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**ANNUAL SUMMARY OF OUTBREAKS
IN NEW ZEALAND 2004**

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EXECUTIVE SUMMARY

In 2004 there were 374 outbreaks involving 4897 cases, an increase over 2003 in respect of the number of outbreaks, associated cases and the average number of cases per outbreak. In terms of agents, rates, settings and geographic distribution, outbreaks in 2004 continued previous years trends. Significant differences are that more resthomes are reporting outbreaks; especially norovirus outbreaks, and these large-scale outbreaks are beginning to dominate the overall picture. The other major difference in 2004 was the pertussis epidemic that began in May 2004, peaked in November and appears to have 'ended' in April 2005

Most of the outbreaks reported were caused by exposure to a common source at a common event - usually a commercial food setting, although a large number also occurred within institutions - predominantly resthomes and continuing care hospitals. The scale of these institutional outbreaks was significant; involving an average of 33 cases per outbreak. The majority of the institutional outbreaks were caused by norovirus or were 'gastroenteritis of unknown aetiology'. Understanding the epidemiology of these institutional outbreaks would be an important step in their control.

A significant issue in terms of the quality of information is the 'interim' status of many reports at the cut-off date for the annual report. Forty-seven outbreaks, some, of diseases of significant public health importance, were not fully described in this annual report as they were still considered 'interim' by the PHS involved, with one PHS reporting only two outbreaks, with a further 14 still being 'interim'.

The lack of data from these 'interim' reports compromises the already limited observations, and ultimately generalisability of the outbreak data.

The 'interim' status, and other data quality issues relating to outbreak data, were examined in 2004, and summarised in a report entitled: "A review of outbreak reporting in New Zealand". The review focussed on the reporting of, rather than the detection of outbreaks. The quality of the data within each field of the outbreak report form was assessed, and the utility of the field in its entirety was reported on.

Recommendations include designing a new, more 'user-friendly' outbreak report form that does not include outbreak management fields. It was recognised that some PHSs rely upon these fields to manage outbreaks, and any changes need to reflect this. One solution proposed is to build sufficient flexibility into the overall notification system such that cases notified can be 'linked' and provided with an outbreak number, from which outbreak-specific fields could be automatically populated (such as 'age range of cases').

The outcome would be that all outbreak-related cases would be included in the national notifiable disease dataset, and the two systems would be more closely aligned with each other. Some residual issues would remain, for example, the notification of cases of 'non-notifiable' diseases e.g. histamine poisoning, but this could be a useful first step to rationalising and enhancing the utility of current processes.

1 INTRODUCTION

1.1 DEMOGRAPHY

The population figure used throughout this publication is 3 737 253¹, which was the total number of people in New Zealand on census night in 2001. 76% of the population reside in the North Island, and the remaining 24% in the South Island. 48.7% are male, while 51.2% are female. 69.8% of people are of European ethnicity, 14.1% Maori, 6.1% Asian, 5.4% Pacific Islanders, 4.0% did not specify their ethnicity and 0.6% were of 'other' ethnicity.

1.2 DATA QUALITY

Outbreak surveillance provides a method for systematically recording outbreak characteristics and investigation. Outbreak summaries are recorded on EpiSurv, and can be linked to individual cases via an outbreak reference number.

The national outbreak surveillance system in EpiSurv has been operational since 1997, although outbreak surveillance began in July 1996. It should be noted that outbreaks involving unusual pathogens or large numbers of cases are more likely to be reported, which will bias the information. Notifiable diseases are more often reported to Public Health Services (PHSs) than outbreaks caused by non-notifiable diseases.

Data recording differences are difficult to resolve as some fields of the outbreak report form are never filled in. The utility of the current systems for national surveillance purposes is currently being re-examined. A result of the pandemic of Severe Acute Respiratory Syndrome in early 2003 is that additional functionality of the surveillance system is necessary. During 2004, a systematic review of the outbreak surveillance system occurred was written. This document reviewed the reporting of outbreaks of communicable disease in humans in New Zealand.

Changing demands on reporting systems with the threat of new and emerging infections are discussed. Issues that impair system performance and quality of data in the current reporting system are examined. In particular, the outbreak report form was scrutinised in detail and recommendations are made for changes. Other possible approaches to reforming the outbreak report form are also described.

Recommendations to address the issues raised are:

- Frequency of reporting to be increased from weekly to daily
- Standardised PHS outbreak detection and reporting to be implemented
- Reporting tools to be improved
- Communication between involved agencies to be improved

- The use of Early Aberration Reporting Systems based on historical data to be considered for PHSs
- Automatic detection systems using other parameters to be explored
- Stakeholders to be consulted during developments and before changes are implemented
- These developments in outbreak detection and reporting to be integrated with the current national surveillance system
- Training programmes to support the implementation of these recommendations to be developed and provided

2 METHODS

2.1 OUTBREAK DEFINITION

For the purposes of this report, an outbreak is defined as: two or more cases thought to be linked by a common exposure except when this common source is well established as a national epidemic and reporting it as a discrete event is no longer appropriate.

If cases are likely to have resulted from secondary transmission within a household, this is not an outbreak, nor is it an outbreak where a single secondary case, or a small number of cases, has resulted from person-to-person transmission from a primary case.

2.2 DATA

Outbreaks identified in the community are assessed by the local PHS. Once confirmed as an outbreak, the PHS record data about the outbreak on a standardised Outbreak Report Form within EpiSurv. PHS are encouraged to enter preliminary data as an interim report as soon as the outbreak is confirmed, then complete the remainder of the Outbreak Report Form when final data are available.

On a weekly basis, this is downloaded from the district database and sent to ESR. It is collated within the national database on behalf of the Ministry of Health. The national database is supplemented by data on outbreaks recorded in the foodborne disease database, and by the ESR enteric reference and virology laboratories. PHS staff are asked to complete an Outbreak Report Form on outbreaks reported from these laboratory sources if appropriate.

