



Campylobacter Risk Management Strategy

2008 - 2011

Prelims

Amendment 0

December 2008

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1 Introduction

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The New Zealand Food Safety Authority's (NZFSA's) mandate is to protect consumers by providing an effective food regulatory programme covering food produced and consumed in New Zealand as well as imports and exports of food products. NZFSA recognises the high rates of human campylobacteriosis in New Zealand and the contribution that food, and poultry especially, make to this unacceptable health burden. With this in mind, NZFSA has set an organisational performance target of 50% reduction in the reported annual incidence of foodborne campylobacteriosis after five years¹.

It has been scientifically established that poultry meat is a primary exposure pathway in New Zealand. NZFSA has developed a comprehensive risk management strategy aimed at achieving sustainable reduction in *Campylobacter* levels in chicken meat through scientifically robust interventions at appropriate points in the food chain, and adopting a multi-pronged approach to *Campylobacter* risk reduction. This strategy was formalised in 2006. It has now been widened to include investigation and management of other potential exposure pathways for humans, besides poultry meat.

The *Campylobacter* risk management strategy includes:

- developing targeted controls throughout the food chain
- focusing on hazard-based controls in the medium term
- focusing on risk-based controls in the longer term
- clarifying the proportionality of poultry compared with other transmission pathways
- intensifying monitoring programmes by establishing new baselines and monitoring changes over time
- promoting good hygienic practice (GHP) by consumers

¹ Annual report of Potentially Foodborne Disease in New Zealand 2007.

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- collaborating with industry, consumers and research institutes of New Zealand on all aspects of risk management
 - collaborating with the international science community on all aspects of risk assessment and risk management

While the ideal is for risk-based controls, given the scale of the public health problem, overseas experience, and the evolving science, hazard-based interventions have been introduced to reduce the public's exposure to *Campylobacter*.

2 Objectives of the *Campylobacter* Risk Management Strategy

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The objectives of the *Campylobacter* risk management strategy are as follows:

1. To reduce the incidence of foodborne human campylobacteriosis in accordance with the NZFSA performance target
2. To estimate the proportion of foodborne cases attributable to poultry and other sources
3. To determine the relative contributions of different interventions throughout the food chain in reducing risks to human health
4. To continue to make well-informed risk management decisions on appropriate control measures and their implementation
5. To assess the effectiveness of risk management decisions by utilising a monitoring and review programme
6. To coordinate and prioritise research activities

3 Background

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3.1 What is *Campylobacter*?

Campylobacter is a bacterial organism that causes the gastrointestinal disease campylobacteriosis when it lodges in the walls of a person's intestine. In particular, there are two species of *Campylobacter* that cause human illness and these are *Campylobacter jejuni* and *Campylobacter coli*.

3.2 Human Campylobacteriosis

Illness usually strikes within 2 – 5 days of exposure but can take up to 10 days. Symptoms include general muscle pain, stomach cramps, nausea, headache or fever followed by sudden watery diarrhoea that may contain blood. Most people feel ill for about a week. During the illness, and up to a fortnight afterwards, bacteria are shed from the gut and can survive on hands and moist surfaces for up to an hour.

The relationship between exposure and human illness continues to be explored. The dose-response relationship of *Campylobacter* and human illness is not well established. The role of immunity is not clear either. Nevertheless it can be assumed that the smaller the exposure, the more likely a reduction in the incidence of human illness will be.

The incidence of human campylobacteriosis in New Zealand is unacceptably high. Much research is being undertaken to identify solutions capable of reducing these high rates, and there is a promising downward trend since November 2007.

3.3 Pathways

There are many pathways for *Campylobacter* to reach the human population (especially in New Zealand) and knowing the relative importance of each of these is obviously very important when prioritizing areas for control. Once a significant pathway has been identified, its relative significance must be established using attribution techniques, and monitored.

Available scientific information shows that poultry meat is the main food pathway.

A risk model is a very useful tool that assists in the decision making process by organizing existing knowledge on potential interventions, identifying data gaps and providing estimates of risk. Knowledge of the cost and the feasibility of application of measures to reduce risks is an important input to risk management decisions.

3.4 Comprehensive Research

The New Zealand Food Safety Authority's (NZFSA) research programme on *Campylobacter* has been comprehensive and longstanding over more than fifteen years, including involvement of the Ministry of Health and the Institute of Environmental Science and Research (ESR). It is now scientifically established that poultry is a primary pathway for the disease in New Zealand accountable for the majority of identifiable infections.

