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SURVEILLANCE REPORT

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Summary of Outbreaks in New Zealand

2011

Prepared as part of a Ministry of Health contract for scientific services by the Health Intelligence Team, Institute of Environmental Science and Research Limited

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SUMMARY

SUMMARY

The following is a summary of the main findings in this report:

Incidence and outcomes

There were 581 outbreaks reported during 2011 involving 7796 cases (3237 confirmed and 4559 probable cases). A total of 204 cases required hospitalisation and four cases died.

The highest number of outbreaks was reported by Auckland Public Health Unit, which represented 29.3% (170/581) of all outbreaks in 2011.

Public health units reporting the highest number of outbreaks per 100 000 population in 2011 were Waikato (28.6 outbreaks per 100 000 population), Manawatu (22.4 outbreaks per 100 000) and Wellington (19.9 outbreaks per 100 000). The national rate was 13.2 outbreaks per 100 000 population.

Causal agents

The causal agent (pathogen, toxin or chemical) was identified in 73.3% (426/581) of outbreaks involving 83.1% (6477/7796) of all outbreak associated cases.

Enteric agents were implicated in 94.0% (546/581) of outbreaks. The most commonly identified enteric pathogen was norovirus in 31.2% (181/581) of outbreaks, followed by *Giardia* spp. in 12.4% (72/581), *Campylobacter* spp. and *Cryptosporidium* spp. both 5.0% (29/581) of outbreaks. The most commonly implicated non-enteric agent was *Bordetella pertussis* in 3.3% (19/581) of outbreaks, followed by the measles virus in 1.0% (6/581) of outbreaks. Outbreaks due to measles also had the highest number of associated cases (560/7796, 7.1%).

Outbreak settings

The most common settings where exposure to or transmission of causal agents occurred were the private home environment (24.8%, 144/581) and long-term care facilities (22.5%, 131/581).

The highest percentage of outbreak-related cases occurred in long-term care facilities (39.6%, 3089/7796), followed by childcare centres (19.0%, 1481/7796) and in private homes (10.5%, 818/7796).

Modes of transmission

Person-to-person transmission was reported for 78.0% (453/581) of outbreaks in 2011. Foodborne and environmental transmission were reported for 21.0% (122/581) and 17.7% (103/581) of outbreaks, respectively. Multiple modes of transmission were implicated in 33.0% (192/581) of outbreaks.

Sources – foodborne outbreaks

Of the 122 foodborne outbreaks in 2011, 27.0% (33/122) had a source or vehicle listed. The main foods implicated in these 33 outbreaks were shellfish (27.3%, 9 outbreaks) and fish (24.2%, 8 outbreaks), followed by poultry (15.2%, 5 outbreaks) and pork and lamb (12.1%, 4 outbreaks each). The highest numbers of cases were associated with outbreaks linked to shellfish (28.9%, 72 cases), pork (19.7%, 49 cases) and fish (18.9%, 47 cases).

Recognition, reporting, investigation and control

Most outbreaks were recognised by increases in disease incidence (51.5%, 299/581), person-to-person contact with other cases (21.2%, 123/581) and when cases attended a common event (11.7%, 68/581).

Contamination of food was the most common factor contributing to foodborne outbreaks (40.2%, 49/122), followed by time/temperature abuse (38.5%, 47/122).

Almost half of all outbreaks (48.0%, 266/554 where information was available) were reported within one week of the onset of illness in the first case. The overall median reporting delay for outbreaks was 7.0 days.

Control measures were reported for 98.6% (573/581) of the outbreaks in 2011. The most common control measures undertaken were health education and advice regarding the source (76.8%, 440/572), followed by cleaning and disinfection (57.4%, 329/573).

Emerging trends

In 2011, the most common outbreak settings were in private homes and long-term care facilities, similar to that observed in the period from 2006 to 2009. Compared with 2010, outbreaks set in long-term care facilities have almost doubled (from 69 to 131 outbreaks) including associated cases (from 1482 to 3089 cases) due to the low number of norovirus outbreaks reported in 2010.

Over the last 10 years substantial changes have occurred in the reporting of modes of outbreak transmission. Over this period, person-to-person transmission emerged as the most frequently reported mode, a change from foodborne transmission which was often the most reported mode between 2001 and 2006. The proportion of foodborne outbreaks reported in 2011 (21.0%, 122/581) is similar to what was reported from 2007 to 2010 (range 15.0% to 23.3%), but less than from 2001 to 2006 (range 28.3% to 52.9%). Between 2001 and 2011, the number of outbreaks with person-to-person transmission reported increased more than three-fold (from 132 to 453, respectively). In 2011 the number of outbreaks with person-to-person transmission was more than three times higher than any other mode of transmission. Environmental transmission is emerging as a more frequently reported mode of outbreak transmission rising from 6.2% (24/389) of outbreaks in 2001 to 20.3% (123/606) in 2010 and 17.7% (103/581) in 2011, respectively.

1. INTRODUCTION

1. INTRODUCTION

Outbreak surveillance in New Zealand has been conducted by the Institute of Environmental Science and Research Ltd (ESR) on behalf of the Ministry of Health since 1996. The outbreak surveillance system collects data on disease outbreaks reported by public health units (PHUs). Since 1997, the outbreak surveillance system has been incorporated as a module within EpiSurv, the national notifiable disease surveillance system.

Outbreak surveillance is undertaken to [1]:

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

2. METHODS

2. METHODS

2.1 Outbreak definition

The Manual for Public Health Surveillance in New Zealand [2] 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.

2.2 Data sources

Outbreaks are reported to, or identified by, local PHUs. Data on each outbreak are recorded by the PHU on a standardised Outbreak Report Form within EpiSurv. PHUs are encouraged to enter data early as an interim report that can be finalised when further data become available. These data are entered at each PHU via a secure web-based portal, onto the EpiSurv database. The real-time data are collated and analysed by ESR on behalf of the Ministry of Health. The national database is supplemented by data from ESR's Enteric Reference Laboratory, and virology and public health laboratories. If an outbreak is first identified by these laboratory sources, the appropriate PHU is asked to complete an Outbreak Report Form.

The Outbreak Report Form and instruction manual can be found at:

<http://www.surv.esr.cri.nz/episurv/index.php>

The Outbreak Report Form consists of the following sections:

- reporting authority (outbreak report date and interim/final report)
- condition and implicated pathogen, toxin or chemical (name of implicated agent and case definitions)
- outbreak demographics (number of cases, outbreak dates, age/sex of cases, incubation period and duration of illness)
- circumstances of exposure/transmission (means of outbreak recognition, setting, geographic location, mode of transmission and vehicle/source evidence)
- factors contributing to the 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.

Genotyping was carried out in the ESR Norovirus Reference Laboratory. Consensus sequences were assembled and genotyping determined by comparison with reference norovirus sequences obtained from the Calicinet and European Foodborne Virus Network databases. The RIVM typing tool [3] was used to assist in identification of genotypes and GII.4 variants.

A separate data set obtained from the ESR Norovirus Reference Laboratory was used for the analysis in the norovirus outbreak section. As not all isolates are referred to the Norovirus Reference Laboratory for confirmation and typing the number of norovirus and sapovirus associated outbreaks reported in this section differ to that reported elsewhere in the report.

2.3 Data analysis

This report contains an analysis of data on outbreaks reported between 1 January 2011 and 31 December 2011, and recorded on EpiSurv as at 24 April 2012. Amendments made to outbreak data on EpiSurv after 24 April 2012 will not be reflected in this report.

The numbers and percentages of outbreaks and/or associated cases were ascertained. Rates were calculated using national and PHU population figures based on the Statistics New Zealand mid-year population estimates for 2011.

The categories and subcategories analysed in this report were directly based on fields in the Outbreak Report Form with two exceptions. Implicated food sources were grouped into one or more food categories, and reporting delay was calculated as the difference between the outbreak report date and the date of onset of illness for the first case.

A new Outbreak Report Form was introduced in October 2010 (see Appendix for current Outbreak Report Form). New fields added to the Outbreak Report Form that have been analysed for this report include:

- Mode of transmission – primary and secondary modes are now reported.
- Contributing factors - are now identified as either “confirmed” or “suspected”.

2.4 Data limitations

The available outbreak data are 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 among PHUs may also impact on outbreak reporting at a regional level. For these reasons caution is advised when interpreting the data contained in this report.

New evidence categories were developed for use with the revised Outbreak Report Form released in 2010. Due to inconsistencies in the use of these categories in 2011 these have not been analysed in this report.

Different methods of data analysis were used for the *Annual Summary of Outbreaks in New Zealand* reports before 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 in past reports should be restricted to the period from 2005 onwards.

3. RESULTS

3. RESULTS

3.1 Characteristics of outbreaks

There were 581 outbreaks reported in 2011, a decrease from the 607 outbreaks reported in 2010. The national rate of 13.2 outbreaks per 100 000 population in 2011 was lower than 2010 when there were 13.9 outbreaks per 100 000 population. Of the outbreak reports in 2011, 99.3% (577/581) were classified as final, while the remaining four outbreaks were classified as interim. A total of 7796 cases were associated with outbreaks, 41.5% (3237/7796) of the cases were confirmed and 58.5% (4559/7796) were probable cases. In 2011, the national rate was 177.0 outbreak cases per 100 000 population, an increase from 2010 when the national rate was 145.5 outbreak cases per 100 000 population.

3.2 Distribution of outbreaks by PHU

The highest number of outbreaks and associated cases was reported by Auckland PHU, which represented 29.3% (170/581) of outbreaks and 20.6% (1606/7796) of associated cases in 2011 (Table 1). Waikato PHU reported the second highest number of outbreaks (18.1%, 105 outbreaks), followed by Wellington (16.7%, 97 outbreaks) and Manawatu (6.4%, 37 outbreaks) PHUs. The highest outbreak rate (28.6 per 100 000 population) was reported by Waikato PHU (Figure 1) while the lowest outbreak rate for PHUs reporting at least five outbreaks was reported by Rotorua PHU (4.9 per 100 000 population).

