Enhanced Surveillance of Potentially Foodborne Enteric Disease within a New Zealand Public Health Service

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Disclaimer:

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Most of all I look forward (with the end of this project) to becoming a less distracted Mum and a more enlightened Health Protection Officer.

Glossary

ARPH	Auckland Regional Public Health
CDC	Centres for Disease Control and Prevention
CMP	*Campylobacter* in the Manawatu project
Common enteric diseases	Salmonellosis, Yersiniosis, Cryptosporidiosis, Giardiasis, Campylobacteriosis
CRF	EpiSurv Case Report Form
DHB	District Health Boards
EARS	ESR's Early Aberration Reporting System
ECC	Early Child Care Centre
EHO	Environmental Health Officer
EpiSurv	New Zealand's Notifiable Disease Database
ESR	Institute of Environmental Science and Research Limited
FBI	Foodborne Illness
FDA	United States Food and Drug Administration
GP	General Medical Practitioner
MCPHS	MidCentral Public Health Service
MoH	Ministry of Health
MOoH	Medical Officer of Health
NHI	National Health Index number
NZDep 06	New Zealand Deprivation Index 2006
NZFSA	New Zealand Food Safety Authority
PHS	Public Health Service
RPH	Regional Public Health (Greater Wellington Region)
TLA	Territorial Local Authority
TO	Technical Officer
USDA	United States Department of Agriculture

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Abstract

An enhanced notified enteric disease surveillance trial began on 1 July 2007 and continued until 30 June 2008. The aim of the trial was to measure the quality, timeliness and completeness of data collected and submitted by a regional Public Health Service (PHS) to the Institute of Environmental Science and Research Limited (ESR), via the national disease database (EpiSurv) for notified cases of enteric diseases. The trial evaluated two different methods of data collection: postal questionnaires and telephone interviews.

Telephone interview techniques were used to improve the contact rate, timeliness and completeness of data gathered from all notified cases of campylobacteriosis in the Manawatu, Horowhenua and Tararua regions. The target set for the project was to achieve a 95% contact rate with 90% full completion of all EpiSurv data fields. For all notified cases of campylobacteriosis a 97% contact rate was achieved in a time frame of between zero to 20 days (three day median) and completeness of all the EpiSurv case report fields ranged between 96 – 100% in the final data. Prior to the commencement of the study, between 1 July 2004 to 30 June 2005, MidCentral PHS (MCPHS) made contact with around 58% of all notified cases of campylobacteriosis and 77% of all other notified enteric disease cases[1].

A short pre-screen mail questionnaire, with reply-paid envelope, was sent to all notified cases of cryptosporidiosis, giardiasis, salmonellosis and yersiniosis in the MCPHS regions. EpiSurv case report fields were completed using information supplied in the returned questionnaires. Return rate, timeliness, and completeness were compared with the telephone interview group. Fifty three percent of cases we attempted to contact via mail questionnaire responded within two to 63 days (six day median) and completeness of all the EpiSurv case report fields ranged between 81 – 100%.

In addition, we monitored the newly introduced ESR Early Aberration Reporting System (EARS) flags for increased levels of disease compared to historical disease rates, and assessed its usefulness as a tool to identify potential outbreaks in the

[1] Contact rates for the 2005 to 2006 period were not comparable as MCPHS had enhanced it's data collection methods for campylobacteriosis in June 2006 to support the *Campylobacter* in the Manawatu project

region. While no outbreaks that had not already been identified by PHS staff were found by monitoring the EARS system, EARS has become an important tool in the MCPHS for comparing our rates of disease with bordering PHSs. EARS also provided a good quick reference tool for media enquiries and the graphs produced in EARS have been well utilised as visual aids for training and seminars presented during the trial period.

The results of the surveillance trial initiatives were compared to the rest of New Zealand (NZ) over the same time frame and with a comparable, medium-sized, PHS. While the results of the telephone interviews from the MCPHS trial were close to the comparable PHS, they were significantly higher than for the rest of NZ. The postal questionnaires achieved a lower contact rate than the comparable PHS but similar to the rest of NZ. However, the quality of data gathered in the returned MCPHS postal questionnaire was significantly higher in most fields. Additional analysis was undertaken which indicated that those cases living in higher deprivation and rural areas were less likely to respond to a postal questionnaire. An over-representation of common enteric disease notifications from rural areas in the MCPHS was also highlighted by our research.

This trial has shown the effectiveness of utilising telephone interviews and telemarketing techniques for gathering timely and complete data for human enteric disease surveillance within the MCPHS. It has also demonstrated that a short pre-screen questionnaire can be effective in collecting good quality data needed to complete the standard EpiSurv case report form.

1. Introduction and literature review

Disease surveillance worldwide is reliant on good data collection. For those on the front line of public health the most important use of surveillance information is to implement preventative measures in a timely manner (Lake, Whyte, & Kliem, 2005). This review of the literature introduces issues associated with common enteric disease surveillance in NZ and considers the diseases included in national surveillance. It also attempts to outline what is known about the burden of these diseases and the ever developing technology and changing legislation which supports disease surveillance in NZ.

1.1 *Public health surveillance*

The Oxford English Dictionary definition of the word "surveillance" is close observation, especially of a suspected spy or criminal (Oxford University Press, 2006). Another definition refers to the Napoleonic wars and the constant watching of subversives (Webb, Bain, & Pirozzo, 2005). Surveillance has a long history in public health and disease surveillance is fundamental to public health decision making and action. Strengthening disease surveillance is a major theme worldwide for identifying and combating emergence of infection. Public health surveillance can be defined as:

> "The ongoing systematic collection, collation, analysis and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link in the surveillance chain is the application of these data to prevention and control" (Thacker & Berkelman, 1988).

Another commonly used definition for surveillance is "information for action" (Goodman, Remington, & Howard, 1992). Surveillance is important for management of disease on local, national, and international level.

Surveillance has been used as a public health tool (at some level) for centuries. Some of the earliest established systems for communicable disease were identified in Europe in the 1700's (Anonymous, 2005). One of the most commonly repeated historical examples of epidemiology demonstrates the power of combining surveillance data with investigation and preventative measures to stop an outbreak of

disease. On the 8th of September 1854 John Snow was instrumental in using epidemiological evidence to convince the municipal authorities to remove a pump handle on the Broad Street pump during a cholera outbreak in the East End of London (Paneth, 2004). This is one of the earliest recorded examples of using science-based "information for action" in response to a disease outbreak. While the science of epidemiology has developed significantly since Snow's time, the aims for, and issues relating to, gathering the basic data required for this science, via statutory notifications, remain as relevant today as they were in 1896:

> "Notification is but a means to an end. If the early and authentic information imparted to health officers by notification is simply filed away in the office, the course of an epidemic will obviously be undisturbed; but when such notifications are followed by conscientious investigation, when the water supply, milk supply, the school attendance, and a number of other factors in connection with a series of cases of infectious diseases are examined, it is evident that the resulting chain of evidence may be, as in many instances it has been, so strong as to lead to immediate preventative measures of a most successful nature, and in other instances to force the most radical reforms upon even unwilling sanitary authorities" (Newsholme, 1896).

Disease surveillance requires current information to enable relevant agencies to implement preventative measures, or to identify trends for policy and evaluation of preventative measures (Tauxe, 2002). Disease surveillance systems can be classified in two ways either active or passive and these methods often co-exist effectively within different agencies undertaking surveillance.

1.1.1 Passive surveillance

Passive disease surveillance systems are reliant on medical practitioners or laboratories (laboratory-based surveillance) reporting cases of diseases under surveillance to a nominated agency or person. The most commonly used passive systems are those for mandated disease notifications based on legislated lists of reportable diseases. Disease notifications take the form of basic information relating to the identified case. This includes the name of both the case and the medical practitioner who requested the test and date of birth. Some notifications will include a current contact phone number and address. Often cases are contacted by public health officials in an attempt to find a source or a link between apparently sporadic cases. This information is then recorded within the passive surveillance system.

The main purpose of passive systems is to monitor trends in disease and risk factors for disease prevention and control. When passive systems gather accurate and timely data they can produce valuable surveillance information. However, if data are incomplete, and different information gathering methods are used between reporting sites, the resulting data can be subject to selection bias and may be of little value (Losos, 1996). Passive disease surveillance systems are less costly as they do not require active participation in finding the disease in the community. However, passive systems are likely to significantly underestimate the burden of disease in the community (Centers for Disease Control and Prevention, 2007; Lake, Adlam, & Perera, 2007; Wheeler, et al., 1999). The data gathered through passive surveillance often forms the basis for more active surveillance within public health. The analysis of passive surveillance data at local, national and international levels often leads to additional activity or further research (M'ikanatha, Lynfield, Van Beneden, & de Valk, 2007).

1.1.2 Active surveillance

Active surveillance relates to systems where active attempts are made to find the burden of disease in the community by targeting sampling sites. Mostly the aim is to identity the true level of cases in the community and this is often done via survey for research purposes - usually over a short time period.

Centres for Disease Control and Prevention (CDC) has estimated that in the USA less than 5% of bacterial foodborne illness (FBI) is notified using passive surveillance systems i.e. direct laboratory notification. In an attempt to capture a better understanding of the other estimated 95% of FBI a more active surveillance system, which combines both active and passive elements, has been developed. CDC, the United States Department of Agriculture (USDA) and the United States Food and Drug Association (FDA) jointly operates FoodNet. It is the core component of their emerging infections programme. While there are passive elements in the system overall it is described as an active surveillance system. FoodNet was first established in 1995 and is now based in ten locations across the USA (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York , Oregon and Tennessee) (Centers for Disease Control and Prevention, 2008b).

FoodNet consists of active surveillance for foodborne diseases and related epidemiologic studies designed to help public health officials better understand the epidemiology of foodborne diseases in the United States. FoodNet provides

infrastructure for surveillance of new and emerging diseases identified within the population and is able to support outbreak investigations.

Overall the goal of the system is to identify and monitor the true burden of disease within populations at specific sites across the USA (Angulo, et al., 1998).

1.1.3 Sentinel surveillance

Another example of active surveillance is the use of selected sentinel surveillance sites. The World Health Organization (WHO) define sentinel surveillance as "surveillance conducted through the monitoring of key health events through sentinel sites, events, or providers" (World Health Organization, 2002). These sites may incorporate medical centres, hospitals or public health services that work with at risk populations. In NZ sentinel medical centres are commonly used for surveillance of influenza. The NZ sites are medical centres that voluntarily participate - in that they receive no additional funding or resource for enhancing surveillance. At these sites data are gathered during the influenza season from patients who fit the case description for influenza. In addition respiratory samples are gathered from three patients each week at each site. Figure 1 shows how the influenza data are used to monitor trends in the measured rates of the disease (Lopez, 2008).

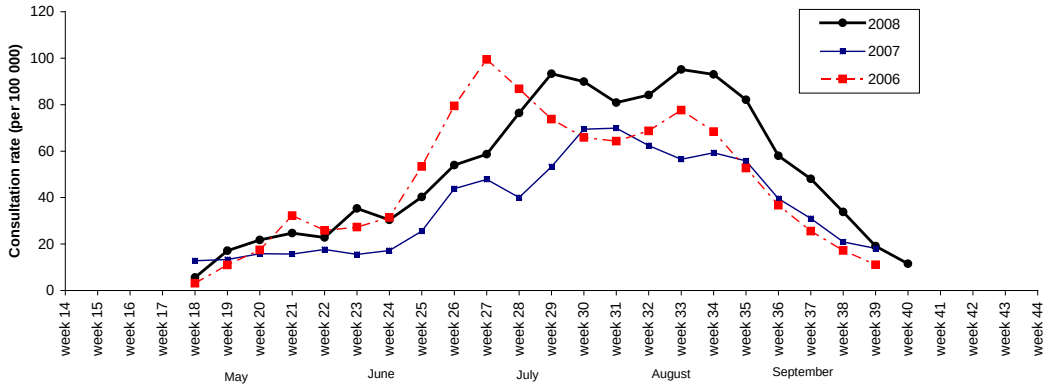

Figure 1: Weekly consultation rates for influenza–like illness in New Zealand in 2006, 2007 and 2008

Sentinel sites are often used to enhance surveillance by gathering more or better quality information than that which is routinely available (Ramsay, Balogun, & Quigley, 2007). This is especially useful when there are limited resources for surveillance (i.e. within the local public health agency) or poor follow up of routine

reports is undertaken. Enhanced surveillance can be targeted at a specific group based on geography, demographic, behaviours or disease (M'ikanatha, et al., 2007 ; Ramsay, et al., 2007).

In the USA it is common for sentinel sites to receive additional funding to enhance the quality of the data gathered from within the selected site. In 2004 the National Centre for Immunisation and Respiratory Diseases established a group of Immunisation Information sentinel sites (representing geographical regions) to gather data on immunisation rates in children less than 19 years old. Each site receives additional funding to achieve high standards of data collection and to regularly undertake analysis and reporting of surveillance data (Centers for Disease Control and Prevention, 2008d).

A study undertaken between 2005 and 2008 in the Manawatu, Tararua and Horowhenua regions of New Zealand investigated source attribution of campylobacteriosis in the population. The study involved MCPHS receiving additional funding to join a sentinel, integrated, food chain surveillance site. During the study MCPHS enhanced surveillance methods for follow up of notified cases of campylobacteriosis (received through the passive NZ notifiable disease surveillance system). The anonymised data gathered from each case was linked to results of subtyping of specimens received from each case. The results of the subtyping were then compared with the subtypes of non-human isolates which had been actively gathered from the local environment (during the same time period). Samples were gathered from animal faecal matter, retail meats, and recreational water in an aim to link the human cases to a source using multilocus sequence typing (MLST) (Mullner, et al., 2008).

1.1.4 Molecular subtyping

There are two main methods used for molecular subtyping. Multilocus sequence typing (MLST) has become a useful tool for human and animal disease surveillance in the search for an affordable, prompt, accurate and timely DNA sequencing method. MLST has been successfully utilised in NZ for source attribution of *Campylobacter* (French, 2008a). One of the key components of the study was the timely gathering of high quality surveillance data to inform epidemiological interpretation of the MLST results (French, 2008a).

The second method that is commonly used is pulse field gel electrophoresis (PFGE). PFGE is the underlying method used in PulseNet, which is coordinated by the CDC and has affiliated sites around the world, including in the USA, Latin America, the European Union, the Middle East, the Asia – Pacific region (including PulseNet Aotearoa) and Canada. The aim is to create an international molecular subtyping network using PFGE for linking foodborne disease by strain typing isolates from human disease cases and potential sources. PFGE has been effectively used in many nationwide outbreaks in the USA (Centers for Disease Control and Prevention, 2008c, 2009; Holtbya, et al., 2006; Jay, et al., 2007).

Salmonella isolates from human cases have been serotyped since the 1960's in the USA and this has become routine in NZ , allowing regular identification of clusters of disease at a national level. The usefulness of this tool was recently highlighted when an increased number of cases of *S. typhimurium* phage type 42 were identified across NZ. Through the use of a case control study these cases were linked to contaminated flour from which *Salmonella typhimurium* phage type 42 was isolated (New Zealand Food Safety Authority, 2008).

Molecular subtyping is now used regularly for the identification of both cases and sources of infection associated with outbreaks (Gilpin, 2007). The science of molecular epidemiology is still in its infancy in moving from research laboratories to the front line of public health, allowing better understanding of the aetiology of pathogens and informing outbreak investigations (Besser, 2007).

> "Molecular testing is used in surveillance to isolate a signal, such as a trend or cluster of disease from back ground noise" (Besser, 2007)

There have been many successful investigations of food and waterborne outbreaks that have used subtyping (across national and international boundaries) to link cases to potential sources (Centers for Disease Control and Prevention, 2009; Jay, et al., 2007). However, the use of data gathered through passive surveillance systems and case interviews remains the foundation of these investigations, especially in identifying where to start sampling when trying to identify a potential source.

The evidence gathered through molecular subtyping, during successful food and waterborne outbreak investigations, can be used to implement world wide recalls of contaminated foods (Centers for Disease Control and Prevention, 2009; Holtbya, et

al., 2006; Jay, et al., 2007; New Zealand Food Safety Authority, 2008). Molecular typing is likely to become more common as the typing reference libraries grow and the surveillance systems, at local national and international levels, develop to incorporate both current and emerging technologies. It will greatly enhance traditional surveillance methods and the ability within public health agencies to link sporadic cases and identify sources of disease during outbreaks.

1.1.5 Data quality

Surveillance quality is reliant on the ability of the data contained within the system to be accurate and complete for analysis and research purposes. It is vital that data are truly representative. Regardless of the complexity of a database, if the initial data entered into the system are not gathered in a uniform way and are timely and complete, little useful information will be gleaned from it to assist in public health initiatives (Fendt, 2004).

> "Data sources are not valuable unless they are complete, timely, and cover the desired population" (Happel Lewis & Wojcik, 2007).

One of the issues highlighted in much of the literature relating to disease surveillance is achieving high quality data in an environment of limited resources, competing local issues and changing technologies (M'ikanatha, et al., 2007 ; Prattley, 2009; Wagner, Moore, & Aryel, 2006).

> "Today, the need continues and has become even more important as government agencies and other regulatory bodies rely more and more on the evaluation of electronically collected, stored, transmitted, and archived data for critical data-based decision making" (Fendt, 2004, p. 1)

When the gathering of data is compromised, it is difficult to develop evidence based public health policies and establish links between health determinants and disease outcomes. Epidemiological research is a key area which is often reliant on surveillance data collected at a local level.

When the validity of data used for research is challenged and cannot be defended political consequences can arise which compromise preventative measures at the local level e.g. funding for improvement of drinking water quality (Taylor, 2007).

WHO has defined the core components of a quality disease surveillance system and these are used for monitoring and evaluating (M & E) disease surveillance systems. The key components for quality reporting can be seen in the bottom left quadrant of Figure 2 (World Health Organization, 2006a).

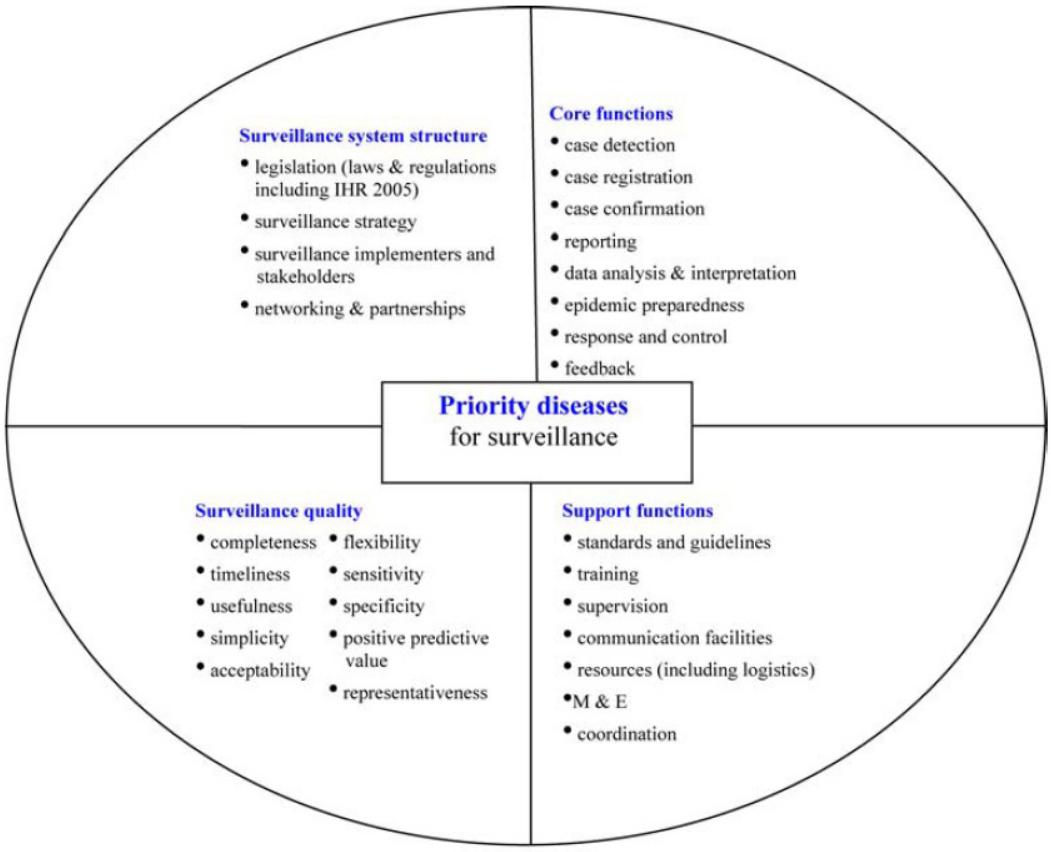

Figure 2: World Health Organization diagram showing components of disease surveillance and response systems (World Health Organization, 2006a)

One of the stated priorities for WHO is the strengthening of national foodborne surveillance systems within member states. The aim is for member states to collaborate both regionally and internationally in detection and response to foodborne disease (World Health Organization, 2002).

1.2 Foodborne and waterborne enteric disease

Enteric diseases are defined as "diseases of the intestine" (Oxford University Press, 2006). This group of diseases are most likely to result in diarrhoea and other common gastroenteritis-type symptoms such as vomiting and abdominal cramps. Infectious agents can be transmitted from a number of sources including contaminated food or water or contact with faeces or vomitus from infected humans or animals. The

pathogen enters the body via the mouth and enters the intestinal tract. It is estimated that more than 1.6 million deaths worldwide (mainly of children) are due to enteric diseases (World Health Organization, 2008). While a large number of these deaths can be attributed to third world countries, most developed countries also have significant burdens of enteric disease. The USA estimates 76 million cases annually and attributes 5000 deaths to enteric disease (Centers for Disease Control and Prevention, 2008a). The United Kingdom has estimated annual case numbers in excess of 9.5 million with around one fifth of the population suffering enteric disease annually (Bloomfield, 2001). In New Zealand Lake et al. (2007) estimated 4,636,240 cases annually, an incidence rate of 1.2 events per person per year.

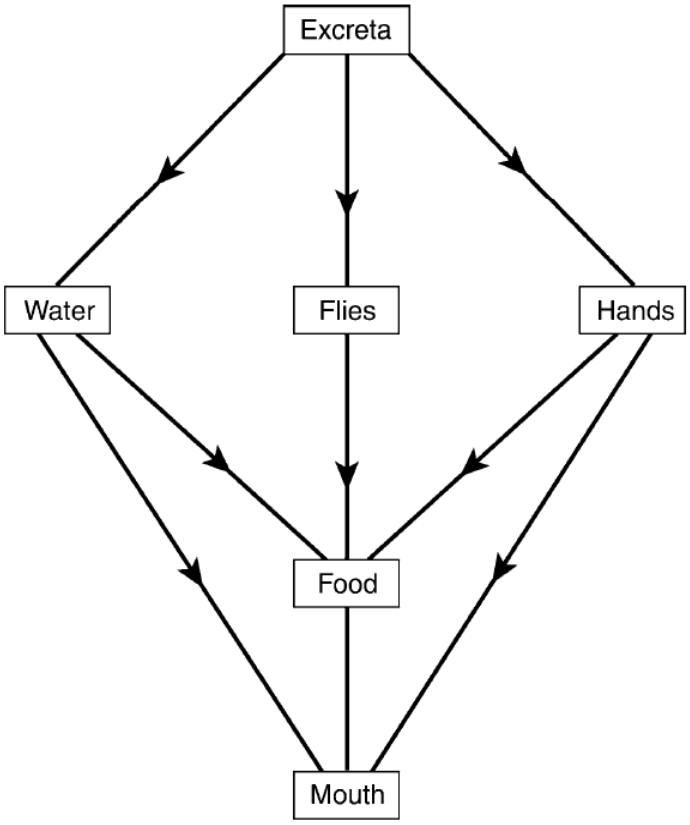

Figure 3: Principle elements of the faecal-oral route (World Health Organization, 1997)

Campylobacter, Salmonella, Giardia, Cryptosporidium, and *Yersinia* are the most frequently notified enteric diseases in the NZ surveillance system. These diseases are responsible for the highest burden of all notified diseases, and most are measured in public health surveillance systems, at some level, within developed countries. The exception to this list is Norovirus which is accepted as the most common community acquired enteric disease pathogen.

However, in NZ Norovirus is only measured when identified as part of an outbreak so little information is known about the true burden of this disease (Kemmeren, Mangen, van Duynhoven, & Havelaar, 2006; Ministry of Health, 1998).

1.2.1 *Campylobacter*

Campylobacter jejuni (most common strain in humans), *C. coli*, *C. lari* and *C. fetus* are zoonotic intestinal pathogens transferred to humans via the faecal-oral route (Figure **3**). The incubation period is between one and ten days with symptoms normally appearing within two to five days after exposure. The clinical illness associated with *Campylobacter* infection (campylobacteriosis) has been estimated to cause 5-14% of all diarrhoeal cases worldwide (Heymann, 2004). In 1980 campylobacteriosis was included in the list of NZ notifiable diseases under the Health Act 1956 (New Zealand Food Safety Authority, 2006a).

The duration of this acute illness is generally up to ten days, although in severe cases the disease may be longer or recur. Symptoms include diarrhoea (and may include bloody stool), abdominal cramps, fever, nausea, general malaise and sometimes vomiting (Heymann, 2004).

In rare cases there are chronic implications for campylobacteriosis cases. Studies have shown that in the two months after infection there is a significant increase in the potential to contract Guillain-Barre' Syndrome (GBS). GBS is an inflammatory disorder of the peripheral nerves that can result in death or permanent paralysis of legs, arms, breathing muscles and the face. Most cases require intensive hospital care over some months. This disease is the leading cause of rapidly acquired paralysis in the USA, affecting 1-2 people per 100,000 in the United States (GBS/CIDP Foundation International, 2007). In the month after infection with *Campylobacter* the case's chances of contracting GBS disease increase by 77 to 100 fold. There is growing evidence which indicates that potentially one of the best preventative measures for GBS is to reduce the rates of campylobacteriosis (McCarthy & Giesecke, 2001; Tam, et al., 2006).

In 2007 there were 12,776 cases of campylobacteriosis in NZ, meaning 302.2 people per 100,000 were notified cases. This was a slight decrease on 2006 which saw the highest recorded number of cases in NZ with 379.3 people per 100,000 notified. Only

20 outbreaks - involving a total of 54 cases - were identified in 2007 (Institute of Environmental Science and Research Limited, 2008).