The data in this report contain all outbreaks reported to ESR by the 18th of February 2005.

A total of 374 outbreaks were reported between 1st January 2004 and 31st December 2004, but only 327 of these were finalised. Due to the nature of the data contained in interim reports, the 47 outbreaks for which final reports were not available were excluded from analyses.

¹ www.stats.govt.nz

3 RESULTS

3.1 CHARACTERISTICS OF OUTBREAKS

Three hundred and seventy four outbreaks were reported to ESR in 2004, a crude national rate of 10 outbreaks per 100 000 population (Table 1). Of the 374 outbreaks reported in 2004, 327 (87.4%) were recorded as 'final reports'. This percentage is less than in 2003 (92.1%).

Table 1. Outbreaks in New Zealand in 2004

Characteristics	Total
Number of Outbreaks	327
Number of Cases	
Confirmed	570
Probable	2765
Total	4085 ^a
Number of Exposed Persons ^b	7883
Number of Hospitalised Persons ^c	181
Number of Deaths ^d	5

a There is a disparity of 750 cases between the total number of cases recorded versus calculated. The calculated total is 3335 and comprises of laboratory-confirmed cases, 'other' confirmed cases and probable cases.

b This was recorded for 231 outbreaks (70.6%)

c This was recorded for 304 outbreaks (93.0%)

d This was recorded for 319 outbreaks (97.6%)

Table 2 describes the interim reports, indicating both the pathogens causing the outbreaks, and the PHUs in which they occurred. Twenty-two of these outbreaks occurred in institutions (46.8%), a further 14 in 'unknown' settings (29.7%) and 7 in commercial

food settings (14.9%). They are not further discussed within this report.

Outbreaks reported during 2004 involved 4085 confirmed and probable cases, a rate of 109.3 cases per 100 000 population at an average of 12.5 cases per outbreak.

The number of outbreaks in 2004 was greater than in 2003 (340), as was the number of outbreak-associated cases (2789 cases in 2003).

Between 1997 and 2003, the number of outbreaks and the number of cases involved in outbreaks have both risen (Figure 1). However, since 2003, the number of outbreaks has decreased, and the number of cases has increased.

Figure 1. Number of Outbreaks and Cases by Year, 1997 - 2004

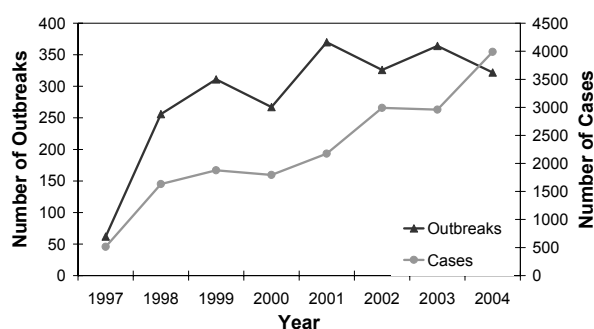


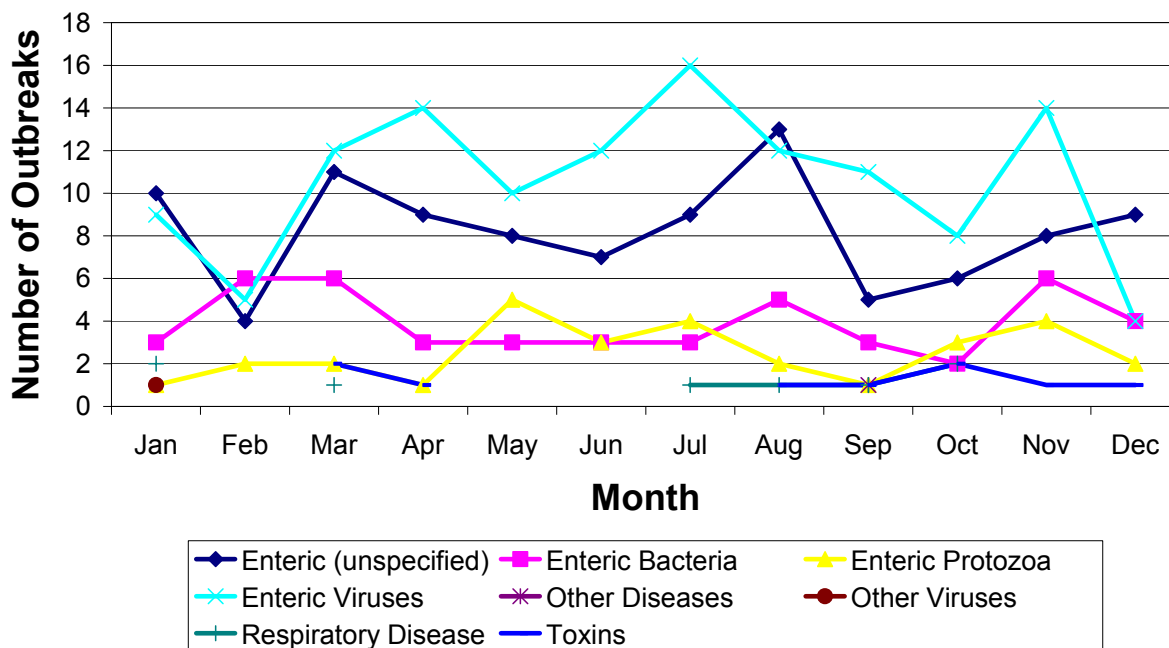
Table 2. Interim Outbreak Reports by Pathogens and Public Health Service (Number of Cases)