Table 1. Outbreaks and associated cases by PHU, 2011

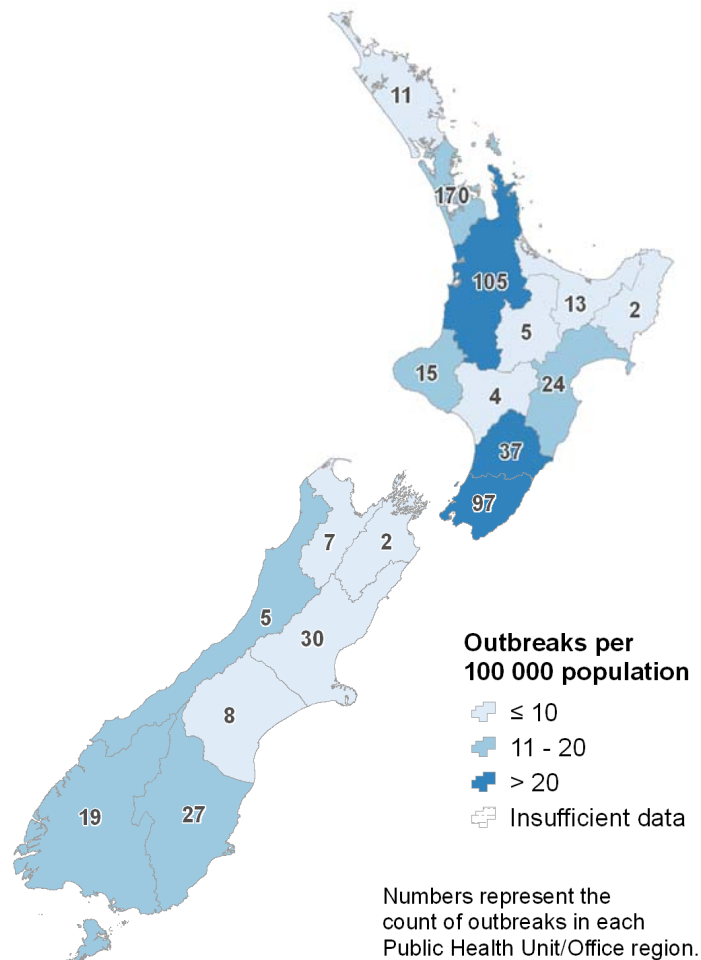
PHU	Outbreaks ¹			Cases ¹	
	Total	% of outbreaks (n=581)	Outbreak rate ¹	Total	% of cases (n=7796)
Northland	11	1.9	7	2.6	206
Auckland ²	170	29.3	11.3	20.6	1606
Waikato	105	18.1	28.6	8.1	632
Bay of Plenty	13	2.2	6.1	2	155
Rotorua	5	0.9	4.9	0.9	72
Taranaki	15	2.6	13.7	3.2	249
Hawke's Bay	24	4.1	15.4	5.2	407
Gisborne	2	0.3	4.3	0.6	48
Whanganui	4	0.7	6.9	0.5	38
Manawatu	37	6.4	22.4	9.6	749
Wellington ³	97	16.7	19.9	21.3	1663
Marlborough	2	0.3	4.2	0.3	24
Nelson	7	1.2	7.6	1.8	141
West Coast	5	0.9	15.2	3.2	253
Canterbury	30	5.2	6.3	5.9	461
South Canterbury	8	1.4	7.5	3.1	245
Otago	27	4.6	16.7	4.7	369
Southland	19	3.3	15.4	6.1	478
Total	581	100	13.2	100	7796

¹ Crude rate of outbreaks per 100 000 population calculated using Statistics New Zealand population estimates for 2011.

² Includes Northwest Auckland, Central Auckland and South Auckland health districts.

³ Includes Wellington, Hutt and Wairarapa health districts.

⁴ Rates calculated where fewer than five outbreaks were recorded should be interpreted with caution.

Figure 1. Number of outbreaks per 100 000 population by PHU, 2011

3.3 Causal agents

The causal agent was identified in 73.3% (426/581) of outbreaks involving 83.1% (6477/7796) of all outbreak associated cases. Of these, eight outbreaks with two causal agents were recorded. No specific pathogen or condition was identified in the remaining 26.7% (155/581) of outbreaks, all of which were recorded as gastroenteritis outbreaks.

Enteric agents were implicated in the vast majority of outbreaks (94.0%, 546/581) and their associated cases (86.3%, 6728/7796) (Table 2). The most common single causal agent implicated in outbreaks in 2011 was norovirus, which resulted in 31.2% (181/581) of reported outbreaks. The next most common enteric causal agents associated with outbreaks were due to *Giardia* spp. (12.4%, 72/581), rotavirus (6.2%, 36/581), *Cryptosporidium* spp. (5.0%, 29/581) and *Campylobacter* spp. (5.0%, 29/581). Outbreaks due to norovirus had the highest number of associated cases (4014/7796, 51.5%) and the highest median number of cases associated with each outbreak (19.0 cases per outbreak) of any enteric agent. This was followed by rotavirus (17.0 cases), which was implicated in 36 outbreaks with 606 associated cases.

Non-enteric agents accounted for 6.0% (35/581) of outbreaks and 13.7% (1068/7796) of the outbreak associated cases in 2011 (Table 2). The three agents involved in more than one outbreak were: *Bordetella pertussis* (3.3%, 19/581), measles virus (1.0%, 6/581), and *Mycobacterium tuberculosis* (0.5%, 3/581). The median number of cases associated with measles outbreaks (22.5 cases) was the

highest of all agent types (enteric and non-enteric) in 2011. Outbreaks due to measles also had the highest proportion of associated cases (7.1%, 560/7796) among non-enteric outbreaks.

Table 2. Outbreaks and associated cases by pathogen, 2011

Pathogen or condition	Outbreaks ¹			Cases ¹	
	Total	% of outbreaks (n=581)	Median cases per outbreak	Total	% of cases (n=7796)
Enteric¹	546	94.0	7.0	6728	86.3
Norovirus	181	31.2	19.0	4014	51.5
<i>Giardia</i> spp.	72	12.4	3.0	242	3.1
Rotavirus	36	6.2	17.0	606	7.8
<i>Campylobacter</i> spp.	29	5.0	3.0	123	1.6
<i>Cryptosporidium</i> spp.	29	5.0	2.0	103	1.3
<i>Salmonella</i> spp.	15	2.6	2.0	77	1.0
<i>Shigella</i> spp.	11	1.9	4.0	77	1.0
Sapovirus	9	1.5	16.0	167	2.1
<i>Salmonella</i> Typhi	5	0.9	3.0	17	0.2
<i>Clostridium perfringens</i>	4	0.7	9.5	56	0.7
<i>Escherichia coli</i> O157:H7	2	0.3	3.5	7	0.1
<i>Yersinia</i> spp.	2	0.3	2.0	4	0.1
<i>Bacillus cereus</i>	1	0.2	2.0	2	0.0
Ciguatera fish poisoning	1	0.2	2.0	2	0.0
Histamine (scombroid) fish poisoning	1	0.2	9.0	9	0.1
<i>Salmonella</i> Paratyphi	1	0.2	2.0	2	0.0
Pathogen not identified ²	155	26.7	5.0	1319	16.9
Non-enteric	35	6.0	7.0	1068	13.7
<i>Bordetella pertussis</i>	19	3.3	6.0	405	5.2
Measles	6	1.0	22.5	560	7.2
<i>Mycobacterium tuberculosis</i>	3	0.5	7.0	25	0.3
Influenza-like illness	2	0.3	15.0	30	0.4
<i>Legionella</i> spp.	1	0.2	14.0	14	0.2
Skin infections	1	0.2	11.0	11	0.1
Acute respiratory infection	1	0.2	10.0	10	0.1
Influenza A (H3N2)	1	0.2	10.0	10	0.1
Lead absorption	1	0.2	3.0	3	0.0

¹ More than one enteric agent was reported in 8 outbreaks with 99 cases.

² All enteric outbreaks with no pathogen identified in 2011 were recorded as gastroenteritis.

3.4 Norovirus outbreaks – strains and setting

The most common causal agent implicated in outbreaks in 2011 was norovirus, which resulted in 31.2% (181/581) of the outbreaks and 51.5% (4014/7796) of the associated cases reported in EpiSurv. The remainder of this section is based on data from the Norovirus Reference Laboratory. The number of norovirus- and sapovirus- associated outbreaks reported in this section differ to that reported elsewhere in the report.

Norovirus was confirmed by laboratory testing for 160 outbreaks. This is an increase from 2010 when 123 laboratory-confirmed outbreaks were reported but lower than 2009 when 264 outbreaks were confirmed as norovirus by the laboratory.

In contrast to previous years, a seasonal peak was observed in the April-June quarter with 40.0% of norovirus outbreaks occurring in this period. This differs from data collected over the previous nine years where the highest number of reported outbreaks occurred in October. In 2011, the highest number of outbreaks was reported in May (27 outbreaks) and the lowest number was reported in February (4 outbreaks) (Figure 2). Since 2002, the lowest overall number of outbreaks has been recorded in February.

Healthcare institutions for the elderly (long-term care facilities and continuing-care hospitals) were the most common setting for norovirus outbreaks (51.9%, 83/160) (Figure 3). Outbreaks were also commonly associated with acute-care hospitals (17.5%, 28/160), food-related settings (14.4%, 23/160) and child-related settings (8.1%, 13/160).

Norovirus genogroup II (GII) was identified in 92.5% (148/160) of outbreaks whereas norovirus genogroup I strains (GI) were identified in only 6.3% (10/160) of outbreaks. In another two outbreaks both GI and GII noroviruses were detected. The norovirus genotype was identified by sequencing in 156 (97.5%) of outbreaks; noroviruses from two mixed GI and GII outbreaks were not identified and two GII noroviruses were not able to be genotyped.

Genotype GII.4 has been the predominant type responsible for outbreaks both in New Zealand and overseas over the last 10 years, especially in healthcare and institutional settings and this continued in 2011. In 2011, GII.4 norovirus strains were identified in 68.1% (109/160) of all outbreaks, including 82.9% (92/111) of healthcare-related outbreaks. Three distinct GII.4 variants were identified in these outbreaks. The GII.4 2010 variant was predominant, causing 72.4% (79/109) of outbreaks. GII.4 2008 variant was identified in 24 outbreaks, GII.4 2006b variant in four outbreaks and for two hospital outbreaks, the GII.4 variant type was not able to be identified. Other GII genotypes, including GII.2, GII.3, GII.6 and GII.7, were associated with outbreaks in private homes, food-related, child-related and travel settings.

Several recombinant norovirus genotypes were identified in 2011. These recombinants result from natural recombination events between two norovirus genotypes usually from the same genogroup. The second most predominant genotype identified in 2011 was the recombinant genotype GII.12-GII.3, which was confirmed in 8.8% (14/160) of outbreaks occurring in child related (5), catered (4), healthcare (4) and private home (1) settings. Other recombinants identified were GII.7-GII.6, GII.b-GII.13, GII.b-GII.3, GII.c-GII.12 and GII.e-GII.4. For noroviruses typed as GII.b, GII.c and GII.e, the RNA polymerase gene does not correspond to any known genotype and so letters have been assigned to the polymerase type to distinguish them from recognised genotypes.

GI genotypes were associated with outbreaks in catered settings (4), child-related settings (2) and healthcare-elderly settings (3). GI.6 and GI.3 were identified in four and three outbreaks respectively.