The most common reservoirs of *Campylobacter* are animals including poultry, cattle, pigs, rodents, and wild birds Studies have shown domestic pets can also act as carriers of the bacteria without displaying symptoms. The most common transmission routes for humans are contaminated meat products (particularly handling raw or eating undercooked chicken), untreated drinking water sources and raw (unpasteurised) milk (Heymann, 2004).

Poultry carry the bacteria as part of their normal gut flora. There have been many epidemiological studies identifying raw/undercooked chicken, contaminated by gut contents during the slaughter process, as the primary source of infection (Baker, et al., 2006; Keener, Bashor, Curtis, Sheldon, & Kathariou, 2004; Wong, On, & Michie, 2006). A study undertaken at Massey University using MLST of potential sources and human cases has identified poultry as likely to be responsible for 60 - 70% of cases (French, 2008a; Mullner, 2008).

1.2.2 *Giardia*

Giardia lamblia, G. intestinalis and G. duodenalis are protozoan cysts. Giardiasis is caused by the cysts entering the intestinal tract via the faecal-oral route either from person-to-person contact or from contaminated foods, water (drinking and recreational) or contact with infected animals. Giardiasis was included in the New Zealand notifiable disease schedule (under the Health Act 1956) on the 1st of June 1996 (Hogue, Hope, & Scragg, 2002); (New Zealand Government, 1996). The incubation period for clinical disease is 3 – 25 days with illness normally developing within 7 – 10 days of exposure. Symptoms include diarrhoea, abdominal cramps, bloating, fatigue, and weight loss. The severity of clinical symptoms is variable and asymptomatic carriage is common in both animals and humans (Heymann, 2004; Tonks, Brown, & Ionas, 1991).

There has been some debate over the position of giardiasis as a zoonotic disease. Studies have shown *Giardia* is carried by animals including cattle, sheep, cats and dogs (Tonks, et al., 1991; U.S. Food and Drug Administration, 1992). Human disease textbooks list both wild and domestic animals as potential reservoirs for *Giardia* (Heymann, 2004; U.S. Food and Drug Administration, 1992). Disease transfer directly to humans from animals is controversial - due to the differing strain types

found in studies of humans and animals - and requires further study as there is little published evidence. Overall, disease transmission is considered to be associated more with contaminated food and water than direct animal contact (Med-Vet-Net, 2007; Snel, Baker, & Venugopal, 2009; U.S. Department of Agriculture, 2000) .

G. lamblia is the most common cause of human non-bacterial diarrhoea in North America - implicated in around 25% of all gastrointestinal disease in the US with an estimated 2% of the population affected annually (U.S. Food and Drug Administration, 1992). In NZ in 2007 there were 1401 cases. This equates to 33.1 people per 100,000 being notified with giardiasis. This was an increase from 29.0 people per 100,000 notified with giardiasis in 2006. In 2007 there were 21 outbreaks identified which were linked with 111 cases (Institute of Environmental Science and Research Limited, 2008).

1.2.3 *Cryptosporidium*

Cryptosporidium parvum and *C. hominis* are the most common species found in humans, the former is believed to be primarily zoonotic, whereas the latter is anthroponotic (human to human spread). Other species include *C. canis*, *C. felis*, *C. meleagridis*, and *C. muris;* these species are more commonly associated with animals, and occasionally human cases are reported. *Cryptosporidium* are parasitic protozoa (Leoni, Amar, Nichols, Pedraza-Dı´az, & McLauchlin, 2006). Cryptosporidiosis is arguably a zoonotic disease and is commonly associated with animal contact and environmental exposure. Oocysts enter the human intestine by the faecal oral route and multiply in the intestinal walls. *Cryptosporidium* has been identified in over 45 vertebrate animal species including poultry, other birds, fish, reptiles, and mammals. Cattle and sheep are a key source for human infection due to the large numbers of oocysts excreted by infected animals and close contact between human and animals (Heymann, 2004; Learmonth, Ionas, Pita, & Cowie, 2005). Other sources include contaminated water (drinking and recreational), and person-to-person spread is widely reported within families and during outbreaks (Heymann, 2004; Institute of Environmental Science and Research Limited, 2008). Cryptosporidiosis was included in the New Zealand schedule of notifiable diseases (under the Health Act 1956) on the 1st of June 1996 (Baker & Heffernan, 1997); (New Zealand Government, 1996). In 2007, 924 cases or 21.9 people per 100,000 were notified in NZ with cryptosporidiosis. This is a significant increase on previous years' notifications (Institute of Environmental Science and Research Limited, 2008).

Symptoms of cryptosporidiosis include diarrhoea, anorexia, vomiting, and abdominal cramping with general malaise. Immunocompromised people are at particular risk with potentially fatal consequences. Studies have found 10 – 20% of AIDs patients have been shown to be infected at some time during their illness (Heymann, 2004). Asymptomatic cases have been identified and infected people can act as carriers, spreading the infection within close cohorts such as child care centres and schools. Isolation of cases from or within institutions, especially when symptomatic, is a key public health control measure to prevent spread of the disease (Current & Garcia, 1991; Heymann, 2004).

Cryptosporidium parvum is considered to be an important agent in the aetiology of the neonatal diarrhea syndrome of calves, lambs, and goat kids. This causes considerable direct and indirect economic losses (de Graafa, et al., 1999; Learmonth, et al., 2005). Avian cryptosporidiosis is an emerging health problem in poultry being associated with respiratory disease in chickens and other galliformes, and with intestinal disease in turkeys and quails (de Graafa, et al., 1999). Because of limited availability of effective drugs the control of cryptosporidiosis relies mainly on hygienic measures and good management for both animal and human populations (de Graafa, et al., 1999; Heymann, 2004).

The first bovine cases of cryptosporidiosis were reported in 1972 and the first human cases were reported in 1976 (Current & Garcia, 1991). To date there is no prophylactic treatment for cryptosporidiosis but it is generally self limiting. Duration of illness can be as long as 30 days and, in the immunocompromised, has been reported up to 60 days (Current & Garcia, 1991; Heymann, 2004).

One of the issues with this pathogen is its environmentally resistant properties that allow it to survive in moist conditions for months outside the host. *Cryptosporidium* oocysts are difficult to kill using the common swimming pool or drinking water chemical treatments e.g. chlorine hypochlorite. It is mainly controlled in water supplies through coagulation and filtration with minimum turbidity levels being the primary control measure in treated water (New Zealand Government, 2004). There have been a number of high profile outbreaks reported associated with municipal drinking water supplies including: 1993 Milwaukee, USA with 400,000 reported cases (Naumova, Egorov, Morris, & Griffiths); 2001 Saskatchewan, Canada with 6280 cases reported (Anonymous, 2001) and 1997 North Thames, UK with 345 cases reported (Willocks, et al., 1998). In New Zealand there were 29 outbreaks linked to

Cryptosporidium in 2007 involving 102 cases (Institute of Environmental Science and Research Limited, 2008; Snel, et al., 2009).

1.2.4 *Salmonella*

Salmonella is a zoonotic bacterial pathogen which is transmitted by the faecal-oral route. Salmonellosis is most commonly considered a foodborne illness (usually foods of animal origin), although other sources include contaminated water (drinking and recreational), infected animals or person-to-person - spread via infected people.

The onset of clinical illness is normally within 12 to 36 hours. Symptoms include sudden onset of headache, abdominal pain, diarrhoea, nausea and sometimes vomiting. The severity of clinical symptoms is variable. Reported chronic carriage is rare in humans however, studies have identified chronic carriage in animals and birds (Heymann, 2004). During 2007 in NZ 1274 cases (30.1 people per 100, 000) were notified with salmonellosis similar to the 2006 rate of 31.9 people per 100,000. Salmonellosis case numbers have remained reasonably stable since 2005 (Institute of Environmental Science and Research Limited, 2008).

For the purposes of public health surveillance *Salmonella* isolates from human cases are routinely phage-typed. Serotyping is usually performed in enteric reference laboratories for the initial characterisation. Differentiation of the specific *Salmonella* species is used as an epidemiological tool for outbreak investigations (Wang, Chiew, Howard, & Gilbert, 2008). Typing allows PHU's to link multiple cases that may otherwise have been considered sporadic cases. The additional support phage typing gives during an outbreak investigation increases the likelihood of identifying sporadic salmonellosis cases which are potentially associated with an outbreak. In 2007, 141 notified cases of salmonellosis were linked to eight outbreaks reported. Typing is especially valuable in identifying cases spread across geographical DHB regions (Institute of Environmental Science and Research Limited, 2008). Public health concerns and the potential for foodborne zoonotic transmission have made *Salmonella* the subject of numerous international, national, and local surveillance programs (World Health Organization, 2006b; Yan, et al., 2003, pp. 189-204). The emergence of antibiotic resistance within *Salmonella* serotype has given further importance to the development of effective surveillance systems for this pathogen (World Health Organization, 2006b; Yan, et al., 2003).

1.2.5 *Yersinia*

Yersinia is a zoonotic bacterial pathogen which passes from animals (wild and domesticated) to humans. Asymptomatic carriage is common in animals and humans. Transfer of *Yersinia* bacteria is via the faecal oral route (Heymann, 2004). In 2007, 527 cases (11.6 people per 100,000) of yersiniosis were notified. The 527 reported cases represent a steady increase over the last three years from a low of 407 in 2005 and are now similar to the highest notification rates for the disease reached in 1998 (Institute of Environmental Science and Research Limited, 2006, 2008). The most commonly reported food source related to human infection is consumption of undercooked pork or pork products. Pharyngeal and gut colonisation is common in pigs (Heymann, 2004; McNally, et al., 2004).

Other sources are contaminated water, person-to-person and through blood transfusion from an infected person. Symptoms include diarrhoea, abdominal pain and acute lymphadenitis – often mistaken for appendicitis. The incubation range is 3 – 7 days. Cases can excrete the bacteria for two to three months, however untreated cases have been shown to excrete the bacteria for more than three months (Heymann, 2004). Yersiniosis was included in the New Zealand schedule of notifiable diseases (under the Health Act 1956) on the 1st of June 1996 (Baker & Heffernan, 1997) (New Zealand Government, 1996). In 2007 New Zealand reported three outbreaks involving 15 cases. Sources were identified as: pre cooked cherrios (small sausages made of precooked processed meat) that were cross contaminated by raw meat and inadequately reheated; person-to-person transmission in a child care facility; and exposure to sick animals (Institute of Environmental Science and Research Limited, 2008).

1.3 Underreporting of enteric diseases

It has been well established in most developed countries that notified cases of food and waterborne enteric disease represent a small number of the actual cases that are contracted within the community (Lake, et al., 2007; Wheeler, et al., 1999). There may be many reasons for this underreporting including socioeconomic; cultural; severity of symptoms; access to healthcare; General Medical Practitioners (GP) not requesting a specimen; patients not delivering the specimen; and the pathogen not being isolated (Lake, et al., 2007; Lake, et al., 2005; Rumball - Smith, 2006). Overseas studies have estimated only 20% of patients with enteric disease symptoms go to the GP and that GP's only request specimens from 19-25% of cases (Hall, Raupach, & Yohannes, 2006;

Majowicz, Edge, Fazil, McNab, & Dore, 2005; Scallan, et al., 2006). As notified disease data excludes all cases that are not notifiable and diarrhoeal diseases are considered to have the greatest burden of all diseases in the world, many countries are now working to estimate the true burden of these diseases at a community level (World Health Organization, 2004). In addition to notified cases, self reported Foodborne Illness (FBI) cases that are aware of or know how to access the PHS, are added to surveillance data. While all diseases that occur in an outbreak situation are notifiable, in reality outbreaks often go unreported (Whyte, 2003).

Community outbreaks of diseases such as rotavirus and norovirus are rarely identified (Lake, Baker, Garret, Scott, & Scott, 2000; Wheeler, et al., 1999). A pyramid diagram is often used in studies to highlight the true burden of disease in the community and the steps that have to happen prior to a case being captured by a surveillance program (Allos, Moore, Griffin, & Tauxe, 2004). Lake et al. (2007) reproduced a similar triangle comparing the percentage of cases notified to PHS to the likely number of actual cases of enteric disease within NZ. An adaptation based on both these sources is shown in Figure 4.

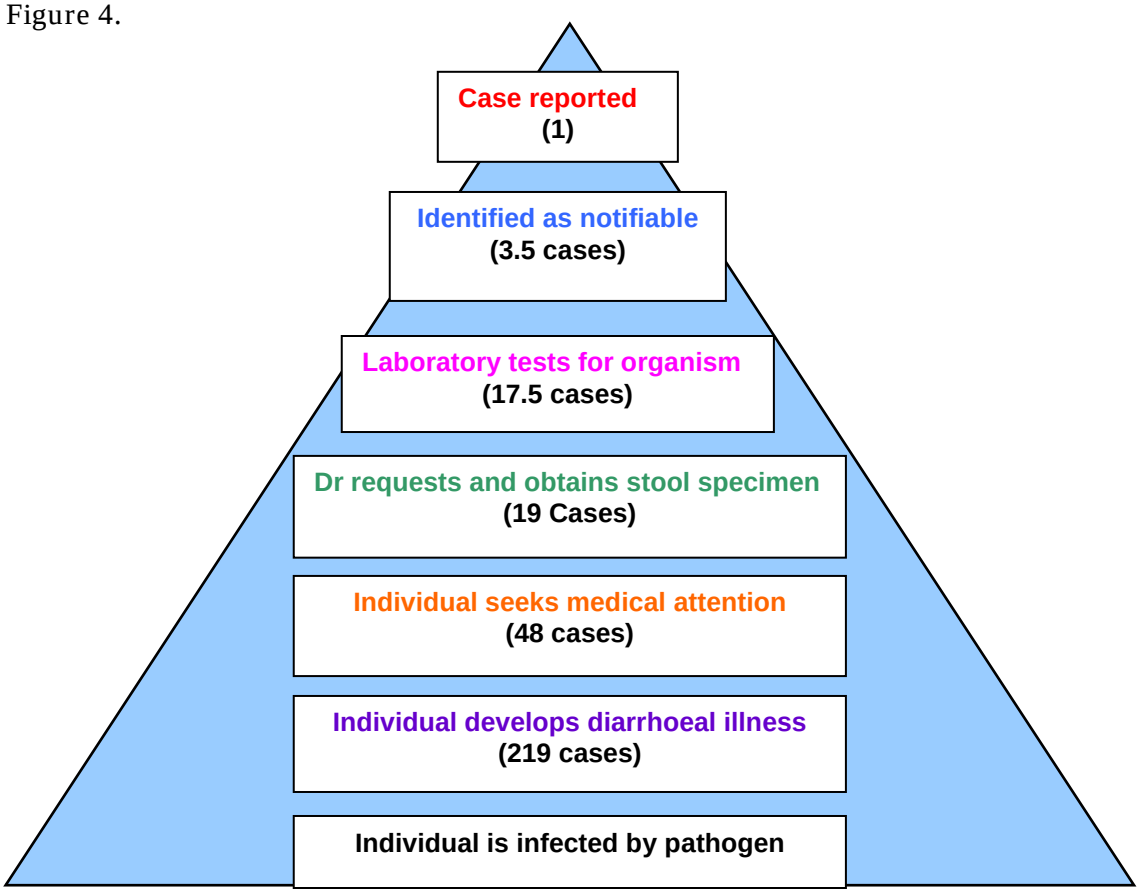

Figure 4: Burden of illness pyramid and steps each case must achieve before being notified with estimated case numbers (Allos, et al., 2004; Lake, et al., 2007).

The New Zealand Acute Gastrointestinal Illness (AGI) study undertaken by Lake et al (2007), highlighted that formal notifications to PHS represent a tiny (0.5%) proportion of actual enteric disease cases in the community. This study estimated around 4,636,240 cases of gastrointestinal or enteric illnesses per year in the community. The AGI study showed (for 2005) that of 256,471 of the faecal specimens submitted for analysis only 20% of these specimens tested positive for an identifiable pathogen and only 7.2% of these were identified as infected with a notifiable pathogen. Therefore of the 256,471 cases of enteric illness who submitted a specimen, less than 18,465 would have been statistics in the 2005 surveillance figures.

The economic impact of food and waterborne illnesses on NZ is significant (especially when the level of underreported cases is considered), with production days lost due to illness estimated at 497,000 (Lake, et al., 2000). The total cost to NZ of estimated foodborne infectious disease - including medical costs, lost productivity, and intangible cost of loss of life - was estimated to be $55.1 million or $462 per case (Scott, Scott, Lake, & Baker, 2000). If the inflation index calculator is applied to update this figure to 2008, the costs per case increase to $581.64 and total costs to $69.2 million (Reserve Bank of New Zealand, 2008). Campylobacteriosis has been singled out as the pathogen responsible for the majority of the costs associated with FBI's in NZ, contributing 72.9% of the total estimated costs (Scott, et al., 2000).

While enteric disease management and identification at community level is beyond the scope of this thesis, it is important to understand that the level of disease reported to PHS has been shown to be highly underreported and significantly less than the actual levels of disease being experienced in the community. This suggests that every case reported could potentially represent 219 cases of actual disease in the community. This indicates the importance of effective screening being undertaken for every case of notified enteric disease that is reported to a public health agency.

1.4 New Zealand's notifiable disease surveillance system

Public health surveillance data collection relating to common notified enteric diseases in New Zealand is undertaken by local Public Health Services (PHSs) (also known as Public Health Units (PHU)) of which there are 12 throughout New Zealand (Ministry of Health, 2005, 2007b) (Figure 9). Common enteric diseases are required to be notified to the local Medical Officer of Health (MOoH) who resides within each PHS. The requirement for medical practitioners to notify the MOoH on suspicion of a patient suffering from a notifiable disease (or a sickness whose symptoms creates

suspicion of a notifiable disease) is legislated in section 74 of Health Act 1956 (New Zealand Government, 1956). The PHSs are contracted by the MoH to receive notifications and report the surveillance data gathered from cases to the crown institute laboratories (ESR). ESR maintains "EpiSurv", the national disease surveillance database. The data are used for disease surveillance at local, national and international levels for the implementation of preventative measures, reporting, monitoring, research, allocation of resources, information and response to media enquiries (Ministry of Health, 2005).

In the last few years there have been significant changes to surveillance within New Zealand. ESR recently introduced the Early Aberration Reporting System (EARS) to NZ a system created by CDC. EARS uses algorithms which generate aberration flags in the system to identify potential outbreaks of disease (Institute of Environmental Science and Research Limited, 2005). EARS uses data from EpiSurv and highlights increases in reported cases compared to the reported case numbers for the prior three years, both regionally and nationally (Figure 5). EARS is updated nationally every week and is the only way (without directly contacting ESR) PHSs can quickly assess the disease levels in neighbouring district health board areas.

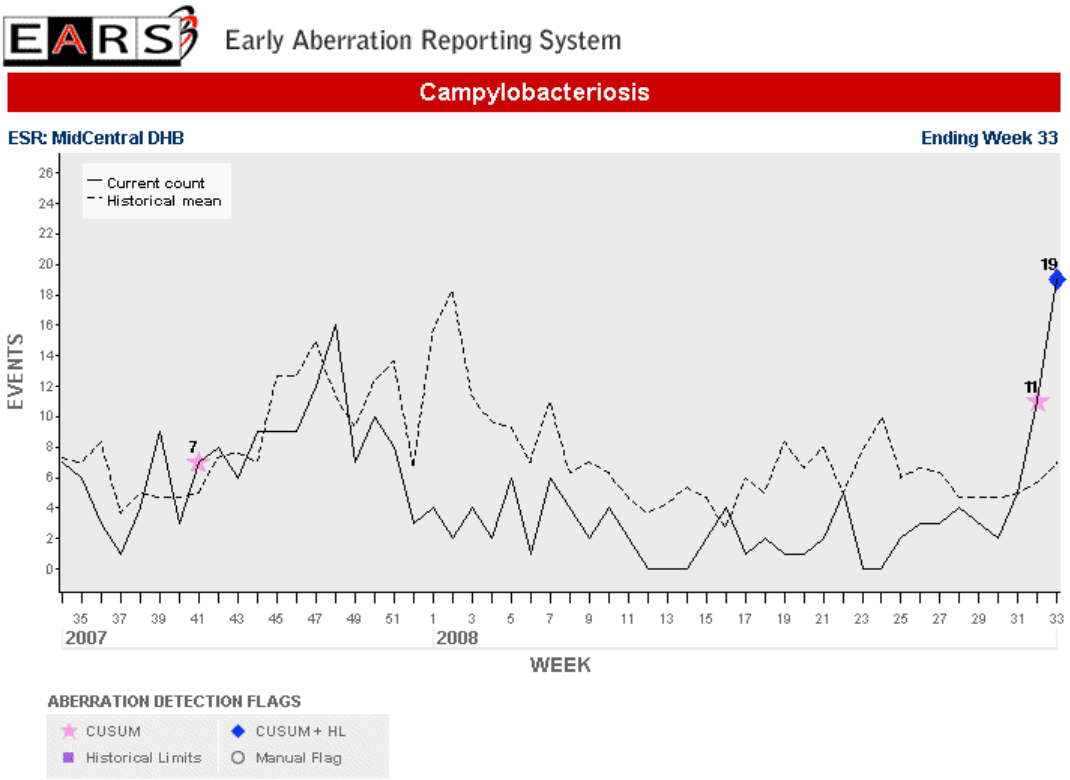

Figure 5: An example of the ESR EARS system. Alerts are based on historical data for the region

On April 3rd 2007 ESR launched SURVINZ EpiSurv Version 7.2.1. EpiSurv became a secure web-based system with the ability for real time data to be logged, and it was no longer reliant on nightly downloads from the PHSs around NZ. The EpiSurv system facilitates New Zealand's compliance with the communicable disease surveillance requirements of the International Health Regulations (2005) (Kliem, 2007).

The surveillance for common enteric diseases within NZ can be described as a passive surveillance system (attempts to gather information on all notified cases). Passive surveillance is reliant on the healthcare provider - in NZ either the medical practitioner (who orders the test) or laboratory (who has a positive result of a test) - contacting local PHSs to notify a suspected or positive case of the disease under surveillance (Webb, et al., 2005). The Manual for Public Health Surveillance in New Zealand describes the system as "a form of clinical surveillance because it is based on reporting by medical practitioners". This description has been superseded by new legislation requiring NZ laboratories to also report cases of notifiable diseases to the MOoH; this means NZ has now added a laboratory-based surveillance system to the public health surveillance tool box.. However, the legislative requirements for medical practitioners to report remains in place (Ministry of Health, 2005, p. 7).

Under the NZ Health Act 1956 medical practitioners are obliged to notify on suspicion of a notifiable disease or a suspect "food poisoning". In reality this rarely happens, with the majority of notifications being based on positive laboratory results (Campbell, 2006; Rumball-Smith, 2007). Positive Predictive Value (PPV) measured in a surveillance system indicates the proportion of cases reported who actually have the reported disease (World Health Organization, 2006a).

$$\mathrm{PPV} = \frac{\text{true positives}}{\text{all positives}}$$

The estimated PPV for surveillance data in EpiSurv relating to cases associated with a specific pathogen has been measured by different studies as 95 – 98% accurate (Lake, et al., 2005; Wilson & Baker, 2005). The exception is the category where cases are identified as "gastroenteritis – unknown pathogen". For most PHS this is where notifications without supporting laboratory results would sit. The majority of these cases are self-reported foodborne illnesses and they are normally reclassified to a specific pathogen (if one is isolated) during an investigation (Wilson & Baker, 2005).

Prior to 2007 some laboratories in NZ had already voluntarily provided results of positive cases of notifiable diseases to local PHSs. On December 18 2007 compulsory direct laboratory notification was introduced. This change means laboratories are now required to implement "Direct Laboratory Notification of Communicable Diseases" meaning they should not only notify the requesting medical practitioner of their patient's test results, but they are also mandated under section 74AA of the Health Act 1956 to immediately notify their local MOoH if a patient tests positive to any notifiable disease listed within the Health Act 1956 (New Zealand Government, 1956). The flow chart below shows the current NZ system for notifiable disease.

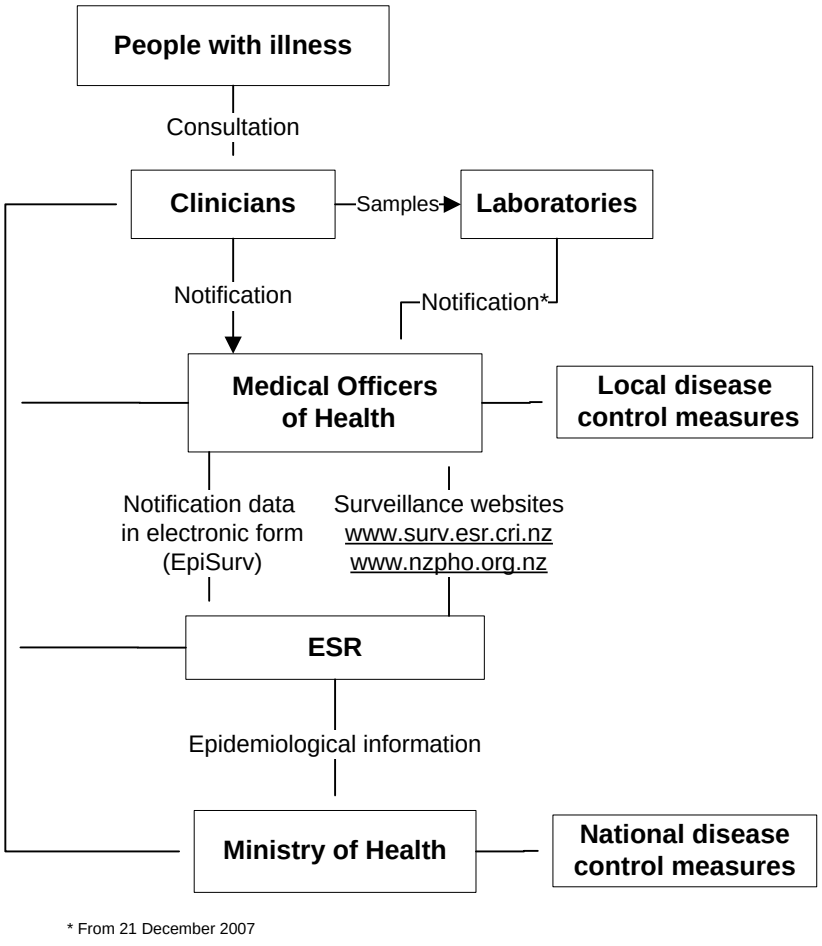

Figure 6: The New Zealand Notifiable disease system including the direct laboratory notification path introduced on 18th December 2007 (Institute of Environmental Science and Research Limited, 2008)

Simmons et al (2002) showed there was potential for direct laboratory notification to increase notifications by >20% resulting in significantly increased work loads for PHS . However, the introduction of direct laboratory notification coincided with the implementation of NZFSA controls aimed at reducing the number of cases of

campylobacteriosis. All PHS throughout NZ have since experienced a reduction in campylobacteriosis notifications that is most likely to be attributable to the controls introduced by the NZFSA *Campylobacter* strategy (New Zealand Food Safety Authority, 2006b). Audits of other notifiable common enteric diseases, to assess if there has been significant increases in notifications since introducing direct laboratory notification to New Zealand, are not yet available (Lake & Sexton, 2009).

