Review of Yersiniosis Notifications in New Zealand 2002-2006

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by

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1 SUMMARY

In the five year period (2002 to 2006) reviewed, the annual notification rate for yersiniosis in New Zealand increased over the four years 2003 to 2006 but remained lower than it was in 2002. A number of District Health Boards (DHBs) (West Coast, South Canterbury, Capital and Coast) had consistently higher notification rates than the overall New Zealand notification rate. Children aged less than 5 years experienced the highest rates of yersiniosis and there was a small increase in the notification rate for the 60 years and over age group.

Not all *Yersinia* spp. are pathogenic and the biotyping data is a very useful tool to investigate notification practices. There was a large variation in the practices of laboratories between DHBs in referring isolates to ESR's Enteric Reference Laboratory for characterisation e.g. laboratories in some DHBs sent in more than 50% of their isolates while in other DHBs no isolates were submitted in the five year period. A feature of the biotyping data in more recent years was the increasing percentage of non pathogenic isolates being typed. Public Health Services (PHSs) requested guidance in the interpretation and use of *Yersinia* biotyping results.

An increasing number of hospitalisations for yersiniosis were reported over the five years reviewed with approximately half of these being admissions for yersiniosis as a primary diagnosis. The numbers were very small but the combining of the yersiniosis hospitalisations data with the *Yersinia* strain and biotyping information showed that an increasing number of the hospitalisations were for non pathogenic strains of *Yersinia*.

PHSs reported varying practices in the investigation of yersiniosis cases with most PHSs investigating yersiniosis cases to some extent. Biotyping results did not appear to be readily available to PHSs and often did not make their way into EpiSurv. The new requirement from 18 December 2007 for laboratories to directly report notifiable diseases to Medical Officers of Health should improve this situation.

2 INTRODUCTION

Yersiniosis is the third most commonly reported potential food-borne disease notified in New Zealand. These numbers have had a major influence on risk ranking exercises carried out by the New Zealand Food Safety Authority (NZFSA) with yersiniosis being estimated to contribute a higher number of disability adjusted life years (DALYs) to the New Zealand burden of food-borne disease than *E. coli* O157 infection (Table 1).

Table 1. DALYs for infectious intestinal diseases in New Zealand

Disease	DALYs
Campylobacteriosis	1554
Norovirus infection	536
Listeriosis, perinatal	229
Salmonellosis	186
Yersiniosis	93
STEC infection	91
Listeriosis, acquired	26

Source: [1]

New Zealand's notification rate for yersiniosis in 2006 (11.8 cases per 100,000 population) was high compared to other OECD countries though lower than Finland.

Table 2. Annual incidence of disease caused by foodborne bacterial agents in OECD countries

Country	Year	Cases	Incidence (per 100 000 population)
Australia	2000	73	0.6
Austria	1998	94	1.2
Belgium	2000	507	5
Denmark	2001	286	5.3
Finland	2001	728	14
Greece	1998	10	0.1
Japan	2001	4	<0.01
Norway	2001	123	2.8
Spain	1998	425	1.1
Sweden	2001	579	6.5
Switzerland	1998	51	0.7
United Kingdom	2000	27	0.05
United States	1999	-[a]	0.4

[a] Data not provided
Source : [2]

In New Zealand there was an apparent surge in yersiniosis cases reported in late 2006, especially in the population served by Christchurch Hospital. Anecdotal evidence suggests that there may have been differing clinical practices (e.g. infection screening versus clinical diagnosis), serology reporting and use of reference services occurring throughout the country leading to differential notification.

In light of both the disease burden and its consequent implications for trade, ESR was contracted by NZFSA to ascertain the validity of the yersiniosis notification data.

The objectives of this project were

- To validate the human yersiniosis disease notification data held in the national notifiable disease database, EpiSurv.

- To validate an agreed sample (time and geography) of yersiniosis notifications utilising notification, clinical, clinical laboratory and reference laboratory information

- To produce a report with recommendations if appropriate based on the findings.

3 METHODS

Three sources of data were used to carry out this review. Yersiniosis notifications held in EpiSurv were used as the primary dataset with supplementary information being obtained by matching notifications to data held by ESR's Enteric Reference Laboratory (ERL) and New Zealand Health Information Service (NZHIS) hospitalisation data.

3.1 Datasets used in the analyses

a) EpiSurv notifiable disease data

Yersiniosis notification data for all of New Zealand was extracted from the EpiSurv database on the 18 October 2007 for the period 1 January 2002 to 31 December 2006, with the following variables:

- EpiSurv identification number
- Case status
- Fits clinical description
- Meets laboratory criteria
- Reporting source (GP, Hospital, Laboratory, Self-reported, Outbreak, Other)
- Was the case hospitalised
- Hospitalisation date
- District Health Board
- Age
- Sex
- Ethnicity (Prioritised)
- Reporting date
- Species and strain information from laboratory

Rates were calculated using Statistics New Zealand mid year population estimates.

b) ERL

Yersinia isolates from cases may be submitted by clinical laboratories for ERL to determine strain and biotype information. This information, stored by ESR in ESRLab, was matched to notifications reported on EpiSurv using case names, sex, date of birth, and report date of disease.

c) New Zealand Health Information Service

Hospitalisation data for cases of "Enteritis due to *Yersinia enterocolitica*" (ICD-10 code A04.6) for all of New Zealand were obtained from NZHIS for the period 1 January 2002 to 31 December 2006 with the following variables:

- Date of admission
- Age
- Gender
- Ethnicity grouping
- District Health Board
- Diagnosis type

Cases were matched to notifications on EpiSurv using age, ethnicity, District Health Board and report date. Cases were also matched to isolates received by ERL either indirectly through their

matched EpiSurv record, or directly using sex, age, date of hospitalisation/date isolate received, DHB and client laboratory.

3.2 Medical Officers of Health survey

A survey of Medical Officers of Health (MOsH) was undertaken to identify differences between PHSs in the handling of yersiniosis cases, in particular what practices were in use to determine whether yersiniosis notifications met the current case definition.

The survey was e-mailed to each public health office with a Medical Officer of Health. Every public health office returned a completed questionnaire giving a 100 % response rate (17 out of 17 public health offices). A list of the respondents can be found in Appendix A and a copy of the questionnaire can be found in Appendix B.

3.3 Case definition for yersiniosis notification

Cases were classified by PHSs as confirmed or probable according to the case definition for yersiniosis in the CDC manual.[3] The case definition included a clinical and laboratory component as shown in below.

Clinical description
An acute illness with diarrhoea, fever and abdominal pain. Mesenteric adenitis may occur and complications include arthritis and systemic infection.

Laboratory test for diagnosis
Isolation of *Yersinia enterocolitica* or *Y. pseudotuberculosis* from blood or faeces
OR
Detection of circulating antigen by ELISA or agglutination test.

Case classification
Probable: A clinically compatible illness that is epidemiologically linked to a confirmed case.
Confirmed: A clinically compatible illness that is laboratory confirmed.

3.4 Pathogenicity of *Yersinia* spp.

Of the 11 species within the *Yersinia* genus only three, *Y. pestis, Y. pseudotuberculosis* and *Y. enterocolitica,* are regarded as pathogenic to humans. [4]

Y. pestis is the causative agent of bubonic and pneumonic plague, *Y. pseudotuberculosis* is a rodent pathogen which occasionally causes mesenteric lymphadenitis, septicaemia and immune-mediated diseases in humans and *Y. enterocolitica* is a versatile intestinal pathogen which is the most prevalent *Yersinia* species amongst humans.

