006.....	7
Table 4: Outbreak type by agent type, 2006 .....	8
Table 5: Hospitalised outbreak cases and total outbreak cases by agent type, 2006 .....	9
Table 6: Outbreaks and associated cases by setting of exposure/transmission, 2006.....	10
Table 7: Outbreaks and associated cases by mode of transmission, 2006 .....	11
Table 8: Foodborne outbreaks and associated cases by agent type, 2006.....	12
Table 9: Foodborne outbreaks and associated cases by implicated food source, 2006 .....	13
Table 10: Foodborne outbreaks by contributing factor, 2006.....	14
Table 11: Person-to-person outbreaks and associated cases by agent type, 2006.....	15
Table 12: Waterborne outbreaks and associated cases by agent type, 2006.....	16
Table 13: Waterborne outbreaks by contributing factor, 2006 .....	16
Table 14: Environmental outbreaks and associated cases by agent type, 2006 .....	17
Table 15: Zoonotic outbreaks and associated cases by agent type, 2006 .....	17
Table 16: Outbreaks with overseas transmission, 2006 .....	18
Table 17: Median reporting delay by outbreak type, 2006 .....	19
Table 18: Outbreaks by means of recognition, 2006 .....	19
Table 19: Outbreaks by control measures undertaken, 2006 .....	20

## LIST OF FIGURES

Figure 1: Outbreak rates by PHU region, 2006.....	4
Figure 2: Number of outbreaks by agent type and mode of transmission, 2006.....	11
Figure 3: Number of outbreaks and associated cases by month, 2006 .....	21
Figure 4: Number of outbreaks by year, 2001-2006 .....	21
Figure 5: Percentage of outbreaks by agent type and year, 2003-2006 .....	22

## EXECUTIVE SUMMARY

### Characteristics

- There were 495 outbreaks reported in 2006 involving 6302 cases.
- The national outbreak rate was 12.0 outbreaks per 100 000 population.
- There were 160 hospitalisations and nine deaths associated with outbreaks in 2006.

### Distribution by Public Health Unit (PHU)

- The highest number of outbreaks was reported by the Auckland PHU, which represented 54.7% (271/495) of all outbreaks in 2006.
- Auckland, West Coast, Otago, and Wellington had outbreak rates higher than the national rate.
- The highest outbreak rate (19.7 per 100 000 population) was observed in Auckland and West Coast.

### Type of outbreak

- Over a third (178/495) of all outbreaks were reported as a common source outbreak, the majority of which resulted from a common event.
- Institutional outbreaks represented 31.5% (156/495) of all outbreaks and 65.4% (4122/6302) of all associated cases.
- Household outbreaks represented 23.8% (118/495) of all outbreaks and 4.9% (307/6302) of all associated cases.

### Causal agents

- The causal agent (pathogen, toxin or chemical) was identified in 69.1% (342/495) of outbreaks involving 77.5% (4887/6302) of outbreak related cases.
- The remaining outbreaks where no organism was isolated were all recorded as gastroenteritis.
- Enteric agents were implicated in 97.2% (481/495) of outbreaks and 97.8% (6162/6302) of outbreak related cases.
- The most common implicated pathogen was norovirus (31.5% of outbreaks), followed by *Campylobacter* (9.5%) and *Giardia* (6.5%).

### Outbreak setting

- The most common settings where exposure or transmission occurred were the home environment (23.4% of outbreaks) and rest homes (19.4%).
- Rest homes had the highest number of outbreak related cases (48.0%, 3026/6302).

### Mode of transmission

- Person-to-person outbreaks were the commonest mode of transmission, accounting for 57.6% (285/495) of outbreaks and 79.4% (5002/6302) of cases.
- Foodborne transmission was recorded in 29.5% (146/495) of outbreaks involving 14.4% (909/6302) of cases.

- Environmental transmission was recorded in 11.7% (58/495) of outbreaks involving 25.3% (1595/6302) of cases.
- Multiple modes of transmission were identified in 23.6% (117/495) of outbreaks associated with 39.8% (2506/6302) of cases.

### **Recognition, investigation and control**

- The majority of outbreaks (58.3%) were reported within 7 days of the onset of illness in the first case.
- The overall median reporting delay for outbreaks was 5.0 days.
- Outbreaks were most frequently identified when cases had person-to-person contact with other cases (57.6% of outbreaks), when cases attended a common event (32.7%), when cases were linked to a common source (25.1%), and when there was an increase in disease incidence (23.0%).
- Outbreak control measures were undertaken in 93.7% (464/495) of outbreaks reported in 2006. The most common measures were health education and advice (413 outbreaks) and modification of procedures (173).

## 1. INTRODUCTION

Outbreak surveillance in New Zealand has been conducted by ESR since 1996. The outbreak surveillance system was incorporated as a module within EpiSurv, the national notifiable disease surveillance system, in 1997.

Outbreak surveillance is undertaken for the following reasons<sup>1</sup>:

- To identify and control widely dispersed outbreaks
- To improve outbreak prevention
- To assess impact of outbreaks and set priorities
- To evaluate prevention strategies
- To improve investigation methods
- To improve public health training
- To improve understanding of emerging diseases
- To meet international reporting requirements

## 2. METHODS

### 2.1. Outbreak definition

The Manual for Public Health Surveillance in New Zealand<sup>2</sup> states that the following types of outbreaks should be reported:

- Two or more cases linked to a common source, in particular where the common source is exposure at a common event, food or water dispersed in the community, an environmental source, or a source in an institutional setting.
- A community-wide or person-to-person outbreak (except when the source has become well established as a national epidemic and reporting it as a discrete event no longer serves a useful purpose)
- Any other situation where outbreak investigation or control measures are being used or considered

Outbreak reporting is encouraged for:

- A secondary case in an institution
- Household outbreaks – if there is a reasonable possibility that the outbreak resulted from a common source exposure for that household group.

Outbreak reporting is not usually required for:

- Most secondary cases.
- Single cases where a specific contaminated source is identified.

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<sup>1</sup> Lopez L, Baker M, Kieft C. *Annual Summary of Outbreaks in New Zealand 2000*. 2001, Institute of Environmental Science & Research Ltd (ESR).

<sup>2</sup> *Manual for Public Health Surveillance*, 2005, Institute of Environmental Science & Research Ltd (ESR).

## **2.2. Data source**

Outbreaks are reported to or identified by the local PHU. Data on each outbreak is recorded by the PHU on a standardised Outbreak Report Form within EpiSurv. PHUs are encouraged to enter early data as an interim report that can be finalised when further data is available. This data is downloaded daily from each PHU's EpiSurv database to be collated within the national EpiSurv database by ESR on behalf of the Ministry of Health. The national database is supplemented by data from the ESR enteric reference, virology and public health laboratories. If an outbreak is first identified by these laboratory sources, the responsible PHU is requested to complete an Outbreak Report Form.

The Outbreak Report Form consists of the following sections:

- Reporting authority (outbreak report date, interim/final report)
- Disease and implicated pathogen, toxin or chemical (name of implicated agent, case definitions)
- Outbreak demographics (number of cases, outbreak dates, age/sex of cases, incubation period, duration of illness)
- Circumstances of exposure/transmission (means of outbreak recognition, type of outbreak, setting, geographic location, mode of transmission, vehicle/source, evidence)
- Factors contributing to outbreak (specific factors relating to foodborne, waterborne, person-to-person and environmental outbreaks)
- Management of the outbreak (control measures undertaken)

The terms used in the Outbreak Report Form that relate to this report are defined in the glossary at the end of this report.