Gastroenteritis outbreaks caused by other enteric viruses

Specimens from outbreaks found to be negative for norovirus were tested for the presence of sapovirus and astrovirus. These viruses are frequently associated with overseas outbreaks of gastroenteritis.

During 2011, specimens from 98 norovirus-negative gastroenteritis outbreaks were analysed for the presence of astrovirus and sapovirus. Sapoviruses were identified in 12 outbreaks. Of these, five outbreaks occurred in child-related settings, four in long-term care facilities, two in catered settings, and no setting was recorded for one outbreak. No astroviruses were detected.

Figure 2. Norovirus Reference Laboratory-confirmed norovirus outbreak typing by month, 2011

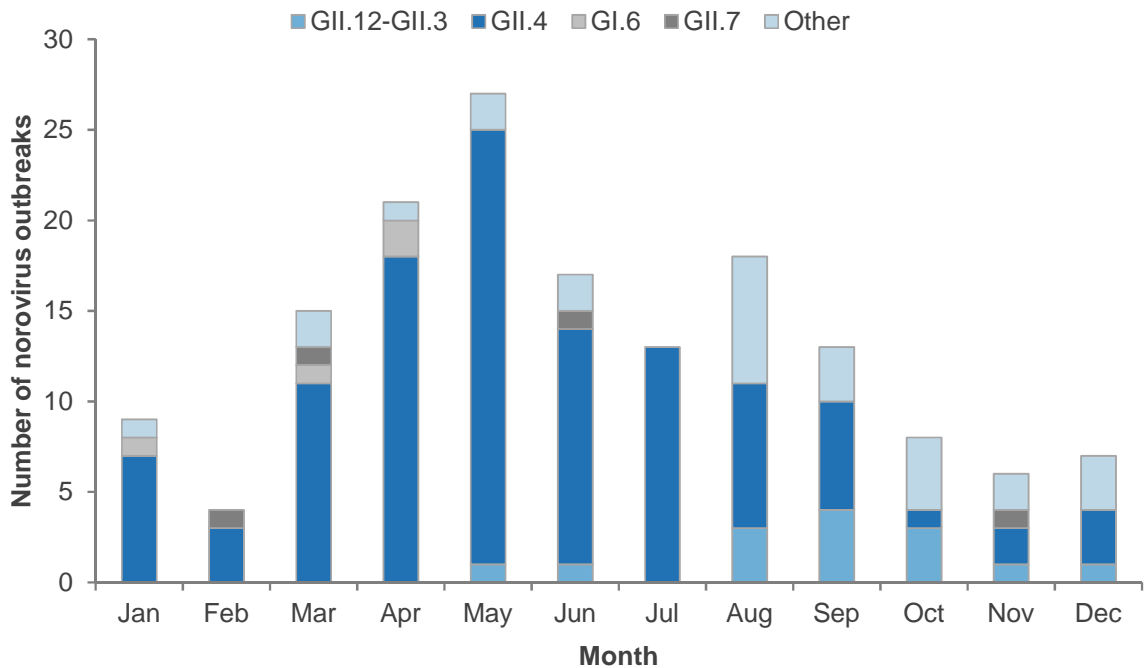
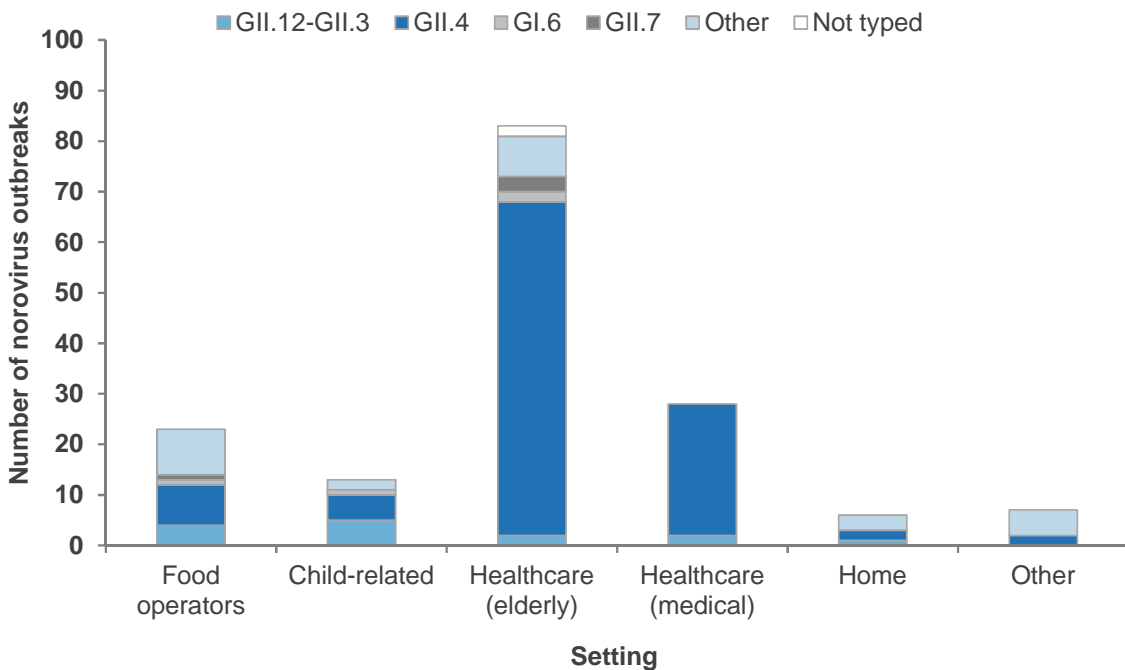


Figure 3. Norovirus Reference Laboratory-confirmed norovirus outbreak strains by setting, 2011



3.5 Morbidity and mortality

Hospitalisation information was recorded for 65.4% (380/581) of outbreaks. A total of 204 (2.6%) outbreak-associated cases were hospitalised. The number of cases hospitalised for outbreaks due to non-enteric pathogens (109 cases) was slightly higher than the number of cases hospitalised due to enteric pathogens (95 cases) (Table 3). A higher percentage of cases associated with non-enteric outbreaks were hospitalised compared with enteric outbreaks (10.2% versus 1.4%). The non-enteric pathogen or condition with the highest proportion of hospitalised cases was *M. tuberculosis* (40.0%, 10/25 cases), followed by *Legionella* spp. (21.4%, 3/14 cases) and measles (15.4%, 86/560 cases). Of the enteric pathogens *Salmonella* Typhi (23.5%, 4/17 cases) represented the highest proportion of hospitalised cases.

Four deaths were associated with four different outbreaks in 2011 (*B. pertussis*, norovirus, gastroenteritis, and influenza A(H3N2)).

Table 3. Hospitalised outbreak cases and total outbreak cases by pathogen or condition, 2011

Pathogen or condition	Outbreaks ¹	Cases ¹		
	Total	Total	No. of cases hospitalised	% of cases hospitalised
Enteric²	546	6728	95	1.4
Norovirus	181	4014	34	0.8
<i>Giardia</i> spp.	72	242	1	0.4
Rotavirus	36	606	18	3.0
<i>Cryptosporidium</i> spp.	29	103	1	1.0
<i>Campylobacter</i> spp.	29	123	2	1.6
<i>Salmonella</i> spp.	15	77	2	2.6
<i>Shigella</i> spp.	11	77	5	6.5
Sapovirus	9	167	1	0.6
<i>Salmonella</i> Typhi	5	17	4	23.5
<i>Clostridium perfringens</i>	4	56	0	0.0
<i>Escherichia coli</i> O157:H7	2	7	1	14.3
<i>Yersinia</i> spp.	2	4	1	25.0
<i>Bacillus cereus</i>	1	2	0	0.0
Ciguatera fish poisoning	1	2	0	0.0
Histamine (scombroid) fish poisoning	1	9	1	11.1
<i>Salmonella</i> Paratyphi	1	2	0	0.0
Pathogen not identified ³	155	1319	24	1.8
Non-enteric	35	1068	109	10.2
<i>Bordetella pertussis</i>	19	405	8	2.0
Measles	6	560	86	15.4
<i>Mycobacterium tuberculosis</i>	3	25	10	40.0
Influenza-like illness	2	30	0	0.0
<i>Legionella</i> spp.	1	14	3	21.4
Skin infections	1	11	2	18.2
Acute respiratory infection	1	10	0	0.0
Influenza A(H3N2)	1	10	0	0.0
Lead absorption	1	3	0	0.0
Total hospitalisations	581	7796	204	2.6

¹ Hospitalisation information was recorded for 65.4% (380/581) of outbreaks, relating to 73.6% (5736/7796) of cases.

² More than one enteric agent was reported in 8 outbreaks with a total of 99 associated cases.

³ All enteric outbreaks with no pathogen identified in 2011 were recorded as gastroenteritis.

3.6 Outbreak settings

The most common outbreak setting was the private home, which was recorded in 24.8% (144/581) of all outbreaks and for 10.5% (818/7796) of cases (Table 4). Institutions were a common outbreak setting, which included long-term care facilities (22.5%, 131/581), childcare centres (16.0%, 93/581), acute care hospitals (9.0%, 52/581), and schools (1.7%, 10/581). Outbreaks set in long-term care facilities also had the highest number of associated cases (39.6%, 3089/7796). Other common outbreak settings were commercial food operators, which included restaurants/cafés (9.3%, 54/581), takeaway outlets (2.9%, 17/581), caterers (1.2%, 7/581), supermarkets/delicatessens (0.5%, 3/581) and other food outlets (0.7%, 4/581). The outbreak setting was unknown in 4.8% (28/581) of the outbreaks.

Table 4. Outbreaks and associated cases by setting of exposure/transmission, 2011

Outbreak setting	Outbreaks ¹		Cases ¹	
	Total	% of outbreaks (n=581)	Total	% of cases (n=7796)
Institutions	298	51.3	6164	79.1
Long term care facility	131	22.5	3089	39.6
Childcare centre	93	16.0	1481	19.0
Hospital (acute care)	52	9.0	741	9.5
School	10	1.7	716	9.2
Camp	5	0.9	99	1.3
Marae	3	0.5	14	0.2
Hotel/motel	1	0.2	12	0.2
Hostel/boarding house	1	0.2	18	0.2
Other institution	7	1.2	109	1.4
Commercial food operators	89	15.3	505	6.5
Restaurant/caf�/bakery	54	9.3	295	3.8
Takeaway	17	2.9	49	0.6
Caterers	7	1.2	90	1.2
Fast food restaurant	4	0.7	11	0.1
Supermarket/delicatessen	3	0.5	6	0.1
Other food outlet	4	0.7	47	0.6
Workplace	26	4.5	101	1.3
Farm	18	3.1	55	0.7
Workplace	8	1.4	46	0.6
Other	170	29.3	1567	20.1
Private home	144	24.8	818	10.5
Community gathering ²	8	1.4	532	6.8
Mode of travel ³	4	0.7	111	1.4
Other setting	26	4.5	154	2.0
Unknown setting	28	4.8	205	2.6

¹ More than one setting was recorded in some outbreaks.