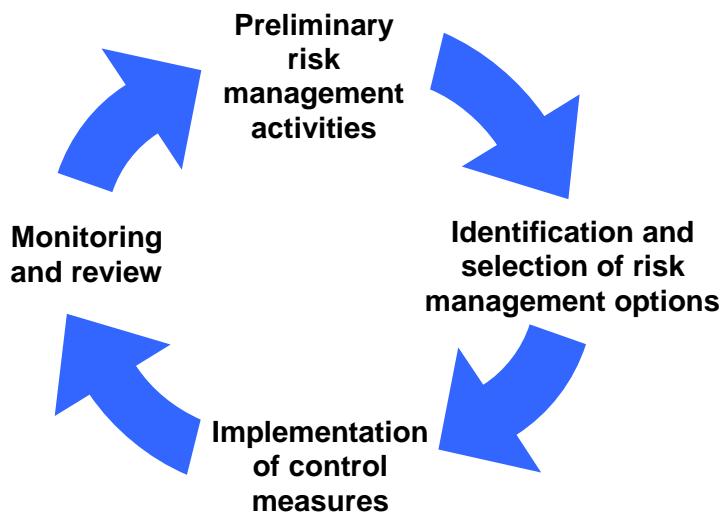
3.5 Risk Management Framework

The NZFSA risk management framework (RMF)² provides a systematic process whereby knowledge on risk and evaluation of other factors relevant to control of hazards are used to choose and implement regulatory standards or other measures. The four components involved in applying a RMF are shown in Figure 1. Effective risk management incorporates appropriate risk communication and stakeholder representation at all steps.

² Details on the NZFSA Risk Management Framework can be found at:

<http://www.nzfsa.govt.nz/about-us/risk-management-framework/page-03.htm>

Figure1: Components of the Risk Management Framework



3.6 Campylobacter Risk Management Strategy Working Group

NZFSA has a dedicated *Campylobacter* risk management strategy working group to coordinate all work relating to *Campylobacter* and update the risk management strategy. The working group represents expertise from several of the business groups within NZFSA.

3.7 Stakeholders

NZFSA works closely with a variety of stakeholders in New Zealand in order to ensure understanding of the comprehensive risk management strategy and to share and obtain feedback on results from the work programme on an ongoing basis.

Stakeholders include:

- District Health Boards and Territorial Authorities
- Enteric Zoonotic Disease Research Steering Committee (administered by NZFSA)
- FSANZ
- Industry associations, e.g. those covering growers, processors, retail and food service
- NZFSA Academy

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- NZFSA Consumers Forum
 - Science organisations, e.g. Crown Research Institutes, Universities

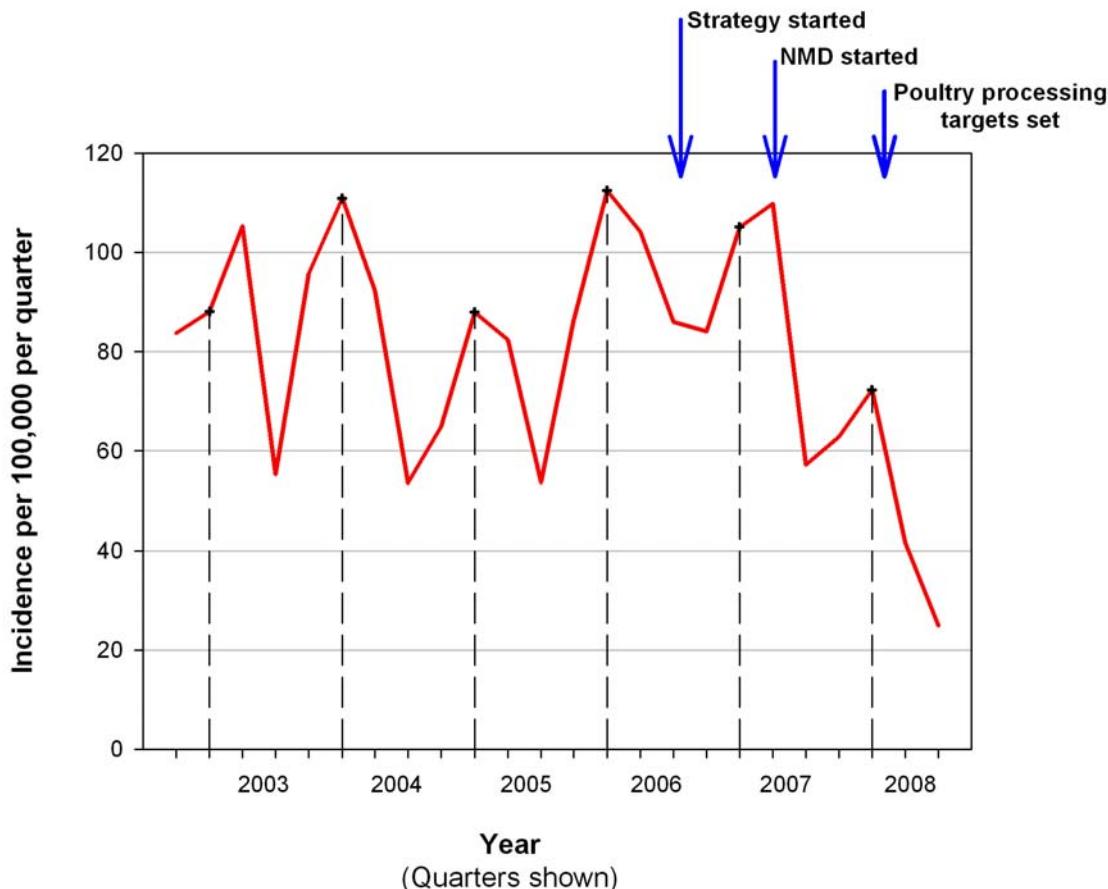
3.8 Key Achievements

These include ³:

1. Establishment of a performance target of 50% decrease in foodborne cases of campylobacteriosis after five years
2. An interim estimation of 60% of foodborne cases attributable to poultry
3. Establishment of a risk model for *Campylobacter* in broiler chicken in New Zealand
4. Development and implementation of a Code of Practice for poultry processors covering primary processing
5. Mandatory *Campylobacter* performance targets for broiler chicken carcasses at the end of primary processing
6. Progress within Monitoring and Review as per the following graphs:
 - a. **Surveillance** – incidence of human cases of campylobacteriosis

The following graph shows quarterly results as at 30 June 2008, for reported incidence of human campylobacteriosis in New Zealand per 100,000 head of population.

³ More detail on achievements under each component of the RMF can be found in section 4 and Annex 1 of this document.



b. National Microbiological Database (NMD)

The following table shows quarterly results for broiler chicken carcass sampling covering prevalence (positive carcasses) and enumeration (mean log count⁴) to 30th June 2008.

NMD Results	Number of carcasses tested	Prevalence %	Mean Log Count all samples
Q2 2007	890	57	3.07
Q3 2007	936	53.8	3.06
Q4 2007	916	45.1	2.75
Q1 2008	1309	45	2.70
Q2 2008	1528	30.6	2.41

⁴ Samples where Campylobacter was not detected were given a value of 2.00 log₁₀CFU/carcass.

3.9 Strategy Update

The Strategy update process occurs annually and takes into account all aspects of implementation of the RMF and progress to-date. This includes consideration of any other relevant sources of information. The update process guides the choice of further scientific work and the future direction of the Strategy.

This updated Strategy document describes the NZFSA *Campylobacter* risk management strategy for the next three years and, specifically, spells out the work programme that will be achieved over the next twelve months. We will regularly report on progress on the NZFSA website.

Implementation of the Strategy is via a work programme aligned to the RMF. Details are found in section 4 of this Strategy.

4 Work Programme

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This work programme is based on application of the RMF and includes the following parts:

- Preliminary Risk Management Activities;
- Risk Management Options;
- Implementation of Control Measures;
- Monitoring and Review;
- Risk Communication; and
- International Collaboration.

For each part, a short overview is given and the key objectives where applicable, are set out. Work completed in the last twelve months and current work for 2008-09 is listed.

Annex 1 backgrounds all completed Science work underpinning the Strategy.

Annex 2 outlines the timetable for deliverables for the next twelve months.

4.1 Preliminary Risk Management Activities

The identification of campylobacteriosis as a food safety issue has been well established and risk profiles on *Campylobacter* in poultry, mammalian and poultry offals, and red meat have been completed. Preliminary risk management activities currently focus on scientific evaluation of data including source attribution data, and risk assessment.

4.1.1 Key Objectives

- To accurately determine the incidence of foodborne human campylobacteriosis from poultry relative to other sources
- To apply genotyping of strains to assist with food source attribution and other epidemiological studies

- To quantify the influence of specific controls at different steps in the food chain on risk estimates in NZ, and create a “menu” of such controls and the resulting risk estimates
- To model “what if” scenarios for new controls that become available e.g. decontamination processes
- To demonstrate the most effective ways to manage the risk to the consumer from *Campylobacter* in poultry while ensuring practicality and feasibility of intervention

4.1.2 Completed Work 2007-2008⁵

- Acute gastro-intestinal studies
- Comparison of human and poultry *Campylobacter* isolates utilising Multi Locus Sequence Typing (MLST) in two additional centres with those available in Manawatu
- Evaluation of the NZ poultry risk model by Med Vet Net⁶
- Study of contamination during secondary processing of poultry
- Comparative exposure model: Incorporation of *Campylobacter* in poultry and red meat

4.1.3 Current Work – Attribution Studies

- Comparison of human and poultry *Campylobacter* isolates utilising MLST pre and post introduction of Sanova (NZFSA/ESR 2008)

This work will involve genotyping using MLST, a statistically valid sample of human *Campylobacter* isolates from the Christchurch area. It also involves collecting and genotyping using MLST, a statistically valid sample of retail poultry *Campylobacter* isolates available from retail outlets in Christchurch. It will be determined whether the human and poultry *Campylobacter* MLST distributions found in this centre differ significantly from those found previously in Christchurch and Auckland, and in the Manawatu.

⁵ Available final science reports will be located at: www.nzfsa.govt.nz/science An overview of all completed science work can be found in Annex 1.

⁶ <http://www.medvetnet.org/cms/>

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- The relative contribution of food pathways to the burden of human campylobacteriosis in New Zealand (NZFSA/Massey University, 2005 – 2009)

This PhD project studies the integration of new pathogen techniques and risk modeling methods to gain a better understanding of the epidemiology of campylobacteriosis in New Zealand, and simulate the overall effectiveness of different control options.