## **2.3. Data analysis**

This report contains an analysis of data on outbreaks reported between 1 January 2006 and 31 December 2006 and recorded on EpiSurv as at 9 March 2007. Amendments made to outbreak data on EpiSurv after 9 March 2007 will not be reflected in this report. One gastroenteritis outbreak in 2006 was excluded from the analyses as no cases were entered.

The number and percentage of outbreaks and/or associated cases were ascertained. Rates were calculated using national and PHU population figures based on Statistics NZ population estimates for 2006. Data on trends was based on data previously published in annual outbreak summary reports for 2001 to 2005.

The categories and subcategories analysed in this report were directly based on fields in the Outbreak Report Form.

## **2.4. Data limitations**

The available outbreak data is restricted to the outbreaks recorded in EpiSurv by PHUs. Outbreaks are more likely to be reported if they involve unusual pathogens, notifiable diseases, a large number of cases or a well defined setting. The differing availability of resources between PHUs may also impact on outbreak reporting at a regional level.

Data recording differences occur when fields in an Outbreak Report Form are incomplete or incorrectly entered, resulting in measurement bias. For example, the date of onset of illness in the first case was not reported for 18 outbreaks and incorrectly entered for seven outbreaks (the date of onset occurring after the report date) in 2006.

Different methods of data analysis have been used in the Annual Summary of Outbreaks in New Zealand prior to 2005. In 2003 and 2004, interim outbreak reports were excluded from analysis. In 2002, causal agents were categorised as laboratory confirmed versus suspected. As a result of these different analytical methods, comparisons of outbreak trends are mostly restricted to 2005 and 2006.

### 3. RESULTS

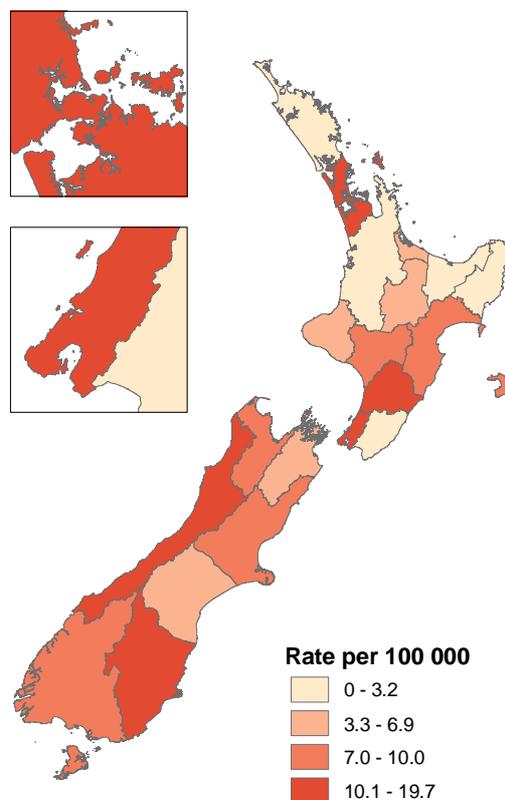
#### 3.1. Characteristics of outbreaks

There were 495 outbreaks reported in 2006 compared to 346 outbreaks reported in 2005. The national rate of outbreaks has increased, with 12.0 outbreaks per 100 000 population in 2006 and 9.3 outbreaks per 100 000 population in 2005. Of the outbreaks reported in 2006, 491 (99.2%) were classified as final, while the remaining four were classified as interim. A total of 6302 cases were associated with outbreaks, at a national rate of 152.2 cases per 100 000 population. Of the total cases, 1470 (23.3%) were confirmed, 4811 (76.3%) were probable, and the status of the remaining 21 cases was unknown.

#### 3.2. Distribution of outbreaks by PHU

The highest number of outbreaks (271) was reported by the Auckland PHU, which represented 54.7% (271/495) of all outbreaks in 2006 (see Table 1). Wellington had the second highest number of outbreaks (55), followed by Canterbury (37). The highest outbreak rate (19.7 per 100 000 population) was observed in Auckland and the West Coast (see Figure 1), although West Coast only accounted for 1.2% (6/495) of all outbreaks reported. No outbreaks were reported in Northland, Eastern Bay of Plenty, and Wairarapa.

**Figure 1: Outbreak rates by PHU region, 2006**



**Table 1: Outbreaks and associated cases by PHU, 2006**

PHU	No. of outbreaks	% of outbreaks (n=495)	No. of cases	% of cases (n=6302)	Outbreak rate <sup>1</sup>
Northland	0	0.0	0	0.0	0.0
Auckland <sup>2</sup>	271	54.7	1469	23.3	19.7
Waikato	11	2.2	118	1.9	3.2
East. Bay of Plenty	0	0.0	0	0.0	0.0
Rotorua	6	1.2	64	1.0	5.9
Tauranga	8	1.6	31	0.5	5.4
Gisborne	1	0.2	58	0.9	2.2
Hawke's Bay	15	3.0	424	6.7	10.0
Taranaki	4	0.8	37	0.6	3.8
Manawatu	18	3.6	361	5.7	11.6
Wanganui	6	1.2	130	2.1	9.7
Wellington <sup>3</sup>	55	11.1	1111	17.6	12.9
Marlborough	3	0.6	33	0.5	6.9
Nelson	9	1.8	173	2.7	9.6
Canterbury	37	7.5	1064	16.9	8.2
South Canterbury	4	0.8	143	2.3	5.0
West Coast	6	1.2	162	2.6	19.7
Otago	31	6.3	523	8.3	17.7
Southland	10	2.0	401	6.4	8.5
<b>Total</b>	<b>495</b>	<b>100.0</b>	<b>6302</b>	<b>100.0</b>	<b>-</b>

1 Rate per 100 000 population calculated using Statistics NZ population estimates for 2006

2 Includes Northwest Auckland, Central Auckland and South Auckland Health Districts

3 Includes Wellington, Hutt and Wairarapa Health Districts

### 3.3. Type of outbreak

Over a third (178/495) of all outbreaks in 2006 were reported as a common source outbreak. Of these outbreaks, 136 reportedly resulted from a common event, 25 from a common source in a specific site and 17 from a common source dispersed in the community (see Table 2). Institutional outbreaks had the highest number of cases per outbreak (26.4), accounting for 31.5% (156/495) of all outbreaks and 65.4% (4122/6302) of outbreak associated cases. Household outbreaks accounted for 23.8% (118/495) of outbreaks but just 4.9% (307/6302) of outbreak cases. Community wide outbreaks, where transmission occurred through person-to-person contact, represented 1.4% (7/495) of reported outbreaks.

**Table 2: Outbreaks and associated cases by type of outbreak, 2006**

<b>Outbreak type</b>	<b>No. of outbreaks</b>	<b>% of outbreaks (n=495)</b>	<b>No. of cases</b>	<b>% of cases (n=6302)</b>	<b>Cases per outbreak</b>
Common event	136	27.5	1079	17.1	7.9
Dispersed common source	17	3.4	58	0.9	3.4
Common site	25	5.1	469	7.4	18.8
Community wide	7	1.4	59	0.9	8.4
Institutional	156	31.5	4122	65.4	26.4
Household	118	23.8	307	4.9	2.6
Other outbreak type	9	1.8	107	1.7	11.9
Unknown outbreak type	27	5.5	101	1.6	3.7
<b>Total</b>	<b>495</b>	<b>100.0</b>	<b>6302</b>	<b>100.0</b>	<b>12.7</b>

### 3.4. Causal agents

The causal agent was identified in 342 (69.1%) outbreaks that were associated with 4887 (77.5%) cases. For each of these outbreaks only one causal agent was recorded. No specific pathogen was isolated in the remaining 153 (30.9%) outbreaks, all of which were recorded as gastroenteritis outbreaks.