² Includes one outbreak at a sports gathering.

³ Includes outbreaks where exposure setting was recorded as cruise ship (2), aircraft (1), and one outbreak occurred in a tour group who travelled by several methods including a cruise ship, aircraft, tour bus or train.

3.7 Modes of transmission

In 2011, the most common reported mode of transmission was person-to-person (78.0%, 453/581 outbreaks), followed by foodborne (21.0%, 122/581) and environmental (17.7% 103/581) modes of transmission (Table 5). Person-to-person transmission also accounted for the highest percentage of cases (91.3%, 7117/7796), followed by the environmental mode of transmission (22.7%, 1770/7796). The mode of transmission was unknown in 5.0% (29/581) of outbreaks.

Table 5. Outbreaks and associated cases by mode of transmission, 2011

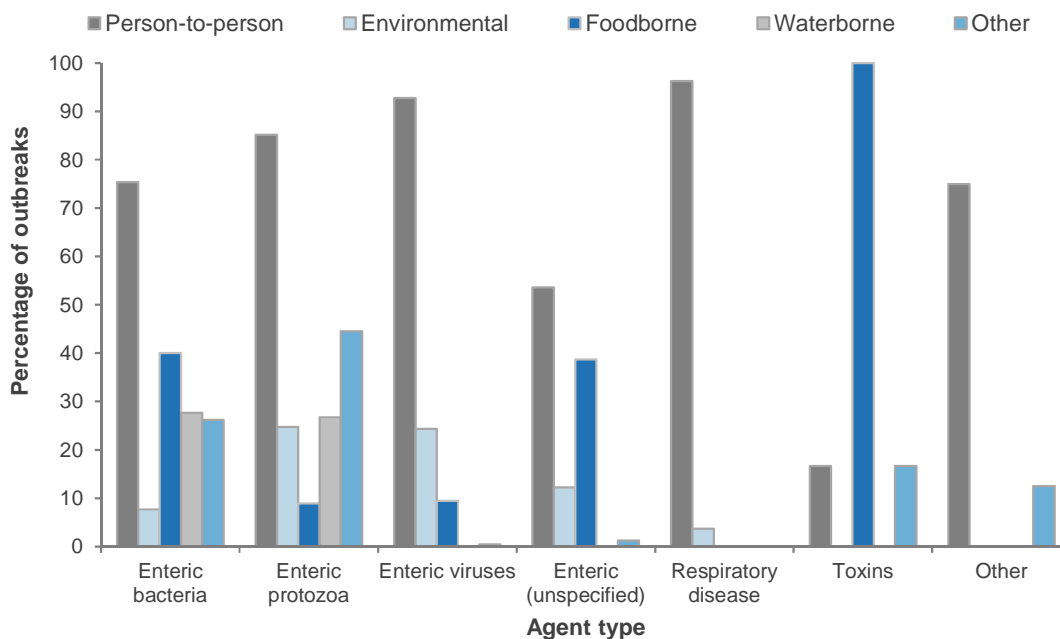
Mode of transmission	Outbreaks ¹				Cases ¹	
	Primary mode	Secondary mode	Total	% of outbreaks (n=581)	Total	% of cases (n=7796)
Person-to-person	319	134	453	78.0	7096	91.3
Foodborne	102	20	122	21.0	656	8.4
Environmental	19	84	103	17.7	1770	22.7
Zoonotic	31	26	57	9.8	187	2.4
Waterborne	20	25	45	7.7	141	1.8
Other	5	4	9	1.5	106	1.4
Unknown	-	-	29	5.0	198	2.5

¹ More than one mode of transmission was recorded for 192 outbreaks and a total of 2276 associated cases, therefore totals add to more than 100%.

Note: No outbreaks with vectorborne, sexual contact, or parenteral as mode(s) of transmission were reported in 2011.

Person-to-person was the most common mode of transmission for enteric bacteria (75.4%, 49/65), enteric protozoa (85.1%, 86/101), enteric viruses (92.8%, 206/222), unspecified enteric pathogens (53.5%, 83/155) and respiratory disease (96.3%, 26/27) (Figure 4). Foodborne transmission was the principal mode of transmission for toxins (100%, 6/6), and it also contributed substantially to outbreaks due to enteric bacteria (39.1%, 25/64) and unspecified enteric pathogens (38.7%, 60/155) (Figure 4). Waterborne transmission was an important mode of transmission for enteric bacteria (28.1%, 18/64) and enteric protozoa (26.7%, 27/101). Environmental transmission contributed substantially to outbreaks of enteric protozoa (24.8%, 25/101) and enteric viruses (24.3%, 54/222).

Figure 4. Percentage of outbreaks by agent type and mode of transmission, 2011



Note: More than one mode of transmission was recorded for some outbreaks therefore totals may add to greater than 100%.

3.8 Foodborne outbreaks

Causal agent

There were 122 foodborne outbreaks with 656 associated cases reported in 2011, 50.8% (62/122) of which were linked to a pathogen or condition (Table 6). Pathogens most commonly associated with foodborne outbreaks included norovirus (16.4%, 20/122), *Campylobacter* spp. (9.0%, 11/122) and *Salmonella* spp. (6.6%, 8/122). Enteric bacteria (*Campylobacter* spp., *Salmonella* spp., *Yersinia* spp., *S. Typhi*, and *Shigella* spp.) were implicated in 21.3% (26/122) of foodborne outbreaks, and enteric viruses (norovirus and sapovirus) in 17.2% (21/122) of foodborne outbreaks.

Table 6. Foodborne outbreaks and associated cases by pathogen or condition, 2011

Pathogen or condition	Outbreaks		Cases	
	Total	% of outbreaks (n=122)	Total	% of cases (n=656)
Norovirus	20	16.4	206	31.4
<i>Campylobacter</i> spp.	11	9.0	53	8.1
<i>Salmonella</i> spp.	8	6.6	42	6.4
<i>Giardia</i> spp.	6	4.9	24	3.7
<i>Shigella</i> spp.	4	3.3	27	4.1
<i>Clostridium perfringens</i>	4	3.3	56	8.5
<i>Cryptosporidium</i> spp.	3	2.5	9	1.4
<i>Salmonella</i> Typhi	2	1.6	5	0.8
Sapovirus	1	0.8	14	2.1
Histamine (scombroid) fish poisoning	1	0.8	9	1.4
<i>Bacillus cereus</i>	1	0.8	2	0.3
Ciguatera fish poisoning	1	0.8	2	0.3
<i>Yersinia</i> spp.	1	0.8	2	0.3
Pathogen not identified ¹	60	49.2	207	31.6
Total²	122	100.0	656	100.0

¹ All enteric outbreaks with no pathogen identified in 2011 were recorded as gastroenteritis.

² Two agents were reported in one foodborne outbreak with two cases, therefore totals add to more than 100%.

Vehicle/source implicated

Thirty three of the 122 (27%) foodborne outbreaks in 2011 had a source or vehicle identified. The main foods implicated in these 33 outbreaks were shellfish molluscs (27.3%, 9 outbreaks) and fish (24.2%, 8 outbreaks), followed by poultry (15.2%, 5 outbreaks) and pork and lamb (12.1%, 4 outbreaks each) (Table 7). The outbreaks with the highest number of cases were associated with outbreaks linked to shellfish (28.9%, 72 cases), pork (19.7%, 49 cases) and goat (14.1%, 35 cases).

Table 7: Foodborne outbreaks and associated cases by implicated vehicle/source, 2011

Implicated vehicle/source	Outbreaks ¹		Cases	
	Total	% of outbreaks (n=33)	Total	% of cases (n=249)
Shellfish (molluscs)	9	27.3	72	28.9
Fish	8	24.2	47	18.9
Poultry	5	15.2	24	9.6
Meat (pork)	4	12.1	49	19.7
Meat (lamb)	4	12.1	13	5.2
Vegetables (root)	3	9.1	19	7.6
Dairy	3	9.1	16	6.4
Meat (beef)	2	6.1	8	3.2
Grains/beans	2	6.1	6	2.4
Meat (goat)	1	3.0	35	14.1
Fruit/nut	1	3.0	31	12.4
Vegetables (leafy)	1	3.0	3	1.2
Vegetables (sprout)	1	3.0	3	1.2
Eggs	1	3.0	2	0.8
Unspecified food source ²	4	12.1	27	10.8
Total	33	100.0	249	100.0

¹ More than one vehicle/source was implicated in some outbreaks.

² A common meal, premise or setting may have been implicated but no specific food items were recorded.

Note: Mixed foods were assigned to multiple categories based on the groupings published by Painter et al 2009 [3]. Only explicit ingredients were assigned into a category. All foods within a mixed item were given equal priority.

Foodborne outbreaks associated with shellfish (27.3%, 9 outbreaks), fish (24.2%, 8 outbreaks), or pork (12.1%, 4 outbreaks) as possible vehicle or sources were most commonly associated with *Salmonella* (shellfish, fish and pork, 2 outbreaks each) (Table 8). Foodborne outbreaks with poultry (15.2%, 5 outbreaks), lamb (12.1%, 4 outbreaks) or dairy (9.1%, 3 outbreaks) as a possible vehicle or source were most often linked to *Campylobacter* spp. (6/6 outbreaks).

The largest foodborne outbreak was reported from Auckland and involved 35 cases (14.1%). *Clostridium perfringens* was identified as the causative agent in the outbreak which was attributed to consumption of goat curry at a wedding function. An epidemiological study carried out by the Auckland Regional Public Health Service identified that the 'goat curry' was the highest risk item with an odds ratio of 6.21 (95% CI:1.45 to 26.63 with a p-value of 0.014).

Table 8. Foodborne outbreaks by causal agent and implicated vehicle/source, 2011

Implicated vehicle/source ¹	Pathogen or condition										Total number of outbreaks
	<i>Campylobacter</i> spp.	Norovirus	<i>Clostridium perfringens</i>	<i>Salmonella</i> spp.	<i>Bacillus cereus</i>	Ciguatera fish poisoning	Histamine (Scombroid) fish poisoning	Sapovirus	<i>Shigella</i> spp.	Pathogen not identified ²	
Shellfish (molluscs)	0	0	0	2	0	0	0	1	1	5	9
Fish	0	0	1	2	1	1	1	0	0	3	8
Poultry	2	1	0	0	0	0	0	0	0	2	5
Meat (pork)	0	1	0	2	0	0	0	0	0	1	4
Meat (lamb)	2	0	0	0	0	0	0	0	0	2	4
Vegetables (root)	0	1	0	0	0	0	0	0	0	2	3
Dairy	2	0	0	0	0	0	0	0	0	1	3
Meat (beef)	0	0	0	1	0	0	0	0	0	1	2
Grains/beans	0	0	0	0	0	0	0	0	0	2	2
Meat (goat)	0	0	1	0	0	0	0	0	0	0	1
Fruit/nut	0	1	0	0	0	0	0	0	0	0	1
Vegetables (leafy)	0	0	0	1	0	0	0	0	0	0	1
Eggs	0	0	0	0	0	0	0	0	0	1	1
Vegetables (sprout)	0	0	0	1	0	0	0	0	0	0	1
Unspecified food source ³	0	2	0	0	0	0	0	0	0	2	4
Total	6	5	2	2	1	1	1	1	1	14	33

¹ More than one vehicle/source was implicated in some outbreaks.