Once a notification is received at the local PHS from medical practitioners and laboratories, cases are logged on a standardised case report form (CRF) which is supplied via the ESR SURVINZ EpiSurv V 7.2.1 system (Institute of Environmental Science and Research Limited, 2008). This work is normally undertaken by the local EpiSurv coordinators or communicable disease clerks. The cases identified as common enteric disease are then followed up at the local PHS. This is usually done by Health Protection Officers (HPOs) utilising various methods according to their local protocol. This can include: no further follow up and logging the information provided by the person who notified the case; providing an educational letter; telephone interview; a visit and face to face interview; or completing a postal questionnaire.

The data quality within EpiSurv is measured annually by ESR, a report is published and the results are fed back to PHSs (Pirie & Peterkin, 2007, 2008). The fields measured within EpiSurv are the compulsory fields. These fields mainly relate to demographics, ethnicity, occupation, and National Health Index number (NHI) data for each case, and ESR measures levels of completeness and the timeliness, measures which show the speed or delay, of reporting to EpiSurv. The purpose of the report is to consider differences in resulting data quality and raise awareness of how each PHS performs within the system (Pirie & Peterkin, 2007, 2008). However, some PHS managers base PHS performance on this data when possibly the data is simply not available for some categories.

> "A consequence not intended is the interpretation that 100% completion of ethnicity, occupation and NHI is required and is achievable for these categories. This is generally not possible and in fact may lead to inaccurate data being provided if the PHU staff strive to obtain 100% completion rate" (Pirie & Peterkin, 2007)

A number of studies undertaken on systems within PHSs and the resulting data quality within EpiSurv have recommended a more standardised and consistent

approach by PHSs across NZ in an aim to improve data quality (Ball, 2006; Lake, et al., 2005; MacBride-Stewart & Boxall, 2005; Whyte, 2003). These reports have highlighted limitations in the quality of data gathered in EpiSurv caused by differing systems within each PHS and limited reporting by some PHS of the optional risk factor fields. Optional risk factor fields are most likely to indicate the cause or trends associated with notified cases, especially for food, waterborne or zoonotic disease. Inconsistencies in the methods of gathering and reporting surveillance data, especially relating to a lack of reporting of risk factors, have been found to limit the potential usefulness of the EpiSurv data for research or outbreak investigation purposes (Ball, 2006; French, 2008a; Lake, 2006; Wilson, 2005).

Having compulsory data and optional data within EpiSurv means that the gathering and reporting of risk factor information becomes a decision made by each PHS. They prioritise their work in different ways based on resources and local needs. However, it is the risk factor information which is often the first indication of commonality between cases (the linking of sporadic cases in an outbreak situation) and identifying trends within the population the notifications are received from. This information could potentially lead to an investigation to discover the source of disease and ultimately direct public health action and support the implementation of effective preventative control measures (Choi, Bonita, & Mc Queen, 2001; Tauxe, 2002). PHSs have to balance the fluctuating workloads in an environment of limited resources, local priorities and other reactive work. This means for those PHS that do contact notified cases of common enteric disease, the aim becomes to reduce the number of outstanding notifications in the limited time available rather than local analysis of the information received. There are PHSs in NZ who complete the EpiSurv notification from basic information (i.e. name, date of birth, address and ethnicity) received from the notifier (Pirie & Peterkin, 2007). Auckland Regional Public Health Service (ARPHS) (representing 32.4% of the NZ population) only follow up notified cases of common enteric diseases if risk factors which potentially require public health intervention are identified e.g. GP advises during notification the case ate a high risk food from a food premises (Mohiuddin, 2006).

In 2007 the NZ MoH undertook a review of notifiable diseases and conditions (Ministry of Health, 2007c). One of the aspects considered was a review of the list of notifiable diseases contained in the NZ Health Act 1956. In a submission made to the

MoH during this review, ARPHS made the following recommendations about the current surveillance system in NZ:

- Campylobacteriosis, yersiniosis and giardiasis should also be categorised as appropriate for policy-based[2] surveillance from laboratory notifications only, if maintained on the schedule at all.
- The Ministry of Health consider alternatives to passive universal surveillance for conditions not requiring a public health response, unless appropriate incentives and inducements to maximise data sensitivity and quality are put in place.
- Consideration be given to making laboratory-only notifications reportable directly to a national surveillance centre (such as ESR).

ARPHS went on to state that "considerable resources are expended by notifiers in providing clinical information on these cases, whereas little of this information is of any value" (Statistics New Zealand, 2006 ; Thornley, 2007).

At the conclusion of the review none of the notifiable common enteric diseases were removed from the Health Act (Ministry of Health, 2007c). However, ARPH had some valid points in relation to the need for all common enteric disease notifications to have PHS based surveillance especially if sensitivity and quality of data gathered within the EpiSurv database is of questionable value or the data was not being utilised at a local level.

The review did identify the need for a national electronic reporting system for notifiable diseases. ESR is currently working towards upgrading the EpiSurv database to enable electronic notification from laboratories which can be received directly into EpiSurv and coexist with PHSs local systems (Ministry of Health, 2007a).

1.4.1 The burden of common enteric diseases in New Zealand

Disease notifications for campylobacteriosis, salmonellosis, cryptosporidiosis, giardiasis, and yersiniosis. annually make up more than 85% of all notifications to EpiSurv, NZ 's national disease data base as shown in Figure 7 (Institute of Environmental Science and Research Limited, 2007, 2008).

[2] Policy-based surveillance gathers information to support prevention strategies at a national level but may not involve investigation of individual notifications (Baker, 2008). The aim is to target preventative measures to those in the population most at risk e.g. free influenza vaccine for all those over 65

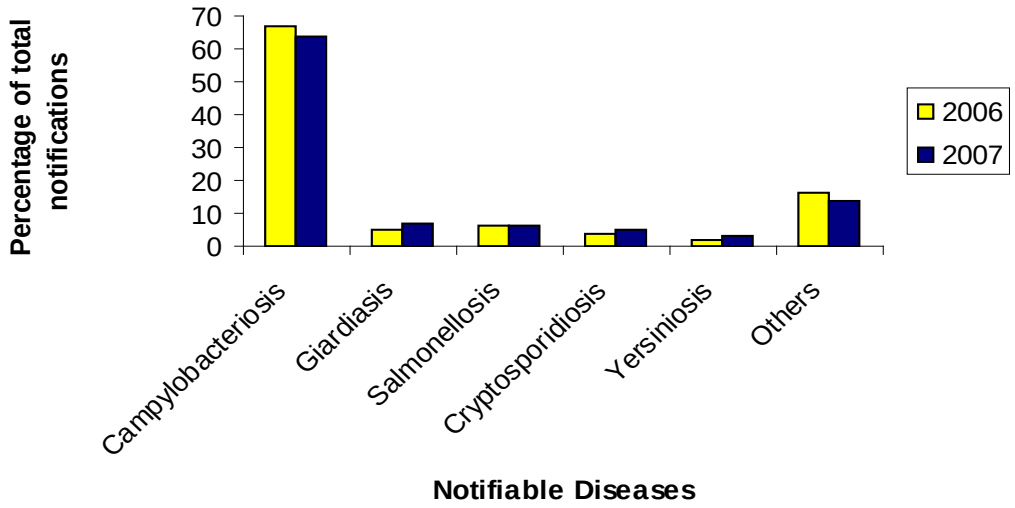

Figure 7: Notifications of common enteric diseases reported in NZ for 2006 and 2007, compared to all other notifiable diseases

In 2006 the total number of notified cases in NZ was 23,584 and in 2007 there were 19,695 notifications received. The majority of these notifications were for potentially food and waterborne enteric diseases (Table 1).

Table 1: Total case numbers for notifiable common enteric diseases in NZ for 2006 and 2007

Disease	2006	2007
Campylobacteriosis	15837	12776
Giardiasis	1214	1401
Salmonellosis	1335	1274
Cryptosporidiosis	924	924
Yersiniosis	527	527
Others	3747	2793
Total	**23,584**	**19,695**

When compared to many other developed countries NZ has higher rates of most notified common enteric diseases (Crump, Murdoch, & Baker, 2001; Hoque, Hope, Scragg, Baker, & Shrestha, 2004; New Zealand Food Safety Authority, 2006b). While there is debate as to why NZ has such high rates of common enteric diseases it is generally considered that differences in surveillance systems internationally are unlikely to account for these higher rates (Orchard, Baker, & Martin, 2000).

> "The high rates of endemic enteric infections are not fully understood. The high ratio of domestic production animals to humans and frequent use of rural water supplies in New Zealand have been raised as hypotheses" (Crump, et al., 2001) .

As a major food exporter NZ has a need to protect the reputation of locally produced food. In an international arena, high rates of potentially foodborne illness infer issues related to the propagation of pathogens along the national food chain. Food products represent 23% of NZ's Gross Domestic Product (GDP), so not only is it important to manage the high rates of common enteric diseases for the health of New Zealanders but also to protect export trade. NZFSA has estimated a loss of consumer confidence in NZ food could cost in excess of $1.4 billion in lost exports and market access (New Zealand Food Safety Authority, 2005).

1.5 Summary

In this chapter public health surveillance was defined and historical development of disease surveillance and the ongoing issues associated with surveillance were discussed. The importance of good data collection as the foundation for any disease surveillance system was highlighted.

Overall the key points identified in the literature review were that following up mandatory notifications in a timely and complete manner has been an issue since the 1800's and continues to be so in the new millennium. Common enteric disease notifications in NZ represent 85% of all notifications received and our rates are among the highest reported for developed nations. Management and control of common enteric disease will only come through good understanding of the epidemiology of these diseases. Skewed or incomplete data within a surveillance system is likely to bias any conclusions which can be drawn from the analysis of it.

Many studies have identified the lack of consistency and completeness of NZ common enteric disease surveillance reporting, indicating there is room for improvement in methods used at the front line of public health with an aim to improving the quality of reporting.

The introduction of direct laboratory notification will further reduce the likelihood of risk factors, associated with a case, being provided to the PHS during the formal

notification. Laboratories are not privy to the diagnosis or any potential risk factors the case may have been associated with. It is therefore important that either the GP/PHS interface is enhanced so relevant information relating to notified cases is managed in an appropriate manner, or timely investigation of notified cases is undertaken by PHS to ensure potential sources of disease can be identified and mitigated.

Changes introducing direct laboratory notification had the potential to increase the number of notifications (Simmons, et al., 2002). However, due to the NZFSA *Campylobacter* strategy, the overall number of notified enteric disease cases reported annually has been reduced. The reduction in cases and the effectiveness of the controls implemented by the strategy has only been measurable through the reporting of cases to EpiSurv. Without this there would be no way to measure the outcomes associated with these controls. Potentially the reduced number of notifications could be an opportunity to focus on improving the quality of reporting from PHSs throughout NZ.

One of the key threats to NZ associated with potentially foodborne illness is the protection and safety of locally produced food and one of our main exports. NZ food is a major export industry, so not only is quality surveillance about protecting New Zealanders, it is also about having robust local epidemiological knowledge relating to pathogens which could potentially effect the reputation of NZ food products.

2. Background and preparation for enhanced surveillance of common enteric disease

2.1 Introduction

One of the core aims of NZFSA is to reduce food-related risks to human health. As part of the NZFSA Science Strategy, human health surveillance has been identified as an essential element of the monitoring and review component of the risk management framework. Evidence from outbreak investigations and epidemiological studies of human enteric diseases are being used increasingly as sources of data for risk assessments.

Application of disease data collected in EpiSurv is compromised by the strength of the evidence presented and its different interpretation within PHS. A further limitation is that most investigations/studies are performed, analysed and interpreted in the context of urgent disease control needs rather than planned aetiological studies.

A range of reports have described deficiencies in the current public health investigation and management of identified cases of human enteric diseases, including differing practices between PHSs. Additional training for HPOs and MOoHs is proposed by both NZFSA and MoH (Ball, 2006; Lake, et al., 2005; MacBride-Stewart & Boxall, 2005; Whyte, 2003).

A multi-agency Human Enteric Disease Surveillance Steering Committee has recently been established. The Steering Committee is to provide a strategic direction for human enteric disease surveillance to ensure there is a co-ordinated system in New Zealand that assists in the reduction of the disease burden of human enteric disease. A paper entitled *Enhanced Sentinel Surveillance for Enteric Disease in New Zealand: the advantages, disadvantages and feasible options,* was circulated to relevant public health agencies by NZFSA for comment (Wilson & Baker, 2005).

Based on the comments received by the NZFSA, two of the priorities identified were to establish a demonstration site for trialling initiatives to modify current public health investigation practices for cases of human enteric disease and to develop a prototype sentinel surveillance site.

Sentinel surveillance systems in this context would involve selecting reporting sites or regions where a number of key components of a surveillance system would be enhanced with the aim of producing enriched surveillance data and more accurate results. One of the most crucial roles in any sentinel surveillance site is the timely and effective reporting of data from cases of the diseases of interest to support additional microbiological or epidemiological analysis that may follow (French, 2008a; World Health Organization, 2002). It was considered that if MCPHS improved its data quality this information could potentially support a prototype sentinel surveillance site within the Manawatu region.

Software enhancements to support improved data collection have recently been made to the EpiSurv programme. EpiSurv is the national database for communicable diseases and is maintained by ESR. Current processes within the Public Health Services (PHSs) have remained essentially unchanged.

NZFSA project aims

The aims of the enhanced surveillance project were to:

- Establish a demonstration PHS in which new methods and processes for surveillance and investigation of potentially foodborne human enteric diseases could be trialled and evaluated.
- Gather information in ways which gave added value; meaning the data were of a quality which could support more in-depth analysis than normal, (i.e. complete both compulsory and optional sections of the EpiSurv case report for notified cases especially potential risk factors or exposures), to inform results obtained through further laboratory investigation i.e. molecular typing (French, 2008a).
- Develop consistency in the data collection and management of notified foodborne disease locally and provide recommendations on the feasibility of this occurring nationally.
- Demonstrate the value of upskilling the health protection workforce through an HPO participating in the Masters in Veterinary Public Health study programme at Massey University.

A steering group for the project was established and included representatives from the NZFSA, Ministry of Health, ESR, MCPHS, Community and Public Health Christchurch, ARPH and MOoHs.

The following outlines the methods used and outcomes for the one year trial, run between 1 July 2007 and 30 June 2008, at the MCPHS. The main aim of the study was to provide a recognised background level for response rates using either telephone or mail questionnaire as tools for data collection. It was hoped the enhancements would provide evidence which could potentially support change, within the NZ notifiable enteric disease surveillance system, allowing utilisation of new technology, speedier notifications (via direct laboratory notifications) and real time data entry. This could ultimately support NZ PHS to undertake a timelier public health response in an outbreak situation.

2.2 Methods

In June 2006 MCPHS was contracted by the NZFSA to undertake a project aimed at establishing MCPHS as a demonstration enteric disease surveillance site. This would involve altering current systems in order to improve quality, timeliness and completeness of data recorded on the EpiSurv national disease database.

The MCPHS region was selected for this project for a number of reasons including population size and the mixture of urban and rural communities in the region.

Population size

The estimated population for the region serviced by the MCPHS health protection team is 155,000[3] (Figure 8) (MidCentral District Health Board, 2007; Ministry of Health, 2006a). MCPHS is defined by ESR as a medium-sized PHS, with a population of between 100,000 and 300,000 people (Pirie & Peterkin, 2008).

[3] The MCPHS area covered by the Health Protection team does not include the Otaki area. The disease notifications for this area are notified to Regional Public Health in Wellington. However, other Public Health Services and Primary healthcare for Otaki remain within MCPHS region.

Figure 8: The geographical area covered by the MCPHS. The horizontal line above Otaki indicates the geographical cut off for disease notifications

Urban rural mix

Approximately half of the MCPHS population lives within Palmerston North City. The remainder lives in smaller population centres and rural communities which include both coastal and inland areas. Therefore the MCPHS population was considered appropriate as a sentinel surveillance site because the population lives in various living environments which are representative of the make up of NZ society (MidCentral District Health Board, 2007).

PHS with enhanced monitoring already in place

MCPHS already had enhanced surveillance within the region through the introduction of a local monitoring database for food premises, recreational water sites, schools and early child care centres. Recent health protection graduates had improved contact and completion of the case report fields within EpiSurv for notified cases of common enteric disease. The work that had been undertaken within MCPHS indicated a proactive approach to surveillance within the PHS and both management and staff were willing to undertake the work necessary to further enhance the system and undertake the proposed project.

Direct laboratory confirmation of isolates

An agreement was in place with the local laboratory to forward to the PHS daily confirmation of positive human isolates for any notifiable disease listed in The Health Act 1956. MCPHS was effectively receiving direct laboratory notification, prior to legislation being introduced in December 2007 mandating this practice. It is widely accepted that direct laboratory notification is a more effective form of notification than reliance on medical practitioners alone. Simmons et al 2002 undertook a study in the Auckland area which identified a >20% loss of notifications between positive, notifiable results received in the lab and those reported to the PHS from GPS.

The first meeting was convened on 13 October 2006 and during this meeting four initiatives were proposed:

1. Trialling a postal questionnaire to all notified cases of salmonellosis, cryptosporidiosis, giardiasis and yersiniosis .

2. Intensively investigating campylobacteriosis cases using telephone marketing techniques as a comparative method of data collection to postal questionnaires.

3. Assessing the use of the ESR Early Aberration Reporting System (EARS) as an outbreak alert tool at PHS – level.

4. That the above studies be written up by the HPO involved in the project and used to form the basis of a Masters thesis.

2.3 Preparation for trial initiatives

This section outlines the preparation of the MCPHS to become a trial site and considers systems in use by other PHS to undertake common enteric disease surveillance and foodborne illness investigation. The steering group held regular teleconferences where feedback from MCPHS was given on the trial progress and steering group members had an opportunity to provide guidance on the trial programme plan.

Two reviews were undertaken prior to the start of the trial, an internal review within MCPHS to prepare staff and gather resources required for the trial and a review to gather as much information as possible about surveillance methods within other NZ PHSs.

2.4 Internal review

2.4.1 Methods

Within the MCPHS, the systems used for reporting of notified enteric diseases to ESR were reviewed. Access and training in the use of EpiSurv was given to HPOs undertaking work for the project. Additional training in designing custom reports within the EpiSurv database was completed.

Protocols around logging and interpreting data were established for those undertaking interviews and reviewing returned questionnaires (Section 11.2).

HPOs were trained in interviewing cases and qualifying their answers, and in the use of real time data entry (i.e. direct entry into EpiSurv website during the telephone interview) using the ESR Case Report Form (CRF).

Training, protocols and resourcing to begin the trial were put in place and a progress report for NZFSA was completed in June 2007 (Shadbolt, 2007a). Templates for quarterly reports were designed as a means for providing progress reports to the steering group during the trial (Shadbolt, 2007b, 2008). Additional resources were sourced including; telephone headsets, telephones compatible with headsets; staff prepared to work evening shifts and a quiet space to make phone calls.

2.4.2 Results and discussion

A review of internal systems was undertaken within MCPHS. This allowed a clear understanding of protocols needed to create, and the level of change required within the MCPHS to be able to meet the aims of the project. The key change was devolving the follow up of notified common enteric diseases from four regional HPOs each responsible for specific geographical areas within the PHS to a single HPO with responsibility for surveillance of all notified cases of common enteric disease regardless of which MidCentral geographical area the case was notified from.

2.5 Review of PHS systems for common enteric disease surveillance

2.5.1 Methods

A telephone survey of NZ PHSs was undertaken in March 2007 to assess current methods of gathering enteric disease notification surveillance data (Figure 9). The core questions asked were:

- What method do you use to follow up notified cases of campylobacteriosis?
- What method do you use to follow up other common enteric disease notifications?
- If you use a postal questionnaire what is your return rate? (If it was not measured they were asked to estimate the response rate).

Services who indicated they used a postal questionnaire were also asked to forward a copy of the questionnaire to MCPHS.

2.5.2 Results

The telephone survey undertaken in March 2007 highlighted the differing approaches taken for gathering of enteric disease surveillance data entered into EpiSurv (Table 2).

The data collection methods used included the following: sending educational advice only by post; sending postal questionnaires - including educational advice; telephone interviews; or face to face interviews with cases. The data collection methods within some PHS were difficult to record as some had no consistent data collection method e.g. the HPO responsible for a geographical area within the PHS could follow up notifications in their area in whichever way they chose. This meant there was no one consistent method within some PHS where multiple HPOs were responsible for surveillance.

There was also variation in how questions regarding potential risk factors were completed. Some PHSs asked about all the risk factor fields and others just completed the section identified by the case as the likely source. Some of the PHSs interviewed forwarded high risk cases (i.e. food workers or all of the common enteric disease notifications) to their local territorial authorities (TLA).

During the interviews no PHS indicated that response rates to postal questionnaires were measured in any formal way. Six of the PHSs interviewed estimated the percentage of questionnaires they thought were returned. Three estimated the return rate for their region was between 60 to 70% and three estimated between 50 to 60%.

Seven questionnaires were forwarded to MCPHS from regional PHSs. The length of the questionnaires varied from two to seven pages, with three of the seven being four pages in length. A one page pre-screen questionnaire received from Regional Public Health (RPH) in Lower Hutt was identified by the project steering group as the most useful format to be adapted for the questionnaire trial. The benefits of the RPH questionnaire were that in a clear lay out on a single page it gathered the majority of the information required to complete an EpiSurv CRF. The questionnaire could easily be adapted with the addition of a second page making it possible to include all the questions required to complete a CRF and give room for any additional comments.

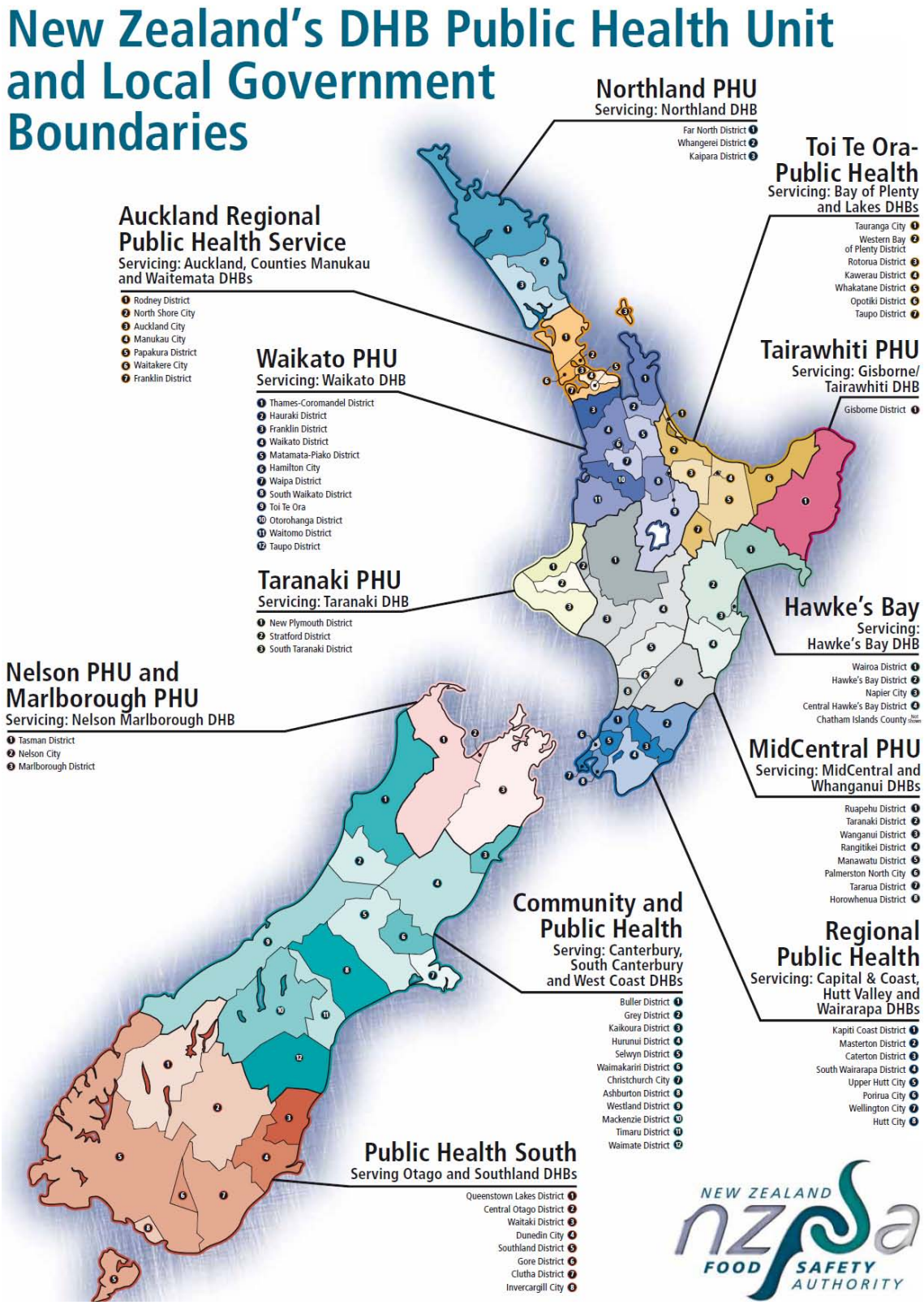

Figure 9: Geographical location of New Zealand Public Health Units

Table 2: Results of survey of NZ PHS identifying data collection methods for notified cases of common enteric disease

PHS	Notified *Campylobacter*	Trigger point*	Action if triggered*	Notified *Giardia*	Notified *Cryptosporidium*	Notified *Salmonella*	Notified *Yersinia*
PHS Northland	TI			TI	TI	TI	TI
ARPHS Auckland	AP	FC, IN	PQ	AP	AP	AP	AP
PHS Waikato	AP			TI, VI	TI, VI	TI, VI	TI, VI
PHS Toi Te Ora	AP	HRG	TI	TI	TI	TI	TI
PHS Tairawhiti	PQ	HRG, IN, FC		PQ	VI	VI	VI
PHS Taranaki	PQ	HRG		TI then PQ	TI then PQ	TI then PQ	TI then PQ
PHS Hawkes Bay	PQ	HRG		PQ	PQ	PQ	PQ
MidCentral PHS Palm Nth	PQ	IN,HRG,FC		TI	TI	TI	TI
MidCentral PHS Whanganui	PQ	HRG		TI then PQ	TI then PQ	TI then PQ	TI then PQ
RPH Lower Hutt	AP	>50 per week**	PQ	AP	AP	AP	AP
RPH Wairarapa	AP	HRG		AP	AP	AP	AP
PHS Nelson/Marlborough	AP			TI	TI	TI	TI
CPH Christchurch	PQ	HRG, IN, FC		PQ	PQ	PQ	PQ
CPH Greymouth	PQ	IN	TI	PQ, VI, TI	PQ, VI, TI	PQ, VI, TI	PQ, VI, TI
CPH Timaru	TI, PQ			TI	TI	TI	TI
Public Health South Dunedin	TI, PQ			TI, PQ	TI, PQ	TI, PQ	TI, PQ
Public Health South Invercargill	TI, VI			TI, VI	TI, VI	TI, VI	TI, VI

Key

Advice by Post	**AP**	Telephone interview	**TI**
High Risk Group	**HRG**	Food Complaint	**FC**
Increase in notifications	**IN**	Postal Questionnaire	**PQ**
Visit	**VI**		

* Six of the 17 PHSs did not follow up notifications of campylobacteriosis routinely. However, some had clearly defined trigger points when further investigation of sporadic cases would be undertaken

** RPH sent questionnaires to sporadic cases of campylobacteriosis cases when there was >50 cases noted in a week

2.5.3 Discussion

A review of other PHS systems allowed the most appropriate systems for use within the project to be considered and identified clear differences in the approaches for gathering common enteric disease surveillance within PHSs nationally.