Enteric agents were implicated in the vast majority of outbreaks (97.2%) and cases (97.8%) (see Table 3). The most common causal agent implicated in outbreaks in 2006 was norovirus, which resulted in 156 (31.5%) outbreaks and 3945 (62.6%) of cases. Norovirus outbreaks had an average of 25.3 cases per outbreak, the second highest of any causal agent in 2006 (after chlorine with an average of 26.5). The next most common agent associated with outbreaks was *Campylobacter* (9.5%), followed by *Giardia* (6.5%), *Cryptosporidium parvum* (5.1%) and *Salmonella* (4.4%).

Non-enteric agents accounted for only 14 (2.8%) outbreaks associated with 140 (2.2%) cases in 2006. The three agents involved in more than one outbreak were: *Bordetella pertussis* (5), *M. tuberculosis* (5), and chlorine (2).

**Table 3: Outbreaks and associated cases by agent type, 2006**

Agent type	No. of outbreaks	% of outbreaks	No. of cases	% of cases
<b>Enteric</b>				
Norovirus	156	31.5	3945	62.6
<i>Campylobacter</i> spp.	47	9.5	223	3.5
<i>Giardia</i>	32	6.5	98	1.6
<i>Cryptosporidium parvum</i>	25	5.1	116	1.8
<i>Salmonella</i> spp.	22	4.4	74	1.2
<i>Clostridium perfringens</i>	12	2.4	62	1.0
Hepatitis A virus	8	1.6	81	1.3
<i>Shigella</i> spp.	8	1.6	27	0.4
Rotavirus	6	1.2	78	1.2
VTEC/STEC	5	1.0	16	0.3
Histamine	4	0.8	12	0.2
<i>Bacillus cereus</i>	2	0.4	11	0.2
Scombroid	1	0.2	4	0.1
Unidentified pathogen	153	30.9	1415	22.5
<b>Total enteric</b>	<b>481</b>	<b>97.2</b>	<b>6162</b>	<b>97.8</b>
<b>Non-enteric</b>				
<i>Bordetella pertussis</i>	5	1.0	57	0.9
<i>M. tuberculosis</i>	5	1.0	24	0.4
Chlorine	2	0.4	53	0.8
<i>Legionella pneumophila</i>	1	0.2	4	0.1
<i>Neisseria meningitidis</i>	1	0.2	2	0.0
<b>Total non-enteric</b>	<b>14</b>	<b>2.8</b>	<b>140</b>	<b>2.2</b>

1 All outbreaks with no pathogen identified in 2006 were classified as gastroenteritis

The specific causal agents implicated in the various outbreak types are shown in Table 4. Common event outbreaks were mostly associated with norovirus (29 outbreaks), *Campylobacter* (19) and *C. perfringens* (8). Outbreaks due to a common source dispersed in the community were most frequently linked to *Campylobacter* (6 outbreaks), while outbreaks due to a common source in a specific site were mostly commonly due to *C. parvum* (6). Norovirus was commonly identified in institutional outbreaks (99). Household outbreaks were frequently associated with *Giardia* (22 outbreaks), *Campylobacter* (15), and *C. parvum* (15).

**Table 4: Outbreak type by agent type, 2006**

Agent type	Outbreak Type								Total
	CEvt <sup>1</sup>	CDsp <sup>2</sup>	CSite <sup>3</sup>	Com <sup>4</sup>	Inst <sup>5</sup>	Hse <sup>6</sup>	Oth <sup>7</sup>	Unk <sup>8</sup>	
<b>Enteric</b>									
Norovirus	29	2	3	0	99	13	5	5	156
<i>Campylobacter</i> spp.	19	6	3	0	2	15	0	2	47
<i>Giardia</i>	2	0	3	1	2	22	0	2	32
<i>Cryptosporidium parvum</i>	2	0	6	0	2	15	0	0	25
<i>Salmonella</i> spp.	5	1	1	1	0	12	0	2	22
<i>Clostridium perfringens</i>	8	2	0	0	0	2	0	0	12
Hepatitis A virus	0	0	1	1	0	4	2	0	8
<i>Shigella</i> spp.	1	0	1	1	0	5	0	0	8
Rotavirus	1	0	0	0	5	0	0	0	6
VTEC/STEC	0	0	0	0	0	4	1	0	5
Histamine	1	3	0	0	0	0	0	0	4
<i>Bacillus cereus</i>	0	0	2	0	0	0	0	0	2
Scombroid	1	0	0	0	0	0	0	0	1
Unidentified pathogen	66	3	2	0	40	25	1	16	153
<b>Total enteric</b>	<b>135</b>	<b>17</b>	<b>22</b>	<b>4</b>	<b>150</b>	<b>117</b>	<b>9</b>	<b>27</b>	<b>481</b>
<b>Non-enteric</b>									
<i>Bordetella pertussis</i>	0	0	0	1	4	0	0	0	5
<i>M. tuberculosis</i>	0	0	0	2	2	1	0	0	5
Chlorine	0	0	2	0	0	0	0	0	2
<i>Legionella pneumophila</i>	0	0	1	0	0	0	0	0	1
<i>Neisseria meningitidis</i>	1	0	0	0	0	0	0	0	1
<b>Total non-enteric</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>6</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>14</b>
<b>Total outbreaks</b>	<b>136</b>	<b>17</b>	<b>25</b>	<b>7</b>	<b>156</b>	<b>118</b>	<b>9</b>	<b>27</b>	<b>495</b>

- 1 Common event
- 2 Common source dispersed in community
- 3 Common site
- 4 Community wide
- 5 Institutional
- 6 Household
- 7 Other
- 8 Unknown

### 3.5. Morbidity and mortality

There were 57 (11.5%) outbreaks reported in 2006 that involved the hospitalisation of cases. A total of 160 outbreak associated cases were hospitalised. There were more hospitalised cases for outbreaks due to enteric agents (137) than due to non-enteric agents (23 cases). However, a higher percentage of cases associated with non-enteric outbreaks were hospitalised, compared to enteric outbreaks (16.4% versus 2.2%) (see Table 5). All *Neisseria meningitidis* cases were hospitalised (2 cases). The agents with the next highest proportion of hospitalised cases were also both non-enteric agents, *M. tuberculosis* (29.2%), and chlorine (20.8%). The enteric agents with the highest proportion of hospitalised cases were *Salmonella* (18.9%), and *Shigella* (11.1%).