Pathogen	Auckland	Canterbury	Gisborne	Hawke's Bay	Manawatu	Marlborough	Northland	Otago	Southland	Tairārapia	Waikato	Wellington	West Coast	Total
<i>B. pertussis</i>	1 (3)					1 (170)								2 (173)
<i>Campylobacter</i> spp.	1 (26)					1 (13)		1 (2)	1 (0)			1 (4)	1 (3)	6 (48)
Gastroenteritis	1 (2)	4 (25)	2 (12)		1 (20)			2 (0)			4 (95)	1 (0)	1 (20)	16 (174)
Giardia	1 (2)									1 (3)				2 (5)
<i>M. tuberculosis</i>				1 (0)										1 (0)
Norovirus	2 (58)	2 (40)			1 (30)	1 (54)					9 (187)			15 (369)
Rotavirus		1 (0)									1 (12)			2 (12)
<i>S. aureus</i>						1 (17)								1 (17)
Unidentified							1 (14)					1 (0)		2 (14)
TOTAL	6 (91)	7 (65)	2 (12)	1 (0)	2 (50)	4 (254)	1 (14)	3 (2)	1 (0)	1 (3)	14 (294)	3 (4)	2 (23)	47 (812)

Reporting of outbreaks was bell-shaped throughout the year, with a high in July (41 outbreaks, 799 cases), and low in February (19 outbreaks, 94 cases);

see Figure 2). Most cases (799) were reported during July when the average number of cases per outbreak was 19.5.

Figure 2. Number and Type of Outbreaks by Month, 2004



3.2 TYPES OF OUTBREAKS

Table 3. Outbreak Types, 2004

Type of Outbreak	Number of Outbreaks	Percent of Outbreaks	Number of Cases	Percent of Cases	Cases per outbreak
Common Event	105	32.1	482	11.8	4.6
Common Source dispersed in community	9	2.8	41	1.0	4.6
Common Source in specific place	23	7.0	114	2.8	5.0
Community-wide person to person transmission	2	0.6	4	0.1	2.0
Institutional	91	27.8	3138	76.8	34.5
Household	37	11.3	116	2.8	3.1
Other	4	1.2	25	0.6	6.3
Unknown	56	17.1	165	4.0	2.9
TOTAL	327		4085		12.5

One hundred and thirty seven outbreaks (41.9%) were reported as occurring from contact with a common source (Table 2). One hundred and five (76.6%) of these were identified with a common event (e.g. conference), 9 (6.6%) with a common source in the community (e.g. dissemination of a contaminated food product during manufacturing)

and 23 (16.8%) with transmission over a protracted period, but from a specific place (e.g. contamination of recreational water). Combined, these outbreaks comprised 637 cases (15.6% of total).

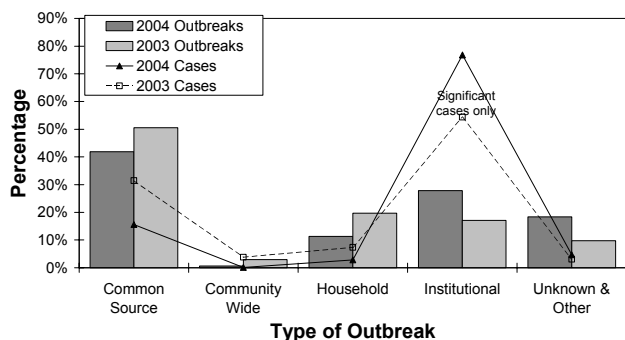
Community wide outbreaks, where transmission occurred through person-to-person contact, accounted for 2 outbreaks (0.6%) and 4 cases involved. This is a significant decrease since 2003 when there were 10 outbreaks involving 106 cases.

One hundred and twenty eight outbreaks (39.1%) and 3254 cases were reported as being due to transmission within a defined setting (i.e. institutional or household outbreaks). Ninety-one (71.1%) of these were institutional outbreaks (e.g. rest homes) involving 3138 cases (96.4%) at an average of 34.5 cases per outbreak.

Thirty seven defined setting outbreaks (28.9%) occurred in households. There were 116 associated cases, an average of 3.1 cases per outbreak.

The percentage of all types of outbreaks remains unchanged. The percentage of cases involved in institutional outbreaks has increased significantly since 2003 (Figure 3).

Figure 3. Comparison of Outbreaks and Cases by Outbreak type, 2004 v 2003



3.3 OUTBREAKS BY PUBLIC HEALTH SERVICE (PHS)

During 2004, outbreaks were reported from all PHUs except Gisborne (Table 2).

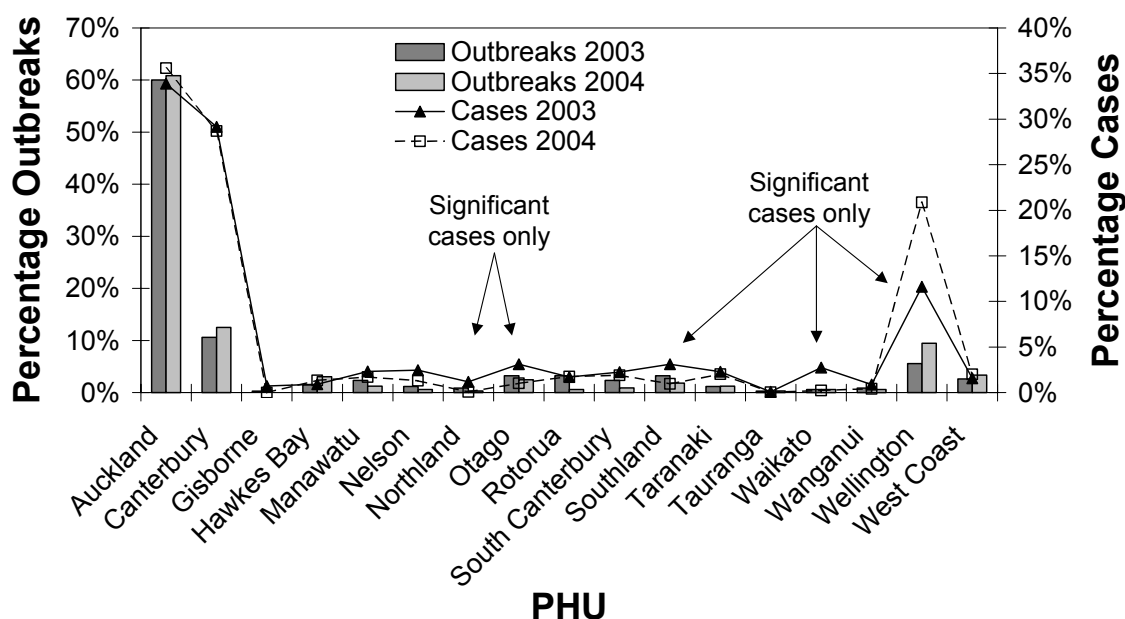
The Auckland PHU (incorporating North West, Central and South Auckland districts) had 199 outbreaks (61%) and 1454 cases (36%). Canterbury had the second highest number of outbreaks (41 outbreaks, 13%) involving 1172 cases (29%) followed by Wellington (31 outbreaks (10%)) involving 853 cases (21%).