² All enteric outbreaks with no pathogen identified in 2011 were classified as gastroenteritis.

³ A common meal, premises or setting may have been implicated but no specific food items were recorded.

Setting where contaminated foods/beverages were prepared

The settings where foods and beverages were prepared were recorded in 86.1% (105/122) of foodborne outbreaks and 81.9% (537/656) of associated cases in 2011. Preparation settings most commonly associated with foodborne outbreaks included commercial food operators (69.5%, 73/105), followed by private homes (24.8%, 26/105), institutions and overseas food manufacturers (4.8%, 5/105, respectively) (Table 9). Foodborne outbreaks where the food was prepared in restaurants, cafés, or bakeries had the highest proportion of cases associated with them (38.2%, 205/537), followed by private homes (17.1%, 92/537) and food prepared by caterers (14.1%, 76/537).

Table 9. Foodborne outbreaks and associated cases by setting of food preparation, 2011

Preparation setting	Outbreaks ¹		Cases	
	Total	% of outbreaks (n=105)	Total	% of cases (n=537)
Commercial food operators	73	69.5	394	73.4
Restaurant/café/bakery	42	40.0	205	38.2
Takeaway	17	16.2	52	9.7
Caterers	7	6.7	76	14.2
Fast food restaurant	2	1.9	38	7.1
Temporary or mobile service	1	1.0	5	0.9
Supermarket/delicatessen	1	1.0	2	0.4
Other food outlet	4	3.8	18	3.4
Institutions	5	4.8	27	5.0
Long-term care facility	2	1.9	16	3.0
Hospital (acute care)	1	1.0	6	1.1
Childcare centre	1	1.0	3	0.6
Marae	1	1.0	2	0.4
Other	35	33.3	149	27.7
Private home	26	24.8	92	17.1
Overseas manufacturer	5	4.8	11	2.0
Commercial food manufacturer	3	2.9	36	6.7
Community gathering	1	1.0	10	1.9
Unknown preparation setting	17	16.2	119	22.2

¹ More than one preparation setting was recorded for some outbreaks.

Contributing factors

The factors contributing to foodborne outbreaks most commonly involved either contamination of food (40.2%, 49/122) or time and temperature abuses (38.5%, 47/122). Contamination of food occurred via cross-contamination with other food (27.9%, 34/122) or via an infected food handler (18.9%, 23/122). The most common time and temperature abuses were undercooking (18.9%, 23/122), inadequate reheating of previously cooked food (16.4%, 20/122), improper storage prior to preparation (15.6%, 19/122) and improper hot holding (9.0%, 11/122) (Table 10). Unsafe sources accounted for 14.8% (18/122) of the outbreaks, including 7.4% (9/122) associated with the consumption of raw food. Factors contributing to foodborne outbreaks were classified as “other factors” in 18.9% (23/122) of outbreaks.

Table 10. Foodborne outbreaks by contributing factor, 2011

Contributing factor	Outbreaks ¹				Cases	
	Confirmed	Suspected	Total	% of foodborne outbreaks (n=122)	Total	% of foodborne cases (n=656)
Contamination of food	2	47	49	40.2	336	51.2
Cross contamination	1	33	34	27.9	207	31.6
Contamination from an infected food handler	2	21	23	18.9	206	31.4
Time/temperature abuse	0	47	47	38.5	242	36.9
Undercooking	0	23	23	18.9	84	12.8
Inadequate reheating of previously cooked food	0	20	20	16.4	140	21.3
Improper storage prior to preparation	0	19	19	15.6	128	19.5
Improper hot holding	0	11	11	9.0	94	14.3
Preparation too far in advance	0	6	6	4.9	53	8.1
Inadequate cooling or refrigeration	0	5	5	4.1	57	8.7
Inadequate thawing	0	5	5	4.1	45	6.9
Unsafe sources	2	16	18	14.8	87	13.3
Consumption of raw food	0	9	9	7.4	34	5.2
Use of untreated water in food preparation	0	5	5	4.1	25	3.8
Use of unpasteurised milk in food preparation	2	2	4	3.3	22	3.4
Use of ingredients from unsafe sources	0	3	3	2.5	25	3.8
Other factors	1	22	23	18.9	100	15.2

¹ More than one contributing factor was recorded for some outbreaks.

Note: No outbreaks with chemical contamination as a contributing factor were reported in 2011.

3.9 Person-to-person outbreaks

Causal agents

In 2011, there were 453 person-to-person outbreaks with 7096 associated cases, 81.7% (370/453) of these outbreaks were linked to a causal agent type (Table 11). The most common causal agent was norovirus, which was recorded in 36.4% (165/453) of person-to-person outbreaks involving 54.8% (3888/7096) of outbreak associated cases. Other common pathogens included *Giardia* spp. (13.7%, 62/453) and rotavirus (7.9%, 36/453). Enteric viruses (norovirus, rotavirus, and sapovirus) were implicated in 45.3% (205/453) of person-to-person outbreaks, followed by enteric protozoa (*Giardia* spp. and *Cryptosporidium* spp.) in 19.0% (86/453) of outbreaks.

The most commonly identified pathogen in outbreaks with 20 or more associated cases was norovirus, accounting for 71.3% (87/122) of the person-to-person outbreaks. The largest person-to-person outbreak was attributed to measles, with 467 cases. The outbreak was reported in Auckland and involved a school setting, and community transmission. The second largest outbreak was due to *B. pertussis* and involved 232 cases. The outbreak occurred in the West Coast region and involved community-wide transmission.

Table 11. Person-to-person outbreaks and associated cases by pathogen or condition, 2011

Pathogen	Outbreaks				Cases	
	Primary mode	Secondary mode	Total	% of outbreaks (n=453)	Total	% of cases (n=7096)
Norovirus	142	23	165	36.4	3888	54.8
<i>Giardia</i> spp.	29	33	62	13.7	217	3.1
Rotavirus	33	3	36	7.9	606	8.5
<i>Cryptosporidium</i>	6	18	24	5.3	62	0.9
<i>Bordetella pertussis</i>	16	3	19	4.2	405	5.7
<i>Campylobacter</i> spp.	8	9	17	3.8	58	0.8
<i>Salmonella</i> spp.	2	11	13	2.9	72	1.0
<i>Shigella</i> spp.	7	3	10	2.2	74	1.0
Sapovirus	7	1	8	1.8	153	2.2
Measles	6	0	6	1.3	560	7.9
<i>Salmonella</i> Typhi	2	3	5	1.1	17	0.2
<i>Mycobacterium tuberculosis</i>	3	0	3	0.7	25	0.4
Influenza-like illness	2	0	2	0.4	30	0.4
<i>Escherichia coli</i> O157:H7	0	2	2	0.4	7	0.1
<i>Yersinia</i> spp.	0	2	2	0.4	4	0.1
Acute respiratory infection	1	0	1	0.2	10	0.1
<i>Clostridium perfringens</i>	0	1	1	0.2	10	0.1
Influenza A (H3N2)	1	0	1	0.2	10	0.1
Pathogen not identified ¹	61	22	83	18.3	985	13.9
Total²	319	134	453	100.0	7096	100.0

¹ All enteric outbreaks with no pathogen identified in 2011 were recorded as gastroenteritis.

² Two agents were reported in 7 person-to-person outbreaks with 97 cases, therefore totals add to more than 100%.

Contributing factors

Exposure to infected people was the primary contributing factor for 94.0% (426/453) of person-to-person outbreaks reported. Other contributing factors reported included poor hygiene of cases (35.1%, 159/453), a compromised immune system (4.4%, 20/453), inadequate vaccination coverage (3.3%, 15/453), inadequate vaccination effectiveness (1.8%, 8/453), and excessively crowded living conditions (1.8%, 8/453).

3.10 Waterborne outbreaks

Causal agents

There were 45 waterborne outbreaks with 141 associated cases reported in 2011, all of which were linked to a specific pathogen (Table 12). The most commonly reported waterborne pathogen was *Giardia* spp. (44.4%, 20/45), followed by *Campylobacter* spp. (20.0%, 9/45). Enteric protozoa (*Giardia* spp. and *Cryptosporidium* spp.) were implicated in 60.0% (27/45) of waterborne outbreaks and enteric bacteria (*Campylobacter* spp., *Salmonella* spp., *Salmonella* Typhi, *Shigella* spp., and *E. coli* O157:H7) in 40.0% (18/45) of waterborne outbreaks.

Table 12. Waterborne outbreaks and associated cases by pathogen, 2011

Pathogen	Outbreaks				Cases	
	Primary mode	Secondary mode	Total	% of outbreaks (n=45)	Total	% of cases (n=141)
<i>Giardia</i> spp.	15	5	20	44.4	62	44.0
<i>Campylobacter</i> spp.	4	5	9	20.0	36	25.5
<i>Cryptosporidium</i> spp.	0	7	7	15.6	19	13.5
<i>Salmonella</i> spp.	1	4	5	11.1	12	8.5
<i>Salmonella</i> Typhi	0	2	2	4.4	5	3.5
<i>Escherichia coli</i> O157:H7	0	1	1	2.2	4	2.8
<i>Shigella</i> spp.	0	1	1	2.2	3	2.1
Total	20	25	45	100.0	141	100.0

Contributing factors

The most common contributing factor linked to waterborne outbreaks was an untreated drinking-water supply (80.0%, 36/45), followed by an inadequately treated water supply (37.8%, 17/45) and source water quality inferior to normal (13.3%, 6/45) (Table 13). Most of the contributing factors associated with waterborne outbreaks were reported as suspected only (92.1%, 58/63).

Table 13. Waterborne outbreaks by contributing factor, 2011

Contributing factor	Outbreaks ¹				Cases	
	Confirmed	Suspected	Total	% of outbreaks (n=45)	Total	% of cases (n=141)
Untreated drinking-water supply ²	4	32	36	80.0	104	73.6
Inadequately treated water supply	1	16	17	37.8	59	41.8
Source water quality inferior to normal	0	6	6	13.3	20	14.2
Post treatment contamination (other)	0	2	2	4.4	8	5.7
Recent or on-going treatment process failure	0	1	1	2.2	8	5.7
Contamination of post treatment water storage	0	1	1	2.2	2	1.4

¹ 12 outbreaks involving 40 cases had two or more contributing factors.