**Table 5: Hospitalised outbreak cases and total outbreak cases by agent type, 2006**

Agent type	No. of hospitalised cases <sup>1</sup>	No. of total cases	% of cases hospitalised
<i>Enteric</i>			
Norovirus	96	3945	2.4
<i>Salmonella</i> spp.	14	74	18.9
Hepatitis A virus	6	81	7.4
<i>Campylobacter</i> spp.	3	223	1.3
<i>Shigella</i> spp.	3	27	11.1
Histamine	1	12	8.3
<i>Giardia</i>	0	98	0.0
<i>Cryptosporidium parvum</i>	0	116	0.0
<i>Clostridium perfringens</i>	0	62	0.0
Rotavirus	0	78	0.0
VTEC/STEC	0	16	0.0
<i>Bacillus cereus</i>	0	11	0.0
Scombroid	0	4	0.0
Unidentified pathogen <sup>2</sup>	14	1415	1.0
<b>Total enteric</b>	<b>137</b>	<b>6162</b>	<b>2.2</b>
<i>Non-enteric</i>			
Chlorine	11	53	20.8
<i>M. tuberculosis</i>	7	24	29.2
<i>Bordetella pertussis</i>	2	57	3.5
<i>Neisseria meningitidis</i>	2	2	100.0
<i>Legionella pneumophila</i>	1	4	25.0
<b>Total non-enteric</b>	<b>23</b>	<b>140</b>	<b>16.4</b>

1 This information was recorded for 93.7% (464/495) of outbreaks, relating to 92.2% (5808/6302) of cases

2 All outbreaks with no pathogen identified in 2006 were classified as gastroenteritis

There were nine deaths associated with outbreaks in 2006; the majority were due to norovirus (5 deaths). An outbreak of gastroenteritis in Southland resulted in three deaths, while the remaining fatality was linked to an outbreak of *Legionella pneumophila* in Auckland. All of the fatalities related to outbreaks in residents of rest homes or hospitals with the exception of the *Legionella* outbreak death. This was an 80 year old.

### 3.6. Outbreak setting

The most common outbreak setting was the home, which was recorded in 116 (23.4%) outbreaks with 432 (6.9%) associated cases (see Table 6). Commercial food operators were also a common outbreak setting, which included restaurants/cafés (75 outbreaks), takeaway outlets (23), caterers (5), other food outlet (5), and supermarkets/delicatessens (4). The most

common institutional settings were rest homes (96 outbreaks), followed by hospital (continuing care) (34). The setting was unknown in 94 (19.0%) outbreaks.

**Table 6: Outbreaks and associated cases by setting of exposure/transmission, 2006**

<b>Outbreak setting</b>	<b>No. of outbreaks<sup>1</sup></b>	<b>% of total outbreaks (n=495)</b>	<b>No. of cases<sup>1</sup></b>	<b>% of total cases (n=6302)</b>
<b><i>Commercial food operators</i></b>				
Restaurant/Café	75	15.2	502	8.0
Takeaway	23	4.6	86	1.4
Caterer	5	1.0	63	1.0
Other food outlet	5	1.0	37	0.6
Supermarket/deli	4	0.8	12	0.2
<b><i>Institutions</i></b>				
Rest/Retirement Home	96	19.4	3026	48.0
Hospital (continuing care)	34	6.9	1306	20.7
Hospital (acute care)	19	3.8	334	5.3
Childcare centre	12	2.4	151	2.4
Camp	8	1.6	216	3.4
School	7	1.4	181	2.9
Hotel/Motel	7	1.4	141	2.2
Hostel/Boarding house	5	1.0	105	1.7
<b><i>Community</i></b>				
Swimming/spa pool	8	1.6	102	1.6
Community/Church gathering	4	0.8	87	1.4
<b><i>Workplace</i></b>				
Workplace	13	2.6	121	1.9
Farm	4	0.8	14	0.2
<b><i>Home</i></b>	<b>116</b>	<b>23.4</b>	<b>432</b>	<b>6.9</b>
<b><i>Other setting</i></b>	<b>36</b>	<b>7.3</b>	<b>832</b>	<b>13.2</b>
<b><i>Unknown setting</i></b>	<b>94</b>	<b>19.0</b>	<b>244</b>	<b>3.9</b>

1 More than one setting was recorded for some outbreaks

### 3.7. Mode of transmission

In 2006, the most common reported mode of transmission was person-to-person (285 outbreaks), followed by foodborne (146) (see Table 7). Person-to-person transmission also accounted for the highest percentage of cases (79.4%). Environmental mode of transmission had the second highest percentage of cases (25.3%). The mode of transmission was unknown in 81 (16.4%) outbreaks.

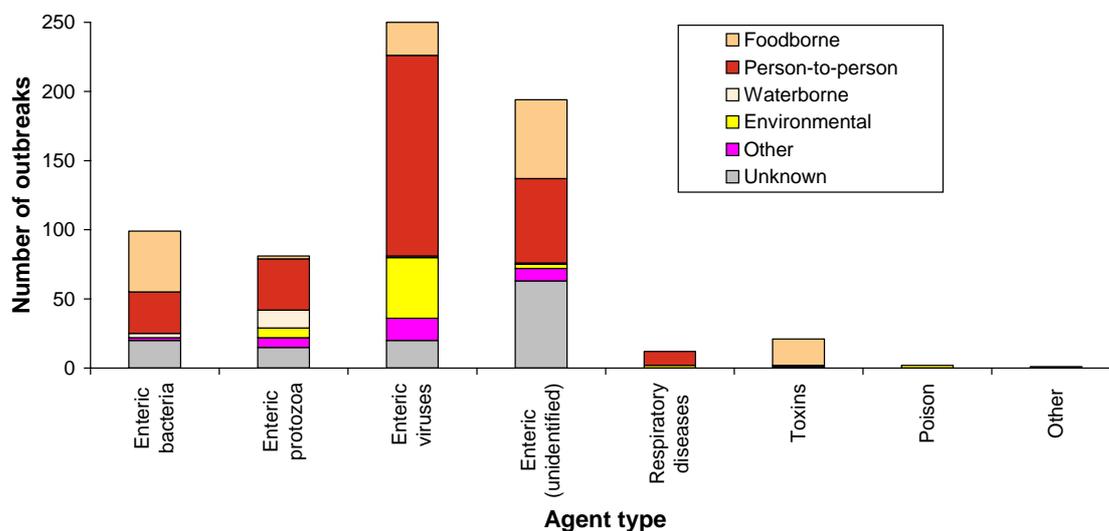
**Table 7: Outbreaks and associated cases by mode of transmission, 2006**

Transmission mode	No. of outbreaks <sup>1</sup>	% of total outbreaks (n=495)	No. of cases <sup>1</sup>	% of total cases (n=6302)
Person-to-person	285	57.6	5002	79.4
Foodborne	146	29.5	909	14.4
Environmental	58	11.7	1595	25.3
Waterborne	18	3.6	284	4.5
Zoonotic	7	1.4	47	0.7
Sexual contact	1	0.2	3	0.0
Other	26	5.3	774	12.3
Unknown	81	16.4	300	4.8

<sup>1</sup> More than one mode of transmission was recorded for 117 outbreaks with 2506 associated cases.

Foodborne transmission was the principal mode of transmission for enteric bacteria and toxins (Figure 2). Person-to-person transmission was the most common mode of transmission for enteric protozoa, enteric viruses, unspecified enteric pathogens and respiratory diseases but also contributed substantially to enteric bacteria outbreaks. Although person-to-person transmission was most commonly reported for outbreaks of respiratory diseases (11 outbreaks), environmental transmission was involved in two outbreaks (*M. tuberculosis* and *Legionella pneumophila*).