There were no significant differences in the percentages of outbreaks occurring in each PHU between 2004 and 2003 although there are some health districts in which there is a significant change in the percentage of cases associated with outbreaks (Figure 4). The percentage of cases in Wellington decreased significantly since 2003, while the percentage of cases in Northland, Otago, Southland and Waikato increased significantly.

Table 2. Outbreaks and Associated Cases by PHU

PHU	Number of Outbreaks	Percent of Outbreaks	Number of Cases	Percent of Cases
Auckland	199	61	1454	36
Canterbury	41	13	1172	29
Hawke's Bay	10	0	55	0
Manawatu	4	3	70	1
Nelson	2	1	53	2
Northland	1	1	3	1
Otago	8	0	42	0
Rotorua	2	2	72	1
South Canterbury	3	1	78	2
Southland	6	1	39	2
Taranaki	4	2	83	1
Tauranga	1	1	2	2
Waikato	2	0	10	0
Wanganui	2	1	17	0
Wellington	31	1	853	0
West Coast	11	9	82	21
TOTAL	327		4085	

Figure 4. Comparison of Outbreaks and Cases by PHU, 2004 v 2003



3.4 CAUSAL AGENTS

The causal agent(s) of outbreaks were identified in 223 outbreaks (69%) involving 3559 cases (87%). A further 99 outbreaks (30%) and 514 cases (13%) were 'gastroenteritis', where no specific pathogen was isolated. Table 3 shows outbreaks and cases by causal organism.

There was no change in the percentage of outbreaks or cases caused by the following groups of agents;

Enteric Bacteria: *Campylobacter* spp., *Salmonella* spp., *Shigella* spp., VTEC/STEC, *Yersinia enterocolitica*

Enteric Protozoa: *Cryptosporidium parvum*, *Giardia* spp.

Enteric Viruses: Hepatitis A, Norovirus

Respiratory Diseases: *Bordetella pertussis*, influenza, *Legionella pneumophila*, *Mycobacterium tuberculosis*

Toxins: *Clostridium perfringens*, Histamine, *Staphylococcus aureus*

Other diseases: *Neisseria meningitidis*, Measles

In 2003, there were outbreaks of anti-cholinergic agents, *Bacillus cereus*, lead absorption, *Lepotospira* spp., Morbillivirus, Rotavirus and Rubella. There were no outbreaks caused by these organisms/toxins/exposures in 2004.

The 5 outbreaks caused by unidentified pathogens involved either 2 or 3 people each. Two outbreaks involved fish and were possibly histamine poisoning (4 cases – all in Auckland). One of the outbreaks was from consumption of caster oil possibly containing wax esters that caused diarrhoea (2 cases – in Auckland). A further outbreak was of lead poisoning involving 3 cases in Southland and there is no information on the remaining outbreak (3 cases – in Southland).

The frequencies of toxins/pathogenic agents implicated in specific types of outbreak are shown in Table 6.

Most common event outbreaks were of gastroenteritis, norovirus or campylobacteriosis.

Norovirus caused 4 common source outbreaks where the source was dispersed in the community. Four additional outbreaks occurred of histamine and gastroenteritis (2 outbreaks each). The number of cases associated with each causative organism in this category was similar, except for 1 outbreak caused by *Campylobacter* spp., which involved 2 cases.

Although *Giardia* spp., caused the most outbreaks of a common source from a specific place (7), only 23 cases were involved. By comparison, norovirus caused 4 outbreaks, involving 44 cases. There was 1 outbreak of legionellosis in this category, involving 3 cases.

There were 2 community spread, person-to-person outbreaks in 2004, 1 caused by *Bordetella pertussis*,

the other by *Salmonella* spp. Each outbreak involved 2 cases.

Table 3. Outbreaks and Associated Cases by Agent of Disease

Pathogen	Number of Outbreaks	Percent of Outbreaks	Number of Cases	Percent of Cases	Cases per outbreak
<i>B. pertussis</i>	5	1.5	14	0.3	2.8
<i>Campylobacter</i> spp.	31	9.5	130	3.2	4.2
<i>C. perfringens</i>	4	1.2	45	1.1	11.3
<i>C. parvum</i>	5	1.5	19	0.5	3.8
Gastroenteritis ^a	99	30.3	514	12.6	5.2
<i>Giardia</i> spp.	25	7.6	82	2.0	3.3
Hepatitis A	1	0.3	3	0.1	3.0
Histamine	3	0.9	15	0.4	5.0
Influenza virus	1	0.3	50	1.2	50.0
<i>L. pneumophila</i>	1	0.3	3	0.1	3.0
Measles	1	0.3	20	0.5	20.0
<i>M. tuberculosis</i>	1	0.3	6	0.1	6.0
<i>N. meningitidis</i>	1	0.3	3	0.1	3.0
Norovirus	126	38.5	3022	74.0	24.0
<i>Salmonella</i> spp.	5	1.5	74	1.8	14.8
<i>S. Paratyphi</i>	1	0.3	11	0.3	11.0
<i>Shigella</i> spp.	6	1.8	46	1.1	7.7
<i>S. aureus</i>	2	0.6	6	0.1	3.0
VTEC/STEC	3	0.9	6	0.1	2.0
<i>Y. enterocolitica</i>	1	0.3	4	0.1	4.0
Unidentified	5	1.5	12	0.3	2.4
TOTAL	327		4085		12.5

^a Gastroenteritis is a 'catch all' pathogen where the causative agent was not isolated from stool samples

Norovirus caused two thirds of all institutional outbreaks (68) and over four fifths of the cases associated with institutional outbreaks (2707). During 2004, a *Neisseria meningitidis* outbreak occurred at a childcare centre in Auckland, involving three cases. A measles outbreak was suspected in a childcare centre in Northland, but further testing has recently ruled out the initial diagnosis.