² Includes surface water with no treatment, roof-collected rainwater with no treatment, groundwater not assessed as secure and no treatment.

3.11 Environmental outbreaks

Causal agents

There were 103 environmental outbreaks with 1770 associated cases reported in 2011, 81.6% (84/103) of which were linked to a specific causal agent (Table 14). The most common causal agent identified in environmental outbreaks was norovirus, which was recorded in 43.7% (45/103) of environmental outbreaks and associated with 69.3% (1227/1770) of cases. Enteric viruses (norovirus, rotavirus, and sapovirus) were implicated in 54.4% (56/103) of environmental outbreaks, and enteric protozoa (*Giardia* spp. and *Cryptosporidium* spp.) in 24.3% (25/103) of environmental outbreaks.

Table 14. Environmental outbreaks and associated cases by pathogen or condition, 2011

Pathogen	Outbreaks				Cases	
	Primary mode	Secondary mode	Total	% of outbreaks (n=103)	Total	% of cases (n=1770)
Norovirus	1	44	45	43.7	1227	69.3
<i>Giardia</i> spp.	10	11	21	20.4	73	4.1
Rotavirus	1	8	9	8.7	172	9.7
<i>Cryptosporidium</i> spp.	2	2	4	3.9	35	2.0
<i>Salmonella</i> spp.	0	2	2	1.9	11	0.6
Sapovirus	0	2	2	1.9	23	1.3
<i>Legionella</i> spp.	1	0	1	1.0	14	0.8
<i>Campylobacter</i> spp.	1	0	1	1.0	6	0.3
<i>Escherichia coli</i> O157:H7	1	0	1	1.0	4	0.2
<i>Shigella</i> spp.	0	1	1	1.0	4	0.2
Pathogen not identified ²	2	17	19	18.4	267	15.1
Total²	19	84	103	100.0	1770	100.0

¹ Two outbreaks involved more than one pathogen therefore individual pathogen and outbreak numbers may not sum to group totals.

² All enteric outbreaks with no pathogen identified in 2011 were recorded as gastroenteritis.

Contributing factors

The major contributing factors to environmental outbreaks were exposure to contaminated environment(s) (69.9%, 72/103 and exposure to other recreational waters (13.6%, 14/103). No contributing factors were recorded for 1.0% (1/103) of the outbreaks.

3.12 Zoonotic outbreaks

Causal agents

There were 57 zoonotic outbreaks with 187 associated cases reported in 2011, 98.2% (56/57) of which were linked to a specific pathogen (Table 15). *Cryptosporidium* spp. was the most commonly identified pathogen where zoonotic transfer was recorded as the primary mode of transmission (29.8%, 17/57). Overall, *Giardia* spp. was the most commonly identified pathogen linked to 38.6% (22/57) of zoonotic outbreaks and 38.5% (72/187) of the associated cases. Enteric protozoa (*Cryptosporidium* spp. and *Giardia* spp.) were implicated in 73.7% (42/57) of the zoonotic outbreaks, and enteric bacteria (*Campylobacter* spp., *Salmonella* spp. and *E.coli* O157:H7) in 24.6% (14/57) of the zoonotic outbreaks.

Table 15. Zoonotic outbreaks and associated cases by pathogen or condition, 2011

Pathogen or condition	Outbreaks				Cases	
	Primary mode	Secondary mode	Total	% of outbreaks (n=57)	Total	% of cases (n=187)
<i>Giardia</i> spp.	8	14	22	38.6	72	38.5
<i>Cryptosporidium</i> spp.	17	3	20	35.1	57	30.5
<i>Campylobacter</i> spp.	3	7	10	17.5	35	18.7
<i>Salmonella</i> spp.	3	0	3	5.3	7	3.7
<i>Escherichia coli</i> O157:H7	0	1	1	1.8	4	2.1
Pathogen not identified ¹	0	1	1	1.8	12	6.4
Total	31	26	57	100.0	187	100.0

¹ All enteric outbreaks with no pathogen identified in 2011 were recorded as gastroenteritis.

Contributing factors

Almost all (98.2%, 56/57) zoonotic outbreaks recorded direct exposure to infected animals as a contributing factor. Multiple settings were identified in eight outbreaks. The most common setting for zoonotic outbreaks was in private homes (36 outbreaks), although six of these outbreaks identified another setting. The second most common setting for zoonotic outbreaks was farms (16 outbreaks) and three of these identified another setting.

3.13 Outbreaks with overseas transmission

There were 24 outbreaks in 2011 with overseas transmission involving 104 cases. Travel to India was associated with the most outbreaks (20.8%, 5 outbreaks), followed by Fiji (4 outbreaks), Australia and Samoa (3 outbreaks each), Tonga and Rarotonga (2 outbreaks each) and all other overseas destinations were associated with a single outbreak each (Table 16). The majority of cases associated with overseas transmission contracted *Giardia* spp. (22.1%, 23/104 cases), followed by measles (20.2%, 21/104 cases). One outbreak involving travel to India had two pathogens identified: *Campylobacter* spp. and *Cryptosporidium* spp.

Table 16. Outbreaks with overseas transmission by destination and pathogen, 2011

Destination	Pathogen									
	<i>Campylobacter</i> spp. ¹	<i>Cryptosporidium</i> spp.	<i>Giardia</i> spp.	Measles	Norovirus	<i>Salmonella</i> spp.	<i>Salmonella</i> Paratyphi	<i>Salmonella</i> Typhi	<i>Shigella</i> spp.	Total
Australia			2			1				3
Cambodia						1				1
Fiji			3			1				4
India	1	1	2			1	1			5
Indonesia								1		1
North-West Europe									1	1
Rarotonga		1			1					2
Samoa						1		2		3
Singapore				1						1
Tanzania			1							1
Tonga								1	1	2
Total outbreaks	1	2	8	1	1	5	1	4	2	24
Total cases	2	6	23	21	8	12	2	15	17	104

¹ Two pathogens were identified in one outbreak involving two cases.

3.14 Outbreak recognition, investigation and control

Timeliness of reporting

For the 554 outbreaks where timeliness of reporting data were available, almost half (48.0%, 266/554) were reported to the PHU within one week of the onset of illness in the first case with a further 37.5% (208/554) of outbreaks were reported between 7 and 30 days (inclusive) after the onset of illness in the first case.

Reporting delay (time between the date of onset of illness in the first case and the report date) varied among the different modes of transmission (Table 17). The shortest median reporting delay (3.5 days) was associated with foodborne outbreaks, followed by environmental (8.0 days) and person-to-person (8.5 days) outbreaks.

Table 17. Median reporting delay by outbreak type, 2011

Outbreak type ¹	No. of outbreaks ²	Median reporting delay (days)
Foodborne	118	3.5
Environmental	101	8.0
Person-to-person	436	8.5
Zoonotic	56	21.0
Waterborne	44	25.0
Other mode	8	36.5
Total	554	7.0

¹ More than one mode of transmission was recorded for some outbreaks.

² Outbreaks were excluded if the date of onset of illness in the first case was missing.

Recognition of outbreaks

In 2011, 51.5% (299/581) of outbreaks were identified through an increase in disease incidence and 21.2% (123/581) through cases having person-to-person contact with other cases (Table 18). Other frequent means of outbreak recognition included cases attending a common event (11.7%, 68/581) and cases being linked to a common source (10.0%, 58/581).

Table 18. Outbreaks by means of recognition, 2011

Means of recognition	No. of outbreaks	% of total outbreaks (n=581)
Increase in disease incidence	299	51.5
Cases had person to person contact with other case(s)	123	21.2
Cases attended common event	68	11.7
Cases linked to common source (e.g. food, water, environmental site)	58	10.0
Common organism type/strain characteristics between cases	11	1.9
Other means	22	3.8

Control measures

Outbreak control measures undertaken were reported in 98.6% (573/581) of outbreaks in 2011, of which 7.3% (42/573) reported taking no control measures. The most common measures undertaken were health education and advice regarding the source (76.8%, 440/573), followed by cleaning and disinfection (57.4%, 329/573) (Table 19).

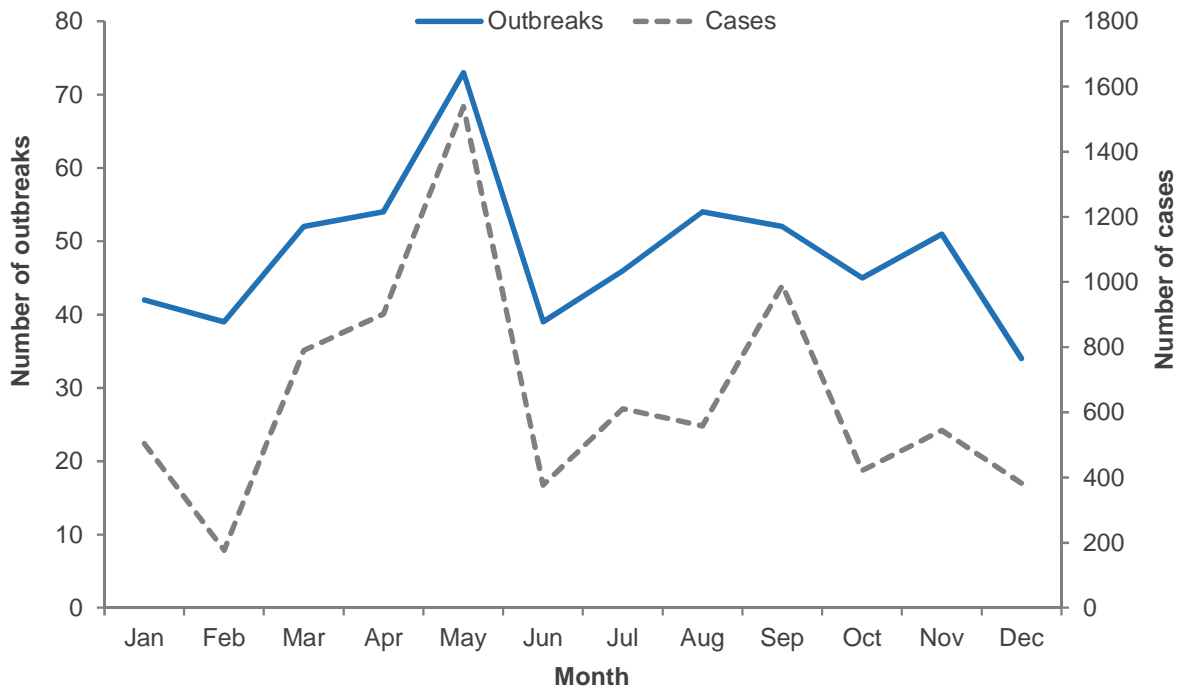
Table 19. Outbreaks by control measures undertaken, 2011