**Figure 2: Number of outbreaks by agent type and mode of transmission, 2006**



### 3.8. Foodborne outbreaks

#### *Causal agents*

There were 146 foodborne outbreaks reported in 2006, 57 (39.0%) of which were not linked to a specific pathogen (see Table 8). Specific pathogens most commonly associated with foodborne outbreaks included *Campylobacter* (32 outbreaks), norovirus (23), *C. perfringens* (12), and *Salmonella* (10). Enteric bacteria (*Campylobacter*, *Salmonella*, and *Shigella*,) were implicated in 30.1% (44/146) of foodborne outbreaks, enteric toxins (*C. perfringens*, histamine, *Bacillus cereus*, and scombroid) in 13.0% (19/146), enteric viruses (norovirus and Hepatitis A) in 16.4% (24/146), and enteric protozoa (*Giardia*) in 1.4% (2/146).

**Table 8: Foodborne outbreaks and associated cases by agent type, 2006**

Agent type	No. of outbreaks	% of outbreaks	No. of cases	% of cases
<i>Campylobacter</i> spp.	32	21.9	137	15.1
Norovirus	23	15.8	346	38.1
<i>Clostridium perfringens</i>	12	8.2	62	6.8
<i>Salmonella</i> spp.	10	6.8	36	4.0
Histamine	4	2.7	12	1.3
<i>Bacillus cereus</i>	2	1.4	11	1.2
<i>Giardia</i>	2	1.4	4	0.4
<i>Shigella</i> spp.	2	1.4	10	1.1
Hepatitis A virus	1	0.7	34	3.7
Scombroid	1	0.7	4	0.4
Unidentified pathogen <sup>1</sup>	57	39.0	253	27.8
<b>Total</b>	<b>146</b>	<b>100.0</b>	<b>909</b>	<b>100.0</b>

<sup>1</sup> All outbreaks with no pathogen identified in 2006 were classified as gastroenteritis

#### *Food sources implicated*

Of the 146 foodborne outbreaks in 2006, 19 (13.0%) outbreaks had a definite source identified and 63 (43.2%) had a suspected source identified. The actual definite or suspected sources were listed in all 82 of these outbreaks. No source was identified for 46 outbreaks, and for 18 outbreaks the source was recorded as unknown. The main foods implicated in these outbreaks were poultry (22 outbreaks), meat (17) and rice/noodles/pasta (14) (see Table 9). The highest number of cases was associated with outbreaks linked to poultry (150 cases) and shellfish (142).

**Table 9: Foodborne outbreaks and associated cases by implicated food source, 2006**

<b>Implicated food source</b>	<b>No. of outbreaks<sup>1</sup></b>	<b>% of outbreaks (n=146)</b>	<b>No. of cases</b>	<b>% of cases (n=909)</b>
Poultry	22	15.1	150	16.5
Meat (lamb, beef, pork)	17	11.6	90	9.9
Rice/noodles/pasta	14	9.6	74	8.1
Fish	9	6.2	28	3.1
Shellfish	8	5.5	142	15.6
Eggs	6	4.1	22	2.4
Fruit and vegetables	4	2.7	29	3.2
Sandwich/burger	4	2.7	11	1.2
Pies	2	1.4	10	1.1
Processed meat	1	0.7	7	0.8
Deli foods	1	0.7	19	2.1
Dairy	1	0.7	6	0.7
Cereal	1	0.7	2	0.2
Unclassifiable	14	9.6	91	10.0
Unknown vehicles	4	2.7	139	15.3

1 More than one food source was implicated in some outbreaks

### *Contributing factors*

The factors contributing to foodborne outbreaks commonly involved time and temperature abuses such as inadequate cooling or refrigeration in 32.9% (48/146), improper hot holding in 14.4% (21/146), undercooking in 14.4% (21/146), and improper storage prior to preparation in 14.4% (21/146) (see Table 10). Cross contamination of food was also a common contributing factor, which was reported in 28.8% (42/146) of foodborne outbreaks.

**Table 10: Foodborne outbreaks by contributing factor, 2006**

<b>Contributing factor</b>	<b>No. of outbreaks<sup>1</sup></b>	<b>% of total outbreaks (n=146)</b>
<b><i>Time/temperature abuse</i></b>		
Inadequate cooling or refrigeration	48	32.9
Improper hot holding	21	14.4
Undercooking	21	14.4
Improper storage prior to preparation	17	11.6
Inadequate reheating of previously cooked food	8	5.5
Inadequate thawing	3	2.1
Preparation too far in advance	3	2.1
<b><i>Contamination of food</i></b>		
Cross contamination	42	28.8
Contamination from an infected food handler	13	8.9
Chemical contamination	1	0.7
<b><i>Unsafe sources</i></b>		
Consumption of raw food	9	6.2
Use of ingredients from unsafe sources	4	2.7
Use of untreated water in food preparation	1	0.7
<b><i>Other factors</i></b>	11	7.5
<b><i>Unknown factors</i></b>	42	28.8

1 More than one contributing factor was recorded for some outbreaks

### 3.9. Person-to-person outbreaks

#### *Causal agents*

There were 285 person-to-person outbreaks with 5002 associated cases in 2006. The most common causal agent was norovirus, which was recorded in 46.0% (131/285) of person-to-person outbreaks involving 70.5% (3528/5002) of cases (see Table 11). Other common pathogens included *Giardia* (7.7%) and *C. parvum* (5.3%). Enteric viruses (norovirus, Hepatitis A, and rotavirus) were implicated in 50.9% (145/285) of person-to-person outbreaks, enteric protozoa (*C. parvum* and *Giardia*) in 13.0% (37/285), enteric bacteria (*Campylobacter*, *Salmonella*, *Shigella*, and VTEC/STEC) in 10.5% (30/285), respiratory pathogens (*M. tuberculosis* and *B. pertussis*) in 3.5% (10/285) and toxins (*C. perfringens*) in 0.4% (1/285). Over 20% of all person-to-person outbreaks were classified as unidentifiable pathogen (gastroenteritis).

There were five *M. tuberculosis* outbreaks in 2006, involving 24 cases. Two of these outbreaks involved overseas exposure and transmission. Sixteen of the cases were part of a Manawatu school outbreak involving both person-to-person and environmental modes of transmission. This outbreak has not been finalised (assessment ongoing).

**Table 11: Person-to-person outbreaks and associated cases by agent type, 2006**

Agent type	No. of outbreaks	% of outbreaks	No. of cases	% of cases
Norovirus	131	46.0	3528	70.5
<i>Giardia</i>	22	7.7	73	1.5
<i>Cryptosporidium parvum</i>	15	5.3	45	0.9
<i>Campylobacter</i> spp.	12	4.2	43	0.9
<i>Salmonella</i> spp.	10	3.5	36	0.7
Hepatitis A virus	8	2.8	81	1.6
Rotavirus	6	2.1	78	1.6
<i>Shigella</i> spp.	6	2.1	17	0.3
<i>Bordetella pertussis</i>	5	1.8	57	1.1
<i>M. tuberculosis</i>	5	1.8	24	0.5
VTEC/STEC	2	0.7	8	0.2
<i>Clostridium perfringens</i>	1	0.4	2	0.0
<i>Neisseria meningitidis</i>	1	0.4	2	0.0
Unidentified pathogen <sup>1</sup>	61	21.4	1008	20.2
<b>Total</b>	<b>285</b>	<b>100.0</b>	<b>5002</b>	<b>100.0</b>

<sup>1</sup> All outbreaks with no pathogen identified in 2006 were classified as gastroenteritis

### *Contributing factors*

Exposure to infected people was the primary contributing factor reported for 99.3% (283/285) of person-to-person outbreaks reported in 2006. Other contributing factors reported were poor hygiene of cases (7.0%, 20/285) and excessively crowded living conditions (2.1%, 6/285).