Household outbreaks were most commonly caused by *Giardia* spp., 14 outbreaks involving 47 cases.

There were four outbreaks of 'other' type, attributed to a variety of pathogens; norovirus, *Mycobacterium tuberculosis* and gastroenteritis. These caused between six and 11 cases each.

Half of the 56 outbreaks of 'unknown' type (165 cases) were caused by norovirus (26 outbreaks, 87 cases), characteristic of this type of outbreak, however, is beset with major data quality issues.

Outbreaks that occur during a national epidemic are not reported to ESR. This report states that there were 5 outbreaks of *B. pertussis* during the year, since a national epidemic began in April/May 2004. In total, 3489 cases of pertussis were notified to ESR in 2004, compared with 589 cases in 2003.

Table 4. Number of Outbreaks and Cases by Pathogen and Outbreak Type, 2004

Pathogen	Common Event		Common Source Dispersed in Community		Common Source in Specific Place		Community Wide – person to person		Household		Institutional		Unknown & Other Outbreak Types		Total Outbreaks	Total Cases
	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases		
<i>Bordetella pertussis</i>							1	2	3	6	1	6			5	14
<i>Campylobacter spp.</i>	14	81	1	2	2	6			4	9	2	13	8	19	31	130
<i>Clostridium perfringens</i>	4	45													4	45
<i>Cryptosporidium parvum</i>					3	13			1	4			1	2	5	19
Gastroenteritis	61	191	2	9	4	19			1	4	14	240	17	51	99	514
<i>Giardia spp.</i>					7	23			14	47			4	12	25	82
Hepatitis A virus									1	3					1	3
Histamine	1	2	2	13											3	15
Influenza virus											1	50			1	50
<i>Legionella pneumophila</i>					1	3									1	3
Measles											1	20			1	20
<i>Mycobacterium tuberculosis</i>													1	6	1	6
<i>Neisseria meningitidis</i>											1	3			1	3
Norovirus	18	137	4	17	4	44			4	19	68	2707	28	98	126	3022
<i>Salmonella spp.</i>					1	3	1	2	2	5	1	64			5	74
<i>Salmonella</i> Paratyphi	1	11													1	11
<i>Shigella spp.</i>	1	3							3	8	2	35			6	46
<i>Staphylococcus aureus</i>	2	6													2	6
VTEC/STEC									2	4			1	2	3	6
<i>Yersinia enterocolitica</i>									1	4					1	4
Unidentified	3	6			1	3			1	3					5	12
TOTAL OUTBREAKS	105		9		23		2		37		91		60		327	
TOTAL CASES		482		41		114		4		116		3138		190		4085

3.5 MORTALITY AND MORBIDITY

A total of five deaths were reported across two outbreaks in 2004. One death was associated with a norovirus outbreak in a Wellington resthome involving 20 cases in September. An additional four deaths occurred during an influenza outbreak in another Wellington resthome, also in September 2004. This latter outbreak involved 50 people, the majority of whom were elderly.

Twenty-four outbreaks (7%) in 2004 resulted in the hospitalisation of 181 cases, not significantly different from 2003.

In 2004, outbreaks caused by norovirus were responsible for the majority of outbreak related hospitalisations (137 hospitalisations, 76%), with an outbreak of influenza accounting for a further 14% of hospitalisations (Table 5). All cases involved in outbreaks of Legionellosis and *Neisseria meningitidis* were hospitalised.

Table 5. Number and Percentage of Hospitalised Cases per Pathogen

Pathogen	Number of Cases (n=4085)	Cases hospitalised (n=181)	Percent of cases Hospitalised	Percent of Hospitalisations
<i>Campylobacter spp.</i>	130	1	0.8	0.6
Gastroenteritis	514	1	0.2	0.6
Influenza virus	50	26	52.0	14.4
<i>L. pneumophila</i>	3	3	100.0	1.7
<i>N. meningitidis</i>	3	3	100.0	1.7
Norovirus	3022	137	4.5	75.7
<i>Salmonella spp.</i>	74	3	4.1	1.7
<i>Shigella spp.</i>	46	6	13.0	3.3
VTEC/STEC	6	1	16.7	0.6

3.6 OUTBREAK SETTINGS

The setting for outbreaks in 2003 and 2004 were similar (Table 6). However, the percentage of outbreaks occurring in unknown settings has increased from 3% to 18% in 2004.

The percentage of cases associated with outbreaks occurring in institutions has increased from 49.5% in 2003 to 74.1% in 2004. This increase is due to the increase in cases occurring in hospitals (both acute and continuing care) and resthomes, from 42.1% to 70.8%. This continues a trend first observed in 2003.