- Dynamic modeling of *Campylobacter* sources in the Manawatu (NZFSA/Massey University and Mid Central Health 2008-2009)

This work will develop statistical methods for dynamically modeling trends in source proportions of foodborne disease. It will demonstrate the ongoing trends in source attribution of campylobacteriosis in the Manawatu and will contribute to the monitoring and review of this Strategy.

- A workshop on pathways and disease attribution involving the research community and industry to agree further work in this area.

4.1.4 Current Work – Scientific Evaluation

- Resuscitation of putative viable but non-culturable foodborne bacteria of significance to New Zealand (NZFSA/ESR 2006-2008)

This work will investigate various aspects of several foodborne pathogens (including *Campylobacter*) that appear not to be dead but that cannot be cultured with commonly used media.

- Quantification of *Campylobacter* from internal and external rinsates (NZFSA/ESR 2007-2008)

This work will quantify numbers of *Campylobacter* recovered from the rinsates of poultry. The intention is to establish the distribution of *Campylobacter* on various parts of the chicken carcass (wings, drumsticks, thighs, breasts, in addition to the thoraco-abdominal cavity and

the stripped carcass). The work will determine whether differences exist in the relative distribution of *Campylobacter* on poultry between two large poultry processing plants.

- *Campylobacter* in uncooked retail meats (NZFSA/ESR 2008 -2009)

This work will repeat the survey of retail meats in order to compare current prevalence with the previous survey of 2003-2004 following the introduction of the *Campylobacter* Performance Target (CPT) in February 2008. The intention of this survey is to evaluate to what degree the *Campylobacter* strategy has been successful in reducing *Campylobacter* on broiler meat at the retail level. In addition meat from birds other than broilers will be tested.

- Microbiological hazards in conventional and organic fresh produce (NZFSA/ESR 2008-2009)

This work will survey domestic fresh produce and imported produce for foodborne pathogens and indicator organisms, compare the microbiological profile of conventional and organically grown fresh produce and if possible, compare the microbiological profile of certified and non-certified organically grown fresh produce. Potential risks to consumers from detected hazards in fresh produce marketed in New Zealand, will be assessed.

4.1.5 Current Work - Risk Assessment

- *Campylobacter* in food and the environment, examining the link with public health (NZFSA, ESR, Massey University, MfE, MORST, NIWA, 2007 - 2010)

This work will improve the existing comparative human exposure models, extending existing ecological/environmental models, and examining the links between human exposure via different pathways.

- Enhancement of the New Zealand farm-to-plate poultry risk model

Options will be evaluated to enhance the current New Zealand model where the primary focus is on broiler chicken. This will be done by including new information and replacing international data in the model with NZ data where possible.

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- Modelling the impact of the NZFSA regulatory target for *Campylobacter* on human health risks in New Zealand (NZFSA/ESR 2008-2009)

This work will utilise the model developed in 2007/2008 and real data from the 2007/2008 NMD to illustrate the likely impact of the NZFSA regulatory target implemented on 1 April 2008 on reduction of foodborne campylobacteriosis in New Zealand. It also is expected to demonstrate the likely impact of changes in the stringency of regulatory response from that specified in the current NZFSA metric, and determine different proportions of national production involved when regulatory actions are taken at the individual premises level.

- Survival of NZ-relevant *Campylobacter* strains under dynamic environmental conditions simulating poultry processing (NZFSA/Massey University 2007-2009)

This work will gather essential data on the survival of New Zealand relevant *Campylobacter* strains under different temperature and other environmental conditions arising during commercial processing and domestic consumption (principally cooking). The research findings will be incorporated into quantitative risk assessment models; providing precise data on strain variability of growth and or death kinetics, or survival on food, and a reduction in parameter uncertainty.

4.2 Risk Management Options

Potential risk management options are identified and then selected according to appropriate criteria. Stakeholders are involved to the extent possible, and a clear rationale must be presented for the final decisions taken. All parts of the food chain should be taken into account when selecting control measures.

4.2.1 Key Objectives

- To identify the most effective and practical intervention(s) and other (e.g. non regulatory) measures at relevant points in the food chain and ensure their implementation
- To establish a quantitative link between implementation of hazard-based controls and achievement of any performance targets that may be established

4.2.2 Completed Work 2007-2008⁷

- On-farm risk factors for *Campylobacter* infection of poultry
- Quantifying the reduction of *Campylobacter jejuni* on skin-on chicken breasts frozen and stored up to 10 weeks in a domestic freezer
- Effect of commercial freezing on reduction of *Campylobacter* on poultry
- Leakproof packaging scientific report
- Assessment of domestic food handling practices
- Poultry Processors Code of Practice – overview and chapter on primary processing
- Establishment of *Campylobacter* performance targets at the end of primary processing for moving window, high count and quarterly NMD results
- Consumer survey on knowledge, attitudes and beliefs with respect to *Campylobacter* in poultry, including acceptability of possible interventions

4.2.3 Current Work

- Farmers' overalls as a transmission route for *Campylobacter* on broiler farms (NZFSA/ESR 2008)

This work will determine if *Campylobacter* is present on farmers' overalls on farms known to have *Campylobacter* present in at least one shed. It also will determine if *Campylobacter* can be transferred via loose particulate matter picked up by the overalls worn by poultry farmers when undertaking daily monitoring visits to multiple sheds.