Of the three pathogenic species of *Yersinia*, *Y. enterocolitica* is the most heterogeneous and can be divided into approximately 30 distinct serotypes (based on antigenic variation in cell wall lipopolysaccharide) and six biotypes (based on variations in biochemical behaviour). Table 3 shows the relationship between biotype, O serotype and pYV (*Yersinia* virulence plasmid) carriage of *Y. enterocolitica.*

Table 3. Biotype, O serotype and pYV carriage of *Y. enterocolitica*

Biotype	Serotype(s)
1A	O:4; O:5; O:6,30; O6,31; O:7,8; O:7,13; O:10; O:14; O:16; O:21; O:22; O:25; O:37; O:41,42; O:46; O:47; O:57; NT[a]
1B	O:4,32[b]; O:8[b] ; O:13[a],13b[b]; O:16; O:18[b]; O:20[b]; O:21[b] ; O:25; O:41,42; NT
2	O:5,27[b]; O:9[b]; O:27
3	O:1,2,3[b]; O:3[b] ; O:5,27[b]
4	O:3[b]
5	O:2,3[b]

[a] NT, not typable.
[b] Serotypes which include strains that carry pYV.
Source: [5]

Y. enterocolitica strains of biotype 1A lack the known virulence determinants of strains in other categories, including the pYV *Yersinia* virulence plasmid, and several chromosomal markers of pathogenicity. For this reason, and also because *Y. enterocolitica* strains of biotype 1A are frequently isolated from the environment or asymptomatic individuals, these bacteria are often assumed to be avirulent.
However there is a considerable body of clinical, epidemiological and experimental evidence to indicate that at least some strains of *Y. enterocolitica* biotype 1A are able to cause gastrointestinal symptoms which resemble those caused by pYV-bearing strains.[5]

The categories shown in Table 4 are used in this report to assist in the analysis of trends in the reporting of yersiniosis and distinguish between the pathogenicity of the different strains of *Yersinia*.

Table 4. Categories used to group *Yersinia* strains by pathogenicity

Category	Description
Non pathogenic	All *Yersinia* species excluding *Y. enterocolitica, Y. pseudotuberculosis* and *Y pestis*
Biotype 1A	*Y. enterocolitica* biotype 1A which are potentially but often not pathogenic
Pathogenic	*Y. enterocolitica* biotypes 1B, 2, 3, 4 and 5 *Y. pseudotuberculosis* and *Y pestis*[a]
Unknown	No strain or biotyping information available

[a] No notifications of *Y. pestis* were reported in EpiSurv during the study period.

3.5 Statistical tests

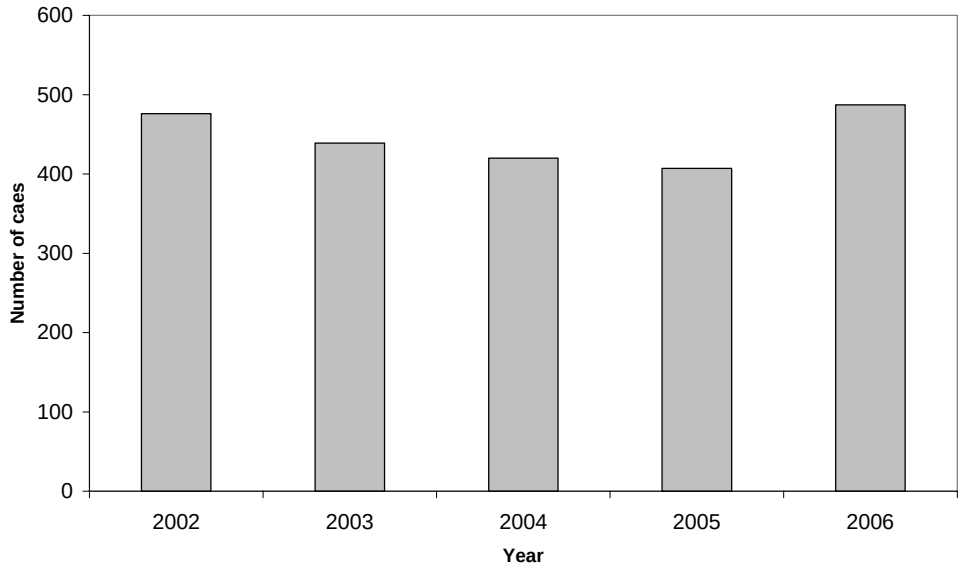
The Mantel-Haenszel chi-square test was used to determine statistical significance. P-values less than 0.05 are considered to be significant at the 95% level of confidence. Fisher's Exact Test was also considered when 25% of the cells had expected counts less than 5.

RESULTS

3.6 EpiSurv notification data trends

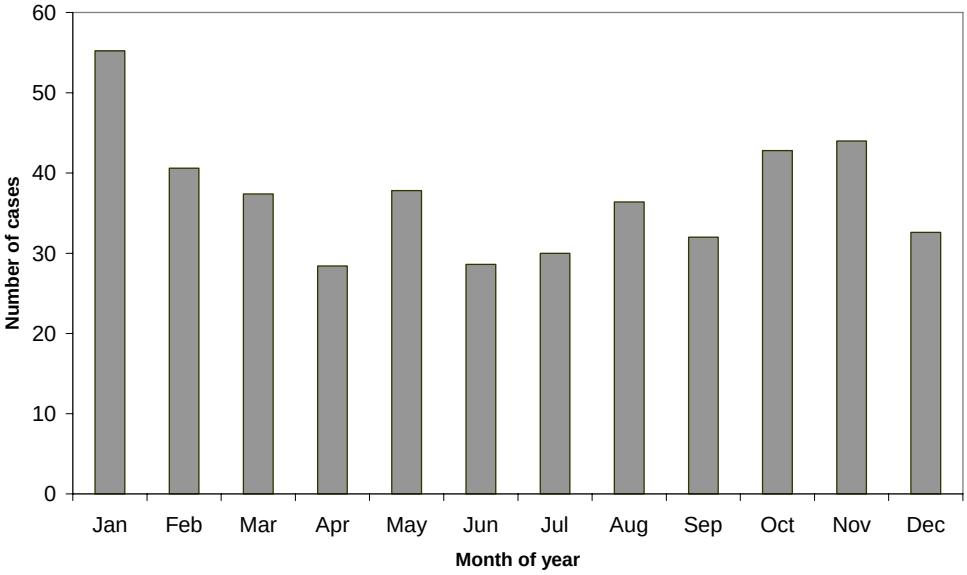
The number of yersiniosis notifications reported in New Zealand decreased from 476 in 2002 to 407 in 2005 before increasing to 487 in 2006 (Figure 1). The national population rate of yersiniosis varied between 9.9 and 12.1 cases per 100 000 population over this time period.

Figure 1. Yersiniosis notifications by year, 2002-2006



There was some seasonality to the reporting of yersiniosis with more cases reported in the spring/summer months of October, November and January than other months over the five year period (Figure 1).

Figure 2. Average number of cases reported per month, 2002 to 2006



Over the five year period 2002 to 2006, the West Coast DHB had a yersiniosis notification rate significantly higher than the overall New Zealand rate every year. South Canterbury and Capital and Coast DHBs had a rate of yersiniosis significantly higher than the New Zealand rate in 2005 and 2006. Northland DHB consistently experienced a yersiniosis notification rate significantly less than the New Zealand rate.