A true response rate for postal questionnaires could not be identified, but estimates were received from those using questionnaires that we could expect between 50 – 70 percent return rate during the trial. This was used to estimate the potential response rate for the postal questionnaire trial.

Larger PHSs have staff who specialise in work associated with communicable disease notifications. Smaller PHSs did not always have consistent surveillance methods within their own region; their HPOs work as generalists and are responsible for all types of work in the PHS within a specific geographical area. Other work undertaken by a generalist HPOs included: commenting on resource consents; health and safety within early child care centres; food complaints; emergency management; outbreak management and biosecurity. Generalist HPOs can then choose to follow up notifications by whichever method they deemed suitable for the time available and the geographical area they are were responsible for.

One of the PHSs who used a number of TLAs to follow up notifications expressed concern that forwarding notifications to TLAs resulted in further filtering of the information from cases and that quality and completeness of follow up varied greatly between different TLAs in their region.

The differences highlighted in Table 2 and discussed above show that between the PHSs there are many different methods of data collection for notified cases of common enteric disease. Potentially this could mean an individual with campylobacteriosis (or any other common enteric disease) in one part of NZ may have no contact with their local PHS, whereas somebody with the same disease in another part of NZ could receive a visit from an HPO and be interviewed in their home. Overall the result is huge variations in the methods used to gather surveillance data for notified cases of common enteric disease. This ultimately affects the quality of data and potentially results in biased conclusions formed by researchers using the data at a local, national or international level.

3. Postal questionnaire trial for notified cases of cryptosporidiosis, giardiasis, salmonellosis and yersiniosis

3.1 Introduction

This section outlines the methods and results of a one year questionnaire trial run within the MCPHS between 1 July 2007 and 30 June 2008. The aim of the trial was to assess the quality and timeliness of data gathered from notified cases of cryptosporidiosis, giardiasis, salmonellosis and yersiniosis received by MCPHS over the trial period.

3.2 Methods

3.2.1 Developing a postal questionnaire

Copies of questionnaires in use throughout the NZ PHSs, and additional food and waterborne disease questionnaires were gathered from the NZFSA, the internet, and from ESR. These questionnaires were reviewed and unique or different approaches were identified to aid the steering group in selecting a questionnaire and adapting it for use in the trial.

A short two page questionnaire was developed based on a format supplied by RPH which was enhanced to gather enough information to complete all fields in an EpiSurv case report form (CRF). A template cover letter to be sent to cases was written and approved by the steering group.

3.2.2 Administration of postal questionnaire

The majority of cryptosporidiosis, giardiasis, salmonellosis and yersiniosis disease notifications received by MCPHS are received directly from the local Medlab Central laboratory through the Palmerston North hospital campus internal mail system. These notifications are initially received by the EpiSurv coordinator, who searches hospital databases for patient details i.e. National Health Index number (NHI), current address and phone numbers. If staff were unable to find these details they contacted the relevant general practice. Demographic information gathered is then entered electronically onto an EpiSurv CRF and a hard copy is printed and referred to during the follow up process.

The time target was to enter all notified cases onto EpiSurv within 24 hours and send mail packs to the cases on the same day notifications were received by the PHS.

The mail pack included:

- Covering letter including information on exclusion from work (those in high risk occupations), school or child care
- Questionnaire
- Reply paid envelope
- Information pamphlet
- Food safe pamphlet
- Fridge magnet (cook, clean, cover and chill).

No further attempt to contact notified cases was made after sending the initial mail pack.

Based on the previous three years notifications it was estimated that there were likely to be 118 to 129 cases of cryptosporidiosis, giardiasis, salmonellosis and yersiniosis notified in the MCPHS region during the trial period.

3.2.3 Data analysis

A custom EpiSurv report was designed to extract data for analysis. It incorporated fields for measuring return rate, timeliness, and completeness of the returned postal questionnaires. Reports of these outcomes were run quarterly, and at the conclusion of the trial. All reports were transferred into Microsoft Excel for analysis.

The trial data was compared to surveillance data provided by ESR from a comparable PHS (with similar region size and predominant industry) and from all NZ PHSs (excluding MCPHS). ESR supplied data sets for all cases of salmonellosis, giardiasis, cryptosporidiosis and yersiniosis in order to investigate contact rate and completeness. The return rate from the postal questionnaire trial was compared with the contact rates from the ESR data from other regions. There was no surveillance data available that indicated which methods were used for collection of data at other NZ PHSs. So it was not possible to compare different methods of data collection. Fields where there were missing data were reviewed and assigned as unknown (the majority) or no these were then calculated using excel to determine completeness.

Table 3: Fields selected to run custom quarterly reports and used for final analysis of data gathered during the trial

EpiSurv Field Name	*Reason for inclusion*
EpiSurv Number	Used as unique identifier to identify hard copy of case if data error entry noticed
Report date*	Hard copies filed under month reported
Status*	Indicates a confirmed case. Probable cases were excluded for analysis
Sex*	Analysis for quality of data gathered
Age*	Analysis for quality of data gathered
Ethnicity*	Analysis for quality of data gathered
Meshblock	For spatial analysis within the region
NZDeprivation Index	For analysis of relationship between deprivation level and response rate
Occupation*	Analysis for quality of data gathered
Onset of illness*	Analysis for quality of data gathered
Fits clinical description	Identifies if the case is deemed a case in EpiSurv
Method of investigation	Analysis for method used
Investigation sent date	Calculate time to contact or return questionnaire
Investigation received date	Calculate time to contact or return questionnaire
Risk Factors**	Subjective fields which can only normally be completed through contact with case and show completeness of information gathered
Comments section	Validates information included in the CRF and includes additional comments relating to the investigation

*** Compulsory fields in EpiSurv which are measured annually by the ESR Quality Report**
**** Contact with: farm animals, sick animals, other sick people, recreational water, consumed untreated water, food at a food premise or been overseas**

Return rate

The return rate was calculated using all postal questionnaires sent out as the denominator. If a case was identified as needing more urgent contact other than by postal questionnaire (e.g. required contact by phone or interview due to a trigger for public health action – such as an increase in notifications or they are potentially associated with an outbreak) then contact was initiated. However, if additional contact was initiated prior to the case receiving or returning a completed postal questionnaire the case was excluded from the trial. If additional contact was initiated after a completed questionnaire had been received by the PHS the case was included in the trial.

Further analysis for MCPHS data was undertaken using the New Zealand Deprivation Index 2006 (NZDep 2006), determined by meshblock (defined as the smallest geographical area from which Statistics New Zealand collects and analyse data (Statistics New Zealand, 2008)), to examine the deprivation level assigned to where a case lived and any association with the response rate in the postal trial.

> "The NZDep 2006 scale of deprivation from 1 to 10 divides New Zealand into tenths of the distribution of the first principal component scores. For example, a value of 10 indicates that the meshblock is in the most deprived 10 percent of areas in New Zealand, according the NZDep 2006 scores" (Salmond, Crampton, & Atkinson, 2007).

The cases were grouped into NZDep 2006 indices, 1-5 being those who are associated with areas of least deprivation, or 6-10 being those who live in the most deprived areas. Expected response rates were calculated by multiplying the number of questionnaires sent to the addresses within the category of NZDep 2006 index with the response rate of the questionnaire trial. A Chi-squared test was used to assess significance.

An additional comparison was made with the data using the known MCDHB population, expressed in NZDep 2006 quintiles, to show if the spread of notifications received was similar to the known deprivation distribution for the region.

In addition analysis using meshblocks and ArcGIS 9 to map the spatial location of notifications received during the trial, was used to determine the rural versus urban locality of notified cases, and the association with response rates in the postal trial. The Chi-Squared Test and p values were calculated to identify if response rates differed significantly by these parameters from the expected response rate (calculation based on overall postal trial response rate) and the differences are plotted in.

The data from other PHS was categorised either as contacted or not contacted. Cases were deemed contacted if they had an onset date recorded and two or more subjective risk factor fields e.g. contact with someone with similar symptoms, food from a food premises, consumed untreated water, recreational contact with water, contact with farm animals, contact with sick animals, or overseas during incubation. This

information is not normally received with notifications, from either the GPs or laboratories; it is usually added to the database once the case is contacted.

Those cases left who were categorised as not contacted were then re-sorted by the comments field and reviewed for statements which indicated contact had been made with the case, e.g. “spoke to case”; “contacted case”; “rang case”; “case says”; “reviewed questionnaire”; and “reviewed, no source identified”. Any case with comments which provided evidence of contact with the case was reclassified as contacted.

Completeness

A report was designed to extract completeness data on the following fields: date of birth, occupation, ethnicity, symptoms (indicating clinical criteria); onset date and all risk factors. Analysis of this report for completeness measured the unknown data by making the assumption that unknown is a non- completed field.

Timeliness

Two fields were added to the extra details section in the latest version of the EpiSurv database. These fields were used to measure time to respond over the trial period. The field for “date investigation sent” recorded the date the questionnaire was posted from the PHS; the date “investigation received” recorded the date the questionnaire was returned to the PHS.

Identification of need for further public health action

The steering group agreed that the risk factor questions that would be most likely to identify potential sources would also indicate cases who required further investigation if they responded positively to any of the following:

- Contact with other symptomatic people
- Consuming food from a food premises during the incubation period
- Consuming untreated water during the incubation period.

The questionnaire was modified by adding an alert requesting that cases associated with other cases should telephone an HPO immediately.

The following response options were identified as internal in that a response did not require interaction outside the PHS (these could be mostly dealt with by administration staff) and external in that additional interaction was required with

others outside the PHS (these triggers required further investigation by an HPO). The following list shows the actions associated with the potential triggers as identified by the steering group:

- **Internal MCPHS response options**
    - Mailing of educational information e.g. household water supplies management booklet (Ministry of Health, 2006b) sent to those identified with their own water supplies
    - Reviewing local risk factor monitoring data set including onset date of illness and information received from the interview or questionnaire e.g. name of local pool, food premises, or early child care centre (ECC)
    - Internally reviewing other cases with possible commonalities to consider if an outbreak response should be considered
    - Reviewing EARS on a weekly basis to identify increases in case numbers either within MCPHS or neighbouring PHSs.

- **External MCPHS response options**
    - Telephoning cases (or caregivers of cases) whose completed and returned questionnaires raised issues that needed further clarification to assess a potential public health risk
    - Telephoning potential sources identified by contacted cases, e.g. telephoning a school or ECC identified by a questionnaire as having other illness. Information on other absenteeism may be obtained
    - Contacting local authority to ask if there were other complaints or issues around a suspect food premises
    - Working with the local Environmental Health Officer (EHO) to investigate premises implicated through the reporting system
    - Emailing other PHSs to advise of food premises outside the MCPHS region which have been identified by cases.

3.3 Results

3.3.1 Developing a postal questionnaire

A qualitative review of 27 questionnaires was undertaken. While the questionnaires were all designed for surveillance of enteric disease at the case/public health interface, the purpose of the questionnaires varied. Some were for sporadic notified cases and others for self reported FBI or outbreak investigation. The questionnaires reviewed were designed for many different modes of delivery including postal, telephone interview, online, and face-to-face interview.

Only one questionnaire (designed by Wellington Regional Public Health) had a "pre-screen" front page which included a number of "yes"/"no" questions. These pre-screen questions gathered most of the data required to complete a case report form in EpiSurv. This meant that people with no clear source or risk factor associations did not have to complete the five page questionnaire. This pre-screen questionnaire was selected and adapted by the steering group for use as a two page postal questionnaire (Appendix 11.1)

Table 4: Qualitative analysis of 27 enteric disease surveillance questionnaires for use either by phone, in person or via a postal service

Information requested by questionnaires	Number requesting information	Comment
Demographic* i.e. name, age/DOB, sex, address	27	
Occupation and place of work*	27	
Early child care centre/school*	27	
Ethnicity*	15	None of the international questionnaires included an ethnicity question, nor was it included in a number of the NZ postal questionnaires
Onset of illness*	27	
Food premises	25	One NZ *Campylobacter* questionnaire and one UK FBI questionnaire didn't request food premises info.
Foods eaten	26	Requests for information were mainly associated with a food premises. Some included space for information on foods eaten at home and optional food diary for the 3 -7 days prior to onset of illness.
Drinking water sources*	25	One questionnaire included water under the food section and a UK FBI questionnaire did not include the question.
Animal contact**	21	12 of the 17 PHS questionnaires requested further information regarding domestic pets and one included a section on wild animals.
Contact with sick animals**	21	Some questionnaires specifically asked about animals with diarrhoea; two requested any diagnosis of animals illness.

Information requested by questionnaires	Number requesting information	Comment
Hospitalisation*	19	Some differentiated between visiting accident and emergency departments and admission to a hospital ward. This information is also gathered by NZ Health Information Service and may not need to be included in a postal questionnaire.
Contact with a person with similar symptoms*	14	Request for further information such as names and relationships. One form requested names and details of all who had stayed in the case's home in the 10 days prior to onset of illness.
Types of symptoms**	14	This information was less likely to be asked for in a mail questionnaire for a notified case and more likely for gastroenteritis or forms for self reported cases.
Contact with a person: same illness**(based on a clinical diagnosis)	13	Requested further information relating to names and relationships
International travel**	13	Including countries visited and dates of departure and arrivals
Recreational water contact *	13	Type of contact
Events/ gatherings	13	Some questionnaires included prompts i.e. wedding, festivals, pot luck dinner
Activities	10	Some specifically asked about camps/outdoor recreation
Listing high risk foods	9	Included lists of high risk foods to prompt cases
Contact sewage faecal matter*	9	
Type of household sewerage system	2	
Food shops used	9	To purchase food for home consumption
Brand name	5	Brand name of consumed products
Duration of illness	8	One included a calculation to work this out
Home food preparation	8	In the context of "failures"; others included a check list audit of kitchen procedures
Specific meats	6	Some included tick boxes and prompts
Undercooked chicken	4	Consumption of undercooked chicken
Handling raw meat or poultry	4	
Fresh or frozen poultry	2	Question related to exposure to fresh or frozen poultry during the incubation period
Domestic travel	6	
Household contacts	5	The number of others living in the house with the case
Holiday or work	1	Was the case on holiday or at work during incubation?
Medications	3	Questions on treatment by GP and type of medications received
Privacy	5	One relating to the use of the case's name during an investigation and one relating to the information gathered relating to others with similar symptoms.
Potential cause of illness	9	What the case thought might have caused their illness either with a direct question or by asking for comments.

* Category three EpiSurv fields =optional data PHS can choose to gather it or not
** Category one = Compulsory EpiSurv fields

3.3.2 Postal questionnaire return rate

A total of 126 cryptosporidiosis, giardiasis, salmonellosis and yersiniosis notifications (excludes campylobacteriosis notifications) were received from within the MCPHS region between 1 July 2007 and 30 June 2008. Thirteen cases were excluded from the trial as they were identified as being associated with outbreaks. A total of 113 cases received questionnaires with a return rate of 53%.

Response rate by NZ Deprivation 2006 Index (NZDep 2006)

Of the 113 cases in the postal questionnaire trial, 12 cases were not able to be assigned to a meshblock in order to determine the NZDep 2006 index. Eleven of these were due to rural delivery addresses. The effect of the missing data on this analysis is difficult to ascertain but few rural areas within the MidCentral region have high NZDep 2006 indices.

Although there appeared to be an association between cases living in higher deprivation areas having a lower response rate than expected, and cases living in lower deprivation areas having a higher response rate than expected, the difference was not statistically significant (p=0.38) (Figure 10).

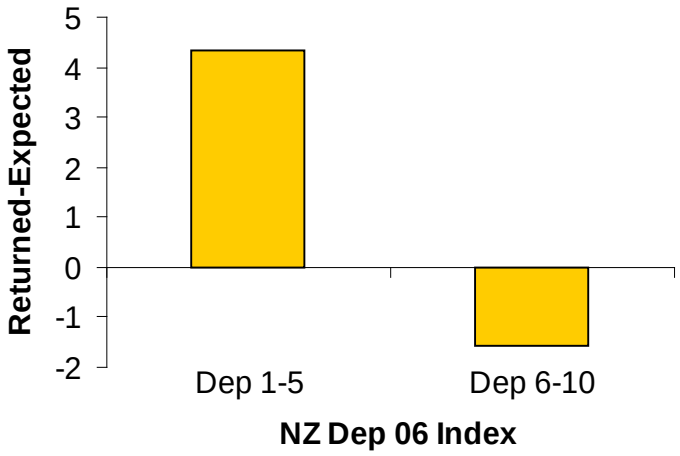

Figure 10: Response rate of postal questionnaire and compared with expected response rate by deprivation

The percentage of the MidCentral DHB population in each NZDep 2006 index quintile was compared to the percentage of notified cryptosporidiosis, giardiasis, salmonellosis and yersiniosis cases in each quintile.

Comparison of Figure 11 and Figure 12 shows that there were a larger proportion of cases notified from Quintile 1 and fewer in Quintile 2 (these represent those living in the most deprived areas of the MCPHS region) and that in the higher deprivation quintiles the percentage of notifications in each quintile was similar in proportion to the MidCentral population quintile distribution. The distribution of cases in indices 1-5 compared with 6-10 is in similar proportions to the overall MidCentral population.

Figure 11: Distribution of NZDep 06 index quintiles in the MidCentral DHB population

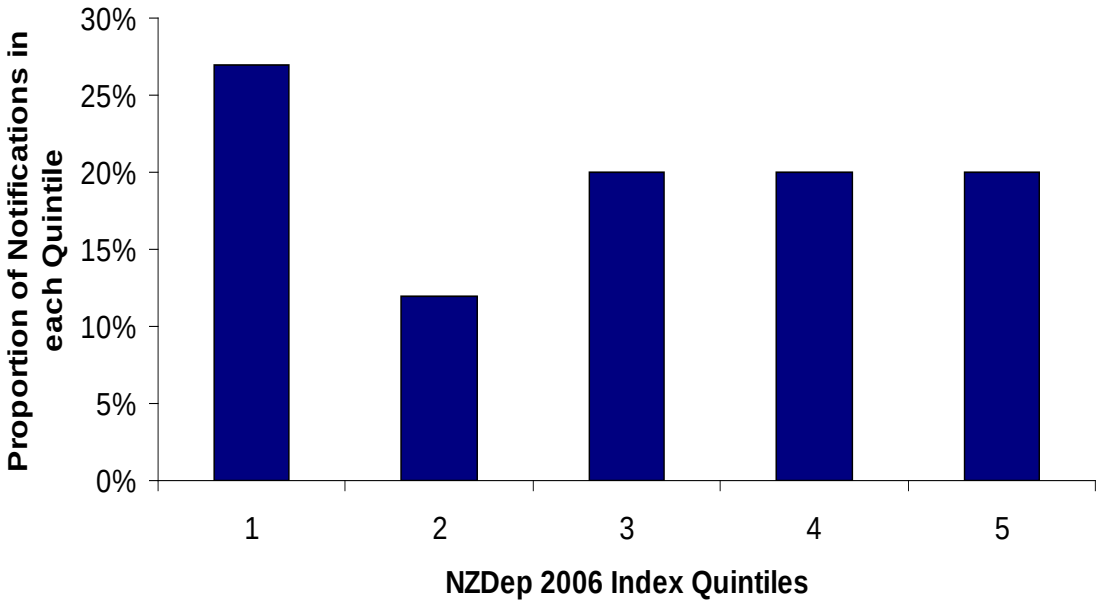

Figure 12: Distribution of NZDep 06 index quintiles for cryptosporidiosis, giardiasis, salmonellosis and yersiniosis

Response rates and rural versus urban locality

The response rate for postal questionnaires was assessed to see if the location of the case (rural versus urban locality) had an effect on the response rate. Although the results suggest that cases in rural localities are less likely to respond to postal questionnaires than expected, and those in urban localities are more likely to respond than expected, this difference was not statistically significant. (p=0.62) (Figure 13).

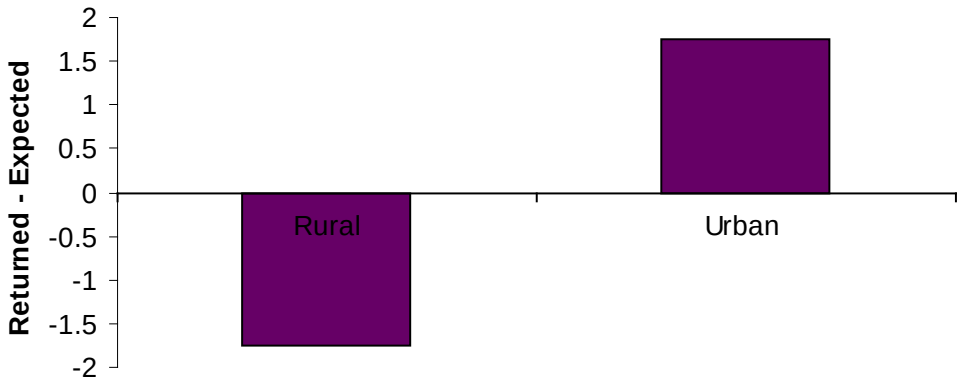

Figure 13: Response rate of postal questionnaire and compared with expected response rate for rural/urban locality

Response rate compared with other PHSs

It was difficult to categorise cases from other PHSs as there was a combination of contact systems, e.g. ringing the notified case to establish if they were in a high risk occupation, and then sending a questionnaire to complete the investigation. The "investigation method field" was explored as a way to sort the data according to the system of data collection used for investigation of the notification. However, a review of this field versus information contained in the "comments" field showed inconsistent results between the system selected in the method field and the system identified as used in the comments section. Therefore, it was not possible to compare the same method of data collection with other PHSs.

Different interpretations on how to complete the ESR CRF were also identified. This led to contradictory information such as some risk factor information in the comments field and no risk factors completed in the appropriate fields, or CRF risk factor fields completed and the comments field including notes such as there was "no

response to letter/questionnaire" or "questionnaire not returned". This may have affected the accuracy of assigning a case to the contacted or not contacted categories.

Analysis of data (supplied by ESR) from a comparable PHS showed that the nominated PHS used both telephone interviews and postal questionnaires for gathering their surveillance data. This was consistent with what was reported during the survey of PHS when the comparable PHS advised they attempted to contact every notified case and utilised both systems to do so. Methods used for data collection by NZ PHSs are given in Table 2.

The contact rates for the postal questionnaire trial, a comparable PHS and all of NZ are presented in Table 5. The response rate of 53% for MCPHS was virtually the same as the estimated 54% contact rate for the rest of NZ. However, the response rate was significantly lower than the estimated 87% contact rate achieved by a similar sized PHS.

3.3.3 Postal questionnaire completeness

An EpiSurv report was run at the end of the trial to determine completeness of data entered into EpiSurv fields. The core EpiSurv fields were likely to contain information identified from the initial laboratory or GP notification. The risk factor fields were subjective and were difficult to complete without direct contact with the case or the caregiver of the case. This is why subjective risk factor fields were used as an indicator of contact with the case.

Completeness data (defined as the number of completed fields for each case) were compared between MCPHS, a similar PHS and to all New Zealand notifications over the same time period as the trial (Table 5 and Table 6).