- Chlorine compounds formed during chlorine washing of chicken (NZFSA/ESR 2008)

This work will determine the chlorinated compounds that may be formed during the chlorine washing of chicken meat and whether any of these are likely to present any public health

⁷ Available final science reports will be located at: www.nzfsa.govt.nz/science An overview of all completed science work can be found in Annex 1.

risk. Appropriate risk management options that can be implemented to protect public health, also will be determined.

- Effectiveness of current practices on level of faecal contamination and cross contamination (NZFSA/ESR 2008-2009)

A proportion of broilers that are submitted for slaughter are infected with *Campylobacter*. Various stages of the dressing process can result in carcasses becoming contaminated with this organism. This work will evaluate how the relative distribution of *Campylobacter* on a broiler carcass changes as a result of various dressing and decontamination steps.

Information on the visual contamination on broilers also will be evaluated.

- Effect of freezing at -12°C on the *Campylobacter* counts on broiler carcasses (NZFSA/ESR 2008/2009)

It is a regulatory requirement to freeze poultry to a maximum of -12°C, if it is frozen. This work will evaluate the initial change in counts (probably reduction) of *Campylobacter* on inoculated broilers as a result of freezing to -12°C. It also will monitor the change in counts after frozen storage for defined periods of time when carcasses are stored at -12°C.

- Updating the table of interventions delivering a 2 log₁₀ or greater reduction of *Campylobacter*
- Completing further chapters for the Poultry Processors Code of Practice on: secondary processing including packaging, and cleaning and sanitation
- Evaluating current standards for retail/food service, and developing changes as required
- Updated guidance material on safe handling of poultry meat and relevant time temperature applications

4.3 Implementation of Control Measures

Sectors throughout the food chain have the primary role in implementation of control measures. Verification of control measures implemented by the food sector will be necessary. The Compliance Group of NZFSA carries out independent audit of regulatory

functions and applies sanctions where control measures have not been properly implemented.

4.3.1 Key Objectives

- To effectively implement regulated and non-regulated measures at relevant points in the food chain

4.3.2 Completed Work 2007-2008

- Non-regulated - Broiler Grower Biosecurity Manual
- Regulated – Code of Practice – chapter on primary processing
- Regulated – *Campylobacter* performance targets at the end of primary processing for moving window, high count and quarterly NMD results

4.3.3 Current Work

- Audit of broiler growing farms to assess the application and effectiveness of the Poultry Industry Broiler Growing Biosecurity Manual
- Compliance audit of primary processing plants to assess the:
 - application and effectiveness of the Poultry Processors Code of Practice – chapter on primary processing
 - implementation of the NMD sampling requirements
 - compliance with the *Campylobacter* performance targets at the end of primary processing

4.4 Monitoring and Review

Monitoring and Review encompasses human health surveillance associated with foodborne illness caused by *Campylobacter*.

Data on the level of control of *Campylobacter* throughout the food chain is gathered, analysed, and reviewed in conjunction with audit reports and human health surveillance data to determine the effectiveness of regulatory activities. Where monitoring indicates that food

safety goals are not being achieved, decisions and/or control measures will need to be reviewed and future research/improvement may be requested.

4.4.1 Key Objectives

- Surveillance - in cooperation with ESR and MoH, to contribute to an effective surveillance programme that will enable demonstration of mid- and long term trends
- Monitoring - to accurately determine the prevalence and level of *Campylobacter* in poultry (all species but beginning with broilers) in New Zealand considering each key stage of the food chain:
 - at point of slaughter (reflecting farm practices);
 - during processing;
 - at retail (one-off studies or intermittent).
- Review - to review effectiveness of outputs from the strategy in contributing to the achievement of a reduction in food-borne campylobacteriosis.
- Review - to identify areas for future research / improvement under this strategy

4.4.2 Completed Work

- Not applicable.

4.4.3 Current Work - Surveillance

- Enhancing surveillance of potentially foodborne enteric diseases in New Zealand (NZFSA/Massey University and Mid Central Health 2008)

This work will expand the present pilot risk attribution study to align with the NZFSA Science and the Human Enteric Disease Surveillance Strategies to enable the quantification of the impact of industry interventions on human health by developing a prototype sentinel surveillance programme.

-
- Development and application of new tools for the analysis of *Campylobacter* surveillance data: identifying the spatial and temporal determinants of raised notifications in New Zealand (NZFSA/Massey University and ESR, 2007-2009)

This work will identify potential risk factors for raised *Campylobacter* notifications in space and time in New Zealand; develop new statistical models that capture and explain the patterns of *Campylobacter* notifications in New Zealand; and enhance the utility of current routinely collected surveillance data in New Zealand.

4.4.4 Current Work – NMD

- Quantification of *Campylobacter* on poultry after consecutive rinses and removal/homogenisation of skin (NZFSA/ESR 2008)

This work will quantify numbers of *Campylobacter* recovered from consecutive rinsates of poultry at the NMD sampling position. The intention is to establish how the NMD counts relate to the actual number of *Campylobacter* organisms on the birds. The work also will quantify numbers of *Campylobacter* recovered from the homogenised skin of these birds after the consecutive rinses have been conducted.