Table 5. Number of cases and rates per 100,000 of yersiniosis notifications by DHB

DHB	Year									
	2002		2003		2004		2005		2006	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Northland	5	3.4*	3	2.0*	4	2.7*	6	4.0*	9	6.0*
Waitemata	70	15.2	78	16.4*	61	12.6	41	8.3	41	8.2*
Auckland	67	16.7*	56	13.5	57	13.5	47	11.0	45	10.5
Counties Manukau	44	10.9	23	5.5*	34	8.0	31	7.1	34	7.7*
Waikato	36	10.9	42	12.5	46	13.6	20	5.9*	33	9.6
Lakes	12	12.0	10	9.9	7	6.9	9	8.9	20	19.7*
Bay of Plenty	24	12.9	13	6.9	16	8.3	9	4.6*	30	15.1
Tairawhiti	3	6.6	15	33.2*	5	11.1	4	8.9	4	9.0
Taranaki	3	2.8*	5	4.7	6	5.7	5	4.8	7	6.7
Hawke's Bay	16	10.8	14	9.4	20	13.4	15	10.0	10	6.6
Whanganui	6	9.3	5	7.8	7	11.0	12	19.2*	9	14.5
MidCentral	12	7.5	8	4.9*	11	6.8	8	4.9*	10	6.1*
Hutt	10	7.3	17	12.3	23	16.6*	6	4.3*	8	5.8*
Capital and Coast	38	14.6	34	12.8	36	13.3	48	17.5*	69	24.7*
Wairarapa	4	10.2	9	22.9*	3	7.6	1	2.5	1	2.5
Nelson Marlborough	4	3.1*	8	6.1	4	3.0*	15	11.1	18	13.2
West Coast	20	64.9*	13	42.3*	14	45.8*	16	52.4*	9	29.5*
Canterbury	65	14.5	58	12.7	40	8.6	69	14.6*	89	18.6*
South Canterbury	10	18.6	8	14.9	11	20.4*	9	16.7	10	18.7
Otago	18	10.1	15	8.3	12	6.6	26	14.3	27	14.8
Southland	9	8.4	5	4.6	3	2.8*	10	9.2	4	3.7*
New Zealand	476	12.1	439	10.9	420	10.3	407	9.9	487	11.8

* significant difference between regional rate and annual NZ rate

The notification rate for children aged less than 1 year old and 1 to 4 years old was significantly higher than the overall New Zealand reported notification rate of yersiniosis in each of the five years (Table 6). Notification rates of yersiniosis in the 15-19 years age group were significantly lower than the overall New Zealand population each year.

Table 6. Number and rates per 100,000 of notifiable yersiniosis cases by age group

Age group	Year 2002		2003		2004		2005		2006	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
<1	30	55.7*	41	74.2*	36	62.2*	25	43.9*	28	49.0*
1 to 4	104	46.1*	91	40.6*	111	49.4*	79	35.1*	85	37.7*
5 to 9	21	7.2*	22	7.5	29	10.0	14	4.8*	10	3.5*
10 to 14	27	8.8	18	5.8*	18	5.8*	21	6.8	12	4.0*
15 to 19	14	4.9*	18	6.1*	13	4.3*	12	3.9*	14	4.5*
20 to 29	57	11.0	43	8.1	39	7.3*	50	9.2	60	10.9
30 to 39	55	9.2	39	6.5*	43	7.2*	36	6.1*	69	11.8
40 to 49	67	11.7	56	9.5	48	7.9	58	9.5	60	9.7
50 to 59	47	10.5	49	10.6	38	8.0	43	8.8	63	12.6
60 to 69	23	7.6*	29	9.5	19	6.0*	24	7.4	37	10.9
70+	28	8.4	31	9.1	17	4.9*	35	9.9	46	12.8
Unknown	3		2		9		10		3	
Total Cases	476	12.1	439	10.9	420	10.3	407	9.9	487	11.8

* significant difference between age group and overall annual rate

3.7 Source of notifications

The majority of notifications over the period 2002 to 2006 were recorded in EpiSurv as originating from General Practitioners (GPs) although this percentage decreased from 87.2% in 2002 to 79.1% in 2006 (Table 7). All other reporting sources (hospital practitioners, laboratories and other sources) increased slightly over this time period.

Table 7. Number and percentage of notifiable yersiniosis cases by reporting source

Reporting Source	Year 2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%
General practitioner	415	87.2	372	84.7	346	82.4	315	77.4	385	79.1
Hospital based practitioner	25	5.3	30	6.8	32	7.6	33	8.1	48	9.9
Laboratory	29	6.1	33	7.5	32	7.6	47	11.5	41	8.4
Other	7	1.5	4	0.9	10	2.4	12	2.9	13	2.7
Total	476	100.0	439	100.0	420	100.0	407	100.0	487	100.0

3.8 Cases meeting yersiniosis case definition

Analysis of the case status data recorded in EpiSurv showed a very high percentage of cases were reported as meeting the criteria for a confirmed case of yersiniosis each year (Table 8).

Table 8. Number and percentage of notifiable yersiniosis cases by case status

Case Status	Year									
	2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%
Confirmed	472	99.2	429	97.7	412	98.1	402	98.8	476	97.7
Probable	1	0.2	0	0.0	1	0.2	1	0.2	1	0.2
Unknown	3	0.6	10	2.3	7	1.7	4	1.0	10	2.1
Total	476	100.0	439	100.0	420	100.0	407	100.0	487	100.0

Over the five year study period a high percentage of the notified cases were consistently recorded by PHS staff in EpiSurv as meeting the clinical criteria for a case of yersiniosis (Table 9).

Table 9. Number and percentage of notifiable confirmed yersiniosis cases reported meeting clinical criteria of case definition

Fits clinical description	Year									
	2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	442	92.9	385	87.7	378	90.0	386	94.8	471	96.7
No	1	0.2	3	0.7	0	0.0	4	1.0	1	0.2
Unknown	33	6.9	51	11.6	42	10.0	17	4.2	15	3.1
Total	476	100.0	439	100.0	420	100.0	407	100.0	487	100.0

Two yersiniosis cases (one each from Tauranga and Rotorua) were de-notified (i.e. made not a case in EpiSurv). The reason for de-notification in both cases was a lack of clinical symptoms consistent with yersiniosis.

3.9 Enteric Reference Laboratory (ERL) *Yersinia* biotyping data

ERL is the only New Zealand laboratory that tests *Yersinia* isolates to determine the strain and biotype. The ERL dataset was therefore used as the definitive *Yersinia* strain and biotyping dataset for this project. Although only *Y. enterocolitica* and *Y. pseudotuberculosis* are notifiable, the strains for all isolates referred to ERL are shown and analysed in this section.

The number of isolates referred to ERL increased by 50% in the five year period from 107 in 2002 to 169 in 2006 (Table 10). The number of *Y. enterocolitica* isolates increased over this time period but the percentage of *Y. enterocolitica* isolates as a proportion of all isolates decreased over the five year period from 95% of isolates in 2002 to 77% in 2006. Over the same period the number of Y. *frederiksenii* isolates increased from 3% to 20% of all isolates.

Table 10. Number of isolates typed by ERL by strain of *Yersinia* as a percentage of all *Yersinia* isolates typed that year.

***Yersinia* strain**	**Year**									
	2002		**2003**		**2004**		**2005**		**2006**	
	No.	%	No.	%	No.	%	No.	%	No.	%
bercovieri	0	0	0	0	0	0	1	1	0	0
enterocolitica	102	95	88	93	75	83	106	79	127	75
frederiksenii	3	3	3	3	9	10	21	16	33	20
intermedia	2	2	2	2	1	1	6	4	3	2
kristensenii	0	0	0	0	2	2	0	0	1	1
pseudotuberculosis	0	0	0	0	0	0	0	0	2	1
rohdei	0	0	1	1	2	2	0	0	1	1
unknown	0	0	1	1	1	1	0	0	1	1
Negative for *Yersinia* spp	0	0	0	0	0	0	1	1	1	1
Total	107	100	95	100	90	100	135	100	169	100

The numbers and relative percentages of different *Y. enterocolitica* biotypes identified changed over the last five years (Table 11). In 2002 biotype 4 (42 cases) was the most common biotype identified followed by biotype 1A and 2. In 2006 biotype 1A (54 cases) was the most commonly reported type followed by biotype 4 (40 cases) and in equal numbers biotypes 2 and 3. Biotype 1A increased from 28 cases in 2002 to 54 cases in 2006. Biotypes 1B and 5 were rarely seen.