Table 5: Analysis of data to measure completeness of data in EpiSurv collected from cryptosporidiosis, giardiasis, salmonellosis and yersiniosis cases notified between 1 July 2007 and 30 June 2008 identified as "contacted" for NZ, MCPHS and a similar size PHS

Question/EpiSurv field	*MCPHS postal questionnaire*	*Other similar PHS*	*NZ Excluding MCPHS*
Date of birth*	100%	100%	99%
Occupation*	96%	93%	85%
Ethnicity*	100%	100%	92%
Symptoms - indicates clinical criteria	100%	99%	99%
Onset date*	81%	92%	93%
Contact with someone with a similar illness	93%	84%	79%
Consumed food from a food premise	97%	87%	65%
Consume water from an untreated source	93%	65%	62%
Have recreational contact with water	95%	89%	73%
Contact with farm animals	95%	95%	87%
Contact with sick animals (diarrhoea)	92%	82%	72%
Overseas travel during the incubation time*	95%	96%	87%
Total cases notified	**113**	**221**	**3967**
Total cases contacted	60	193	2136
Percentage of cases contacted	**53%**	**87%**	**54%**

* Compulsory EpiSurv data usually identified from initial notification prior to contacting case

Table 6: Analysis to measure completeness of data in EpiSurv from cryptosporidiosis, giardiasis, salmonellosis and yersiniosis cases notified between 1 July 2007 and 30 June 2008 identified as " not contacted" for NZ, MCPHS and a similar size PHS

Question/EpiSurv field	*MCPHS postal questionnaire*	*Other similar PHS*	*NZ Excluding MCPHS*
Date of birth*	100%	100%	*99.0%*
Occupation*	47%	75%	*35.0%*
Ethnicity*	33%	98%	*45.0%*
Symptoms - indicates clinical criteria	4%	92%	*85.0%*
Onset date*	0%	54%	*37.0%*
Contact with someone with a similar illness	0%	0%	*2.0%*
Consumed food from a food premise	0%	0%	*1.0%*
Consume water from an untreated source	9%	4%	*1.0%*
Have recreational contact with water	0%	4%	*1.0%*
Contact farm animals	0%	0%	*0.0%*
Contact with sick animals (diarrhoea)	0%	0%	*0.2%*
Overseas travel during the incubation time*	0%	4%	*14.0%*
Total cases notified	**113**	**221**	**3967**
Cases not contacted	53	28	1831
Percentage of "not contacted"	**47%**	**13%**	**46.0%**

* Compulsory EpiSurv data usually identified from initial notification prior to contacting case

3.3.4 Postal questionnaire timeliness

The questionnaires had a median return time of six days. The least time to return was one day, and was due to the case telephoning the PHS to complete over the phone, and one case (a hospital worker) returned the questionnaire in person to the PHS.

Cases sent questionnaires over the Christmas and New Year periods were associated with the longest delays in responding. The longest time to reply was 56 days.

3.3.5 Identification of need for further public health action

Returned postal questionnaires were reviewed for triggers that required additional public health action (see also Section 3.2.3). Of the 60 returned questionnaires, 40 cases had answered "yes" to an identified trigger question. These were mostly managed with internal systems as highlighted below (Table 7).

Table 7: Triggers hit by postal questionnaires returned from notified cases of giardiasis, cryptosporidiosis, yersiniosis, and salmonellosis in the MCPHS region during the trial

Trigger fields	Response	Questionnaires requiring further action	Action
Consumption of food in a food premises during incubation period	Yes	29	**Internal:** added to food premises watch-list and questionnaire reviewed for high risk foods
Consumption of untreated water during incubation period	Yes	22	**Internal:** Mailed a copy of booklet about managing household water supplies
Contact with other symptomatic people	Yes	3	**Internal:** Reviewed information supplied
		2	**External**: Telephoned case, case's parent or implicated source i.e. child care centre

3.4 Discussion

The initial questionnaire review identified a number of issues that were discussed by the steering group.

- That no PHS was identified as measuring response rates or completeness of either postal questionnaires or telephone interviews when used as a method for gathering common enteric disease surveillance data.
- Gathering additional information (other than what was required to complete an EpiSurv CRF) requested in some of the NZ questionnaires reviewed may be unnecessary and unlikely to be used in surveillance of sporadic cases of an enteric disease. This could be considered a breach of the Health Information Privacy Code 1994 (Privacy Commissioner, 1999).
- The appropriateness of using more in depth questionnaires as a first contact (screen) of a probable sporadic case when a trigger or commonality with other cases had not yet been identified.
- The use of additional fields within EpiSurv to gather/store risk factor information which may be of concern or topical to a PHS on a local level e.g. unpasteurised milk consumption in rural areas.

The review of questionnaires identified a short yes/no questionnaire (currently in use as a pre-screen by Regional Public Health (Appendix 11.1) as having the most favourable layout for the trial. This questionnaire was enhanced and adapted by the steering group into four disease-specific questionnaires for notified sporadic cases of cryptosporidiosis, giardiasis, salmonellosis and yersiniosis received by MCPHS. These were used for the postal questionnaire trial initiative (Section 11.1).

It was intended to compare trial results with pre-trial surveillance data within MCPHS. Prior to the beginning of the trial there was a significant change to EpiSurv with the launch of SURVINZ EpiSurv V 7.2.1 on 3 April 2007. This resulted in a changed format for the collected surveillance data and the start of recording investigation method. Prior to the implementation of EpiSurv 7.2.1 the method of follow up used for notified cases was not recorded in the EpiSurv system. In addition, there was no provision in the previous EpiSurv format for recording questionnaire return/contact dates for notified cases. Unfortunately, in the pre-trial surveillance data the method of contact varied and was not recorded, so it was not possible to compare directly the historical method of contact with the trial data.

One of the limitations of the EpiSurv database identified during the data collection phase relates to the use of the unknown option. An HPO during an interview can choose between "yes", "no", or unknown. The unknown option is often used if the case doesn't know the answer to a question (i.e. they ate out at a food premises but couldn't remember where, or if their child was a case and was with other people/family and may have eaten out, or in the water section when cases visited a rural address or bach but did not know the source of the water they drank). However, if the HPO fails to complete (or ask) the question the incomplete data defaults to unknown. Thus an unknown option can therefore have several different interpretations making it difficult to analyse as it is missing data. Subjective fields, mainly risk factor fields, are more likely to have lower completion rates.

The postal questionnaire trial response rate of 53% was lower than expected based on feedback from the NZ PHSs. However the result was greater than a similar enhanced surveillance study undertaken in Australia, where a response rate of 49.2% (using postal questionnaires) was achieved over a similar study period (Leighton, 2004). The contact rate for the rest of NZ (for the same diseases using multiple methods) was estimated at 54%.

This indicates that a response rate of 53% is likely to be representative of what can be expected by using postal questionnaires for common enteric disease surveillance. While the data from those who did return the questionnaire was better compared to the data from the rest of NZ the overall completeness is questionable due to the lack of responders (Table 5). A significantly better response rate of 87% was achieved by the similar PHS that uses a combination of postal questionnaires and telephone interview follow up.

The results from the cases deemed to be not contacted provide a picture of what surveillance data quality might be like where no investigation of sporadic cases is undertaken at the PHS level and as much information as possible is gleaned from the GP and laboratory notifications to complete the CRF in EpiSurv (Table 6). These results suggest that if no attempt was made to contact these cases the basic demographic information could potentially remain reasonably complete when reported to EpiSurv. However, source attribution information would be poor. This

could significantly prolong source identification in an outbreak situation and delay the potential linking of risk factor commonalties between sporadic cases.

It was noted in the analysis of not contacted cases that the completeness of the field relating to symptoms (that indicates if the case fits the clinical criteria) remains at high levels and this may indicate a lack of understanding or different interpretations relating to this field. Within MCPHS the field is only completed if we had information from the patient (or doctor) that the case was symptomatic and met the clinical criteria for the reported disease. The other reason for a high level of completeness in this section may be a better primary and public health interface within other PHSs whereby this information is accessible or supplied by the health practitioner providing the notification.

The majority of returned questionnaires that answered yes to trigger questions gathered enough information not to require further contact with the case. There was no evidence that the questionnaire missed any potential linked cases. Two of the returned questionnaires were later identified as linked to a nationwide *Salmonella* outbreak. While we did not identify these cases as linked (based on the information contained in the returned questionnaires) the national outbreak investigation was only able to link cases through strain typing of *Salmonella* Chester. While this unusual strain type linked cases across regional borders no common food source was ever identified (Sexton, 2009).

The median response time for our questionnaire was six days. However, the additional processing of questionnaires once they were received in the PHS (such an HPO reviewing the returned questionnaire and administration staff logging the final data into EpiSurv) would have caused further delays. Depending on reactive work loads within the PHS there could potentially be weeks for final reporting and closing of the case within EpiSurv.

Analysis of the NZDep 2006 and the locality of cases sent questionnaires was tested and, while neither result was of statistical significance, this may be a reflection of a small sample size. However, a lower response rate from deprived or rural areas would not be unexpected, and it has been indicated in other studies that cases living in lower social deprivation areas 1-5 would be more likely to return questionnaires than those living in higher deprivation areas 6-10 (Erlewyn-Lajeunesse & Edmondson-Jones,

2003; Steptoe & Feldman, 2001). This is likely to be due to a number of socioeconomic and geographical issues such as lack of time, priorities, literacy levels, and accessing postal boxes. Overall lack of response could affect the representativeness of surveillance data collected using the postal method.

Analysis was also undertaken to look at the impact of deprivation and urban/rural locality on response rates. The distribution of these parameters was considered for all notified cases and compared with the spread of these for the MCPHS population (Figure 11 and Figure 12). The analysis showed that there were significantly more notifications received from those who live in less deprived areas and slightly less notifications from those in more deprived areas than what would be expected from the population used in the trial.

An analysis of locality of MCPHS cases by meshblock indicated that notifications of enteric disease received were similar to the 18% rural and 82% urban spread within the region. Using the Statistics NZ classification of urban versus rural status the percentage of cryptosporidiosis, giardiasis, salmonellosis and yersiniosis cases in the trial identified as rural was 30% and urban 70%. Campylobacteriosis cases also had a similar distribution, with 23% rural and 77% urban. There is a suggestion that there is an over-representation of rural cases of cryptosporidiosis, giardiasis, salmonellosis and yersiniosis cases in the MCPHS region.

4. Telephone interview trial for campylobacteriosis cases

4.1 Introduction

This section describes a one year enhanced surveillance trial run within the MCPHS between 1 July 2007 and 30 June 2008. The aim of the trial was to assess the quality and timeliness of data gathered from notified cases of campylobacteriosis (defined as cases who tested positive for *Campylobacter* and were notified to the PHS over the trial period).

4.2 Methods

4.2.1 System of telephone interview

The majority of campylobacteriosis notifications received by MCPHS were directly from the local Medlab Central laboratory. These notifications were received by administration staff, who search hospital databases for NHI, current address and phone numbers. If staff were unable to find patient details they contacted the relevant general practice. Demographic information gathered was entered into the EpiSurv CRF. Those cases whose phone numbers were not found by administration staff received a letter requesting them or their parent or guardian contact the PHS.

All notified cases of campylobacteriosis arising from the MCPHS region between 1 July 2007 and 30 June 2008 were interviewed via telephone by HPOs unless the cases were hospitalised in which case they were interviewed in person on the hospital ward. The interview was based directly on the EpiSurv enteric disease (campylobacteriosis) CRF.

It had been identified that there was likely to be between 245 and 333 cases of campylobacteriosis notified in the MCPHS region over the year of the trial (based on notifications in 2005 and 2006).

4.2.2 Administration of telephone interview

Whenever possible case interviews were

- Completed between 3pm and 7pm to achieve maximum contact with cases. This also allowed a focused time with no other distractions in the office
- The majority of the case interviews were undertaken on Tuesdays and Thursdays with an aim of a maximum of two working days' delay to follow up of cases
- Headsets were a key tool allowing HPOs free hands to undertake real time data entry of information into the EpiSurv database during the interviews.
- Protocols were developed around the interpretation of the information gathered during interviews.
- A target of three working days from notification to closing cases was set.
- If no current telephone details were available, or after three failed telephone attempts the HPO was unable to contact the case, letters were sent advising the PHS was unable to contact them and requesting they telephone the PHS.
- Telephone messages were left on landlines and/or cellular phones, and text messages were also used. When a message was left the case was advised that MCPHS could call them back if they were using a mobile phone, so as to avoid incurring costs to the user.
- Education information packs were sent to all those contacted by phone and interviewed (unless they declined the offer during the interview), including information on managing household water supplies for those identified as not being on town supply.

4.2.3 Data analysis

Analysis of the telephone interview trial looked at contact rate, timeliness and completeness. Reports of these outcomes were run quarterly and at the conclusion of the trial. All reports were transferred into Microsoft Excel for analysis. Results were compared with the other similar sized PHS data and with MCPHS pre-trial surveillance data.

A custom EpiSurv report was designed to extract data for analysis, incorporating fields for measuring return rate, timeliness, and completeness of the returned postal questionnaires (Table 8). The trial data was compared to surveillance data provided by ESR from a comparable PHS (with similar region size and predominant industry) and from all NZ PHSs (excluding MCPHS) over the same time period.

Table 8: EpiSurv fields selected to run custom quarterly reports and used for final analysis of data gathered during the trial

EpiSurv Field Name	*Reason for inclusion*
EpiSurv Number	Used as unique identifier to identify hard copy of case if data error entry noticed
Report date*	Hard copies filed under month reported
Status*	Indicates a confirmed case. Probable cases were excluded for analysis
Sex*	Analysis for quality of data gathered
Age*	Analysis for quality of data gathered
Ethnicity*	Analysis for quality of data gathered
Meshblock	For spatial analysis within the region
NZDeprivation Index	For analysis of relationship between deprivation level and response rate
Occupation*	Analysis for quality of data gathered
Onset of illness*	Analysis for quality of data gathered
Fits clinical description	Identifies if the case is deemed a case in EpiSurv
Method of investigation	Analysis for method used
Investigation sent date	Calculate time to contact or return questionnaire
Investigation received date	Calculate time to contact or return questionnaire
Risk Factors**	Subjective fields which can only normally be completed through contact with case and show completeness of information gathered
Comments section	Validates information included in the CRF and includes additional comments relating to the investigation

*** Compulsory fields in EpiSurv which are measured annually by the ESR Quality Report**
**** Contact with: farm animals, sick animals, other sick people, contact with recreational water, consumed untreated water, food at a food premise or been overseas**

ESR supplied data sets for all cases of campylobacteriosis to compare contact rate and completeness (Table 9). The contact rate from the telephone interview trial was compared with contact rates from the ESR data from other regions. Missing field data was reviewed and assigned as unknown (the majority) or no in order to assess completeness.

Return / contact rate

The contact rate was calculated by using the denominator of all campylobacteriosis cases notified from within the MCPHS geographical region. The numerator was the number of campylobacteriosis cases who were contacted.

The contact rate was also compared with other PHSs contact rate. The investigation method field was explored as a way to sort the data according to the system of data collection used for investigation of the notification. However, a review of this field versus information contained in the comments field showed inconsistent results between the system selected in the method field and the system identified as used in the comments section. Therefore, it was not possible to compare the same method of data collection with other PHSs.

The data from other PHSs was used to determine the percentage of notifications contacted by other PHSs. To determine whether a notification was contacted or not, cases were categorised into two groups contacted and not contacted. Cases were deemed contacted if an onset date was recorded and positive or negative responses were recorded for two or more subjective risk factor fields: contact with someone with similar symptoms; food from a food premise; consumed untreated water; recreational contact with water; contact with farm animals; contact with sick animals; or overseas during the relevant incubation period for campylobacteriosis.

Those cases who were categorised as not contacted were re-sorted by the comments field and reviewed for statements which indicated contact with the case e.g. if someone had spoken to the case or reviewed a returned questionnaire. Any case with comments which provided evidence of being contacted was reclassified as contacted.

Some cases were difficult to categorise, especially when individual PHSs used a combination of contact systems, e.g. ringing the notified case to establish if they were in a high risk occupation, and then sending a questionnaire to complete the investigation. This led to contradictory information such as some risk factor information in the comments field and no risk factors completed in the appropriate fields, or CRF risk factor fields completed and the comments field including notes such as there was “no response to letter/questionnaire” or “questionnaire not returned”. This may have affected the accuracy of assigning a notification to contacted versus not contacted.

Completeness

A report was designed to extract completeness data on the following fields: date of birth, occupation, ethnicity, symptoms indicates clinical criteria, onset date, and all risk factors. Analysis of this report for completeness measured the unknown data by making the assumption unknown is a non- completed field (Table 8).

Timeliness

Two fields were added to the extra details section in the latest version of the EpiSurv data base. These fields were used to measure time to respond over the trial period. The dates the case was notified and the dated the case interview was undertaken was recorded within the fields.

A review of historical reporting by MCPHS to EpiSurv was undertaken for the period 1 July 2004 to 30 June 2005. Cases were assigned as contacted if there was an onset date stated and two or more questions were answered in the risk factor section.

4.3 Results

4.3.1 Telephone interview contact rate

The total number of campylobacteriosis cases recorded for the MCPHS region over the trial period was 231. Nineteen cases were excluded as they were investigated by bordering PHSs and transferred across to MCPHS at a later date. There were 212 cases notified from within the MCPHS region during the trial. This included 204 cases who were interviewed by telephone, one person requested and responded to a written questionnaire (due to language difficulties) and three cases who were visited in the Palmerton North hospital wards. Only four of the cases notified locally to MCPHS over the trial period could not be located and were therefore not contacted.

A contact rate of 97% was achieved for notified cases of campylobacteriosis received from within the MCPHS region between 1 July 2007 and the 30 June 2008, over the trial period.

4.3.2 Telephone interview completeness rates

An EpiSurv report was run at the end of the trial to determine completeness of data entered into EpiSurv fields. This was compared to completeness data for a comparable PHS and to the completeness data for all NZ campylobacteriosis notifications. The results of the analysis are shown in Table 9 and Table 10.

Table 9: Analysis to measure completeness of data in EpiSurv from campylobacteriosis cases notified between 1 July 2007 and 30 June 2008 identified as "contacted" for MCPHS, a similar size PHS and NZ

Question/EpiSurv field	*Telephone interview*	*Other similar PHS*	*NZ Excluding MCPHS*
Date of birth*	100%	100%	99%
Occupation*	96%	90%	90%
Ethnicity*	99%	97%	93%
Symptoms - indicates clinical criteria	99%	100%	99%
Onset date*	98%	73%	85%
Contact with someone with a similar illness	99%	95%	85%
Consumed food from a food premise	94%	97%	77%
Consume water from an untreated source	97%	88%	69%
Have recreational contact with Water	99%	97%	79%
Contact with farm animals	99%	100%	94%
Contact with sick animals (diarrhoea)	98%	92%	78%
Overseas travel during the incubation time*	99%	98%	88%
Total cases notified	**212**	**342**	**8298**
Total cases contacted	208	219	2214
Percentage of cases contacted	**98%**	**64%**	**27%**

* Compulsory EpiSurv data usually identified from initial notification prior to contacting case

Table 10: Analysis to measure completeness of data in EpiSurv from campylobacteriosis cases notified between 1 July 2007 and 30 June 2008 identified as "not contacted" for MCPHS, a similar size PHS and NZ

Question/EpiSurv field	*Not interviewed*	*Other similar PHS*	*NZ Excluding MCPHS*
Date of birth*	100%	100%	99.0%
Occupation*	0%	36%	34.0%
Ethnicity*	25%	83%	27.0%
Symptoms - indicates clinical criteria	25%	98%	92.0%
Onset date*	0%	42%	41.0%
Contact with someone with a similar illness	0%	2%	0.70%
Consumed food from a food premise	0%	5%	1.10%
Consume water from an untreated source	0%	5%	0.50%
Have recreational contact with Water	0%	5%	0.20%
Contact farm animals	0%	0%	0.20%
Contact with sick animals (diarrhoea)	0%	0%	0.0%
Overseas travel during the incubation time*	0%	3%	9.0%
Total cases notified	**212**	**342**	**8298**
Cases not contacted	4	123	6084
Percentage of not contacted	**2%**	**36%**	**73%**

* Compulsory EpiSurv data usually identified from initial notification prior to contacting case

4.3.3 Telephone interview timeliness

The telephone interviews had a median contact time of two days. The least time to contact was less than one day and the longest was 28 days. Three attempts were made to contact each notified case by telephone; we left messages on answer machines and sent a letter requesting the cases to telephone the PHS (if none of the previous attempts were successful). Long delays were often associated with people returning from being away and responding to telephone messages or correspondence on their return.

4.4 Discussion

It was intended to compare the trial outcomes with methods used prior to the trial commencement. However, we could not use data from the same time period 2005-2006 as our comparison, as campylobacteriosis surveillance had been enhanced as part of another study from June 2006.

Prior to the beginning of the trial there was a significant change to EpiSurv with the launch of SURVINZ EpiSurv V 7.2.1 on 3 April 2007. This resulted in an altered format for the collected surveillance data and the start of recording investigation method. Prior to the implementation of EpiSurv 7.2.1 the method of follow up used for notified cases was not recorded in the EpiSurv system. In addition, there was no provision in the previous EpiSurv format for recording questionnaire return/contact dates for notified cases, meaning we were unable to compare timeliness from data prior to April 2007.

A review of MCPHS historical data between 2004 - 2005 was undertaken and identified 260 cases of campylobacteriosis with 58% assigned as contacted, with completeness between 70–99% in fields measured[4]. Unfortunately, during this period of time the method of contact varied and was not recorded, so it is not possible to directly compare the historical method of contact with the trial data.

The results from the telephone trial showed the methods adopted within MCPHS were very successful at contacting and facilitating the completion of full EpiSurv datasets for each notified case of campylobacteriosis. Over the 12 months of the trial

[4] The same fields were measured as listed in Table 3

we were able to contact 97% of cases and complete the ESR CRF fields at between 94 to 100% (in fields measured) for contacted cases.

As with the postal trial, results from not contacted cases identified across NZ provides a potential picture of surveillance data quality in a scenario where no investigation of sporadic cases was undertaken at the PHS level, and as much information as possible was gleaned from the GP and laboratory notifications to complete the CRF in EpiSurv. These results suggested (as with the postal data) the basic demographic information for campylobacteriosis cases would be at a level of completeness similar to that shown in Table 10, which also indicates source attribution information would be very poor.

Due to the high contact rate (208 contacted of the 212 notified cases), the association with NZDep 2006 Index and rural versus urban locality was not examined for those contacted by telephone. It is likely that telephone interview is more effective, especially when incorporating cellular phones and texting, for cases living in higher deprivation index areas than postal questionnaires. This result is supported, in part, by feedback from Northland PHS (during the PHS enteric disease data collection survey) that they have historically had poor response rates to questionnaires in their region (a region identified as proportionately higher needs population than the NZ population). Northland are much more likely to contact people by mobile phone as many local people cannot afford telephone rental for land lines and used prepaid mobile phones as incoming calls and texts are free (Silver, 2006).

Overall the telephone interviews achieved a higher level of contact and achieved excellent completeness. This is supported by the high contact rates achieved by the comparable PHS who also utilise telephone interviews to contact those cases who have not returned a questionnaire. MCPHS surveillance data was logged into EpiSurv as it was collected, meaning that during the trial MCHPHS supplied data at the national level in real time. The information gathered was truly representative of the notified cases as there were only four cases out of 212 that were not contacted. The higher contact rates can be attributed to implementing an early evening work shift and introducing text messaging to our surveillance toolbox.

5. Spatial analysis of cases contacted by telephone interview or postal questionnaire

5.1 Introduction

In this chapter geographical data from cases gathered from surveillance initiatives, (telephone interviews and postal questionnaires) were analysed using spatial analysis techniques to identify if there was any different geographical clustering between the data sets within the MCPHS region.

5.2 Methods

The EpiSurv dataset contained the geographical meshblock where each case resided. Meshblocks are the smallest geographical area from which Statistics New Zealand collect and analyse data.

> "A meshblock is the smallest area used to collect and present statistics. The size of a meshblock depends primarily on the number of people and type of area covered. Generally, meshblocks in rural areas have a population of around 60 people, while in urban areas meshblocks are roughly the size of city blocks and contain approximately 110 people" (Statistics New Zealand, 2008).

The dataset used for the project included the meshblocks for all notified cases received during the trial period.

ArcGIS 9.1 (Environmental Systems Research Institute Incorporated, 2009) was used to plot spatially the geographical meshblock location of all cases who were contacted (via either postal questionnaire or telephone interviews).

In addition the non responders for the postal questionnaire were also plotted. No spatial analysis was undertaken for the non contacted telephone interviews due to the high contact rate. Only four cases were not contacted over the 12 months of the trial.

5.3 Results of spatial analysis

Figure 14 and Figure 15 show the location of cases contacted via postal and telephone methods respectively. Of note, 12 of the postal responses could not be mapped, including 11 identified as being in rural locations while 21 of the telephone interviews could not be mapped including 17 identified as being from a rural locality.