- NMD not detected rinsates (NZFSA/ESR, 2008)

A proportion of NMD rinsates do not detect any *Campylobacter* organisms. This may be because there are no *Campylobacter* organisms on the carcass or because the number of organisms is small and below the bacteriological limit of detection. This work will examine a number of samples with a lower limit of detection to get a better understanding of the extent of this issue.

- NMD monitoring of caecal and carcass sampling
- NMD monitoring of compliance with *Campylobacter* performance targets at the end of primary processing

4.4.5 Current Work - Review

- Participation in the NMD review project to ensure that non-compliance reporting and response mechanisms for *Campylobacter* performance targets at the end of primary processing, are simple, timely and effective
- Review of systems that ensure that laboratory performance is acceptable including:
 - Laboratory Accreditation Scheme
 - Laboratory Audits
 - Inter-Laboratory Comparison Programme
 - Improvements to laboratory methods
- Review of caecal sampling results to identify areas for improvement or further research and also whether there is an ongoing need for monitoring at this point in the food chain
- Review of on farm practices and the Poultry Industry Broiler Growing Biosecurity Manual taking into account the findings from other relevant work above
- Review of the *Campylobacter* performance targets at the end of primary processing, after a full year's set of results is available (so that seasonality issues can also be taken into account)

4.5 Risk Communication

Risk communication encompasses a continuous and interactive exchange of information between all parties involved in food safety. It describes the work done by NZFSA to bridge the gap between the evaluation of risk by experts and the views of other stakeholders. NZFSA takes into account knowledge, attitudes, values, practices and perceptions of stakeholders when communicating risk management options and decisions.

Further information including press releases, reports, research and resources can be found at <http://www.nzfsa.govt.nz/>

Details of various NZFSA funded risk profiles and research can be found at:
<http://www.nzfsa.govt.nz/science>

4.5.1 Key Objectives:

- To proactively inform interested parties (both public and industry) of major developments, milestones and decisions (and the reasons for those decisions)
- To communicate via multiple methods, where appropriate, to ensure that interested parties have every opportunity to get the information they need, in the way they need it, in a timely manner

4.5.2 Current Work

- Ensuring that the NZFSA website is the key repository of all information relating to the *Campylobacter* Risk Management Strategy, that it is updated as required and that the information can be easily accessed from the dedicated web page

4.6 International Collaboration

NZFSA works closely with international counterparts to coordinate research, and to share and discuss scientific approaches and results in order to maximize the benefits of scientific knowledge on *Campylobacter* in poultry for inclusion into New Zealand's risk management strategy. Collaborative science projects are underway with international food safety agencies.

- **Med-Vet-Net.** Close collaboration continues with risk model comparisons
- **Codex International standards.** The Codex Alimentarius Commission is regarded as a key body for international food related standard setting activities. The Codex Committee on Food Hygiene has tasked New Zealand with leading the international risk-based standard for *Campylobacter* control in poultry. This is a five year project and two years of drafting work has taken place with two international working groups held since May 2007
- **FSANZ.** New Zealand is observing development of the poultry primary production and processing standard including a Code of Practice and associated guidance material that will apply to Australia

Annex 1: Completed Scientific Work

December 2008

1 Preliminary Risk Management Activities

1.1 Attribution

Campylobacteriosis in New Zealand: Results of the Magic Study

A multi-centre case-control analysis of gastroenteritis induced by *Campylobacter* carried out by ESR for Ministry of Health and Public Health Commission.

A Systematic Review of the Aetiology of Human Campylobacteriosis in New Zealand

A systematic review of the available evidence around the aetiology of human *Campylobacteriosis* in the New Zealand setting, including a consideration of the scientific quality of that evidence (particularly foodborne transmission).

National Typing Database

A standardised, national, pulse-field gel electrophoresis (PFGE) microbial sub-typing database that targets micro sub typing studies to improve epidemiological and food attribution knowledge.

Acute Gastro-intestinal Studies

A series of studies to estimate the burden of disease associated with acute gastro-intestinal illness in New Zealand and associated under-ascertainment in the surveillance process.

Comparison of Human and Poultry *Campylobacter* Isolates Utilising MLST in Two Additional Centres with those Available in Manawatu

A study determining whether the human and poultry *Campylobacter jejuni* isolate findings from the present Manawatu attributions studies are indicative for other areas in New Zealand.

1.2 Scientific Evaluation

Campylobacter jejuni / coli in Poultry

A risk profile that discusses issues relating to *Campylobacter* in poultry.

Campylobacter jejuni/coli on Mammalian and Poultry Offals

A risk profile that discusses issues relating to *Campylobacter* in red meat and poultry offal.

Campylobacter jejuni/coli on Red Meat

A risk profile that discusses issues relating to *Campylobacter* and uncooked bovine, ovine and porcine meat.