Table 6. The Setting of Outbreaks in 2004

Outbreak Setting	Number of Outbreaks	Percent of Outbreaks	Number of Cases	Percent of Cases
Commercial Food	95	29.1	398	9.7
Café	51	15.6	177	4.3
Caterers	2	0.6	21	0.5
Hotel	3	0.9	82	2.0
Other Food				
Outlet	9	2.8	33	0.8
Supermarket				
Deli	1	0.3	2	0.0
Takeaway	29	8.9	83	2.0
Institutions	91	27.8	3025	74.1
Camp	2	0.6	22	0.5
Childcare	5	1.5	38	0.9
Hospital Acute	17	5.2	684	16.7
Hospital Continued	9	2.8	280	6.9
Hostel	2	0.6	66	1.6
Rest/Retirement				
Home	55	16.8	1929	47.2
School	1	0.3	6	0.1
Community Groups	2	0.6	26	0.6
Community	1	0.3	23	0.6
Swim/Spa	1	0.3	3	0.1
Workplace	12	3.7	73	1.8
Workplace	12	3.7	73	1.8
Household	54	16.5	180	4.4
Other	15	4.6	187	4.6
Unknown	58	17.7	196	4.8
TOTAL	327		4085	

^aOther food outlets included foodcourts, service stations and the likes

3.7 TRANSMISSION

The predominant mode of transmission in terms of outbreak numbers was foodborne, although person-to-person outbreaks involved more cases (Table 7). The percentages of outbreaks caused by each mode of transmission are similar to 2003, however, the percentage of cases attributable to outbreaks spread by multiple modes of transmission has increased (from 10.6% to 35.1%).

Table 7. Principal Modes of Transmission for Outbreaks in 2004

Principal Mode of Transmission	Number of Outbreaks	Percent of Outbreaks	Number of Cases	Percent of Cases
Foodborne	97	29.7	357	8.7
Person-to-Person	96	29.4	2046	50.1
Multiple	67	20.5	1432	35.1
Unknown	57	17.4	202	4.9
Environmental	5	1.5	30	0.7
Waterborne	4	1.2	15	0.4
Zoonotic	1	0.3	3	0.1
TOTAL	327		4085	

Multiple modes of transmission were implicated in 35.1% of all outbreaks. This is because the faecal-oral route of transmission allows pathogens first to spread from food to exposed susceptible cases and then from person-to-person. Determining the major mode of transmission of an outbreak is often impossible (Table 8).

Table 8. Multiple Modes of Transmission of Outbreaks and Cases in 2004

Multiple Modes of Transmission	Number of Outbreaks	Percent of Outbreaks	Number of Cases	Percent of Cases
Two Modes	57	85.1	1397	97.6
Three Modes	7	10.4	27	1.9
Four Modes	3	4.5	8	0.6
TOTAL	67		1432	

A total of 160 outbreaks, involving 3457 cases were attributed to person-to-person spread, this includes outbreaks where multiple modes of transmission were suspected (Table 9).

Table 9. Modes of Transmission including Multiple Modes

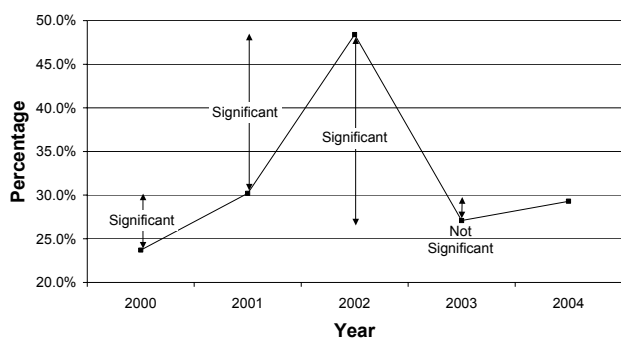
Modes of Transmission (all inclusive)	Number of Outbreaks	Percent of Outbreaks	Number of Cases	Percent of Cases
Person-to-Person	160	39.0	3457	61.9
Foodborne	116	28.3	630	11.3
Unknown	57	13.9	202	3.6
Environmental	48	11.7	1153	20.6
Waterborne	22	5.4	116	2.1
Zoonotic	7	1.7	28	0.5
TOTAL	410		5586	

3.8 FOODBORNE OUTBREAKS

Of the 116 outbreaks associated with the foodborne mode of transmission, 82 had source vehicles identified (71%). The percentage of foodborne outbreaks with no source identified has increased

slightly since 2003, but the increase is not significant. The arrows in Figure 5 indicate whether the change in the percentage of outbreaks with an identified food source was significant compared with the previous year.

Figure 5. Percentage of Foodborne Outbreaks with Unidentified Sources, 2004



Chicken was involved in 11 outbreaks in 2004 (67 cases), in comparison to 2003, when 32 were identified (87 cases), a similar percentage of foodborne outbreaks but two thirds as many cases.

Table 10. Food Implicated in Foodborne Outbreaks

Source of Infection	Number of Outbreaks	Percent of Outbreaks	Number of Cases	Percent of Cases
Mixed ^a	33	28.4	127	20.2
Chicken	11	9.5	67	10.6
Fish	8	6.9	25	4.0
Oysters	6	5.2	23	3.7
Pork	4	3.4	15	2.4
Fish'n'Chips	3	2.6	10	1.6
Lamb	3	2.6	6	1.0
Vegetable	2	1.7	14	2.2
Beef	1	0.9	8	1.3
Cheese	1	0.9	3	0.5
Eggs	1	0.9	2	0.3
Meat	1	0.9	3	0.5
Milk	1	0.9	2	0.3
Sewage	1	0.9	8	1.3
Taro	1	0.9	3	0.5
Wine	1	0.9	2	0.3
Unknown	4	3.4	9	1.4
Blank	34	29.3	303	48.1
TOTAL	116		630	

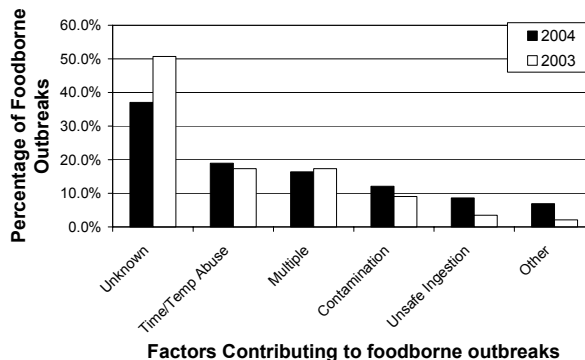
^a Infers a mixture of products e.g. egg, pork, lamb, chicken, rice, beef, vegetables etc.