Outbreak control measure	No. of outbreaks ¹	% of total outbreaks (n=573)
Source	518	90.4
Health education and advice	440	76.8
Cleaning, disinfection	329	57.4
Exclusion	301	52.5
Isolation	249	43.5
Modification of procedures	170	29.7
Health warning	119	20.8
Closure	104	18.2
Treatment	36	6.3
Removal	15	2.6
Vehicle and vector	7	1.2
Treatment	6	1.0
Removal	2	0.3
Contacts and potential contacts	123	21.5
Health education and advice	120	20.9
Chemoprophylaxis	14	2.4
Vaccination	9	1.6
Other control measures	120	20.9
No control measures	42	7.3

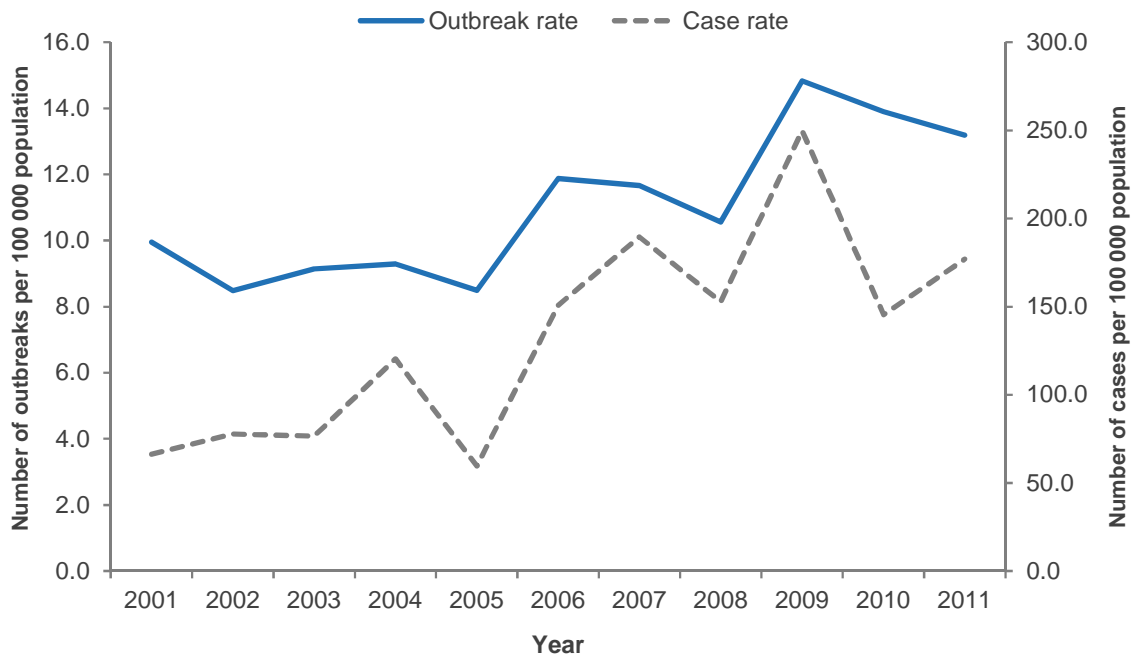
¹ More than one control measure was recorded for some outbreaks.

3.15 Summary of trends

In 2011, the highest number of outbreaks was reported in May (73 outbreaks). The number of outbreaks was more or less stable (range 39 to 54) for the remaining months apart from a decrease in December (34 outbreaks). The highest number of outbreak-related cases also occurred in May (1538 cases). The next highest number of outbreak-related cases occurred in September (990 cases) (Figure 5).

Figure 5. Number of outbreaks and associated cases by month, 2011

The national annual outbreak rate for 2011 (13.2 outbreaks per 100 000 population) was slightly lower than the rate for 2010 (13.9 outbreaks per 100 000 population), but greater than the rates from 2001 to 2008 (Figure 6). The national outbreak case rate of 177.0 cases per 100 000 population in 2011 was higher than the 2010 case rate (145.5 cases per 100 000), but was similar to the rate in 2007. Since 2005 both the outbreak rate and the case rate have tracked upwards, both peaking in 2009.

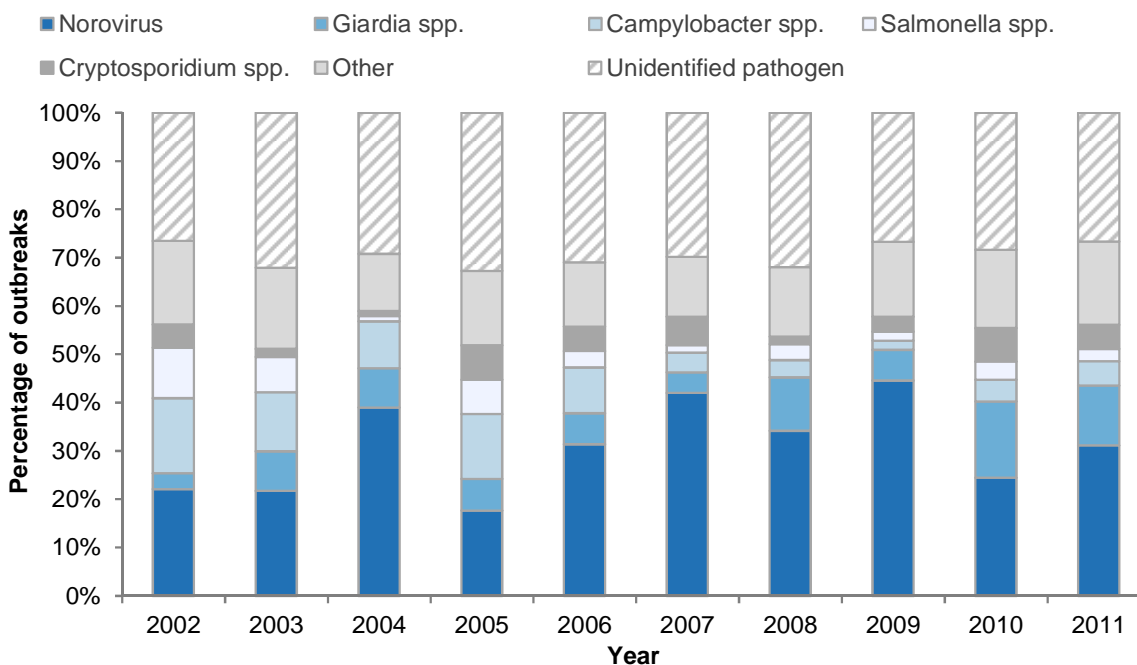
Figure 6. Outbreak rates and associated cases by year, 2001–2011

Since 2002, the number of outbreaks linked to an identified causal agent has remained close to 70% (range 67.2% to 73.4%). In 2011, 73.3% (425/581) of outbreaks were linked to an identified pathogen or condition. Since 2004, the causal agent associated with the greatest number of outbreaks and greatest number of outbreak cases has been norovirus, although the number and percentage of norovirus outbreaks and cases has varied considerably from year to year (Figure 7). In 2011 there were 181 norovirus outbreaks reported with 4014 associated cases. The number of *Giardia* spp. outbreaks increased more than four-fold between 2007 (21 outbreaks and 111 cases) and 2010 (97 outbreaks and 378 cases) although the number reported decreased in 2011 (72 outbreaks and 242 cases). The number of rotavirus outbreaks reported has increased from 16 outbreaks (128 cases) in 2008 to 36 outbreaks (606 cases) in 2011.

In contrast, the number of outbreaks and the number of cases linked to *Campylobacter* have decreased since 2006. The number of *Campylobacter* spp.-associated outbreaks decreased by 40.4% between 2006 and 2011 (from 47 to 29 outbreaks), while the number of associated cases decreased by 44.3% (from 221 cases to 123). *Campylobacter* has consistently remained one of the five most commonly reported causal agents for outbreaks for each year since 2001.

Measles accounted for six outbreaks and 560 associated cases (7.2% of total cases) in 2011. This is the highest number of outbreaks and cases reported for measles since reporting began in 2001. Measles also had the highest median number of cases per outbreak reported in 2011 (22.5 cases per outbreak) - higher than norovirus with 19.0 cases per outbreak.

Figure 7. Percentage of outbreaks by pathogen or condition and year, 2002–2011



In 2011, the most common outbreak settings were in private homes and long-term care facilities, similar to that observed in the period from 2006 to 2009. Compared with 2010, outbreaks set in long-term care facilities have almost doubled (from 69 to 131 outbreaks) including associated cases (from 1482 to 3089 cases) due to the low number of norovirus outbreaks reported in 2010.

Over the last 10 years substantial changes have occurred in the reporting of modes of outbreak transmission. Over this period, person-to-person transmission emerged as the most frequently reported mode, a change from foodborne transmission which was often the most reported mode between 2001 and 2006. Between 2001 and 2011, the number of outbreaks with person-to-person transmission increased

more than three-fold (from 132 to 453, respectively). In 2011 the number of outbreaks with person-to-person transmission was more than three times higher than any other mode of transmission. The number of outbreaks linked to foodborne transmission has varied each year with no clear trend. The proportion of foodborne outbreaks reported in 2011 (21.0%, 122/581) is similar to what was reported from 2007 to 2010 (range 15.0% to 23.3%), but less than between 2001 to 2006 (range 28.3% to 52.9%). Environmental transmission is emerging as a more frequently reported mode of outbreak transmission rising from 6.2% (24/389) of outbreaks in 2001 to 20.3% (123/606) in 2010 and 17.9% (104/581) in 2011 respectively. When interpreting these trends it should be noted that between 2001 and 2011 the proportion of outbreaks with multiple modes of transmission reported has varied between 9.7% and 33.8%.

Since 2001 poultry has been one of the most commonly implicated food sources reported in foodborne outbreaks. The proportion of outbreaks attributed to poultry has declined from 25.7% in 2007 to 15.2% in 2011 while the proportion of outbreaks attributed to shellfish has increased from 5.4% to 27.3% during the same period. It is important to note that very few outbreaks have a suspected source confirmed by epidemiological or laboratory methods. In 2011 only 27.0% (33/122) of foodborne outbreaks reported had recorded that a source was identified.

In 2011, 24 outbreaks involving 104 cases had overseas transmission. This is the highest number of outbreaks since the reporting of overseas transmission began in 2006. In 2011 travel to India (5 outbreaks), Fiji (4), Australia and Samoa (3 outbreaks each) were the most commonly reported destinations. Between 2006 and 2010 the annual number of outbreaks with overseas transmission reported ranged between five and 15 (with total outbreak associated cases ranging from 30 to 289). No country was associated with more than two outbreaks during this period.