Undercooked Chicken Livers as a Vehicle for Campylobacteriosis

A microbiological evaluation of chicken liver pate recipes, resulting in identification of optimal hygiene practice for preparation and provision of educational materials.

Campylobacter Pathways Discussion Document

A review document identifying the relative importance of different transmission routes for *Campylobacter*.

Pathogen Loading on Freshly Slaughtered Chickens

Data on the prevalence and numbers of *Campylobacter* on freshly slaughtered chickens immediately after exsanguination and before scalding.

1.3 Risk Assessment

Comparative Risk Model: Campylobacter spp. in Red Meat and Poultry (ESR)

A computer based model constructed to estimate and compare exposures of New Zealanders to *Campylobacter* from three types of red meat (sheep, pig meat, beef) and poultry.

Preliminary Relative Risk Assessment for *Campylobacter* Exposure in New Zealand (Enteric Zoonotic Disease Modelling Group)

Web link: <http://www.zoonosesresearch.org.nz/>

Two models, one of which explores the relative importance of four of the most commonly identified infection exposures and the other which explores the persistence of *Campylobacter* in a rural setting.

Quantitative Risk Model: *Campylobacter* spp. in the Poultry Food Chain (ESR)

A quantitative risk model that investigates *Campylobacter* spp. contamination in the processing and consumption stages of the New Zealand poultry food chain.

Secondary Processing of Poultry (NZFSA/ESR 2006-2007)

Improvement of the model for *Campylobacter* contamination through the poultry food chain; particularly in regard to the modelling of secondary processing, to assist risk management of campylobacteriosis.

Comparative Exposure Model: Incorporation of *Campylobacter* in Poultry and Red Meat (NZFSA/ESR 2006 – 2007)

Integration of existing files for *Campylobacter* in poultry and meat into the "Preliminary relative risk assessment for *Campylobacter* exposure in New Zealand".

2 Risk Management Options

The Effect of Refrigeration on *Campylobacter* Survival on Poultry Meat

An evaluation of the effectiveness of temperature controls in the reduction of *Campylobacter* numbers achieved under standard industry practice and potential new chilling and freezing regimes.

Domestic Food Practices in New Zealand – Freezer Survey

A survey to provide baseline information on domestic freezer types commonly in use in New Zealand. Information on typical domestic freezer temperatures was collected. Freezing and thawing temperature profiles for chicken samples were recorded with a view to generating information to support a more quantitative assessment of the effects of freezing.

On-farm Factors for *Campylobacter* Infection of Poultry (NZFSA/ESR 2006 – 2007)

The identification of on-farm risk factors that contribute to the *Campylobacter* status of New Zealand poultry flocks. Current control measures for those on-farm risk factors were analysed including their implementation and their likely effectiveness.

Quantifying the Reduction of *Campylobacter jejuni* on Skin-on Chicken Breasts Frozen and Stored for up to 10 weeks in a Domestic Freezer (NZFSA/ESR 2007)

Establishment of the reduction of the numbers of two *Campylobacter* isolates following simulated domestic freezing and frozen storage for up to 10 weeks.

Effect of Commercial Freezing on Reduction of *Campylobacter* on Poultry (NZFSA/ESR 2007 – 2008)

The quantification of the effect of commercial freezing followed by simulated distribution and domestic storage on levels of *Campylobacter* on skin-on chicken breast portions.

Leakproof Packaging (NZFSA/ESR 2007 – 2008)

A survey of drip from poultry (whole birds, portions and livers) that has been leak proof packaged. The amount of fluid is measured and presence or absence of *Campylobacter* established. Where present, *Campylobacter* have been enumerated.

Assessment of Domestic Food Handling Practices (NZFSA/ESR 2006-2007)

The further investigation of *Campylobacter* transfer rates and the risk of consuming foods that have been prepared by barbecuing.

Consumer Survey on Knowledge, Attitudes and Beliefs with Respect to *Campylobacter* in Poultry, Including Acceptability of Possible Interventions (NZFSA/ESR 2008)

A consumer survey informing risk managers for their decision making process in relation to *Campylobacter* controls for broiler chicken.

3 Implementation of Control Measures

Nil

4 Monitoring and Review

4.1 Surveillance

Evaluation of the Foodborne Disease Outbreaks/Human Health Surveillance Interface

An evaluation of current foodborne disease surveillance with the aim of improving the quality of epidemiological information that is gained from foodborne disease surveillance, investigation and reporting.