### **3.10. Waterborne outbreaks**

#### *Causal agents*

Of the 18 waterborne outbreaks reported in 2006, the most commonly reported pathogen was *Giardia* (7 outbreaks) followed by *C. parvum* (6) (see Table 12). Enteric protozoa (*Giardia* and *C. parvum*) were implicated in 72.2% (13/18) of waterborne outbreaks and enteric bacteria (*Campylobacter* and *Salmonella*) in 16.7% (3/18). An enteric virus (norovirus) was reported for one (5.6%) waterborne outbreak which resulted in 218 cases (76.8%). The pathogen was not specified for one (5.6%) waterborne outbreak, which was recorded as gastroenteritis.

For the norovirus outbreak, this pathogen was identified in a water sample from the suspected source. For two of the other outbreaks (one *Campylobacter* and one *Giardia*) high levels of faecal coliforms, but not the implicated pathogen, were identified in water samples.

**Table 12: Waterborne outbreaks and associated cases by agent type, 2006**

Agent type	No. of outbreaks	% of outbreaks	No. of cases	% of cases
<i>Giardia</i>	7	38.9	22	7.7
<i>Cryptosporidium parvum</i>	6	33.3	15	5.3
<i>Campylobacter</i> spp.	2	11.1	24	8.5
Norovirus	1	5.6	218	76.8
<i>Salmonella</i> spp.	1	5.6	2	0.7
Unidentified pathogen <sup>1</sup>	1	5.6	3	1.1
<b>Total</b>	<b>18</b>	<b>100.0</b>	<b>284</b>	<b>100.0</b>

<sup>1</sup> All outbreaks with no pathogen identified in 2006 were classified as gastroenteritis

### *Contributing factors*

The contributing factors linked to waterborne outbreaks include an untreated water supply (15 outbreaks) and contamination of water source (8) (see Table 13).

**Table 13: Waterborne outbreaks by contributing factor, 2006**

Contributing factor	No. of outbreaks <sup>1</sup>	% of total outbreaks (n=18)
Untreated water supply	15	83.3
Contamination of water source	8	44.4
Other factors	2	11.1
Contamination of reservoir(s)/holding tank(s)	1	5.6
Unknown factors	1	5.6

<sup>1</sup> More than one contributing factor was recorded for some outbreaks

### **3.11. Environmental outbreaks**

#### *Causal agents*

The most common causal agent identified in environmental outbreaks was norovirus, which was recorded in 72.4% (42/58) of environmental outbreaks and associated with 84.3% (1344/1595) cases (see Table 14). Enteric viruses (norovirus and rotavirus) were implicated in 75.9% (44/58) of environmental outbreaks, enteric protozoa (*C. parvum* and *Giardia*) in 12.1% (7/58), respiratory pathogens (*L. pneumophila* and *M. tuberculosis*) in 3.4% (2/58) and chlorine in 3.4% (2/58). Outbreaks of gastroenteritis, where no pathogen was identified, accounted for 5.2% (3/58) of all environmental outbreaks.

A definite link through environmental sampling was reported only for the *L. pneumophila* outbreak. For this outbreak, samples from a water blaster hose and several domestic rainwater tank supplies tested positive.

**Table 14: Environmental outbreaks and associated cases by agent type, 2006**

Agent type	No. of outbreaks	% of outbreaks	No. of cases	% of cases
Norovirus	42	72.4	1344	84.3
<i>Cryptosporidium parvum</i>	6	10.3	61	3.8
Chlorine	2	3.4	53	3.3
Rotavirus	2	3.4	23	1.4
<i>Giardia</i>	1	1.7	3	0.2
<i>Legionella pneumophila</i>	1	1.7	4	0.3
<i>M. tuberculosis</i>	1	1.7	16	1.0
Unidentified pathogen <sup>1</sup>	3	5.2	91	5.7
<b>Total</b>	<b>58</b>	<b>100.0</b>	<b>1595</b>	<b>100.0</b>

<sup>1</sup> All outbreaks with no pathogen identified in 2006 were classified as gastroenteritis

#### *Contributing factors*

The major contributing factor associated with environmental outbreaks was exposure to a contaminated environment, which was recorded in 89.7% (52/58) of environmental outbreaks. The other contributing factors were exposure to contaminated and inadequately maintained swimming pools (each 5.2%, 3/58), and infected animals or animal products (3.4%, 2/58).

### **3.12. Zoonotic outbreaks**

#### *Causal agents*

Over 70% (5/7) of the zoonotic outbreaks and almost 90% (42/47) of zoonotic outbreak cases reported in 2006 were linked to *C. parvum* (see Table 15). Enteric protozoa (*C. parvum* and *Giardia*) were implicated in 85.7% (6/7) of zoonotic outbreaks and enteric bacteria (*Campylobacter*) in 14.3% (1/7).

**Table 15: Zoonotic outbreaks and associated cases by agent type, 2006**

Agent type	No. of outbreaks	% of outbreaks	No. of cases	% of cases
<i>Cryptosporidium parvum</i>	5	71.4	42	89.4
<i>Campylobacter</i>	1	14.3	2	4.3
<i>Giardia</i>	1	14.3	3	6.4
<b>Total</b>	<b>7</b>	<b>100.0</b>	<b>47</b>	<b>100.0</b>

#### *Contributing factors*

Exposure to infected animals or animal products was reported as a contributing factor for all (7/7) zoonotic outbreaks in 2006. Other contributing factors included exposure to infected people for 57.1% (4/7) and exposure to contaminated environment for 28.6% (2/7).

A petting zoo was implicated as a possible source for two outbreaks (one *Campylobacter* and one *C. parvum*). Farm animals were a suspected source for a further four *C. parvum* outbreaks. The source of the *Giardia* outbreak was not specified. None of the animal sources were confirmed through laboratory testing.

### 3.13. Outbreaks with overseas transmission

There were 13 outbreaks in 2006 with overseas transmission involving 30 cases. Four outbreaks were *Giardia* and three were *Salmonella* (see Table 16). The countries most commonly associated with the outbreaks were Fiji (4) and India (3).

**Table 16: Outbreaks with overseas transmission, 2006**

Agent type	Fiji	India	Kiribati	Thailand	Thailand, Malaysia, India	PNG	Samoa	Vanuatu	No. of outbreaks	Total cases
<i>Giardia</i> spp.	2	1	0	0	1	0	0	0	4	8
Hepatitis A	0	0	0	0	0	0	1	1	2	7
<i>Salmonella</i> spp.	1	2	0	0	0	0	0	0	3	6
<i>M. tuberculosis</i>	0	0	1	0	0	1	0	0	2	4
Gastroenteritis	1	0	0	0	0	0	0	0	1	3
Norovirus	0	0	0	1	0	0	0	0	1	2
<b>Total</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>13</b>	<b>30</b>

### 3.14. Outbreak recognition, investigation and control

#### *Timeliness of reporting*

For the 470 outbreaks where timeliness data was available, the majority were reported to the PHU within 7 days of the first onset of illness (58.3%, 274/470), while 29.8% (140/470) of outbreaks were reported between 8 and 30 days after the onset and 7.9% (37/470) of outbreaks were reported between 31 and 60 days after the onset. Nineteen (4.0%) outbreaks were reported more than 60 days after the first onset of illness. The longest reporting delay was 790 days related to an outbreak of *M. tuberculosis* involving two cases.