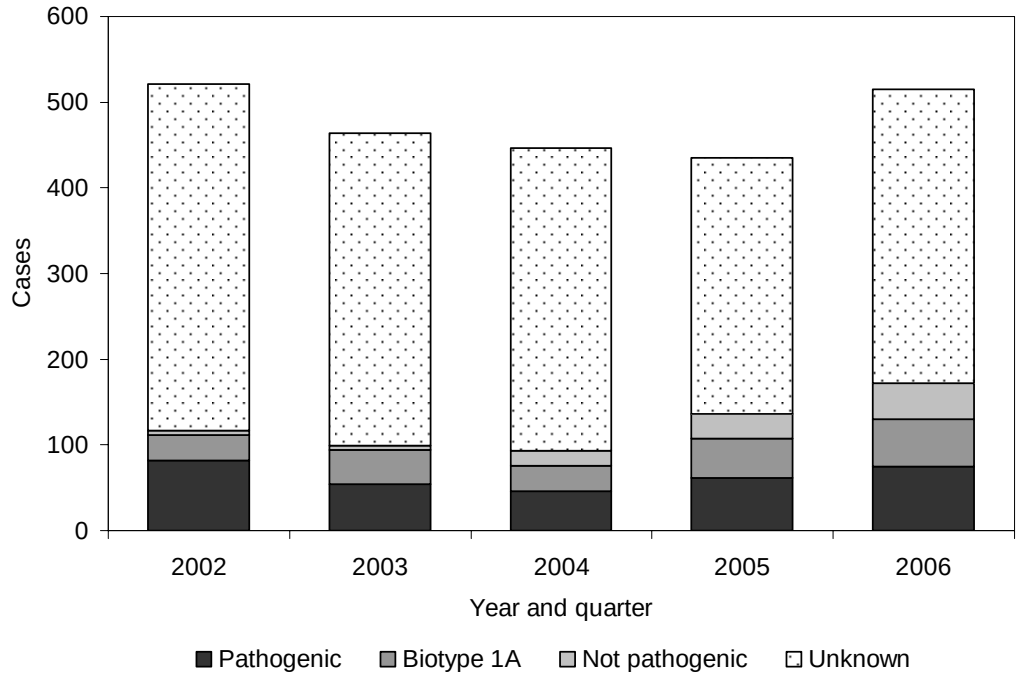
Table 11. Number and percentage of isolates typed by ERL by biotype of *Y. enterocolitica*

***Y. enterocolitica* biotype**	**Year**									
	2002		**2003**		**2004**		**2005**		**2006**	
	No.	%[a]	No.	%	No.	%	No.	%	No.	%
1A	28	27	38	43	29	39	46	43	54	43
1B	1	1	0	0	1	1	1	1	1	1
2	26	25	19	22	9	12	15	14	16	13
3	5	5	3	3	2	3	19	18	16	13
4	42	41	27	31	34	45	25	24	40	31
5	0	0	1	1	0	0	0	0	0	0
Total	102	100	88	100	75	100	106	100	127	100

[a]% - percentage of all *Y. enterocolitica* isolates sent to ERL in that year

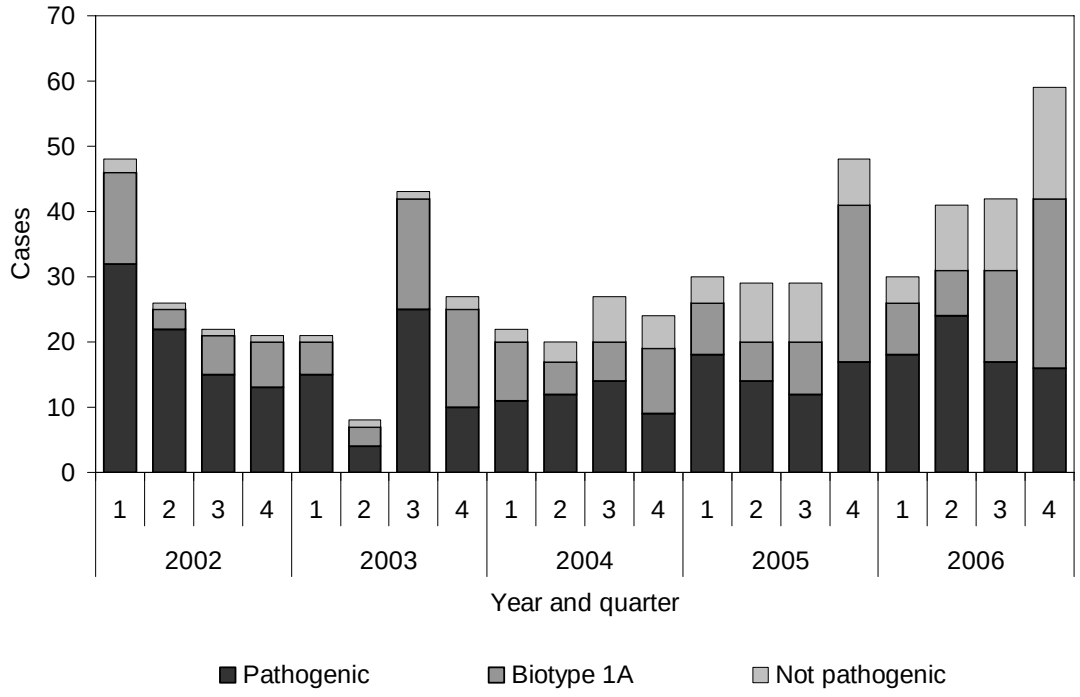
Using the pathogenic groupings discussed earlier the *Y enterocolitica* biotype 1A cases represented a significant percentage (43%) of all reported cases typed in 2006 and the non pathogenic group of *Yersinia* cases represent an increasing percentage (3% in 2002 and 20% in 2006) of all typed isolates since mid 2004 (Figure 3). The number of cases that were pathogenic *Y enterocolitica* biotypes remained similar throughout the time period.

Figure 3. Graph of notifications by pathogenic group of *Yersinia* by year, 2002-2006



The pathogenic groupings were also used to examine variation in the biotypes by year and quarter. There was clustering of the different pathogenic groups in different quarters of the year (Figure 4).

Figure 4. Graph of *Yersinia* isolates by year, quarter and pathogenic grouping, 2002-2006



In order to carry out analysis by DHB and audit the notification data, *Yersinia* biotyping data was obtained for EpiSurv notifications by matching the records as described in the methods section. Table 12 shows the percentage of isolates matched to EpiSurv cases. The percentage of ERL *Yersinia* isolates matched to EpiSurv yersiniosis cases increased from 69% in 2002 to 85% in 2006.

Table 12. Number and percentage of isolates typed by ERL and matched to an EpiSurv case

	Year									
	2002		2003		2004		2005		2006	
Isolates	No.	%	No.	%	No.	%	No.	%	No.	%
Received by ERL for biotyping[a]	107		95		90		135		169	
Matched to an EpiSurv case	72	67	74	78	67	74	108	80	143	85

[a] Duplicate isolates for an individual case have been removed

More than 50% of isolates referred to ERL each year for notified diseases came from laboratories in the Canterbury and Otago DHBs (Table 13). Very few *Yersinia* isolates were sent to ERL from laboratories in other DHBs for typing although 2006 saw an increase for several DHBs (Waikato, Northland and Nelson Marlborough).