The median delay between date of onset of illness in the first case and the outbreak report date in 2011 was 7.0 days which was similar to 2010 (7.5 days) and an increase from 2008 and 2009 (4.0 days, respectively).

Health education and advice related to the outbreak source has been the most common control measure used since 2001 and accounted for 76.8% (440/518) of outbreaks reported in 2011. Between 2007 and 2011 cleaning and disinfection as a control measure was the second most common control measure reported, a change from modification of procedures pertaining to the source which was the second most common control measure undertaken between 2001 and 2006. The proportion of outbreaks where it was reported that no control measures were undertaken has decreased from 27.8% in 2001 to 7.3% (42/573) of outbreaks in 2011.

GLOSSARY

GLOSSARY

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

An 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

An outbreak that occurs among individuals in a 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-causing 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 factors which are external to the individual human host.

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

An outbreak confined to members of a single household.

Institutional outbreak

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

Outbreak

Two or more cases of a specific disease or health-related condition occurring in a location over a period of time in excess of the expected numbers for the place and time.

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.

REFERENCES

REFERENCES

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3. Painter, J.A., T. Ayers, R. Woodruff, E. Blanton, N. Perez, R.M. Hoekstra, P.M. Griffin, and C. Braden, *Recipes for foodborne outbreaks: a scheme for categorizing and grouping implicated foods*. *Foodborne Pathog Dis*, 2009. **6**(10): p. 1259-64.

APPENDIX

Outbreak Summary	Outbreak No. _____
Circumstances of Exposure/Transmission	
How was the outbreak first recognised?	
<input type="radio"/> Increase in disease incidence <input type="radio"/> Cases had person to person contact with other cases(s)	
<input type="radio"/> Cases attended common event <input type="radio"/> Common organism type/strain characteristics between cases	
<input type="radio"/> Cases linked to common source (eg food, water, environmental site)	
<input type="radio"/> Other means (specify) _____	
Were these cases part of a well-defined exposed group (eg Common event, institutional, environmental, household) <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown	
If yes, date of exposure _____ If exposure >1 day, date exposure ended _____	
Description of exposure event _____	
First setting where exposure occurred	
Setting unknown <input type="checkbox"/>	
<input type="radio"/> Food premises <input type="radio"/> Institution <input type="radio"/> Workplace/Community/Other	
<input type="radio"/> Restaurant/café/bakery <input type="radio"/> Hostel/boarding house <input type="radio"/> Workplace	
<input type="radio"/> Takeaway <input type="radio"/> Hotel/motel <input type="radio"/> Farm	
<input type="radio"/> Supermarket/delicatessen <input type="radio"/> Long term care facility <input type="radio"/> Petting zoo	
<input type="radio"/> Temporary or mobile service <input type="radio"/> Hospital (acute care) <input type="radio"/> Home	
<input type="radio"/> Fast food restaurant <input type="radio"/> Prison <input type="radio"/> Community, church, sports gathering	
<input type="radio"/> Caterers <input type="radio"/> Camp <input type="radio"/> Cruise ship, airline, tour bus, train	
<input type="radio"/> Other food outlet <input type="radio"/> School <input type="radio"/> Childcare centre <input type="radio"/> Other setting	
<input type="radio"/> Marae <input type="radio"/> Other institution	
Setting name _____	
Setting Address Number _____ Street _____ Suburb _____	
Town/City _____ Post Code _____ <input type="checkbox"/> GeoCode _____	
Second setting where exposure occurred	
Setting unknown <input type="checkbox"/>	
<input type="radio"/> Food premises <input type="radio"/> Institution <input type="radio"/> Workplace/Community/Other	
<input type="radio"/> Restaurant/café/bakery <input type="radio"/> Hostel/boarding house <input type="radio"/> Workplace	
<input type="radio"/> Takeaway <input type="radio"/> Hotel/motel <input type="radio"/> Farm	
<input type="radio"/> Supermarket/delicatessen <input type="radio"/> Long term care facility <input type="radio"/> Petting zoo	
<input type="radio"/> Temporary or Mobile Service <input type="radio"/> Hospital (acute care) <input type="radio"/> Home	
<input type="radio"/> Fast food restaurant <input type="radio"/> Prison <input type="radio"/> Community, church, sports gathering	
<input type="radio"/> Caterers <input type="radio"/> Camp <input type="radio"/> Cruise ship, airline, tour bus, train	
<input type="radio"/> Other food outlet <input type="radio"/> School <input type="radio"/> Childcare centre <input type="radio"/> Other setting	
<input type="radio"/> Marae <input type="radio"/> Other institution	
Setting name _____	
Setting Address Number _____ Street _____ Suburb _____	
Town/City _____ Post Code _____ <input type="checkbox"/> GeoCode _____	

Outbreak Summary	Outbreak No. _____
Circumstances of Exposure/Transmission contd	
Mode of transmission (indicate the primary mode and all secondary modes)	
<input type="checkbox"/> Foodborne, from consumption of contaminated food or drink (excluding water)	
Mode <input type="radio"/> primary <input type="radio"/> secondary	Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4
<input type="checkbox"/> Waterborne, from consumption of contaminated drinking water	
Mode <input type="radio"/> primary <input type="radio"/> secondary	Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4
<input type="checkbox"/> Person to person spread, from (non-sexual) contact with an infected person (including droplets)	
Mode <input type="radio"/> primary <input type="radio"/> secondary	Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4
<input type="checkbox"/> Sexual, from sexual contact with an infected person	
Mode <input type="radio"/> primary <input type="radio"/> secondary	Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4
<input type="checkbox"/> Parenteral, from needle stick injury or reuse of contaminated injection equipment	
Mode <input type="radio"/> primary <input type="radio"/> secondary	Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4
<input type="checkbox"/> Environmental, from contact with an environmental source (eg swimming)	
Mode <input type="radio"/> primary <input type="radio"/> secondary	Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4
<input type="checkbox"/> Zoonotic, from contact with an infected animal	
Mode <input type="radio"/> primary <input type="radio"/> secondary	Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4
<input type="checkbox"/> Vectorborne, from contact with an insect vector	
Mode <input type="radio"/> primary <input type="radio"/> secondary	Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4
<input type="checkbox"/> Other mode of transmission (specify) _____	
Mode <input type="radio"/> primary <input type="radio"/> secondary	Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4
Mode of transmission unknown <input type="checkbox"/>	
Vehicle/source of common source outbreak	
Was a specific contaminated food, water or environmental vehicle/source identified?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown
If yes,	
Source 1 _____	
Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4	
Food category _____	ESR Updated <input type="checkbox"/> Date _____
Source 2 _____	
Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4	
Food category _____	ESR Updated <input type="checkbox"/> Date _____
Source 3 _____	
Level of evidence <input type="radio"/> 1 <input type="radio"/> 2a <input type="radio"/> 2b <input type="radio"/> 3a <input type="radio"/> 3b <input type="radio"/> 3c <input type="radio"/> 4	
Food category _____	ESR Updated <input type="checkbox"/> Date _____

Outbreak Summary	Outbreak No.	
Factors Contributing to Outbreak		
Foodborne outbreak (tick all that apply)		
<input type="checkbox"/> Inadequate reheating of previously cooked food	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Improper storage prior to presentation	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Inadequate thawing	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Preparation too far in advance	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Undercooking	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Improper hot holding	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Inadequate or slow cooling or refrigeration	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Cross contamination due to improper handling or storage	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Cross contamination from an infected food handler	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Chemical contamination	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Use of ingredient from an unsafe source	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Use of untreated water in food preparation	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Consumption of unpasteurised milk	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Consumption of raw food	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Other factors, specify _____	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
Waterborne outbreak (tick all that apply) (Pre latest form revision: <input type="checkbox"/> Untreated water supply)		
<input type="checkbox"/> Surface water with no treatment	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Roof collected rainwater with no treatment	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Groundwater not assessed as secure and with no treatment	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Source water quality inferior to normal, If source water quality inferior to normal, specify _____	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Inadequately treated water supply	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Recent or ongoing treatment process failure	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Contamination of post treatment water storage	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Post treatment contamination (other) If post treatment contamination (other), specify _____	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
Specify the WINZ supply code of the implicated water supply _____		
Person to person outbreak (tick all that apply)		
<input type="checkbox"/> Inadequate vaccination cover	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Inadequate vaccination effectiveness	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Exposure to infected person	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Poor hygiene of cases	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Excessively crowded living conditions	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Unprotected sexual activity	<input type="radio"/> Confirmed	<input type="radio"/> Suspected
<input type="checkbox"/> Compromised immune system	<input type="radio"/> Confirmed	<input type="radio"/> Suspected

Outbreak Summary	Outbreak No.
Factors Contributing to Outbreak	
Environmental outbreak (tick all that apply)	
<input type="checkbox"/> Exposure to contaminated land	<input type="radio"/> Confirmed <input type="radio"/> Suspected
<input type="checkbox"/> Exposure to contaminated air (including ventilation)	<input type="radio"/> Confirmed <input type="radio"/> Suspected
<input type="checkbox"/> Exposure to contaminated built environments (inc dwellings)	<input type="radio"/> Confirmed <input type="radio"/> Suspected
<input type="checkbox"/> Exposure to infected animals or animal products	<input type="radio"/> Confirmed <input type="radio"/> Suspected
<input type="checkbox"/> Exposure to contaminated swimming/spa pools	<input type="radio"/> Confirmed <input type="radio"/> Suspected
<input type="checkbox"/> Exposure to contaminated other recreational water	<input type="radio"/> Confirmed <input type="radio"/> Suspected
Other outbreaks	
<input type="checkbox"/> Other risk factor, specify _____	<input type="radio"/> Confirmed <input type="radio"/> Suspected
Management of the Outbreak	
Was there any specific action taken to control the outbreak? <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown	
If yes, list the control measures undertaken (tick all that apply)	
Source	Specify
<input type="checkbox"/> Closure	_____
<input type="checkbox"/> Modification of procedures	_____
<input type="checkbox"/> Cleaning, disinfection	_____
<input type="checkbox"/> Removal	_____
<input type="checkbox"/> Treatment	_____
<input type="checkbox"/> Exclusion	_____
<input type="checkbox"/> Isolation	_____
<input type="checkbox"/> Health education and advice	_____
<input type="checkbox"/> Health warning	_____
Vehicles and vectors	
<input type="checkbox"/> Removal	_____
<input type="checkbox"/> Treatment	_____
Contacts and potential contacts	
<input type="checkbox"/> Chemoprophylaxis	_____
<input type="checkbox"/> Vaccination	_____
<input type="checkbox"/> Health education and advice	_____
Other control measures (specify)	