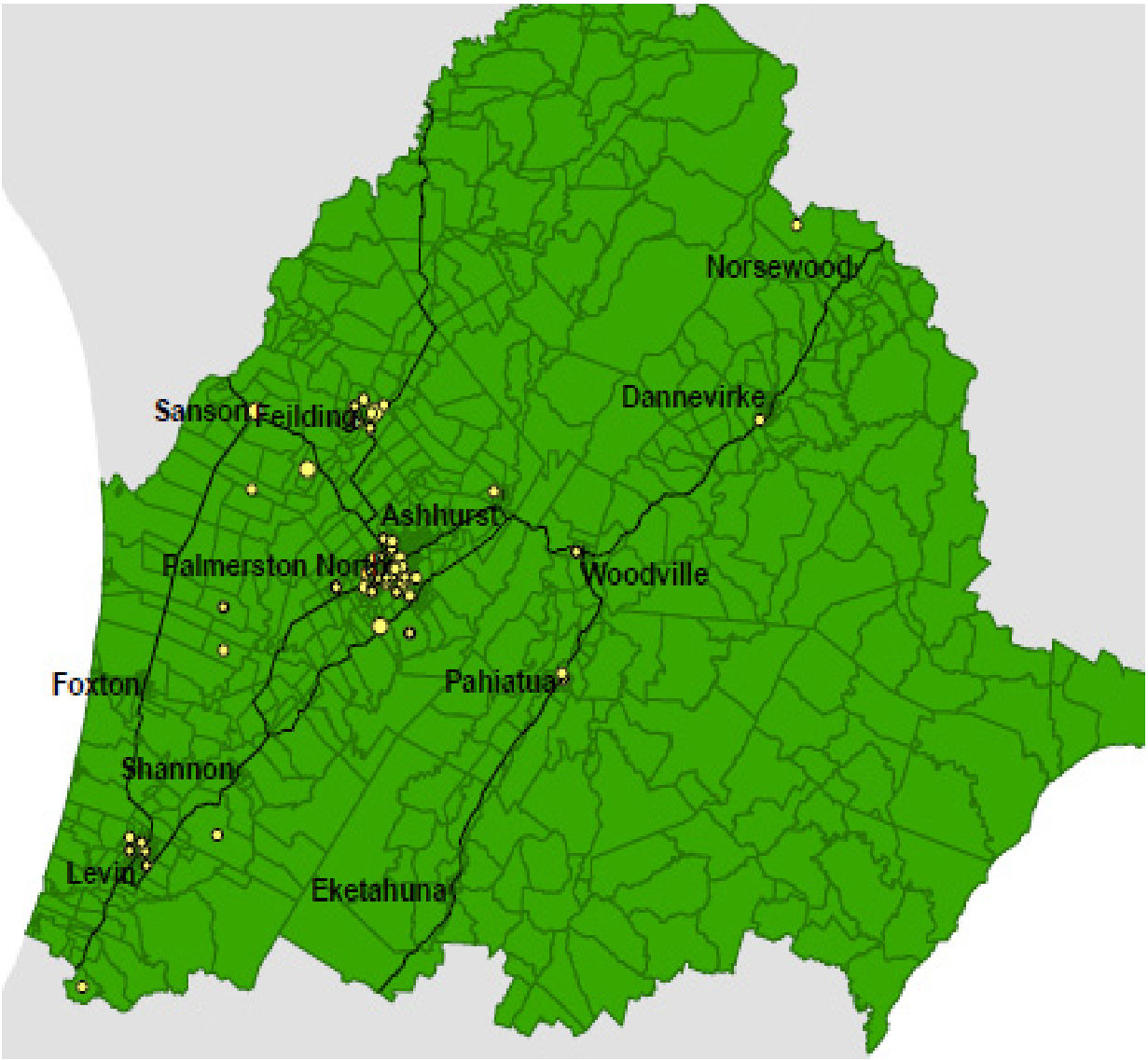

Figure 14: Geographical spread of postal questionnaires returned during the trial period the larger circles indicate multiple cases within the meshblock

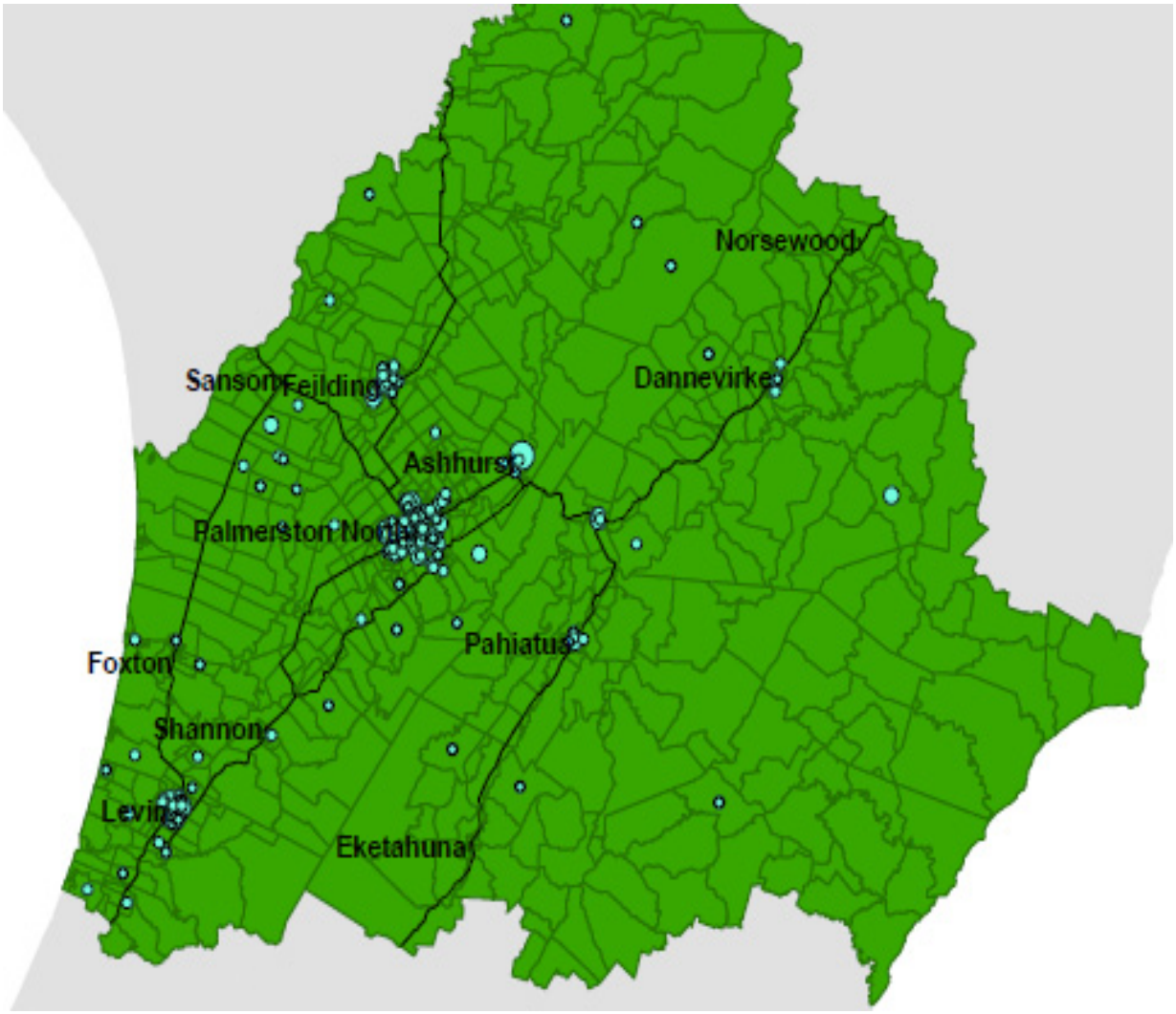

Figure 15: Geographical spread of telephone interviews undertaken during the trial period

A review of the postal non responders (those cases not investigated) by meshblock was also undertaken. The spread of those cases who were not investigated appears similar to the contacted cases in (Figure 16). Figure 13 suggested rural cases are less likely to return questionnaires than expected. In addition, 8/12 of the cases not able to be mapped were those cases not investigated and 11/12 were rural cases. There are eight rural cases missing from Figure 16.

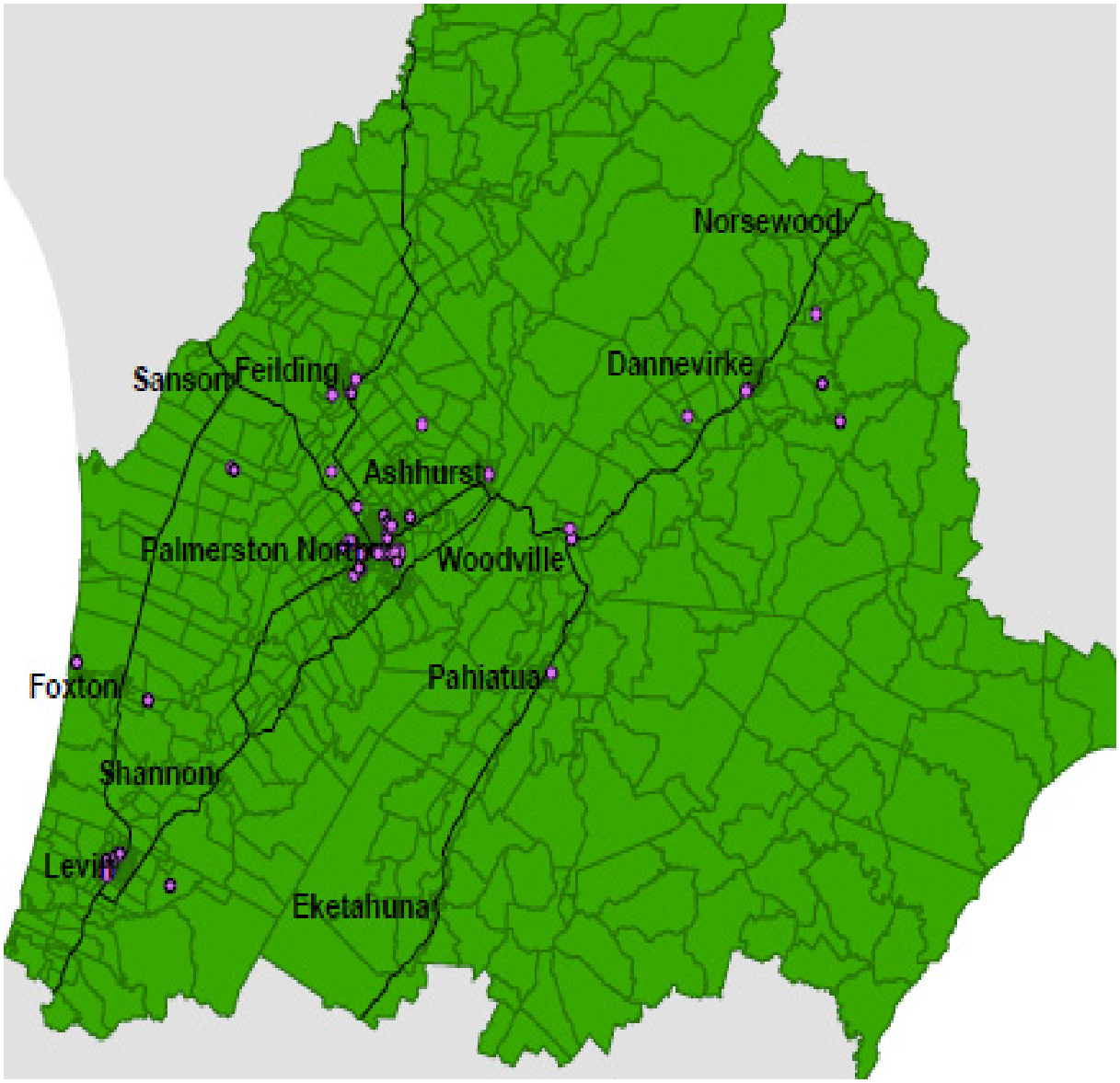

Figure 16: Geographical spread of non responders (postal questionnaires) during the trial period

5.4 Discussion

The spatial analysis showed there was a reasonably even geographical spread across our region for those cases contacted by telephone and those who responded to the postal questionnaires. The non responders appeared clustered in the urban centres but this would be expected as, based on higher population numbers, more questionnaires where sent to urban areas and the areas of higher deprivation (for MCPHS) are mainly in the urban areas.

Limitations were identified in the use of meshblocks for spatial analysis due to the difficulty in plotting rural addresses which included Rural Delivery (RD) numbers and

not street numbers. This potentially leads to a systemic bias in the location of rural cases identified by RD numbers that starts at the point of data collection. Those who live rurally (on a rural delivery run and have no street number) and are notified cases of common enteric disease (or indeed any disease) are difficult to geocode using the current system within EpiSurv. They can only be geocoded as residing somewhere within a Local Territorial Authority (TLA) boundary (as apposed to an exact geographical location which can be achieved with a street numbers). This limits the potential use of spatial analysis for rural data. If poor geocoding is done within the PHS and limitations within EpiSurv prevent accurate geocoding, this makes additional work for investigators or places limitations on data usability (E. Holmes, 2007; Parkes, et al., 2004). The accuracy of the geocoding will be improved by incorporating a new system within EpiSurv which will geocode to rural addresses using the rural address property identification number (RAPID), TLAs throughout NZ are introducing RAPID numbers to support emergency services identifying the location of rural dwellings in an emergency.

> "RAPID numbering is administered by territorial authorities. Numbers are allocated according to a formula based on the distance of the property (or access point) from the beginning of the road on which it is located. The numbers are recorded in Land Information New Zealand's databases and made available to emergency services through mapping services such as Terralink" (New Zealand Police, 2005).

The value of combining geographical data for human and animal cases in an outbreak of zoonotic disease was demonstrated in NZ during the recurring *Salmonella* Brandenburg outbreaks between 1996 and 2000 (Baker, Thornley, Lopez, Garrett, & Nicol, 2007; J. Holmes, 2004). If rural cases of disease are not geocoded accurately, spatial clusters of disease may not be identified if their residential addresses are geocoded at the TLA level.

This chapter has illustrated the geographical representativeness of the data collected over the 12 months of the enhanced surveillance trial within the MCPHS region.

6. Evaluation of postal questionnaire and telephone interview data using a WHO framework

Overall the results suggest that better data were achieved through contact with notified cases. When a case is contacted (or has responded by phone or the return of a questionnaire) there is a higher level of data completeness than when no contact is made with the case and only the information gleaned from a laboratory or GP notification is logged in EpiSurv. The greatest data gain during the trial was shown in the sections relating to source attribution or the potential exposure to the disease.

Using telephone interviews the contact rate was 44% higher than what was achieved by using mail questionnaires. While the return rate for postal questionnaires was much lower it was comparable with the contact rates achieved by the rest of NZ. However, the data quality/completeness of those who did return questionnaires was of a higher level when compared to the rest of NZ.

The World Health Organization (WHO) has identified key components for evaluating the quality of a surveillance system (World Health Organization, 2002):

- Completeness
- Timeliness in notification and reporting
- Usefulness of surveillance data
- Representativeness
- Usefulness of surveillance data in identifying alerts
- Simplicity
- Acceptability of the system.

These quality components for the enhanced surveillance trial are considered in the discussion below on the findings of the trial.

6.1 Completeness

Completeness of data was measured for campylobacteriosis cases contacted by telephone in the MCPHS region and ranged between 94 – 100% for various data fields. This level of completeness was similar to the percentages achieved within a

comparable PHS at 73 – 100% but consistently higher, through the fields measured, than the rest of NZ at 69 – 99% (Table 9).

Completeness of data for cryptosporidiosis, giardiasis, salmonellosis and yersiniosis using the postal questionnaire in the MCPHS region remained high (range 81 – 100%). However, while the comparable PHS achieved a better contact rate, 87% versus our 53%, the completeness was lower (range 65 – 100%). While the MCPHS contact rate using the postal questionnaire was similar to the rest of NZ, the MCPHS field completeness for those who did respond was consistently higher than identified for all PHSs, (ranged 62 – 99%). However, lack of response is a major limitation for overall completeness and this is highlighted when postal questionnaire contact rate and completeness is compared to the much higher levels achieved through the use of telephone interviews.

One of the interesting outcomes from the completeness data was around the core data fields also used by ESR to measure completeness: age, date of birth, ethnicity, sex, NHI, and occupation. The levels of completeness remain high in these fields even for cases who are not contacted. This indicates much of this information is received or gathered at the time of notification prior to entering it into EpiSurv. When cases are not contacted the data most likely to be missing is the risk factor information (e.g. potential exposures such as food premises, animal contact and contact with other cases). This information is crucial for source attribution (Table 6 and Table 10).

6.2 Timeliness

The most timely method used in the MCPHS trial was telephone interviews, with a contact range 0 – 28 days, an average contact time of four days and a median contact time of two days. This demonstrates that the three working day target was usually met using this system. By comparison the postal questionnaire had a response range of 1 -56 days, with an average of ten and a median of six days. We were unable to measure the timeliness on a national level as there were no comparable data.

6.3 Usefulness

The review of reporting systems and data collection methods used throughout NZ PHSs clearly identified that there are a range of collection methods being used for enteric disease surveillance in NZ. Within the PHSs surveyed there are further inconsistencies as HPOs and TLAs (if called upon) can choose which system they use

for reporting for their geographical region. The four systems identified were: educational information with cover letter, telephone interviews, postal questionnaire, and face to face visits. Some PHS contact the case by phone to establish the case's occupation before forwarding a questionnaire. During the telephone survey with PHSs, return rates for postal questionnaires were estimated by those using them at between 50 – 70%. While EpiSurv 7.2.1 has provision to record this information in the extra details section, neither MCPHS nor other PHSs surveyed were identified as using this additional section or any other formal method to record return rates of questionnaires.

An issue that may limit the utilisation of either the free fields, or fields relating to the dates the investigation started and concluded, is that they are contained in a separate section to the CRF. This section is not automatically printed out on the hard copy form and the hard copy of a CRF is often used within PHSs to complete case investigations.

The review of 27 questionnaires used for investigating enteric diseases identified that a number of PHSs used quite detailed questionnaires. Potentially a two page questionnaire could be used to complete the requirements of an EpiSurv CRF. A pre-screening questionnaire from Regional Public Health Wellington was adapted as a postal questionnaire for use during the trial.

Inconsistencies in reporting methods are likely to bias potentially valuable risk factor and source attribution data towards the null due to under reporting. For research at the PHS or national level, risk factor/source attribution data are likely to be inaccurate or inconclusive e.g. if larger centres do not collect certain information then the amount of data is significantly reduced. The lack of risk factor data is highlighted in the outcomes of those not contacted (refer Table 6 and Table 10).

Although consistency is not one of the specific WHO criteria for a surveillance system, a particular strength of the trial was the development and adherence to protocols around how cases were interviewed and entered data into EpiSurv (Section 11.3 Protocols for entering data and the trigger tree).

A commitment from the EpiSurv coordinator, HPOs and the MOoH in using the agreed protocols, especially around the use of the unknown field, was key in

maintaining consistency of data collection between HPOs undertaking the telephone interviews.

The strength of these protocols was further supported when a recently graduated HPO was employed at MCPHS and undertook a large percentage of the telephone interviews at the beginning of 2008. The results in the following quarter remained unchanged. Use of protocols around interpretation of collected information ensures consistent and reproducible surveillance information, even when different individuals are collecting and entering data.

The usefulness of collecting good quality data from the majority of notified cases has been highlighted by the way the MCPHS data on campylobacteriosis has been used by researchers (French, 2008b; Mullner, 2008). It is also likely that the information gathered over the enhanced surveillance trial will continue to support research at a national level.

6.4 Representativeness

Different reporting methods affect the representativeness of the data being collected in EpiSurv. Attempting to inform public health response at a national level or attempting to combine PHS data using current risk factor data is unlikely to give a representative picture.

The contact rate for telephone interviews was significantly higher at 97% compared to 53% of the mail questionnaires. The contact rate for campylobacteriosis cases by MCPHS (telephone interviews) was also significantly higher than the comparable PHS at 64% and the rest of NZ at 27% (both using a combination of data collection methods). While the response rate of 53% for cryptosporidiosis, giardiasis, salmonellosis and yersiniosis using postal questionnaires was poor it was comparable to the 54% of cases identified as contacted for the rest of NZ, but significantly lower than the 87% achieved by the comparable PHS using a combination of postal questionnaires and telephone interviews (Table 5 and Table 9).

Overall the analysis indicated utilising telephone interviews for common enteric disease surveillance was more effective than using postal questionnaires as only 2% of cases were not contacted in the MCPHS area during the trial compared to 73% of the cases not being contacted in the rest of NZ. However, using the postal questionnaire for surveillance of other common notifiable enteric diseases 47% of cases were not

contacted in MCPHS during the trial this was similar to the number not contacted nationally (46%).

The geographical representation of interviews undertaken and postal questionnaires received showed a good spread across the region. Although the non responders/not contacted cases in the questionnaire trial were also evenly spread through the region there is a potential that rural locality is associated with a lower likelihood of response. The method of data collection could potentially affect the representativeness of contacted cases according to NZDep 2006 Index, i.e. postal may be less successful than telephone interviews for gathering surveillance information from cases living in higher deprivation areas.

6.5 Usefulness in identifying alerts

One of the key concerns for MCPHS using the postal questionnaires was the timely recognition of outbreaks which could be compromised by the additional delay and poor response when using the postal questionnaire. Information was clearly included requesting that groups of sick people should ring the PHS immediately. During the postal questionnaire trial, two phone calls were received in response to this request and in both cases the infections were most likely associated with person-to-person spread.

Alerts which needed public health action to potentially further reduce illness were identified if postal questionnaire responses indicated that there were other symptomatic people, an implicated food premise, or untreated drinking water associated with the case. During the trial, 29 food premises were logged into EpiSurv and the MCPHS local monitoring system (which logs cases against risk factors in week of onset of illness). Twenty two household water supply booklets were posted during the trial. Three cases were contacted by phone due to triggers (contact with other symptomatic people) but after clarification of type of contact these did not require further follow up.

These results indicate the triggers identified in our system were quite sensitive, but the associated work could be easily managed using internal systems. No outbreaks were identified by postal questionnaires over the year of the trial. Two of the cases associated with the *Salmonella* Chester outbreak did complete questionnaires and were not identified as associated. However, the national outbreak investigation was also unable to identify a common source.

It is believed that the screening questionnaire would have been sensitive enough to identify any potentially linked cases.

6.6 Simplicity and acceptability

While MCPHS used telephone headsets and direct entry for logging campylobacteriosis data directly into EpiSurv in real time during the telephone interviews, it was identified that the current CRF needed a call centre friendly front end. Ideally this would only show questions that would relate to a case being interviewed, including caregiver/parents name and the option of free fields for additional questions of concern at a local level. The current form is too cluttered with technical and case management fields to be easily navigated while on the telephone.

While MCPHS believes direct entry is the most efficient and effective method to log data it is unlikely to continue in the future unless EpiSurv is modified. Instead MCPHS have developed a one page telephone screening form based on the postal questionnaire format. This contains all the CRF questions. A limitation of this system over direct EpiSurv entry during the telephone interview is that it is likely to result in less timely data entry of this information into the system, as it is subject to being reviewed by an HPO and being logged into EpiSurv by an administrator.

Postal questionnaires involved more human resource than the telephone interviews, as a letter was sent to each case, mail packs were compiled, and the questionnaire when returned was reviewed and then logged into EpiSurv. In addition to telephone interviews being more efficient the early evening timing of phone calls was successful in reducing time spent by HPOs attempting to contact cases and, overall, appeared to reduce time spent on follow up. This is due to the fact that more people were at home in the early evening than during working hours. Even if the people at home were not the case, additional contact numbers for the case such as mobile telephone numbers could be obtained.

One of the core changes to the approach taken by HPOs during the telephone interviews was to remove the focus from a long source-searching conversation with a notified case, to advising cases there was a short “standard questionnaire to complete with them”. This re-focusing of the interview appeared to reduce the overall time taken to interview. Moving to a standard questionnaire format gives more scope for

well-trained support staff to undertake the interviews rather than solely relying on HPOs.

HPOs face fluctuating reactive workloads subject to varying staffing levels within PHSs and the demands of both the community in which they work and the agencies they report to. The follow up of common enteric disease notifications is often one of the areas most likely to suffer due to high reactive workloads in other areas. This may be one of the key reasons PHSs have utilised their administration staff and developed questionnaires to contact notified cases of common enteric diseases.

This trial indicates that contact rates, timeliness and completeness of common enteric disease reporting to EpiSurv could be significantly improved through delivery of a short telephone pre-screen questionnaire by well trained administration staff, and in smaller PHS this may possibly be an extension of the EpiSurv coordinator's role, to collect basic EpiSurv data. This would allow HPOs to focus their skills on the cases who trigger alerts and any further investigation that may be required.

7. Assessing the ESR early aberration reporting system as a PHS tool

7.1 Introduction

The ESR Early Aberration Reporting System (EARS) was introduced to NZ in 2005. Training and access to EARS was given to all NZ PHS in 2006. EARS is a widely available surveillance tool developed by CDC which uses algorithm models to flag events which are aberrations on normal data and may require follow up. Aberration is defined as a change in the distribution or frequency of health events when considered in the context of the historical data (Institute of Environmental Science and Research Limited, 2005). ESR have adapted the program to utilise EpiSurv data to signal when disease levels are being reported at levels above the historical seasonal endemic rates for the disease in the region. EARS uses two models which raise alerts within the system if an aberration is identified. The three alerts are the Historical limits; the seasonally adjusted calculation of a cumulative sum (CUSUM), and the CUSUM + Historical limits. These are illustrated in Figure 17.

Historical limits

The Historical limits flag identifies when the current reported rates of the disease are greater than two deviations of the mean of nine four week totals, using the previous and subsequent four week periods over the past three years (Institute of Environmental Science and Research Limited, 2005).

CUSUM

The CUSUM model uses predetermined thresholds set by ESR which are adjusted (based on historical data) for seasonal increases of disease and sums the positive deviations from the mean over a specified time (Institute of Environmental Science and Research Limited, 2005).

It was identified by the steering group that MCPHS could utilise EARS as backup to identify regional disease increases - that were an aberration on historical rates of disease - during the delay period traditionally associated with postal questionnaires This chapter looks at the data and discusses the benefit of the EARS system for common enteric disease surveillance in a medium-sized NZ PHS.

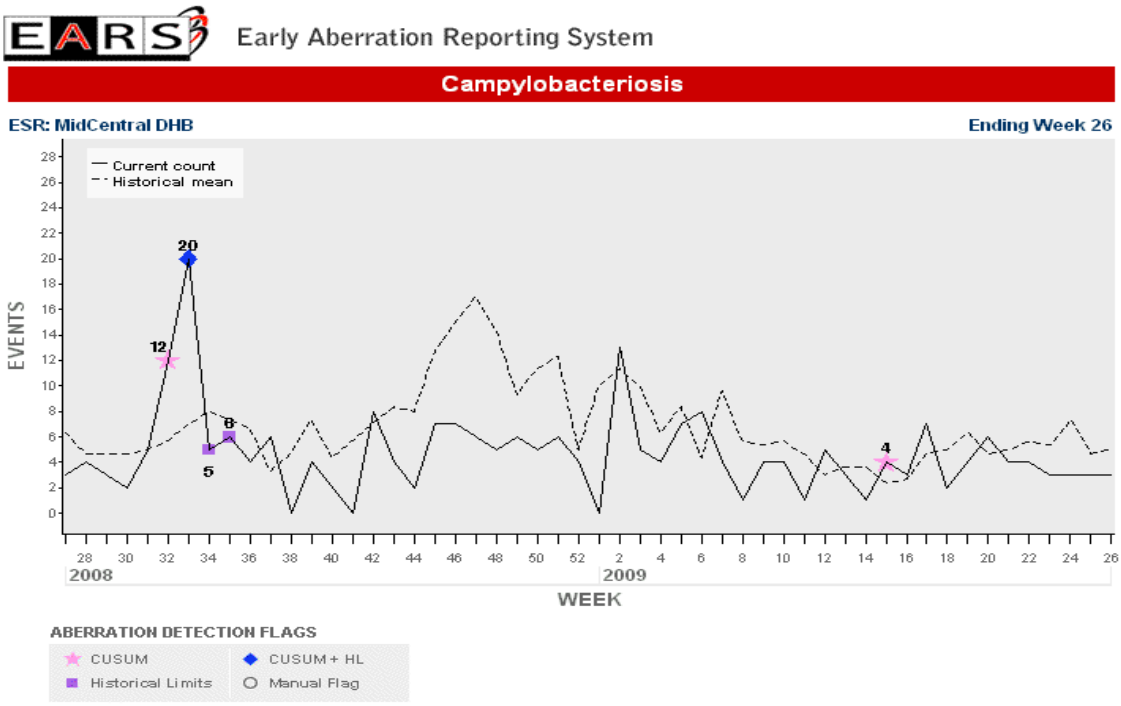

Figure 17 An example of the ESR EARS system. Alerts are based on historical data for the region

7.2 Methods

MCPHS had access to EARS for the first time in mid 2006 but had not utilised the database prior to this project. MCPHS previously was reliant on a local monitoring spread sheet and email notification from ESR if potential outbreaks were noted in the EpiSurv data. EARS was monitored from week 47 ending (28/11/2006) to week (26 ending 1/07/08).