Fish (including seafood, shellfish etc.) was implicated as the source in a similar percentage of outbreaks and cases as in 2003. The percentage of outbreaks and cases where meat (includes: beef, pork and lamb) was implicated as a source in 2004 is similar to 2003.

34 foodborne outbreaks (29%) can be considered only 'presumptive', as they had no food source identified. A further 4 foodborne outbreaks were caused by an 'unknown' food source.

There were no significant differences in the percentage of factors identified between 2004 and 2003. Unknown factors remain the single predominant 'factor', although this may be due to default choices when investigating the outbreak and entering the data (Figure 6). Time and temperature abuse, and multiple factors influenced a similar percentage of foodborne outbreaks.

Figure 6. Percentage of Foodborne Outbreaks with Contributory Factors



3.9 WATERBORNE OUTBREAKS

Table 11. Pathogens and Factors Contributing to Waterborne Outbreaks

Pathogen	Inadequate source	Multiple	Unknown Untreated Supply	Total
<i>Campylobacter</i> spp		3	1	4
<i>C. parvum</i>			1	1
Gastroenteritis			1	2
<i>Giardia</i> spp.	1	2	8	11
<i>Shigella</i> spp.		1		1
VTEC/STEC	1		1	2
<i>Y. enterocolitica</i>			1	1
TOTAL	2	6	13	22

There were 4 waterborne *Campylobacter* spp. outbreaks (34 cases), 1 was due to consumption of untreated water, 2 to untreated water, and inadequate source of the water, and one to untreated water, a contaminated reservoir and an inadequate source (Table 11).

Of the 11 waterborne *Giardia* spp. outbreaks (34 cases) 8 were attributed to untreated water supplies, as was the single *Cryptosporidium parvum* outbreak (8 cases) and the outbreak of *Yersinia enterocolitica* (4 cases). Inadequate source water and untreated water supply caused all of the VTEC/STEC outbreaks (4 cases).

The *Shigella* outbreak (23 cases) was caused by both inadequate source water, and water supply treatment failure.

Contributing factors were not identified in one of the gastroenteritis outbreaks (3 cases), the other was due to untreated water (6 cases).

3.10 PERSON-TO-PERSON OUTBREAKS

No contributory factors were reported for 7 person-to-person outbreaks (107 cases), two of which were gastroenteritis (25 cases), two norovirus (13 cases) and one each of *Giardia* (2 cases) and *Salmonella* (64 cases) and an unidentified pathogen (3 cases).

Table 12 indicates the percentage of person-to-person outbreaks caused by different pathogens.

One hundred and thirty two person-to-person outbreaks (2961 cases) involved exposure to infected people, although this same factor contributed to a total of 169 outbreaks (3318 cases). Outbreaks contributed to by exposure to infected people included those caused by: *Bordetella pertussis* (5 outbreaks/ 14 cases), *Campylobacter* (6/17), *Cryptosporidium parvum* (2/6), Gastroenteritis (20/270), *Giardia* (17/56), Hepatitis A virus (1/3), Influenza (1/50), Measles (1/20), *Mycobacterium tuberculosis* (1/6), Norovirus (85/2851), *Salmonella* (4/10), *Shigella* (4/31), VTEC/STEC (3/6) and *Yersinia enterocolitica* (1/4).

Vaccine related factors (either inadequate coverage or inadequate efficacy) were associated with 6 of these outbreaks (82 cases), 4 outbreaks of *Bordetella pertussis*, and one each of influenza and measles.

3.11 ENVIRONMENTAL OUTBREAKS

Four of the 14 environmental outbreaks were due to exposure to a contaminated environment alone (1103 cases). These were outbreaks of gastroenteritis (65 cases), salmonellosis (3 cases), norovirus (1033 cases) and giardiasis (2 cases).

One outbreak each of campylobacteriosis (19 cases), cryptosporidiosis (2 cases) and giardiasis (2 cases) were caused by exposure to recreational water.

One gastroenteritis outbreak (3 cases) was linked to exposure to a contaminated pool.

Three environmental outbreaks of giardiasis (6 cases), Legionnaires' disease (3 cases) and an unidentified pathogen (3 cases) were caused by unknown factors.

The remaining four environmental outbreaks were influenced by exposure to the environment and by exposure to animals (giardiasis – 3 cases, VTEC/STEC - 2 cases), exposure to recreational water (giardiasis - 2 cases) and all three factors (giardiasis - 5 cases).

Table 12. Pathogens causing Person-to-Person Outbreaks, 2004

Pathogen	Number of Outbreaks	Percent of Outbreaks	Number of Cases	Percent of Cases
Norovirus	87	54.4	2864	82.8
Gastroenteritis	23	14.4	298	8.6
<i>Giardia spp.</i>	18	11.3	58	1.7
<i>Campylobacter spp.</i>	6	3.8	17	0.5
<i>B. pertussis</i>	5	3.1	14	0.4
<i>Salmonella spp.</i>	5	3.1	74	2.1
<i>Shigella spp.</i>	4	2.5	31	0.9
VTEC/STEC	3	1.9	6	0.2
<i>C. parvum</i>	2	1.3	6	0.2
Hepatitis A	1	0.6	3	0.1
Influenza	1	0.6	50	1.4
Measles	1	0.6	20	0.6
<i>M. tuberculosis</i>	1	0.6	6	0.2
<i>N. meningitidis</i>	1	0.6	3	0.1
<i>Y. enterocolitica</i>	1	0.6	4	0.1
Unidentified	1	0.6	3	0.1
TOTAL	160		3457	

3.12 ZOOONOTIC OUTBREAKS

Cryptosporidium parvum (11 cases) and *Giardia spp.* (9 cases) were linked to two zoonotic outbreaks each, while one outbreak was caused by each of *Campylobacter spp.* (2 cases), VTEC/STEC (2 cases) and *Yersinia enterocolitica* (4 cases).