Table 13. Number of isolates typed by ERL and matched to an EpiSurv case as a percentage of all isolates typed that year, by DHB

DHB	Year									
	2002		2003		2004		2005		2006	
	No.	%[a]	No.	%[a]	No.	%[a]	No.	%[a]	No.	%[a]
Northland	2	3	0	0	0	0	5	5	9	6
Waitemata	1	1	1	1	3	4	5	5	1	1
Auckland	3	4	2	3	5	7	8	7	1	1
Counties Manukau	5	7	0	0	2	3	2	2	0	0
Waikato	2	3	6	8	6	9	2	2	13	9
Lakes	1	1	0	0	1	1	0	0	1	1
Bay of Plenty	0	0	0	0	0	0	0	0	3	2
Tairawhiti	2	3	2	3	0	0	0	0	2	1
Hawke's Bay	4	6	3	4	10	15	0	0	4	3
Taranaki	2	3	2	3	1	1	0	0	2	1
MidCentral	0	0	2	3	1	1	2	2	3	2
Whanganui	1	1	1	1	0	0	0	0	1	1
Capital and Coast	0	0	0	0	0	0	0	0	0	0
Hutt Valley	0	0	0	0	2	3	1	1	0	0
Wairarapa	0	0	0	0	0	0	0	0	0	0
Nelson Marlborough	1	1	3	4	1	1	3	3	12	8
West Coast	1	1	0	0	0	0	6	6	8	6
Canterbury	26	36	33	44	19	28	43	40	60	42
South Canterbury	1	1	2	3	2	3	2	2	0	0
Otago	18	25	15	20	13	19	25	23	23	16
Southland	2	3	2	3	1	1	4	4	0	0
Total	72	100	74	100	67	100	108	100	143	100

[a]% - percentage of all isolates sent to ERL in that year

Most of the non pathogenic strains of *Yersinia* that were identified in isolates referred to ERL came from South Island DHBs (Table 14). Canterbury and Otago DHBs contributed 275 (59%) of the

Table 14. Number and percentage of *Yersinia* isolates typed by ERL and matched to an EpiSurv case that meet the current laboratory criteria for yersiniosis notification (*Y. enterocolitica or Y. pseudotuberculosis)* by DHB

DHB	Year														
	2002			2003			2004			2005			2006		
	Total isolates	Meet notification criteria		Total isolates	Meet notification criteria		Total isolates	Meet notification criteria		Total isolates	Meet notification criteria		Total isolates	Meet notification criteria	
	No.	No.	%	No.	No.	%	No.	No.	%	No.	No.	%	No.	No.	%
Northland	2	2	100							5	5	100	9	9	100
Waitemata	1	1	100	1	1	100	3	3	100	5	5	100	1	1	100
Auckland	3	3	100	2	2	100	5	5	100	8	8	100	1	1	100
Counties Manukau	5	5	100				2	2	100	2	2	100			
Waikato	2	2	100	6	6	100	6	5	83	2	2	100	13	13	100
Lakes	1						1	1	100				1	1	100
Bay of Plenty													3	3	100
Tairawhiti	2	2	100	2	2	100							2	2	100
Hawke's Bay	4	4	100	3	3	100	10	10	100				4	3	75
Taranaki	2	2	100	2	2	100	1	1	100				2	2	100
MidCentral				2	2	100	1	1	100	2	2	100	3	3	100
Whanganui	1	1	100	1	0	-							1	0	-
Capital and Coast															
Hutt Valley							2	2	100	1	1	100			
Wairarapa															
Nelson Marlborough	1	1	100	3	3	100	1	1	100	3	3	100	12	11	92
West Coast	1	1	100							6	6	100	8	5	63
Canterbury	26	23	88	33	33	100	19	12	63	43	32	74	60	38	63
South Canterbury	1	1	100	2	2	100	2	2	100	2	2	100			
Otago	18	18	100	15	13	87	13	9	69	25	14	56	23	17	74
Southland	2	2	100	2	2	100	1	0	-	4	2	50			
Total	72	68	94	74	71	96	67	54	83	108	84	78	143	109	76

464 isolates over the 5 year period but accounted for 68 (87%) of the 78 non pathogenic strains of *Yersinia* isolated.

Analysis of the combined yersiniosis notification and biotyping data for the five year period showed an increasing number of isolates being referred to ERL. However the percentage of these isolates that met the notification criteria and the percentage of the isolates that were found to be a pathogenic strain both decreased over the five year period. (Table 15).

Table 15. Summary of notifications and laboratory biotyping results, 2002 to 2006

Year	Notifications	Samples sent to ERL[a]		Meets notification criteria[b]		Pathogenic strain	
	No.	No	%	No.	%	No	%
2002	476	72	15.1	68	94.4	53	73.6
2003	439	74	16.9	71	95.9	41	55.4
2004	420	67	16.0	54	80.6	34	50.7
2005	407	108	26.5	84	77.8	48	44.4
2006	487	143	29.4	109	76.2	63	44.1

[a] This includes only samples that were matched to a disease notification
[b] Includes only *Y. enterocolitica* or *Y. pseudotuberculosis* isolates

Further analysis of this trend for DHBs that submitted more than five samples to ERL in the five year period revealed low percentages of pathogenic strains of *Yersinia* were being identified for some DHBs e.g. Canterbury (33.7%), West Coast (26.7%), Southland (22.2%) (Table 16).

An audit of the *Yersinia* biotyping information entered into EpiSurv against the biotyping data that was available in the ERL database showed that a large percentage of the potentially available *Yersinia* biotyping information had not been entered into EpiSurv (Table 17). The records with *Yersinia* strain information entered increased from 14% (11/78) of cases in 2002 to 26.2% (38/145) of cases in 2006.

Table 16. Summary of notifications and laboratory biotyping results by DHB for the period 2002 to 2006

DHB	Notifications	Samples sent to ERL [a]		Meets notification criteria [b]		Pathogenic strain	
	No.	No	%	No.	%	No	%
Northland	27	16	59.3	16	100.0	13	81.3
Waitemata	291	11	3.8	11	100.0	8	72.7
Auckland	274	19	6.9	19	100.0	16	84.2
Counties Manukau	164	9	5.5	9	100.0	9	100.0
Waikato	187	29	15.5	28	96.6	25	86.2
Lakes	57	3	5.3	2	66.7	1	33.3
Bay of Plenty	91	3	3.3	3	100.0	2	66.7
Tairawhiti	31	6	19.4	6	100.0	4	66.7
Hawke's Bay	75	21	28.0	20	95.2	17	81.0
Taranaki	27	7	25.9	7	100.0	4	57.1
MidCentral	59	8	13.6	8	100.0	4	50.0
Whanganui	29	3	10.3	1	33.3	1	33.3
Capital and Coast	215	0	0.0	0	-	0	-
Hutt Valley	64	3	4.7	3	100.0	3	100.0
Wairarapa	18	0	0.0	0	-	0	-
Nelson Marlborough	49	20	40.8	19	95.0	14	70.0
West Coast	72	15	20.8	12	80.0	4	26.7
Canterbury	322	181	56.2	138	76.2	61	33.7
South Canterbury	48	7	14.6	7	100.0	3	42.9
Otago	105	94	89.5	71	75.5	48	51.1
Southland	24	9	37.5	6	66.7	2	22.2
Total	2229	464	20.8	386	83.2	239	51.5

[a] Includes only samples that were matched to a disease notification
[b] Includes only *Y. enterocolitica* or *Y. pseudotuberculosis* isolates

Table 17. Number of yersiniosis notifications reported on EpiSurv, *Yersinia* isolates typed by the ERL and EpiSurv records updated with *Yersinia* strain by DHB and year, 2002 to 2006.