The weekly updated EARS reports were assessed for increased activity or flags with the aims of:

- Identifying disease clusters prior to the MCPHS identifying them
- Identifying disease clusters prior to postal questionnaire responses being received
- Reporting on overall usefulness in a medium-sized PHS environment

EARS reports were run weekly within MCPHS (normally on a Tuesday afternoon) after email notification was received from ESR advising the weekly update was complete.

A regular meeting to discuss the status of common enteric disease notifications was implemented between HPOs working with the notifications, the EpiSurv coordinator

and the MOoH. These were held on Tuesday afternoons after the update of EARS. The forum was used to review files relating to cases that had triggered alerts, and any public health actions were discussed with the MOoH.

If the cases reported for the MCPHS in EARS indicated an increase over historical notifications, the files for the cases that triggered the alerts were reviewed. The aim was identifying time/person/place commonalities using demographic information provided by the initial notification of the case. The case review was undertaken when either a historical limit or the CUSUM + Historical limits flags were raised in the EARS weekly update for the region. This action included the following steps:

1. Review of available demographic information on the CRF.
2. If commonalities were identified then a telephone interview of cases would be undertaken.

7.3 Results

7.3.1 Campylobacteriosis

As there was a higher historical endemic rate of campylobacteriosis, flags were raised at higher case numbers than the other enteric diseases monitored. Over the monitoring period CUSUM flags were raised five times at between seven or eight cases in a single week and Historical limits were raised twice at between six and 13 cases in a single week. Combined CUSUM + Historical limits were raised twice during two outbreaks. These outbreaks were identified in November 2006 from telephone interviews with single notified cases (these cases did not initially trigger EARS). The interviews with these cases identified contact with other symptomatic people. One was linked to a school camp and children swimming in a pond after a heavy rain event and the other was linked to an undercooked chicken pie served by a caterer at a 70th birthday function. The resulting CUSUM + historical limit flags, which triggered in EARS, came from additional cases, identified by the PHS HPOs during the outbreak investigations, being logged into EpiSurv in the three preceding weeks. This was on top of the typical Christmas season peak normally seen with campylobacteriosis cases at this time of year.

As with all the other common enteric diseases monitored in EARS, outbreaks were identified prior to being alerted by EARS, and in fact investigations undertaken by the PHS generated many of the triggers during the trial.

7.3.2 Cryptosporidiosis

CUSUM flags appeared with between one to four cases notified in a single week. The CUSUM + Historical limits flag was triggered seven times with one historical limit flag and two CUSUM in a 17 week period when 17 cases were notified over the period. No linking factor was identified for these cases. The cases coincided with calving season and contact with scouring calves is commonly associated with this disease (Learmonth, et al., 2005). Increased rates were identified in rural areas around the country, using EARS, over the same time period.

7.3.3 Giardiasis

CUSUM flags appeared between two to four cases notified in a single week and the CUSUM + Historical limits was hit twice when three cases a week were notified over a three week period. A family outbreak was identified by the MCPHS involving three cases prior to appearing in EARS .

7.3.4 Salmonellosis

The CUSUM flags appeared between one to two cases. The exception was three cases notified in a single week which only triggered a CUSUM but not a historical limit flag. However, three cases notified in the following week triggered both CUSUM + historical limit flag and two cases were identified, by typing, as part of a multi region *Salmonella* Chester outbreak in 2008.

7.3.5 Yersiniosis

There were ten CUSUM flags raised by one notified case in each week (a case was notified) with the exception of one CUSUM that was raised by two cases, over the monitoring period. None of these cases were identified as part of an outbreak. This illustrates that CUSUM alone can be overly sensitive as a trigger, when the number of cases is very low, supporting the advice from ESR to set the triggers at Historical limits or CUSUM + Historical limits.

Table 11: Flags raised in the EARS reporting system over the period of the monitored period 28/11/06 to 1/07/08

Disease	*CUSUM*	*Historical limits*	*CUSUM +Historical limits*
Campylobacteriosis	5	3	1
Cryptosporidiosis	7	1	8
Giardiasis	14	3	2
Salmonellosis	12	3	2
Yersiniosis	10		
Total	**48**	**10**	**13**

7.3.6 Qualitative findings

Within the monitoring period the MCPHS staff became confident in the use of EARS and utilised the information in a number of seminars and training sessions given by MCPHS staff, and as a quick reference for media enquiries e.g. a request from media regarding numbers of listeriosis cases in both ours and surrounding regions (associated with the large recall of locally produced smoked chicken breasts which had been found to be contaminated with *Listeria* monocytogenes). PHS staff found EARS reduced the time taken for analysis of notifiable diseases within the PHS as they were able to retrieve information in a timely manner without designing and running custom reports and comparing results or having to request information from other PHS or ESR.

7.4 Discussion

The EARS reporting system was user friendly and staff could be easily trained in its use. It was utilised as a quick reference tool for media enquiries and assessing the disease rates in bordering PHS. EARS supplied back up information on disease rates for questionnaires not yet returned or not responded to.

All increases in disease notifications were noted in the MCPHS prior to being triggered in the EARS system. No outbreaks were initially identified by EARS flags. However, over the 12 months of the trial EARS was utilised in the MCPHS for the following:

- Assessing increased disease rates nationally
- Assessing and comparing our disease rates with bordering PHS
- Prompting reviews of case files during periods of increased notifications
- Presenting EARS graphs at training and lectures given by MCPHS
- Providing additional access to data in a timely manner without running reports or comparing results through EpiSurv. Resulting in a reduction of analytical work by frontline staff.

The identification of outbreaks by EARS is reliant on case notification to EpiSurv. This means the PHS is likely to have identified an outbreak at the point of loading the notifications or creates the triggers during the investigation of an outbreak by identifying and logging additional cases.

A limitation of EARS that was identified during retrospective data analysis, was that flags change as new data are logged into EARS. This can make accurate retrospective analysis from hard copy information difficult.

Overall while EARS was a useful new tool for PHS notifiable disease surveillance its use remains limited as cases are analysed based on report date not onset date of disease. This means cases that are associated with a single source may not necessarily appear in the same week. Individual cases with the same onset of disease are not necessarily logged on the same day if there have been delays in seeking medical attention, analysis of specimens or a delay in notifying to the PHS. The accuracy remains reliant on a passive surveillance system and data being logged in a timely and accurate manner within EpiSurv.

8. Conclusions

The aims of the enhanced surveillance project were achieved in that:

1. MCPHS with the support of the enhanced surveillance project steering group has successfully established a demonstration PHS in which new methods and surveillance processes have been trialled and evaluated.

2. We have developed consistency in both data collection and management of notified cases of common enteric diseases (potentially foodborne disease) within the MCPHS region by:

    a. Demonstrating the use of a pre-screening questionnaire to collect both compulsory and optional enteric disease surveillance data, including good completeness of risk factor data.

    b. Developing a standard protocol for enteric disease surveillance data collection that can be promoted for use in other PHSs to improve the consistency of data collection.

    c. Demonstrating excellent contact rates and completeness being achieved through the use of telephone administered questionnaires and incorporating early evening contact.

    d. Using additional fields provided by ESR within EpiSurv to assist with gathering of data at a local level.

    e. Utilising the date fields introduced by ESR at a local level to measure time from receipt to contact or return of questionnaires.

3. MCPHS aims to modify the systems developed during the enhanced surveillance project and to incorporate these for daily surveillance activities. This will include:

a. Developing and trialling a short telephone pre-screening survey (based on the postal questionnaire used during the project) that completes all of the EpiSurv fields

b. Appointing a 0.2 FTE technical officer for a six month trial period to undertake telephone delivery of the questionnaire for all notified enteric disease cases in an early evening work shift twice a week. Cases identified as triggering alerts will be passed to HPOs.

4. The MCPHS has added value to the local data collected and has been able to inform the French (2008a) study with high quality epidemiological information, from campylobacteriosis cases reported to EpiSurv (French, 2008a).

The research undertaken within the MCPHS overall has given greater understanding of the value of quality reporting to those at the front line.

9. Recommendations

The following recommendations have been broken down according to relevant agencies.

NZFSA/Ministry of Health

1. That MCPHS continues to be utilised and funded as a sentinel surveillance site for enhanced surveillance to support on going enteric disease research.

2. That scoping is undertaken, at a national level, to assess the implementation of a basic, standardised pre-screen questionnaire delivered via telephone from either a single or multiple sites to notified enteric disease cases. This would ensure consistency, and those cases that trigger further follow up would be forwarded to local HPOs, in a timely manner.

3. That a standard national questionnaire is developed (ideally including additional free fields that could be used for research projects) and an agreed annual target for completion of questionnaires within each PHS is agreed upon.

4. That a national agreement around the percentage of cases contacted annually and the quality and quantity of data, gathered from within each region, with an aim to gather a more representative sample of data from across NZ.

ESR

5. Agencies work together to develop a user friendly front end for EpiSurv, based on a call centre format, to allow for real time logging of surveillance data for those PHSs who choose to use the telephone for following up cases.

6. An alternative default option, rather than unknown for fields incomplete fields, is included in all EpiSurv fields to remove the ambiguity around the unknown option during analysis of EpiSurv data

7. More training and feedback is undertaken to support HPOs in developing a greater understanding of the value of data collected, the importance of the way the data is reported to EpiSurv, and the importance of this tool for learning

about the aetiology of potentially foodborne diseases at local, national and international levels.

Public Health Services

8. Consider administering a short (standard) questionnaire by telephone for notified cases of common enteric disease with questions (alerts) that could indicate the need for further follow up.

9. Development and commitment to agreed national protocols around consistent gathering of data and reporting to EpiSurv.

MCPHS – Local level

10. Scoping is undertaken at the interface between general practice and the PHS with the aim of improving the demographic data received at the time of case notification to the PHS. The aim is to reduce time taken in gathering demographic information.

11. A Technical Officer is employed on a part time basis to manage sporadic common enteric disease in a timely manner, which is not affected by emergent events within the PHS, utilising a short standardised telephone questionnaire.

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11. Appendices

11.1 Regional Public Health's pre-screen questionnaire adapted for use as a postal questionnaire during the trial

HUTT VALLEY DHB

CAMPYLOBACTER QUESTIONNAIRE EPI #……

NAME: _____

(first name(s)) (surname)

PHONE NUMBERS: (home) ( )_____ (work) ( ) _____

DATE OF BIRTH: ____/____/____ **SEX:** o **Male** o **Female**

ETHNICITY *(tick all that apply)*

o **NZ Maori** o **NZ European/Pakeha**
o **Pacific Island** o **Other European**
o **Other** ***(specify)***
_____

OCCUPATION: *(Please be specific and include any part time jobs)*

_____

NB ***If you work as a food handler, in childcare, or in healthcare please call us immediately for advice. Ph (04) 570-9002 and ask for the communicable disease health protection officer.***

PLACE of work/school/study: **1.** _____

2.

If you have a diary or calendar it would be good to have this in front of you to help you answer the questions.

In the 1-10 days before you became ill did you do any of the following?

- Have contact with anyone who had similar symptoms? **Yes** o **No**o
- Visit an overseas country? **Yes** o **No**o
- Drink untreated water (ie not from council/public/mains)? eg. at a farm or camp, on holiday **Yes** o **No**o
- Go swimming or have contact with water in a river, lake or stream? **Yes** o **No**o
- Have contact with farm animals or birds? **Yes** o **No**o
- Have food from a restaurant/bar/café/deli/takeaway or at a function? **Yes** o **No**o

If YES to any of these questions please complete the short questionnaire on the following pages and return it in the pre-paid envelope.

If NO to all of these please tick the box below and return this in the pre-paid envelope.

☐ **NO**

THANK-YOU FOR YOUR ASSISTANCE

11.2 Cover letter and questionnaires used during the trial

XXXXXXXXXXXXXX
XXXXXXXXXXXXXX
PALMERSTON NORTH

XX XXX 2007

Dear XXXXX

Notification of XXXXXXXXX illness

The Public Health Services have been notified that you/your child has tested positive to the above illness.

We have enclosed information for you on the illness. We would appreciate it if you could take the time to complete the enclosed questionnaire relating to how you or your child may have contracted this illness in the community. While you do not have to supply the information requested in the questionnaire your participation is important to us to help monitor and reduce the levels of disease in our region. Any personal or identifying information you supply to us will remain confidential to the Public Health Services.

Once we have received your completed questionnaire we may give you a ring to discuss any further investigation that Public Health may undertake to prevent others becoming unwell.

Work, Child care, and School Exclusions:

If you are in a high risk occupation i.e. an occupation where you deal with food prepared for others, a child care centre, hospital or health care facility please remain home while you are symptomatic and **do not return to work until one whole day (24 hours)** after symptoms (i.e. diarrhoea/vomiting) have stopped.

If it is your child who is unwell they should **remain home from school or daycare until at least one whole day (24 hours)** has passed since symptoms (i.e. diarrhoea/vomiting) have stopped. **Do not swim in public pools until two weeks after symptoms have finished.**

A person who has this infection can continue to excrete the bugs that caused the illness for a number of weeks after they become well, so keeping up good hand washing is vital.

We would appreciate it if you could return the enclosed questionnaire as soon as possible and if you have any queries or would like further help to complete the form please contact the duty Health Protection Officer on 06 350 9110.

Kind Regards

Tui Shadbolt
Health Protection Officer
PUBLIC HEALTH SERVICES

MidCentral Health

EpiSurv Number_____

CRYPTOSPORIDIUM QUESTIONNAIRE

NAME - of ill person: _____

CONTACT NUMBERS: Home ( )_____ **Work** ( ) _____ **Mobile** ( )_____

DATE OF BIRTH: ____/____/____ **SEX:** ❑ **Male** ❑ **Female**

PLACE of work/school/child care: **1.** _____

2. _____

OCCUPATION: *(Please be specific and include any part time jobs)*

_____

If the ill person is one of a group of people who are or were sick call a Health Protection Officer immediately for advice on (06) 350 9110

ETHNICITY *(tick all that apply)* ❑ **NZ European** ❑ **Maori** ❑ **Samoan** ❑ **Cook Island Maori** ❑ **Niuean** ❑ **Chinese** ❑ **Indian** ❑ **Tongan** ❑ **Other**_____***(specify)***

Tick the symptoms you/your child had when you visited the Doctor:

Diarrhoea ☐ Stomach pain ☐ Vomiting ☐ No Symptoms ☐ Other _____

Use the calendar, work out what day you/your child became ill and write it here ____/____/____
Work backwards 14 days before the illness started. The questions below relate to this 14 day period.

In the 14 days before you/your child became ill did you/your child do any of the following?

- Have contact with anyone who had a similar illness? Yes ❑ No ❑
- Have food from a restaurant/bar/café/deli/takeaway or at a gathering? Yes ❑ No ❑
  If yes please complete table on back of form
- Drink water other than mains/town supply? Yes ❑ No ❑
  If yes please complete table on back of form
- Go swimming or have contact with water in a river, lake, stream or public pool? Yes ❑ No ❑
  If yes please complete table on back of form
- Have contact with farm animals Yes ❑ No ❑
- Have contact with animals with diarrhoea Yes ❑ No ❑
- Visit an overseas country? ***(if yes list countries visited on reverse)*** Yes ❑ No ❑
- If you have any comments or further information for us please turn over

NAME - of person completing form if different from above

_____

THANK-YOU FOR YOUR ASSISTANCE

Details included below are for the fourteen days prior to yours or your child's illness starting:

Name of place food consumed	Address of place	Date food consumed	Food eaten
Name of place water consumed	**Address of place**	**Date you drank water**	**Type e.g. Tank, bore, spring**
Name of place you had contact with water	**Address (approx is ok)**	**Date you had contact with water**	**Type of contact e.g. swimming, fishing boating**
Countries visited	**Date entered**	**Date departed**	**Date arrived in NZ**

Comments:

Once you have completed the form please return in the pre-paid envelope

Thank you for providing us with additional information. We may give you a call if we have any further questions

EpiSurv Number_____

GIARDIA QUESTIONNAIRE

NAME - of ill person: _____

CONTACT NUMBERS: Home ( )_____ **Work** ( ) _____ **Mobile** ( )_____

DATE OF BIRTH: ____/____/____ **SEX:** ❑ **Male** ❑ **Female**

PLACE of work/school/child care: **1.** _____

2. _____

OCCUPATION: *(Please be specific and include any part time jobs)*

_____

If the ill person is one of a group of people who are or were sick call a Health Protection Officer immediately for advice on (06) 350 9110

ETHNICITY *(tick all that apply)* ❑ **NZ European** ❑ **Maori** ❑ **Samoan** ❑ **Cook Island Maori** ❑ **Niuean** ❑ **Chinese** ❑ **Indian** ❑ **Tongan** ❑ **Other**_____***(specify)***

Tick the symptoms you/your child had when you visited the Doctor:

Diarrhoea ☐ Stomach pain ☐ Vomiting ☐ No Symptoms ☐ Other _____

Use the calendar, work out what day you/your child became ill and write it here ____/____/____
Work backwards 14 days before the illness started. The questions below relate to this 14 day period.

In the 14 days before you/your child became ill did you/your child do any of the following?

- Have contact with anyone who had a similar illness? Yes ❑ No ❑
- Have food from a restaurant/bar/café/deli/takeaway or at a gathering? Yes ❑ No ❑
  If yes please complete table on back of form
- Drink water other than mains/town supply? Yes ❑ No ❑
  If yes please complete table on back of form
- Go swimming or have contact with water in a river, lake, stream or public pool? Yes ❑ No ❑
  If yes please complete table on back of form
- Have contact with farm animals Yes ❑ No ❑
- Have contact with animals with diarrhoea Yes ❑ No ❑
- Visit an overseas country? ***(if yes list countries visited on reverse)*** Yes ❑ No ❑
- If you have any comments or further information for us please turn over

NAME - of person completing form if different from above

_____

THANK-YOU FOR YOUR ASSISTANCE

Details included below are for the fourteen days prior to yours or your child's illness starting:

Name of place food consumed	Address of place	Date food consumed	Food eaten
Name of place water consumed	**Address of place**	**Date you drank water**	**Type e.g. Tank, bore, spring**
Name of place you had contact with water	**Address (approx is ok)**	**Date you had contact with water**	**Type of contact e.g. swimming, fishing boating**
Countries visited	**Date entered**	**Date departed**	**Date arrived in NZ**

Comments:

Once you have completed the form please return in the pre-paid envelope

Thank you for providing us with additional information. We may give you a call if we have any further questions

EpiSurv Number_____

YERSINIA QUESTIONNAIRE

NAME - of ill person: _____

CONTACT NUMBERS: Home ( )_____ **Work** ( ) _____ **Mobile** ( )_____

DATE OF BIRTH: ____/____/____ **SEX:** ❑ **Male** ❑ **Female**

PLACE of work/school/child care: **1.** _____

2. _____

OCCUPATION: *(Please be specific and include any part time jobs)*

_____

If the ill person is one of a group of people who are or were sick call a Health Protection Officer immediately for advice on (06) 350 9110

ETHNICITY *(tick all that apply)* ❑ **NZ European** ❑ **Maori** ❑ **Samoan** ❑ **Cook Island Maori** ❑ **Niuean** ❑ **Chinese** ❑ **Indian** ❑ **Tongan** ❑ **Other**_____***(specify)***

Tick the symptoms you/your child had when you visited the Doctor:

Diarrhoea ☐ Stomach pain ☐ Vomiting ☐ No Symptoms ☐ Other _____

Use the calendar, work out what day you/your child became ill and write it here ____/____/____
Work backwards 7 days before the illness started. The questions below relate to this 7 day period.

In the 7 days before you/your child became ill did you/your child do any of the following?

- Have contact with anyone who had a similar illness? Yes ❑ No ❑
- Have food from a restaurant/bar/café/deli/takeaway or at a gathering? Yes ❑ No ❑
  If yes please complete table on back of form
- Drink water other than mains/town supply? Yes ❑ No ❑
  If yes please complete table on back of form
- Go swimming or have contact with water in a river, lake, stream or public pool? Yes ❑ No ❑
  If yes please complete table on back of form
- Have contact with farm animals Yes ❑ No ❑
- Have contact with animals with diarrhoea Yes ❑ No ❑
- Visit an overseas country? ***(if yes list countries visited on reverse)*** Yes ❑ No ❑
- If you have any comments or further information for us please turn over

NAME - of person completing form if different from above

_____

THANK-YOU FOR YOUR ASSISTANCE

Details included below are for the seven days prior to yours or your child's illness starting:

Name of place food consumed	Address of place	Date food consumed	Food eaten
Name of place water consumed	**Address of place**	**Date you drank water**	**Type e.g. Tank, bore, spring**
Name of place you had contact with water	**Address (approx is ok)**	**Date you had contact with water**	**Type of contact e.g. swimming, fishing boating**
Countries visited	**Date entered**	**Date departed**	**Date arrived in NZ**

Comments:

Once you have completed the form please return in the pre-paid envelope

Thank you for providing us with additional information. We may give you a call if we have any further questions

EpiSurv Number_____

SALMONELLA QUESTIONNAIRE

NAME - of ill person: _____

CONTACT NUMBERS: Home ( )_____ **Work** ( ) _____ **Mobile** ( )_____

DATE OF BIRTH: ____/____/____ **SEX:** ❑ **Male** ❑ **Female**

PLACE of work/school/child care: **1.** _____

2. _____

OCCUPATION: *(Please be specific and include any part time jobs)*

_____

If the ill person is one of a group of people who are or were sick call a Health Protection Officer immediately for advice on (06) 350 9110

ETHNICITY *(tick all that apply)* ❑ **NZ European** ❑ **Maori** ❑ **Samoan** ❑ **Cook Island Maori** ❑ **Niuean** ❑ **Chinese** ❑ **Indian** ❑ **Tongan** ❑ **Other**_____***(specify)***

Tick the symptoms you/your child had when you visited the Doctor:

Diarrhoea ☐ Stomach pain ☐ Vomiting ☐ No Symptoms ☐ Other _____

Use the calendar, work out what day you/your child became ill and write it here ____/____/____
Work backwards 3 days before the illness started. The questions below relate to this 3 day period.

In the 3 days before you/your child became ill did you/your child do any of the following?

- Have contact with anyone who had a similar illness? Yes ❑ No ❑
- Have food from a restaurant/bar/café/deli/takeaway or at a gathering? Yes ❑ No ❑
  If yes please complete table on back of form
- Drink water other than mains/town supply? Yes ❑ No ❑
  If yes please complete table on back of form
- Go swimming or have contact with water in a river, lake, stream or public pool? Yes ❑ No ❑
  If yes please complete table on back of form
- Have contact with farm animals Yes ❑ No ❑
- Have contact with animals with diarrhoea Yes ❑ No ❑
- Visit an overseas country? ***(if yes list countries visited on reverse)*** Yes ❑ No ❑
- If you have any comments or further information for us please turn over

NAME - of person completing form if different from above

_____

THANK-YOU FOR YOUR ASSISTANCE

Details included below are for the three days prior to yours or your child's illness starting:

Name of place food consumed	Address of place	Date food consumed	Food eaten
Name of place water consumed	**Address of place**	**Date you drank water**	**Type e.g. Tank, bore, spring**
Name of place you had contact with water	**Address (approx is ok)**	**Date you had contact with water**	**Type of contact e.g. swimming, fishing boating**
Countries visited	**Date entered**	**Date departed**	**Date arrived in NZ**

Comments:

Once you have completed the form please return in the pre-paid envelope

Thank you for providing us with additional information. We may give you a call if we have any further questions

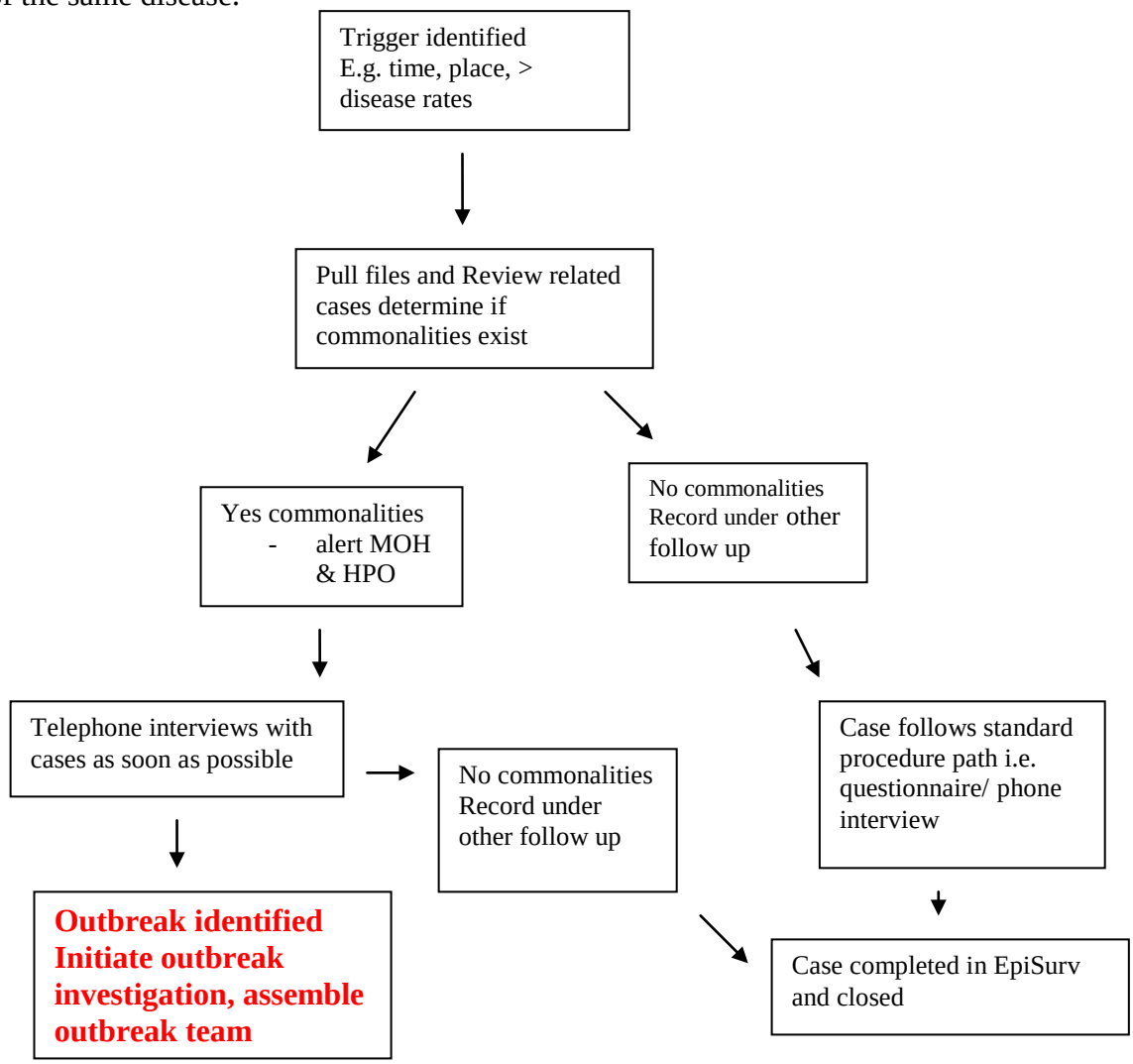
11.3 Protocols for entering data and the trigger tree

Procedure for Responding to Early Enteric Disease Triggers

Definition of an early Trigger

Aim - An early trigger should initiate timely investigation allowing swift Public Health intervention if required.