Reporting delay (time between date of onset of illness in the first case and the report date) varied between different outbreak types (see Table 17). The shortest median reporting delay (3.0 days) was associated with a common event, followed by those with common source dispersed in the community (4.0), and institutional outbreaks (6.0). The longest median reporting delay (50.0 days) occurred with community-wide person-to-person transmission.

**Table 17: Median reporting delay by outbreak type, 2006**

<b>Outbreak type</b>	<b>No. of outbreaks<sup>1</sup></b>	<b>Median reporting delay (days)</b>
Common event	133	3.0
Institutional (transmission within a defined setting)	149	6.0
Household (transmission within a single household)	107	11.0
Common source in specific place	22	13.0
Common source dispersed in community	17	4.0
Other outbreak type	9	8.0
Community wide person-to-person transmission	7	50.0
Unknown outbreak type	26	1.0
<b>Total</b>	<b>470</b>	<b>5.0</b>

<sup>1</sup> Outbreaks with the date of onset of illness in the first case either missing or incorrectly entered were excluded

### *Recognition of outbreaks*

Almost 60% (285/495) of outbreaks were identified when cases had person-to-person contact with other cases. Other frequent means of outbreak recognition were when cases attended a common event (32.7%), when cases were linked to a common source (25.1%), and when there was an increase in disease incidence (23.0%) (see Table 18). There was more than one means of recognition for 37.8% (187/495) of outbreaks.

**Table 18: Outbreaks by means of recognition, 2006**

<b>Means of recognition</b>	<b>No. of outbreaks<sup>1</sup></b>	<b>% of total outbreaks (n=495)</b>
Cases had person-to-person contact with other cases	285	57.6
Cases attended common event	162	32.7
Cases linked to common source	124	25.1
Increase in disease incidence	114	23.0
Common organism type/strain characteristics in cases	43	8.7
Other means	10	2.0
Unknown means	8	1.6

<sup>1</sup> More than one means of recognition was recorded for some outbreaks.

### *Control measures*

Outbreak control measures were undertaken in 93.7% (464/495) of outbreaks reported in 2006. The most common measures undertaken were health education and advice for those working with the source (413 outbreaks), followed by modification of procedures (173) (see Table 19).

**Table 19: Outbreaks by control measures undertaken, 2006**

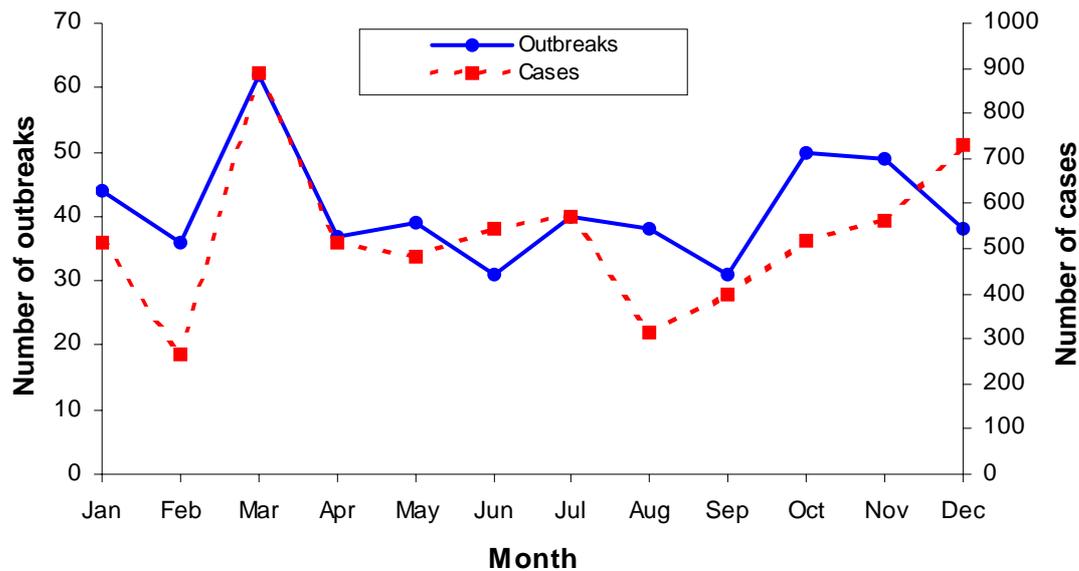
<b>Outbreak control measure</b>	<b>No. of outbreaks<sup>1</sup></b>	<b>% of total outbreaks (n=495)</b>
<b><i>Source</i></b>		
Health education and advice	413	83.4
Modification of procedures	173	34.9
Cleaning, disinfection	138	27.9
Exclusion	114	23.0
Isolation	112	22.6
Closure	30	6.1
Health warning	28	5.7
Treatment	20	4.0
Removal	19	3.8
<b><i>Vehicle and vector</i></b>		
Removal	6	1.2
Treatment	1	0.2
<b><i>Contacts and potential contacts</i></b>		
Health education and advice	48	9.7
Chemoprophylaxis	12	2.4
Vaccination	6	1.2
<b><i>Other control measures</i></b>	39	7.9
<b><i>No control measures</i></b>	19	3.8
<b><i>Unknown control measures</i></b>	12	2.4

<sup>1</sup> More than one control measure was recorded for some outbreaks

### 3.15. Summary of trends

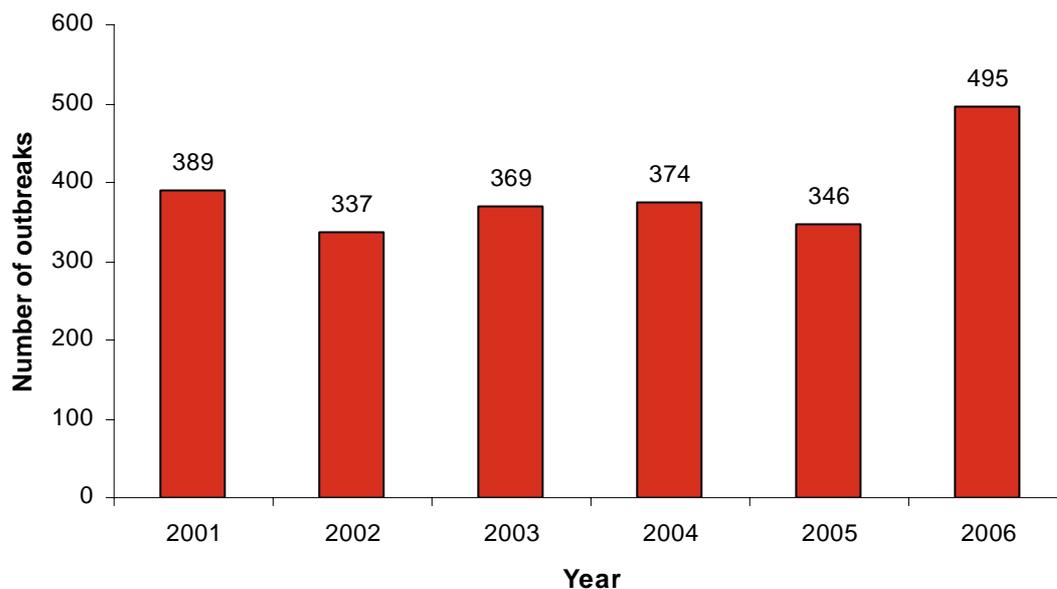
In 2006, the highest number of outbreaks was reported in March (62 outbreaks), October (50) and November (49), while the highest number of outbreak related cases occurred in March (888 cases) and December (729) (see Figure 3).