	Year														
	2002			2003			2004			2005			2006		
DHB	Epi[a]	ERL[b]	Updtd[c]	Epi	ERL	Updtd	Epi	ERL	Updtd	Epi	ERL	Updtd	Epi	ERL	Updtd
Northland	5	2		3			4			6	5		9	9	1(0)
Waitemata	70	1		78	1		61	3		41	5		41	1	
Auckland	67	3		58	2		57	5		47	8		45	1	
Counties Manukau	44	5		21			34	2		31	2		34		
Waikato	38	2		43	6		47	6		25	2		34	13	
Lakes	12	1		10			7	1		9			19	1	
Bay of Plenty	23			13			16			9			30	3	
Tairawhiti	3	2	2(1)	15	2	1(0)	5			4			4	2	
Hawke's Bay	16	4		14	3		20	10		15			10	4	
Taranaki	3	2		5	2		6	1		5			8	2	
MidCentral	14			10	2	1(0)	11	1		10	2		14	3	
Whanganui	4	1		4	1	1(1)	6			7			8	1	
Capital and Coast	36			32			36			46			65		
Hutt Valley	10			17			23	2		6	1		8		
Wairarapa	4			9			3			1			1		
Nelson Marlborough	4	1		8	3		4	1		15	3		18	12	2(2)
West Coast	20	1		13			14			16	6		9	8	
Canterbury	66	26	9(5)	58	33	15(12)	40	19	11(10)	69	43	23(17)	89	60	34(33)
South Canterbury	10	1		8	2		11	2	1(0)	9	2		10		
Otago	21	18		15	15		14	13		28	25	4(4)	27	23	1(1)
Southland	6	2		5	2		1	1		8	4		4		
Total	476	72	11(6)	439	74	18(13)	420	67	12(10)	407	108	27(21)	487	143	38(36)

[a] Epi = number of notified cases reported on EpiSurv
[b] ERL = number of EpiSurv cases that could be matched to a *Yersinia* isolate typed by ERL
[c] Updtd = number of EpiSurv cases that have been updated with the strain (and biotype) of *Yersinia* as determined by ERL.

3.10 Hospitalisations

Two sources of hospitalisation data, EpiSurv notifications and NZHIS morbidity data were used to analyse trends in yersiniosis over the past five years.

The percentage of EpiSurv cases that were as hospitalised on EpiSurv increased from 6.3% in 2002 to 11.5% in 2006 (Table 18).

Table 18. Number and percentage of notified yersiniosis cases admitted to a hospital reported on EpiSurv

Hospitalised	Year									
	2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	30	6.3	30	6.8	25	6.0	41	10.1	56	11.5
No	305	64.1	234	53.3	215	51.2	212	52.1	293	60.2
Unknown	141	29.6	175	39.9	180	42.9	154	37.8	138	28.3
Total	476	100.0	439	100.0	420	100.0	407	100.0	487	100.0

The number of cases reported to NZHIS with ICD-10 code A046 (yersiniosis) for both primary and other relevant diagnosis increased from 26 in 2002 to 50 in 2006 (Table 19).

Table 19. Number of hospitalised yersiniosis cases (ICD10 A046) by diagnosis status, as reported by NZHIS

Type of diagnostic code	Year				
	2002	2003	2004	2005	2006
Principal diagnosis	14	7	17	12	27
Other relevant diagnosis	12	10	13	15	23
Total	26	17	30	27	50

The NZHIS hospitalisation records for yersiniosis were matched to the EpiSurv and ESRLab records as described in the methods section. Table 20 shows the number of records that were matched from these sources.

Table 20. Number and percentage of hospitalised yersiniosis reported by NZHIS that could be matched to cases on EpiSurv and isolates typed by ERL

NZHIS records	Year									
	2002		2003		2004		2005		2006	
	No.	%	No.	%	No.	%	No.	%	No.	%
Matched to EpiSurv	17	65	17	100	20	67	19	70	38	76
Matched to ERL	6	23	10	59	15	50	12	44	26	52
NZHIS Total	26	-	17	-	30	-	27	-	50	-

The ERL *Yersinia* strain and biotype data that was derived for the NZHIS hospitalised cases is shown in Table 21. The numbers were very small but a trend of an increasing number of cases of *Y. enterocolitica* 1A and *Y. frederiksenii* can be seen in recent years.

Table 21. *Yersinia* strain and biotype (from ERL) for NZHIS reported yersiniosis cases by diagnostic status

Yersinia strain and biotype	Year									
	2002		2003		2004		2005		2006	
	Principal diagnosis	Other relevant diagnosis	Principal diagnosis	Other relevant diagnosis	Principal diagnosis	Other relevant diagnosis	Principal diagnosis	Other relevant diagnosis	Principal diagnosis	Other relevant diagnosis
enterocolitica 1A	1	1		6	4	4	2	7	6	7
enterocolitica 2	1				1	1	1		1	
enterocolitica 3		1								
enterocolitica 4	1		3	1	2	1			2	1
frederiksenii						1		2	3	4
intermedia		1								1
rohdei					1					
unknown										1
Total	3	3	3	7	8	7	3	9	12	14

Table 22 shows that with the exception of the 2004 reporting year more hospitalisations were reported on EpiSurv than the total number of cases hospitalised with yersiniosis as a primary or other level diagnostic code reported through NZHIS. Approximately half of the EpiSurv notifications matched an NZHIS yersiniosis record with yersiniosis as a primary diagnosis.

Over the past five years the number of hospitalisations reported in EpiSurv for each DHB was generally less than 5 with the exception of the Canterbury DHB which in 2006 accounted for 32 of the 56 hospitalisations (57%) reported for all of New Zealand.

Table 22. Number of hospitalised yersiniosis cases reported on EpiSurv compared to NZHIS reported cases.

DHB	Year									
	2002		2003		2004		2005		2006	
	Epi[a]	HIS(1º)[b]	Epi	HIS (1º)	Epi	HIS (1º)	Epi	HIS (1º)	Epi	HIS (1º)
Northland						2 (1)		1 (0)	3	4 (4)
Waitemata	1	3 (1)	1		2	3 (2)			1	2 (1)
Auckland	1	3 (2)	1	3 (3)	1	2 (1)	1	2 (2)	2	3 (3)
Counties Manukau	2	4 (2)	2	2 (1)		4 (1)	1	3 (1)		5 (4)
Waikato			6	2 (2)	3	1 (0)	5		1	1 (0)
Lakes		1 (1)			1				2	1 (1)
Bay of Plenty	2	3 (3)	2		1	1 (1)	2	1 (1)	3	4 (1)
Tairawhiti	3		1	1 (1)	1	1 (0)				
Hawke's Bay			2		2	2 (2)	1			1 (0)
Taranaki		1 (0)						3 (1)		
MidCentral	1	2 (1)	2	1 (0)	1	1 (1)	1	1 (1)	1	2 (1)
Whanganui						1 (1)	2	1 (1)		
Capital and Coast	5				2		7	4 (2)	3	2 (0)
Hutt Valley					1	1 (0)			1	2 (2)
Wairarapa							1			
Nelson Marlborough		1 (1)	1		1	1 (1)			3	2 (0)
West Coast	4	3 (2)	3	1 (0)		1 (1)	1	1 (0)	1	3 (0)
Canterbury	8	5 (1)	5	5 (0)	6	5 (1)	18	9 (3)	32	14 (8)
South Canterbury			1	1 (0)		1 (1)		1 (0)		
Otago	1		1	1 (0)	2	2 (2)	1		3	4 (2)
Southland	2		2		1	1 (0)				
Total	30	26 (14)	30	17 (7)	25	30 (16)	41	27 (12)	56	50 (27)

[a]Epi - number of hospitalised yersiniosis cases reported on EpiSurv
[b]HIS (1º) - total number of hospitalised yersiniosis cases (yersiniosis given as the principal diagnosis) reported by the NZHIS

3.11 *Yersinia* testing methodologies used by clinical laboratories in New Zealand

The Acute Gastrointestinal Illness (AGI) Study: Laboratory Survey of 46 community, hospital and public health laboratories across New Zealand, undertaken in mid-2006, investigated the criteria and laboratory methodologies used to test for various enteric pathogens including *Yersinia.* [6]

This survey, which had a 76% response rate, found that it was generally standard practice to include testing for *Yersinia* when undertaking an "enteric screen" on faecal specimens (32/34 respondents).