3.13 OUTBREAK RECOGNITION, INVESTIGATION AND CONTROL

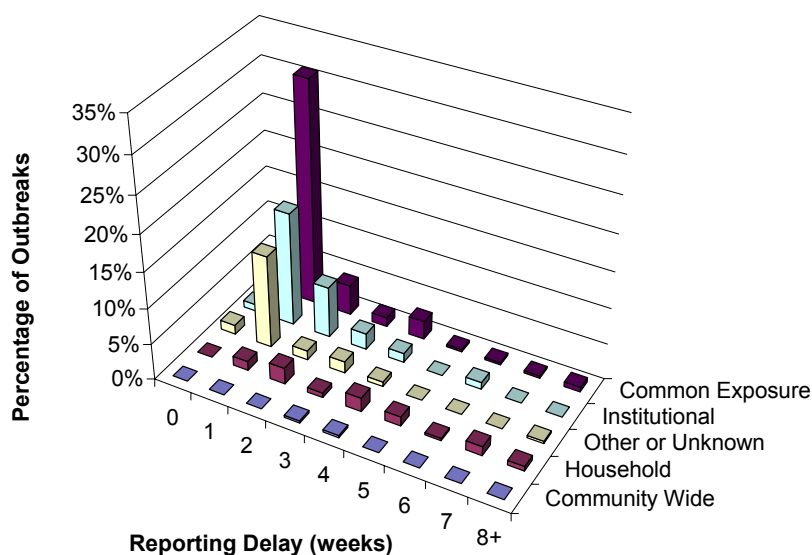
The date that outbreaks were reported to ESR is defined as the report date upon which the Public Health Service (PHS) was aware of the outbreak. Variability exists between the period of time it takes for PHS staff to report to EpiSury, rather than the time taken for practitioners to report to the PHS.

The date of onset of illness was recorded for the index case in 317 outbreaks (96.9%), a significant increase in the percentage of outbreaks for which these data was recorded compared with 2003 (87.6%). However, six outbreaks had incorrect data entered (i.e. report date before first onset date); thus were excluded from analysis.

Of the remaining 311 outbreaks, 284 (91.3%) were reported within one calendar month (30 days). This percentage is similar to that of 2003 (94.6%).

A further 24 (7.7%) were recorded on EpiSury between one and three months from the date of onset. Two outbreaks (0.6%) were reported between three and six months of the date of onset, and one Hepatitis A outbreak (0.3%) was reported 200 days after the initial date of onset for the index case.

Figure 7. Reporting Delays by Outbreak Type



Different types of outbreaks caused different reporting delays. Figure 7 shows that the majority of common exposure (i.e. common event, common source in a specific place, or common source dispersed in the community) outbreaks were reported in the first three weeks following the onset of illness. Institutional and other or unknown outbreak types mimicked this trend, however, household outbreaks are reported up to six weeks after onset of illness.

When comparing the average delay period (in days) of different outbreak types, the median is the most useful measurement of central tendency.

Table 13. Recognition of Outbreaks

Means of Recognition	Number of Outbreaks	Percent of Outbreaks	Number of Cases	Percent of Cases
Multiple	212	64.8%	2859	70.0%
Person-to-Person	55	16.8%	1003	24.6%
Common Source	51	15.6%	168	4.1%
Common Event	5	1.5%	48	1.2%
No Means	2	0.6%	5	0.1%
Other	1	0.3%	2	0.0%
Increase in Incidence	1	0.3%	0	0.0%
TOTAL	327		4085	

Table 14 displays the mean and the median number of days delay for reporting. Most outbreaks were reported within five days of onset of illness, apart from community wide or household outbreaks, which often took between three and four weeks to be reported.

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No Means	2	0.6%	5	0.1%
Other	1	0.3%	2	0.0%
Increase in Incidence	1	0.3%	0	0.0%
TOTAL	327		4085	

Table 14. Average Reporting Delay for Different Types of Outbreaks

Type of Outbreak	Number of Outbreaks	Number of Cases	Mean Delay (days)	Median Delay (days)
Common Event	104	475	4.6	2.0
Common Source Dispersed	8	37	2.9	1.0
Common Source Specific	23	114	21.7	13.0
Community Wide	2	4	31.5	28.0
Household	30	90	30.8	23.5
Institutional	88	3082	9.6	6.0
Other	2	15	9.5	9.5
Unknown	54	159	14.5	4.0
TOTAL	311	3976	11.7	5.0

Two hundred and twelve outbreaks (64.8%, 2859 cases) were recognised via multiple means, and had more than one type of linkage between cases – either epidemiological or laboratory confirmed links (Table 16). The remaining 115 outbreaks (involving 1226 cases) were recognised by a single set of circumstances.

Outbreaks were most often identified by cases that had contact with other cases, being linked to a common source (food, water or an environmental site) or having attended a common event.

Specific action was taken to control 289 outbreaks (88.4%) during 2004, while 27 outbreaks (8.3%) had no control measures reported. The control measures that were applied are described in Table 15.

All outbreaks that were controlled via a specific method were controlled at the source, and health advice was provided in 80.3% of these.

Table 15. Control Measures Taken for Outbreaks in 2004

Control Method	Number of Outbreaks	
Controlled Outbreaks	289	
Controlled at Source		289
Closed		30
Modified Procedures		107
Cleaned		78
Removed		6
Treatment		13
Isolation		75
Health Education & Advice		232
Health Warning		28
Vector Control		3
Vector Treated		1
Vector Removed		2
Contacts Control		3
Chemoprophylaxis		2
Vaccination		1
Health Education & Advice		15
Not Controlled	27	
Unknown	11	
TOTAL	327	