**Figure 3: Number of outbreaks and associated cases by month, 2006**



At 495, the annual number of outbreaks in 2006 was the highest since 2001 (see Figure 4).

**Figure 4: Number of outbreaks by year, 2001-2006**

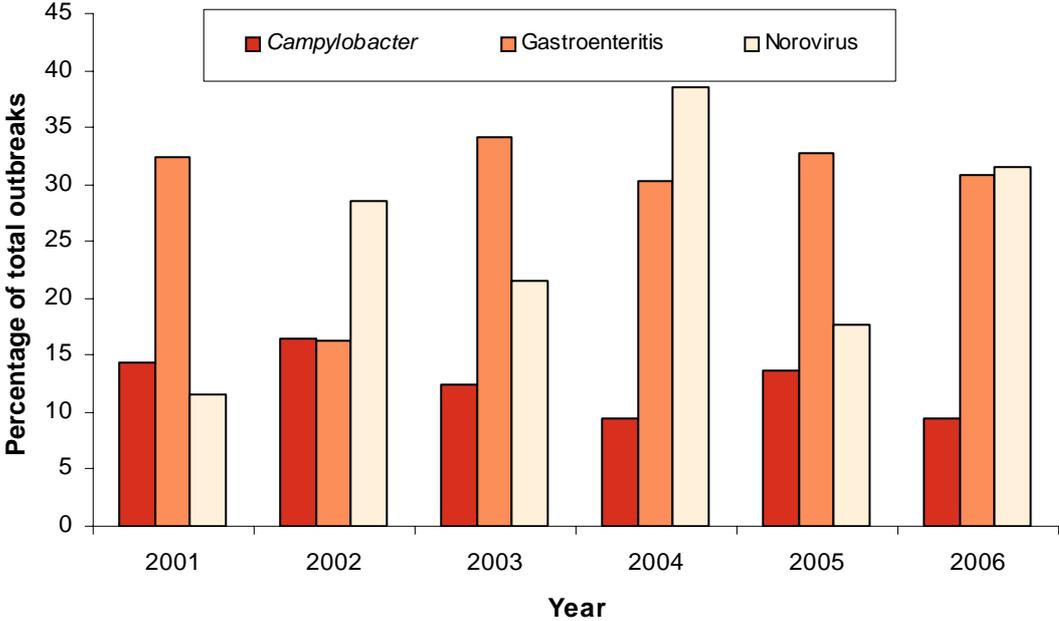


The national annual outbreak rate for 2006 (12.0 per 100 000 population) is greater than the highest rate for the preceding five-year period (10.4 in 2001). Similarly, the national outbreak case rate of 152.2 cases per 100 000 population in 2006 has increased compared with the rate of 65.2 in 2005 and 109.3 in 2004.

Common event outbreaks were consistently the most frequent outbreak type between 2001 and 2005. However, in 2006, institutional outbreaks were the most common outbreak type, with 48% of the cases occurring in rest/retirement homes. Norovirus was the most common pathogen linked to these institutional outbreaks while person-to-person contact with other cases was the most common mode of transmission for this pathogen.

In 2006, 69.1% (342/495) of outbreaks were linked with an identified agent, slightly higher than in 2005 (67.3%, 233/346) but similar to 2004 (69.4%, 227/327). Norovirus and *Campylobacter* were the most common single agent types linked to outbreaks from 2001 to 2006 (see Figure 5). The number of norovirus outbreaks and associated cases decreased by more than half between 2004 and 2005 (2004: 126 outbreaks, 3022 cases; 2005: 61 outbreaks and 1159 cases). However, in 2006, there was a marked increase in norovirus outbreaks (156) and associated cases (3945) to above 2004 levels.

**Figure 5: Percentage of outbreaks by agent type and year, 2003-2006**



The most common outbreak settings over the previous five years were restaurants/cafés and the home, except in 2004 when rest homes were the most common setting due to outbreaks of norovirus. In 2006, homes followed by rest homes were the most common settings, although rest homes had the most cases associated with outbreaks.

The principal modes of transmission from 2001 to 2005 were foodborne and person-to-person transmission. In 2006, person-to-person was the most common mode of transmission and had the highest proportion of associated cases.

In 2006, 13 outbreaks had overseas transmission involving 30 cases. In comparison, 15 outbreaks involving 108 cases had overseas transmission in 2005. For both years, Fiji and India were the countries most commonly associated with the outbreaks.

The median reporting delay calculated for 2006 was 5.0 days, the same delay being noted in 2002 to 2005.

Health education and advice related to the outbreak source was the most common control measure in the past 5 years, followed by modification of procedures pertaining to the source. The proportion of outbreaks where no control measures were reportedly undertaken has decreased from 27.8% of outbreaks in 2001 to 3.5% in 2005, and 3.8% in 2006.

## **GLOSSARY**<sup>3</sup>

### **Common event outbreak**

An outbreak due to exposure of a group of persons to a noxious influence that is common to the individuals in the group, where the exposure is brief and essentially simultaneous and all resultant cases develop within one incubation period of the disease. Cases therefore have exposures that are grouped in place and time (synonymous with point source outbreak).

### **Common site outbreak**

An outbreak due to exposure of a group of persons to a noxious influence that is common to the individuals in the group, where exposures have occurred at the same place (or site) but over a longer time-period than those of common event outbreaks (i.e. grouped in place but not in time). In the Outbreak Report Form, these outbreaks are called *common source in a specific place*.

### **Common source outbreak**

Outbreak due to exposure of a group of persons in the community to a noxious influence that is common to the individuals in the group. These outbreaks are subcategorised into common event (where exposures are grouped in time and place), dispersed common source (grouped in time but not in place) and common site (grouped in place but not in time).

### **Community wide outbreak**

Outbreak of individuals in the community, where transmission predominantly occurs by direct exposure of susceptible people to infectious people (synonymous with person-to-person outbreak).

### **Contamination**

The presence of a disease agent on a body surface, in clothes, bedding, toys, or other inanimate articles or substances including water and food.

### **Dispersed common source outbreak**

Outbreak due to exposure of a group of persons in the community to a noxious influence that is common to the individuals in the group, where the exposures are not grouped in place (and may or may not be grouped in time). These outbreaks are often due to a distributed vehicle of infection transmission, such as a commercially prepared food item or a water supply.

### **EpiSurv**

The national notifiable disease surveillance system managed by ESR to record data on notifiable diseases and outbreaks reported by public health units.

### **ESR**

Institute of Environmental Science & Research Limited.

### **Environment**

All that which is external to the individual human host.

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<sup>3</sup> Adapted from *Disease Outbreak Manual*. 2002, Institute of Environmental Science & Research Ltd (ESR).

**Exposure**

Proximity and/or contact with a potential source of a disease agent in such a manner that effective transmission of the agent and harmful or protective effects of the agent may occur.

**Household outbreak**

Outbreak confined to members of a single household.

**Institutional outbreak**

Outbreak confined to the population of a specific residential or other institutional setting, such as a hospital, rest home, prison or boarding school.

**Outbreak**

An epidemic limited to a localised increase in the incidence of a disease, such as in a town or closed institution.

**Source (of illness)**

The person, animal, object or substance from which a disease agent passes to a host.

**Transmission of illness**

Any mechanism by which a disease agent is spread through the environment or to another person. Mechanisms are defined as either direct or indirect.