Approximately half of laboratories reported that they would refer on positive *Yersinia* isolates to the Enteric Reference Laboratory.

3.12 Medical Officers of Health Survey

Responses to the survey were received from every Public Health office with a Medical Officer of Health..

3.12.1 Source of notification

All PHSs reported receiving yersiniosis notifications from GPs. Fifteen reported receiving notifications from hospital clinicians and eight received notifications direct from laboratories. For those receiving direct laboratory notifications five (Wanganui, Canterbury, Tairawhiti, Hawke's Bay and Blenheim) had been receiving results for more than five years and three (MidCentral, Northland and Taranaki) started receiving results in the last five years.

Four PHSs reported having carried out an audit of laboratory data against notification data to assess whether all cases are notified. The proportion of all yersiniosis cases notified varied from 70% in Auckland to 90% in Tauranga and 100% in Nelson and Otago.

All PHSs except Northland and Canterbury reported entering all yersiniosis notifications onto EpiSurv. Northland reported entering only those cases that met the case definition. .A respondent from Canterbury PHS reported that "as per the Public Health Surveillance Manual only *Y. enterocolitica* and *Y. pseudotuberculosis* are entered as cases. However if we do not have the type of *Yersinia* at the time of notification they are all entered. When the typing comes through this is updated on EpiSurv and made "not a case" if they are any type other than those mentioned above."

3.12.2 Investigation of cases

All PHSs except Auckland investigate all of the yersiniosis cases that are notified. Auckland will investigate a geographic cluster of cases and when two or more cases are potentially linked to a common source.

Investigation of yersiniosis cases is undertaken by Health Protection Officers (or PHS Designated Officers) in 12 of the 17 PHSs. Environmental Health Officers are involved in the investigation of yersiniosis notification in five PHSs and EpiSurv Co-ordinators were responsible for investigation in two PHSs.

Nine PHSs use a specific questionnaire and seven of these have developed their own questionnaire.

Fourteen PHSs make a phone call to the case as part of the investigation. Six PHSs post out questionnaires with return rates ranging from 57 to 95%. Two PHSs administer the questionnaire in person.

Ten PHSs confirmed that the notified cases had met the yersiniosis clinical description with the case or notifying practitioner. The policy for two PHSs was to

confirm that the case met the clinical criteria during the case investigation and the remaining six PHSs reported having no policy.

3.12.3 Local trends in yersiniosis notifications

Twelve PHSs had not noticed any trends in yersiniosis notifications over the past 1-2 years. Four PHSs (Tauranga, Capital and Coast, West Coast and Canterbury) had noticed recent increases and one (Auckland) had seen occasional clusters.

3.12.4 *Yersinia* strain and biotyping information

Only one PHS (MidCentral) reported always receiving species information. Ten PHSs reported sometimes receiving information on the species of Yersinia and four PHSs (Auckland, Hamilton, Nelson and Hawke's Bay) reported never receiving species information. Two PHSs did not know or did not answer the question.

Of the PHSs receiving information on the species of *Yersinia* (10 PHSs), this information came from the local laboratory (6/10 Tauranga, Tairawhiti, MidCentral, Wanganui, Canterbury, Otago), the GP (4/10 Tauranga, West Coast, Canterbury, South Canterbury) and ERL (4/10, Tairawhiti, Capital and Coast, West Coast, Canterbury).

For four PHSs (Tauranga, West Coast, Canterbury and Blenheim) it was their policy to enter all *Yersinia* species results received onto EpiSurv. The policy for the remainder varied. Some only entered the "unusual species i.e. the non *Y. enterocolitica* species".

3.12.5 De-notification of yersiniosis cases

De-notification of a yersiniosis case (i.e. changing the status in EpiSurv to "not a case") was never considered by eight PHSs.

The remaining considered de-notification if subsequently advised by the laboratory or GP that the case did not meet the clinical symptoms or a negative *Yersinia* laboratory result was reported (6 PHSs) or the case did not meet the case definition as per the *Communicable Disease Control* manual (3).

3.12.6 Other Comments

One respondent asked for "more information as to what the pathogenic and non pathogenic strains are as apparently Y. enterocolitica biotype 1A is also non pathogenic which would make up the bulk of our notifications. The typing is received from the hospital lab after they receive it from the ESR ERL."

4 DISCUSSION

The number of yersiniosis notifications reported increased from 2002 to 2006. Most of this increase appeared to be from South Island DHBs and particularly Canterbury DHB. Despite the low population of the West Coast DHB it consistently reported higher population rates of yersiniosis notifications than other DHBs and sufficient numbers were reported for stability of rates to be an unlikely explanation for the higher rates.

Only a small percentage of all notifications were typed by ERL. The practice of referring isolates for biotyping varies throughout the country with clinical laboratories in some DHBs (e.g. Capital and Coast) referring no isolates to ERL in the five year period and laboratories in other DHBs (e.g. Canterbury) referring a high percentage of isolates.
The percentage of notified cases with isolates referred to ERL increased in the last two years with most of this increase found to be due to non pathogenic subtypes e.g. *Y. frederiksenii*.

The case definition for yersiniosis includes both isolation of *Y. enterocolitica* or *Y. pseudotuberculosis* from blood or faeces and detection of circulating antigen by ELISA or agglutination test. In the AGI study no laboratories were found to be routinely carrying out the latter test and this was never noted in EpiSurv as the test undertaken for the notification in time period analysed.

Given that isolation is the primary means of identification for *Yersinia* and only ERL carries out strain and biotyping of *Yersinia* to determine whether the cases are *Y. enterocolitica* or *Y. pseudotuberculosis.* For 70% of notifications it was not possible to say whether the case met the yersiniosis case definition. Further study of a DHB with high numbers of cases typed (e.g. Canterbury) may further inform this question but it is difficult to generalise this information to other DHBs where no typing had been undertaken.

There was a large amount of variation in the percentage of pathogenic strains of *Yersinia* being isolated in the samples submitted by clinical laboratories from different DHBs. Of most concern is the increasing numbers of samples being submitted to ERL and the increasing percentage that are either not pathogenic or *Yersinia enterocolitica* biotype 1A. It would be useful to examine in greater detail the methods being used by different laboratories to isolate *Yersinia*. The Acute Gastrointestinal Illness (AGI) Study: Laboratory Survey provided insufficient detail to address this issue.

Although some PHSs indicated they would de-notify yersiniosis cases where the case definition was not met, this did not appear to happen very often.

Over the past three years ESR has been matching many of the ERL isolates to EpiSurv records. This information has been used to identify non notified cases of disease where ESR carries out typing of all isolates (e.g. salmonellosis and meningococcal disease) and the PHS is provided with information to follow up the disease cases not notified. With diseases such as salmonellosis, laboratories refer almost all samples to ERL for typing. ESR matches the ESRLab data with EpiSurv

notifications and requests PHSs to de-notify cases where the laboratory criteria have not been met. This is more difficult for yersiniosis given the small percentage of isolates referred to ERL and therefore the many yersiniosis notifications for which the strain is unknown.