An early trigger - prior to case interview or questionnaire response - may be identified either through EARS or an educated hunch based on information supplied when reported to PHU – either from Dr, support staff or HPO reviewing cases it is likely to be based on demographic information such as place/age and or time increased levels of the same disease.



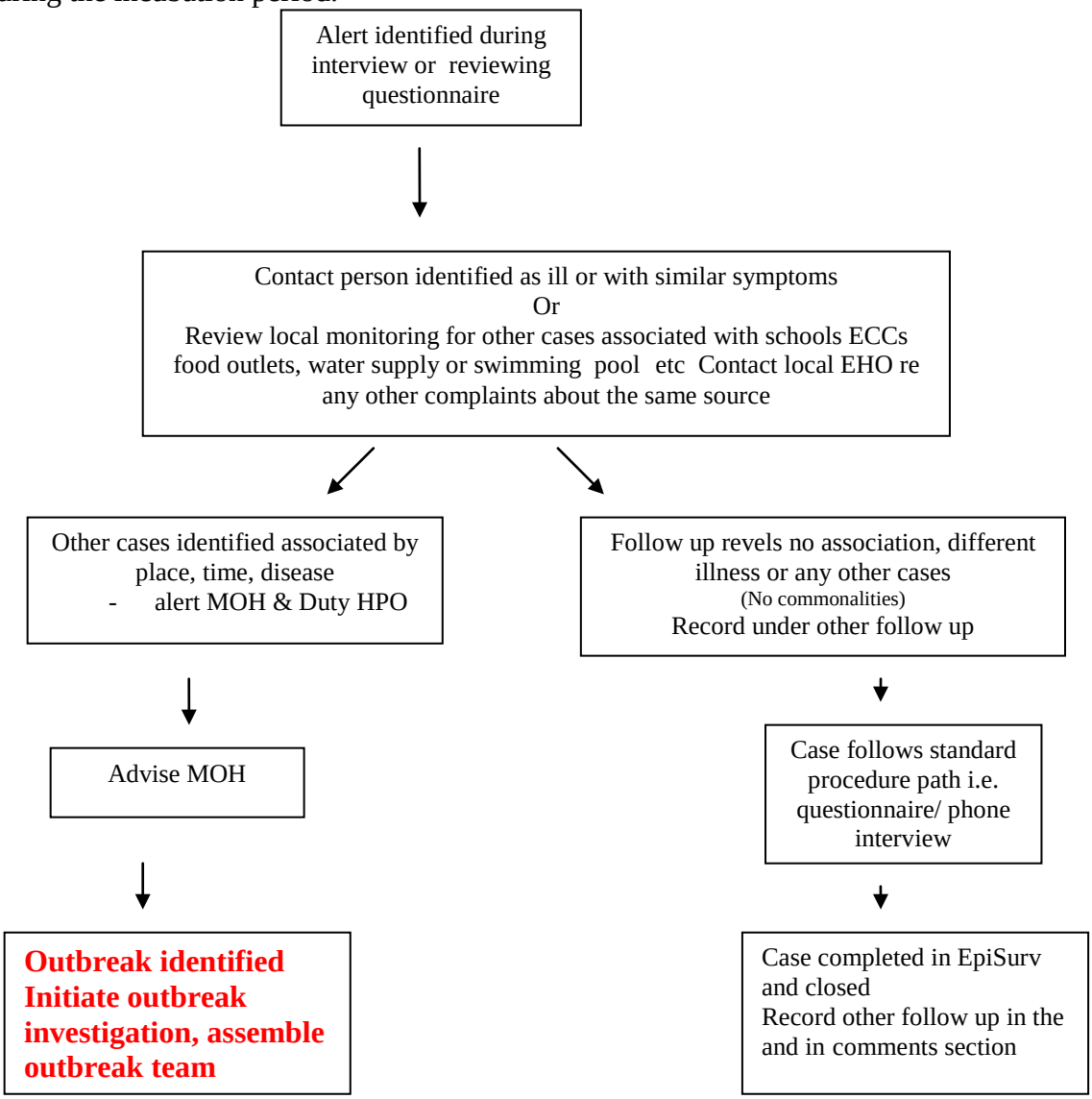
Version 2: 26/05/08

Procedure for identified commonalities from enteric interviews or questionnaires

Definition of an early alert

Aim - An identified commonality should initiate further timely investigation allowing swift Public Health intervention if required.

An alert identified during an interview or from a returned questionnaire. Most alerts are likely to be identified by two questions "contact with another case or symptomatic person" with similar exposures or case eaten "high risk foods at a food premises" during the incubation period.



Version 2: 26/05/08

Procedure for Completing Campy Calls in EpiSurv

Date: 27/5/08 Version: 4

Key points

1. **If you are speaking to case who won't/can't answer put unknown**
2. **Where possible try to avoid using unknown option i.e. contact with another case if they can't name them and are not sure put no and record information under other symptomatic. Attempt to qualify answer i.e. Unsure of consumption of untreated water have they been to any rural sites likely to have untreated water supply and drunk water there?**
3. **Onset date If case is unsure of onset advise them date sample taken to Dr and ask how long they had been sick prior to this date, if they are vague, i.e. "I think about three weeks" calculate from date specimen taken and use "approximate" tick box**

Field	Correct completion
Occupation	State it / unknown
Ethnicity	Tick relevant box/ unknown
Clinical criteria	Ask if they had D's if not what other symptoms yes if they meet criteria or no if not
Meets Lab criteria	yes
Status	Confirmed if symptomatic /not a case if not
Epi Criteria	Confirmed case contact – Yes/No (if they don't know anybody who tested positive put no) Part of an outbreak – if we are not investigating an outbreak and they have said no to above – No (this could change under other symptomatic persons)
Samples Food/water	No
Date of Onset	Date or unknown
Hospitalised	Yes/No
Died	No – if your talking to them
Outbreak details	No tick
Food Premises	Yes/ No/ Unknown -if don't know name of premises – yes and unknown in premise name and region
Drinking water	Home address water code
Consumed untreated water	Yes/No/Unknown
Rec Water contact	Yes/ No/Unknown
Overseas recently	Yes/No
Prior travel	Yes/No
Human contact	Attendance school, Ecc Yes/No Contact with nappies/sewage etc Yes/No/UK Farm animals Yes/No/UK Sick animals Yes/No/UK
Source	Epi evidence – No Lab evidence – No Probable source – list if known
Case Management	Excluded – Yes/No Ecc worker – Yes/No Food worker – Yes/No Water worker – Yes/No

	Intel/physical impaired – Yes/No Health/rest home worker – Yes/No Clearance – Yes/No Number of contacts - state number Number of contacts followed – 0 or number if you do
Extra details	Local Case management "date sent for investigation" = date file put on HPO desk "date investigation received" = date phone interview undertaken Name of care giver

Additional Information for Massey Campylobacter Project

Either complete questions on sticker attached to hard copy or Open Access data base: log lab number from lab notification, log EpiSurv number, date reported, date contacted.
(unable to contact leave blank and record "No contact" in comments)

Did you consume raw (unpasteurised milk in the incubation)	**Yes/No/ Unknown (drop box or tick box on sticker on hardcopy)**
What meats did you eat in the incubation period Lamb, chicken, pork, beef, deli ham, bacon, venison,	**Yes/No/Unknown/ in each of the meat categories (drop box or tick box on sticker on hardcopy)**

Procedure for Completing Returned Questionnaires in EpiSurv

Date: 27/05/08 **Version: 4**

Key points - Look for questions answered within the comments
- include comments word for word in “”

Field	Correct completion	Alert
Occupation	Closest option available/unknown	
Ethnicity	Ethnicity listed by case/unknown	
Clinical criteria	Symptoms ticked = yes/no/Unknown	
Meets Lab criteria	yes	
Status	Confirmed - based on assumption a case visiting a Dr, providing a faecal spec is likely to have symptoms which motivated them	
Epi Criteria	Confirmed case contact – UK Part of an outbreak – No (unless it is)	
Samples Food/water	No/ unless further follow up is undertaken	
Date of Onset	Onset listed by case/unknown	
Hospitalised	Unknown	
Died	No	
Outbreak details	Not tick (unless it is)	
Food Premises	Premises listed/No/ unknown -if don’t know name of premises – yes and unknown in premise name and region	Further contact if high risk food or other known cases Send email to PHU if premise outside region
Drinking water	Home address water code/ or as listed on back	If tank/bore send info pack
Rec Water contact	As listed/unknown	
Overseas recently	As listed /unknown	
Prior travel	If listed /unknown	
Human contact	Another symptomatic person – yes/no/unknown Contact faecal/vomit unknown (not in questionnaire)	Further contact via telephone
Animal contact	Contact Farm animals – yes/no/unknown Contact sick animals – yes/no/unknown	
Source	Epi evidence – No Lab evidence – No Probable source – list if likely source id /no/unknown	
Case Management	Excluded – Unknown/unless known Ecc worker – Unknown/unless known Food worker – Unknown/unless known Water worker – Unknown/unless known Intel/physical impaired – Unknown (unless Dr/they have advised) Health/resthome worker – Unknown/unless known Clearance – No/unless we request it Number of contacts - 0 Number of contacts followed - 0	
Extra Details	Case management date sent for investigation = date questionnaire sent date investigation received = date questionnaire returned name of person completing questionnaire	

Procedure for Completing Non-returned Questionnaires in EpiSurv

Date: 27/05/08 **Version: 4**

Key points - No presumptions

Field	Correct completion
Occupation	Complete if advised by Dr
Ethnicity	Leave incomplete if unknown
Clinical criteria	Unknown (unless Dr advises symptoms)
Meets Lab criteria	yes
Status - based on assumption a case visiting a Dr, providing a faecal spec is likely to have symptoms which motivated them	Confirmed
Epi Criteria	Confirmed case contact – UK Part of an outbreak – No (unless it is)
Samples Food/water	No
Date of Onset	Unknown
Hospitalised	Unknown
Died	No
Outbreak details	Not tick
Food Premises	Unknown
Drinking water	Home address water code
Rec Water contact	Unknown
Overseas recently	Unknown
Prior travel	Unknown
Human contact	Another symptomatic person – Unknown Contact faecal/vomit - Unknown
Animal contact	Contact Farm animals – Unknown Contact sick animals - Unknown
Source	Epi evidence – No Lab evidence – No Probable source - Unknown
Case Management	Excluded – Unknown Ecc worker – Unknown Food worker – Unknown Water worker – Unknown Intel/physical impaired – Unknown (unless Dr has advised) Health/resthome worker – Unknown Clearance – No Number of contacts - 0 Number of contacts followed - 0
Extra details	Do not include dates

11.4 Draft two page telephone pre screening form in use by MCPHS

Episurv No:_____ Disease:_____ Report date: / /

Case:_____ Age:_____ Parent/guardian:_____

Address:_____

Phone No (1): (____)_____ Phone No (2): (____)_____

To do:	Send N/C letter ☐	Send Ed info ☐	Send H2O info ☐

Person (initial)	1st Episurv Entry (date entered)	N/C Letter sent (date sent)	Contacted Case (date phoned)	Info sent (date sent)	Local database (onset week)	Campy Database (Phone ID #)

Attempts to contact: (3X in one session, then send letter. Continue to phone for 3 more sessions)

Initial	Date/time	Initial	Date/time	Initial	Date/time

Probable source(s):

If not, were any probable sources identified?*

Specify probable source(s)* ○ Yes ○ No ○ Unknown

- ☐ From consumption of contaminated food or drink, specify food or drink _____
- ☐ From consumption of contaminated drinking water, specify supply _____
- ☐ From contact with infected animal, specify type of animal _____
- ☐ Person to person contact with another case, specify relationship to case _____
- ☐ From other probable source, specify source _____

Additional completed actions: i.e. email to TLA/another PHS, water sampling

_____

_____

_____

_____

	Initial	Date
HPO/TO sign off		
Details entered on Episurv (incl. extra details)		
Closed off on Episurv		
MoH sign off		

	Initial	Date
HPO/TO sign off		
Details entered on Episurv (incl. extra details)		
Closed off on Episurv		
MoH sign off		

Telephone Screening Form for Episurv No:_____

Occupation:_____

Name of workplace/school/ECC:_____

Address of workplace/school/ECC:_____

Ethnicity: NZ Euro Maori Samoan Chinese Indian Other:_____

Symptoms: Dia Abdo Nausea Headache Fever Fatigue Vomiting Weight-loss Bloating Flatulence Muscle-pain
Other:_____ Meets clinical description? (use table) Y N

Were you hospitalised? Y N **Date:** / / **Hospital:** _____ A&E ☐ Wards ☐

Did you/ your child have contact with somebody with the same illness? *(lab confirmed):* YES NO

Did you/ your child have contact with somebody with a similar illness? *(same symptoms):* YES NO
(Answers confirmed case & other symptomatic fields)
Name and association with person/place: _____

What date did you/your child first become sick/have symptoms _____ ☐ **Approx**
(prompt: advise date specimen taken to Dr how long – number of days before this time you became ill & calculate on calendar)

Did you/your child eat in or from any food outlets in the ____ days before illness YES NO
(based on incubation of disease counting back from onset date above)

Name of premise	Address	Foods eaten	Date	TLA/local PHS advised date

CAMPY ONLY - Have you/your child consumed any of the following in 7 days prior to illness (tick if yes)
Unpasteurised/raw milk ☐ Lamb ☐ Beef ☐ Chicken ☐ Deli meats ☐
Pork ☐ wild meats ☐ Home kill ☐

Source of water supply at; Home:_____**Work/school:**_____**Other:**_____

Did you/your child consume water from an untreated water supply? e.g. roof, bore, spring YES NO

Specify where:_____

Have you/your child had recreational water contact? E.g. pools, fishing, boating YES NO

Activity	Where	Date

Have you/your child had any contact with Farm animals? YES NO **Specify** _____

Have you/your child had any contact with sick animals? YES NO **Specify** _____

Did you/your child have contact with faecal matter? YES NO **Specify** _____
Animal ☐ e.g. poop scoop **Human** ☐ e.g. nappies, broken sewerage systems

Have you/your child been overseas in the incubation period? YES NO **Date returned to NZ:** / /
Countries visited: _____
Did you/your child stay at home while symptomatic*? YES NO N/A
*for those in high risk jobs e.g. food prep, ECC, health care or children in ECC's etc
Number of contacts identified: E.g. household, work colleagues, school friends etc_____

Any thing you think has caused your/your child's illness i.e. contact with faecal matter (if not already discussed)

11.5 EpiSurv enteric disease case report form

CASE REPORT FORM **Enteric Disease**

Enteric Disease EpiSurv No.

Disease Name

○ Gastroenteritis - unknown cause ○ Gastroenteritis/foodborne intoxication - specify

○ Campylobacteriosis ○ Cholera ○ Cryptosporidiosis ○ Giardiasis

○ Paratyphoid fever ○ Salmonellosis ○ Shigellosis ○ Typhoid fever ○ Yersiniosis

Reporting Authority

Name of Public Health Officer responsible for case

Notifier Identification

Reporting source* ○ General Practitioner ○ Hospital-based Practitioner ○ Laboratory ○ Self-notification ○ Outbreak Investigation ○ Other

Name of reporting source **Organisation**

Date reported* **Contact phone**

Usual GP **Practice** **GP phone**

GP/Practice address Number Street Suburb Town/City Post Code ☐ GeoCode

Case Identification

Name of case* Surname Given Name(s)

NHI number* **Email**

Current address* Number Street Suburb Town/City Post Code ☐ GeoCode

Phone (home) **Phone (work)** **Phone (other)**

Case Demography

Location **TA*** **DHB***

Date of birth* **OR** **Age** ○ Days ○ Months ○ Years

Sex* ○ Male ○ Female ○ Indeterminate ○ Unknown

Occupation*

Occupation location ○ Place of Work ○ School ○ Pre-school

Name

Address Number Street Suburb Town/City Post Code ☐ GeoCode

Alternative location ○ Place of Work ○ School ○ Pre-school

Name

Address Number Street Suburb Town/City Post Code ☐ GeoCode

Ethnic group case belongs to* (tick all that apply)

☐ NZ European ☐ Maori ☐ Samoan ☐ Cook Island Maori

☐ Niuean ☐ Chinese ☐ Indian ☐ Tongan

☐ Other (such as Dutch, Japanese, Tokelauan) *(specify)

Enteric Disease EpiSurv No. _____

Basis of Diagnosis

CLINICAL CRITERIA

Fits clinical description* ○ Yes ○ No ○ Unknown

LABORATORY CRITERIA (refer to case definition)

Meets laboratory criteria* ○ Yes ○ No ○ Unknown

Organism / toxin / antigen / oocysts / cysts / trophozoites isolated or detected from body site* ○ Yes ○ No ○ Not Done ○ Awaiting Results

Specify site* ○ Faeces ○ Blood ○ Other site (*specify) _____

Organism / toxin isolated or detected from linked food or water* ○ Yes ○ No ○ Not Done ○ Awaiting Results

EPIDEMIOLOGICAL CRITERIA

Contact with a confirmed case of the same disease* ○ Yes ○ No ○ Unknown
(If yes also record details in risk factors section)

Part of an identified common source outbreak* ○ Yes ○ No ○ Unknown
(If yes also record details in outbreak section and risk factors section)

STATUS* ○ Under Investigation ○ Probable ○ Confirmed ○ Not a case

ADDITIONAL LABORATORY DETAILS

Organism species/serotype/phage toxin etc* _____

ESR Updated ☐ Laboratory _____

Date result updated _____ Sample Number _____

ASSOCIATED FOOD/WATER/ENVIRONMENTAL SAMPLES

Were there any food, water or environmental samples associated with this case? ○ Yes ○ No ○ Unknown

If yes, specify type(s) and results

Sample Type	Sample Number	Result

Clinical Course and Outcome

Date of onset* _____ ☐ Approximate ☐ Unknown

Hospitalised* ○ Yes ○ No ○ Unknown

Date hospitalised* _____ ☐ Unknown

Hospital* _____

Died* ○ Yes ○ No ○ Unknown

Date died* _____ ☐ Unknown

Was this disease the primary cause of death?* ○ Yes ○ No ○ Unknown

***If no, specify the primary cause of death**

_____

Outbreak Details

Is this case part of an outbreak (i.e. known to be linked to one or more other cases of the same disease)?*

☐ Yes **If yes, specify Outbreak No.*** _____

Enteric Disease EpiSurv No.

Risk Factors

FOOD PREMISES

Did the case consume food from a food premises during the incubation period?~ ○ Yes ○ No ○ Unknown

If yes, specify

1. Name of premises

Address Number Street Suburb

Town/City Post Code ☐ GeoCode

Foods eaten **Date consumed**

Comments **Status** ○ Suspected ○ Confirmed ○ Exonerated

2. Name of premises

Address Number Street Suburb

Town/City Post Code ☐ GeoCode

Foods eaten **Date consumed**

Comments **Status** ○ Suspected ○ Confirmed ○ Exonerated

3. Name of premises

Address Number Street Suburb

Town/City Post Code ☐ GeoCode

Foods eaten **Date consumed**

Comments **Status** ○ Suspected ○ Confirmed ○ Exonerated

DRINKING WATER

Current address* water supply code or specify

Work/school/pre-school* water supply code or specify

Did the case consume water other than regular supply (home or work / school / pre-school) during the incubation period?~ ○ Yes ○ No ○ Unknown

If yes, specify address* Water supply code

Water supply code

Did the case consume untreated surface water, bore water or rain water during the incubation period?~ ○ Yes ○ **No** ○ **Unknown**

If yes, specify water source:~

RECREATIONAL WATER CONTACT

Did the case have recreational contact with water during the incubation period?~ ○ Yes ○ No ○ Unknown

If yes, nature of contact

☐ **Swimming in public swimming pool, spa pool or in other pool (e.g. school, hospital, motel, private pool)**

1. Name of pool

Address Number Street Suburb

Town/City Post Code ☐ GeoCode

Comments Date of exposure

2. Name of pool

Address Number Street Suburb

Town/City Post Code ☐ GeoCode

Comments Date of exposure

Enteric Disease EpiSurv No.

3. Name of pool

Address Number Street Suburb

Town/City Post Code GeoCode

Comments Date of exposure

Swimming in streams, rivers, sea etc

1. Name of stream/river/beach

Address Number Street Suburb

Town/City Post Code GeoCode

Comments Date of exposure

2. Name of stream/river/beach

Address Number Street Suburb

Town/City Post Code GeoCode

Comments Date of exposure

3. Name of stream/river/beach

Address Number Street Suburb

Town/City Post Code GeoCode

Comments Date of exposure

Other recreational contact with water specify Date of exposure

Location of other recreational contact with water

HUMAN CONTACT

Attendance at school, preschool or childcare~ Yes No Unknown

Did the case have contact with other symptomatic people during the incubation period?~ Yes No Unknown

If yes, specify type of contact

If yes, give names of people

Did the case have contact with children in nappies, sewage or other types of faecal matter or vomit during the incubation period?~ Yes No Unknown

If yes, specify what they had contact with

ANIMAL CONTACT

Did the case have contact with farm animals during the incubation period?~ Yes No Unknown

If yes, specify type of animal

Did the case have contact with sick animals during the incubation period?~ Yes No Unknown

If yes, specify type of animal and illness

OVERSEAS TRAVEL

Was the case overseas during the incubation period for this disease* Yes No Unknown

If yes, date arrived in New Zealand*

Specify countries visited*	Country	Date Entered	Date Departed
Last (most recent):*			
Second last:*			
Third last:*			

Enteric Disease EpiSurv No.

Risk Factors continued

If the case has not been overseas recently, is there any prior history of overseas travel that might account for this infection?* ○ Yes ○ No ○ Unknown

If yes, specify*

OTHER

Other risk factor for disease (specify)~

Source

Was a source confirmed by*

a) Epidemiological evidence* ○ Yes ○ No ○ Unknown

e.g. part of an identified common source outbreak (also record in outbreak section) or person to person contact with a known case

b) Laboratory evidence* ○ Yes ○ No ○ Unknown

e.g. organism or toxin of same type identified in food or drink consumed by case

Specify confirmed source(s)*

☐ From consumption of contaminated food or drink, specify food or drink

☐ From consumption of contaminated drinking water, specify supply

☐ From contact with infected animal, specify type of animal

☐ Person to person contact with another case, specify relationship to case

☐ From other confirmed source, specify source

If not, were any probable sources identified?*

Specify probable source(s)* ○ Yes ○ No ○ Unknown

☐ From consumption of contaminated food or drink, specify food or drink

☐ From consumption of contaminated drinking water, specify supply

☐ From contact with infected animal, specify type of animal

☐ Person to person contact with another case, specify relationship to case

☐ From other probable source, specify source

Management

CASE MANAGEMENT

Case excluded from work or school/preschool/childcare until well? ○ Yes ○ No ○ NA ○ Unknown

Does the case fit any of the following high risk categories?

Early childhood centre work ○ Yes ○ No ○ Unknown

Food handler ○ Yes ○ No ○ Unknown

Water supply worker ○ Yes ○ No ○ Unknown

Intellectually/physically impaired ○ Yes ○ No ○ Unknown

Healthcare/rest-home worker ○ Yes ○ No ○ Unknown

If yes, to any of the above, was the case excluded from work until microbiological clearance achieved? ○ Yes ○ No ○ NA ○ Unknown

CONTACT MANAGEMENT

Number of contacts identified

Number of contacts followed up according to national or local protocols

Enteric Disease EpiSurv No.

Comments*

Food Premises

4. Name of premises

Address Number Street Suburb

Town/City Post Code GeoCode

Foods eaten **Date consumed**

Comments **Status** Suspected Confirmed Exonerated

5. Name of premises

Address Number Street Suburb

Town/City Post Code GeoCode

Foods eaten **Date consumed**

Comments **Status** Suspected Confirmed Exonerated

6. Name of premises

Address Number Street Suburb

Town/City Post Code GeoCode

Foods eaten **Date consumed**

Comments **Status** Suspected Confirmed Exonerated

7. Name of premises

Address Number Street Suburb

Town/City Post Code GeoCode

Foods eaten **Date consumed**

Comments **Status** Suspected Confirmed Exonerated

8. Name of premises

Address Number Street Suburb

Town/City Post Code GeoCode

Foods eaten **Date consumed**

Comments **Status** Suspected Confirmed Exonerated

Version 3rd August 2007 *** core surveillance data, ~ optional data**