4.2 National Microbiological Database (NMD)

Nil

4.3 Review

Nil

Annex 2: Key milestones 2008-2009

December 2008

Preliminary Risk Management Activities	
Attribution Studies	
Activity	Expected completion date
Comparison of human and poultry <i>Campylobacter</i> isolates utilising MLST pre and post introduction of Sanova (NZFSA/ESR 2008)	31 December 2008
Workshop on pathways and disease attribution involving the research community and industry to agree further work in this area	31 March 2009
The relative contribution of food pathways to the burden of human <i>campylobacteriosis</i> in New Zealand (NZFSA/Massey University, 2005 – 2009)	30 June 2009
Dynamic Modelling of <i>Campylobacter</i> sources in the Manawatu (NZFSA/Provider. 2008-2009)	30 June 2009
Scientific Evaluation	
Activity	Expected completion date
Resuscitation of putative viable but non-culturable foodborne bacteria of significance to New Zealand (NZFSA/ESR 2006-2008)	31 December 2008
Quantification of <i>Campylobacter</i> from internal and external rinsates (NZFSA/ESR 2007-2008)	30 November 2008
Microbiological hazards in conventional and organic fresh produce (NZFSA/ESR 2008-2009)	30 June 2009
<i>Campylobacter</i> in uncooked retail meats (NZFSA/ESR 2008 -2009)	30 September 2009
Risk Assessment	
Activity	Expected completion date

Modelling the impact of the NZFSA regulatory target for <i>Campylobacter</i> on human health risks in New Zealand (NZFSA/ESR 2008-2009)	20 December 2008
Enhancement of the New Zealand farm-to-plate risk model	30 June 2009
Survival of NZ-relevant <i>Campylobacter</i> strains under dynamic environmental conditions simulating poultry processing (NZFSA/Massey University 2007-2009)	30 June 2009
<i>Campylobacter</i> in food and the environment, examining the link with public health (NZFSA, ESR, Massey University, MfE, MORST, NIWA, 2007 - 2010)	30 June 2010
Risk Management Options	
Activity	Expected completion date
Chlorine compounds formed during chlorine washing of chicken(NZFSA/ESR 2008)	30 September 2008
Updated guidance material on safe handling of poultry meat and relevant time temperature applications (NZFSA/ESR 2008-2009)	31 December 2008
Farmers' overalls as a transmission route for <i>Campylobacter</i> on broiler farms (NZFSA/ESR 2008)	31 January 2009
Poultry Processors Code of Practice: <ul style="list-style-type: none"> • Chapter on secondary processing including packaging 	31 March 2009
Effect of freezing at -12°C on the <i>Campylobacter</i> counts on broiler carcasses (NZFSA/ESR 2008/2009)	30 June 2009
Effectiveness of current practices on level of faecal contamination and cross contamination (NZFSA 2008-2009)	30 June 2009
Poultry Processors Code of Practice: <ul style="list-style-type: none"> • Chapter on cleaning and sanitation 	30 June 2009
Changes to standards for retail/food service	30 June 2009

Update table of interventions	30 June 2009
Implementation of Control Measures	
Activity	Expected completion date
Audit of broiler farms to assess the application and effectiveness of the Poultry Industry Broiler Growing Biosecurity Manual	31 January 2009
Compliance audit of primary processing plants to assess: <ul style="list-style-type: none"> • application and effectiveness of the Poultry Processors Code of Practice – chapter on primary processing • implementation of NMD sampling • compliance with the <i>Campylobacter</i> performance target at end of primary processing 	31 January 2009
Monitoring and Review	
Surveillance	
Activity	Expected completion date
Enhancing surveillance of potentially foodborne enteric diseases in New Zealand (NZFSA/Massey University and Mid Central Health 2008)	31 December 2008
Development and application of new tools for the analysis of <i>Campylobacter</i> surveillance data: identifying the spatial and temporal determinants of raised notifications in New Zealand (NZFSA/Massey University and ESR, 2007-2009)	30 June 2009
NMD	
Activity	Expected completion date
Quantification of <i>Campylobacter</i> on poultry after consecutive rinses and removal/homogenisation of skin (NZFSA/ESR 2008)	31 December 2008
NMD not-detected rinsates (NZFSA/ESR, 2008)	31 December 2008

Review	
Activity	Expected completion date
Participation in the NMD review project to ensure that non-compliance reporting and response mechanisms for <i>Campylobacter</i> performance targets (at the end of primary processing) are simple, timely and effective	As required
Review of systems that ensure that laboratory performance is acceptable including: a) Laboratory Accreditation Scheme b) Laboratory Audits c) ILCP d) Improvements to laboratory methods	As required
Review of caecal sampling results to identify areas for improvement or further research and also whether there is an ongoing need for monitoring at this point in the food chain	31 December 2008
Review of on-farm practices and the Poultry Industry Broiler Growing Biosecurity Manual taking into account the findings from other relevant work above	30 June 2009
Review of the NMD premises <i>Campylobacter</i> performance targets (at the end of primary processing) after a full year's set of results is available (so that seasonality issues can also be taken into account)	30 June 2009
Risk Communication	
Activity	Expected completion date

<p>Ensuring that the NZFSA website is the key repository of all information relating to this strategy, that it is updated as required and that the information can be easily accessed from the home page. This includes improvements to Campylobacter information on website.</p> <ul style="list-style-type: none"> • Agree updated content • Sign off of web editorial process • Updated content live on website • Highlight updated content in appropriate columns/articles and inform stakeholders 	<p>Ongoing</p> <p>30 November 2008</p> <p>31 December 2008</p> <p>31 January 2009</p> <p>Ongoing from February 2009</p>
International Collaboration	
Activity	Expected completion date
Agree progress for draft Guidelines at 40 th Session CCFH	5 December 2008
Co-lead International Working Group, Brazil	TBC 2009