When the *Yersinia* isolates have been biotyped by ERL, the results are sent back to the requesting clinical laboratory but many of the results do not appear to have been received by the PHSs and updated on EpiSurv. Many PHSs in the MOsH survey stated that if they received laboratory test results these would be added to the appropriate notification records on EpiSurv. The new requirement (implemented from 18 December 2007) under the Health Act for laboratories to directly report notifiable diseases to Medical Officers of Health will allow ERL to send biotyping data for yersiniosis cases directly to PHSs.

In addition to informing PHSs of non notified cases of disease, since the implementation of the web based EpiSurv in April 2007 the ESR held organism typing information for selected diseases (e.g.*Salmonella, Shigella*) is now updated by ESR directly into EpiSurv. The organism typing information for *Yersinia* in EpiSurv could be added to this process.

Biotyping data was rarely used by PHS staff even in PHSs where typing data was available. There was uncertainty about how to use the biotyping data to inform investigations and in particular which strains and biotypes of *Yersinia* are pathogenic or non pathogenic.
Given the issue of pathogenicity of different strains of *Yersinia* the biotyping data is an essential tool for the investigation of clusters of yersiniosis cases. Monitoring of the biotyping data at a national and regional level would ensure that clusters are identified. Better use of the biotyping data would also assist PHSs to prioritise the investigation of yersiniosis cases and look for common sources amongst the same pathogenic biotypes.

The number of records in some of the matched datasets (e.g. hospitalisations) was very small and therefore suffered from the usual issues of instability with small numbers. However there was a clear recent increasing trend in the notifications for hospitalised cases from the Canterbury DHB area that would benefit from further investigation.
The larger number of reported hospitalisations among EpiSurv yersiniosis cases than reported by NZHIS suggests that a clinical diagnosis of yersiniosis may not always be present. Further investigation by the PHS staff is needed to understand this situation better.

5 RECOMMENDATIONS

It is recommended that

1) NZFSA communicates the findings of this report to MoH and other interested parties e.g. PHSs to consider the development of the following enhancements for *Yersinia* surveillance

a) Development of guidelines for the use of *Yersinia* biotyping data in yersiniosis investigations by PHS staff

b) Development of a consistent policy for clinical laboratories to refer *Yersinia* isolates to ESR for *Yersinia* biotyping.

c) Development of a policy for the recording and updating of the case status (e.g. confirmed, not a case) in EpiSurv on receipt of *Yersinia* laboratory test results

d) Development of aberration reporting to detect time and space clusters of *Y. enterocolitica* biotypes.

2) ESR consider adding yersiniosis to the list of disease records that are matched between ESRLab and EpiSurv and update strain and biotyping data for yersiniosis notifications directly into EpiSurv.

3) Canterbury DHB further investigates the recent increase in the Canterbury DHB and the high rates in the South Canterbury and West Coast DHBs using available biotyping data.

4) ESR reviews the methods for typing of *Yersinia* isolates and considers options for improving the turnaround time for biotyping of results.

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APPENDIX A – MEDICAL OFFICERS OF HEALTH YERSINIOSIS SURVEY RESPONDENTS

Public Health Office	Respondent
Northland	Jonathan Jarman
Auckland, Waitemata, Counties Manukau	Craig Thornley
Waikato	Maureen O'Halloran
Bay of Plenty	Lynnette Borissenko
Tairawhiti	Alan Hall
Taranaki	Viv O'Leary
Hawke's Bay	Paul Buckley
MidCentral	Peter Wood
Wanganui	Margaret Tunbridge
Capital & Coast, Hutt Valley	Quentin Ruscoe
Nelson	Leanne Punt
Marlborough	Kirsten Todd
Canterbury	Debbie Smith
West Coast	Cheryl Brunton
South Canterbury	Daniel Williams
Otago	Kaylene Newell
Southland	Chris McCall

APPENDIX B – YERSINIOSIS QUESTIONNAIRE

Public Health Service Yersiniosis Notifications Questionnaire

Yersiniosis is the third commonest potential food-borne disease notified in New Zealand. New Zealand's notification rate for yersiniosis (11.8 cases per 100,000 in 2006) is high compared to many other countries.

NZFSA has asked ESR to review the yersiniosis data for the past five years. A review of yersiniosis notifications reported on EpiSurv, laboratory data held by ESR's Enteric Reference Laboratory and yersiniosis hospitalisation data from NZHIS is currently being carried out.

To assist in validating and interpreting the EpiSurv data we would appreciate if **one person from each Public Health Service,** or Public Health Office if each office has different reporting procedures, completes this questionnaire and return to Jonathan Williman jonathan.williman@esr.cri.nz at ESR by the 5pm, Wednesday 14th November 2007.

Public Health Service / Office: _____

Name of person completing questionnaire: _____

Please check appropriate answer. Text boxes will expand as you type.

1. In your PHS where do yersiniosis notifications come from? *(tick all that apply)*

☐ GP

☐ Hospital clinician

☐ Directly from local laboratory (e.g. hospital or community laboratory)

If yes to direct laboratory notification please answer these questions

a) When did direct laboratory notification start (approximately)? _____

b) Which isolations of *Yersinia* are you notified of?

☐ All positive isolations

☐ Only positive isolations where case is known to have clinical illness

☐ Other _____

☐ Other source (*please specify*) _____

2. Has your PHS ever audited laboratory data against notification data to assess whether all cases (i.e. positive laboratory result and clinical illness present) are notified?

☐ Yes ☐ No ☐ Don't know

If yes, what proportion of all yersiniosis cases are notified? _____%

3. Are all notifications of yersiniosis that your PHS receives entered onto EpiSurv?

☐ Yes

☐ No *please give details of types of notifications not entered* _____

4. Which yersiniosis cases do you investigate[1]? ☐ All ☐ Some ☐ None ☐ Don't know

If you answered None *or* Don't know ***please go to Question 5***

a) Please outline the criteria used by your PHS for deciding which cases will be investigated

_____

b) What percentage of cases do you investigate? _____

c) Who undertakes the yersiniosis investigations?

☐ HPOs ☐ EHOs ☐ Other *please specify* _____

d) Is a specific yersiniosis questionnaire used?

☐ Yes ☐ No ☐ Don't know

If yes, did your PHS develop this or was it acquired from somewhere else?

☐ Developed by PHS ☐ Acquired from _____

e) How is the questionnaire administered?

☐ Phone call to case

☐ Posted out

*If **posted out** please answer these questions*

i) Is the postal questionnaire followed up if not returned

☐ Yes ☐ No ☐ Don't know

ii) What percentage of postal questionnaires are returned? _____%

☐ Other *please specify* _____

[1] Contact with case through questionnaire, phone call or visit

f) What is it the policy at your PHS for confirming that notified cases meet the yersiniosis clinical description?

(e.g. no policy, ask notifying practitioner, confirm with case)

_____

5. Have you noticed any particular local trends in yersiniosis notifications over the last 1-2 years (e.g. increase or decrease in incidence, demographics of cases, risk factors, sources of notification)?

☐ Yes *please give details* _____
☐ No

6. Does your PHS receive information regarding the particular species of *Yersinia*?

☐ Yes, always ☐ Yes, sometimes ☐ No, never ☐ Don't know

If yes

a) Where does the information regarding the *Yersinia* species come from?

☐ GP
☐ Local laboratory
☐ ESR Enteric Reference Laboratory
☐ ESR Population and Environmental Health Group

b) Is it the policy at your PHS to enter all *Yersinia* species results received onto EpiSurv (i.e. into the Additional Laboratory Results field)?

☐ Yes ☐ No ☐ Don't know

7. Under what circumstances would you consider de-notification of a yersiniosis case (i.e. changing the status in EpiSurv to "not a case")?

_____

8. Do you have any other comments regarding yersiniosis notifications?

_____