Dissemination of Food Standards Agency Scotland (FSAS) funded research on *Campylobacter*

Our Dynamic Earth

17th June 2009

FOOD STANDARDS AGENCY SCOTLAND
Buidheann Inbhe-Bidhe an Alba

Summary of Presentations

Introduction

Reducing *Campylobacter* in the food chain has been a key target in the Food Standards Agency's (FSA's) strategy on foodborne disease since its inception in 2000, and will continue to be a focus in FSA's new strategic plan for 2010-2015. The Agency in Scotland (FSAS) contributes to achieving overall UK targets on *Campylobacter* through its work to ensure that interventions are effective in reducing levels of infection in the Scottish population. In recognition of the importance of this pathogen, FSAS has funded several projects which aim to improve our understanding of the sources and epidemiology of *Campylobacter* infection in Scotland. The three projects presented during the dissemination day represented a five year programme of work which was developed to investigate the importance of risk factors that were highlighted by an earlier UK-wide sentinel surveillance programme on *Campylobacter*; the differences in the number of cases that are observed across different Scottish Health Boards in the clinical surveillance data collected by Health Protection Scotland (HPS); and to follow-up recommendations by the Advisory Committee on the Microbiological Safety of Food (ACMSF) for the Agency to explore the use of molecular typing methods to support epidemiological studies of *Campylobacter* infection in the UK.

The morning session started with a presentation from Dr Kathryn Callaghan on the Food Standards Agency's UK-wide strategy on *Campylobacter*, which has focussed on promotion of on-farm biosecurity and interventions in poultry slaughterhouses. It was highlighted that the Agency intends to continue working in partnership with the Industry to identify and implement cost-effective measures to tackle *Campylobacter* in the poultry production chain. It also aims to collaborate more effectively with other research funders in the future to ensure UK-funded research is targeted to the Agency's policy drivers in this area.

Dr John Cowden, a consultant epidemiologist at Health Protection Scotland provided an overview of epidemiology and surveillance of *Campylobacter* infection in Scotland. Dr Cowden discussed the significance of *Campylobacter* as a foodborne pathogen, reporting practices in Scotland, and vehicles for infection identified through case control studies of sporadic cases. He also discussed the difficulties experienced in investigating outbreaks of *Campylobacter*, the potential role of immunity, and the strengths and weaknesses of typing schemes in unravelling the complex epidemiology associated with this pathogen.

Research Presentations

S01023/S14024 Case control study assessing private water supplies as a risk factor for *Campylobacter* infection in Aberdeenshire and Aberdeen City *(A. Smith-Palmer, Health Protection Scotland; N. Strachan, University of Aberdeen*)

The main aim of this study was to identify a role of the consumption of water from a private water supply as a risk factor for *Campylobacter* infection in Aberdeenshire and Aberdeen City. The secondary aims of the project were to identify whether private water supplies play a role in the seasonality of *Campylobacter* infection and if there is an association between particular molecular (MLST) types of *Campylobacter* and private water supplies.

The study consisted of a self-completed postally-administered questionnaire and a water quality testing of household drinking water supply for coliforms, *Campylobacter*, enterococci and *E. coli* (including O157).

Key study findings

- Risk factors identified for *Campylobacter* infection in Aberdeenshire and Aberdeen City included:
  - Use of private water supply as drinking water
  - Residency in Aberdeenshire vs. in Aberdeen City
  - Travel outside the study area
- There was no significant correlation between the seasonality of private water consumption and *Campylobacter* infection
- *Campylobacter* was detected in three water samples; all three samples were from private water supplies
- Work is ongoing to link the MLST data (obtained through the MLST project S14006) to the epidemiological data (acquired in this study) to determine whether there is a specific *Campylobacter* molecular type associated with infection of cases on private water supplies.

This project is expected to be published during early 2010.

S14006 The molecular epidemiology of Scottish Campylobacteriosis using multilocus sequence typing (MLST) (*K. Forbes, University of Aberdeen*)

This project aimed to examine the population genetics of *Campylobacter* isolated from clinical, food and environmental samples and to investigate epidemiological links and sources of *Campylobacter* infection in the Scottish population.

Clinical *Campylobacter* isolates obtained from Scottish NHS diagnostic laboratories over a 14-month period were typed using MLST. These were compared with the MLST profiles from more than 1000 food and environmental isolates collected over the same period throughout Scotland. This represents the world's largest national-scale, contemporaneous comparison to date of *Campylobacter* strain types from clinical cases and a broad range of environmental and food sources of infection.

Key study findings

- There is a high diversity of strains in Scotland among clinical, food and environmental isolates
- The distribution of strains across Scotland is homogeneous
  - seasonality of strains among clinical isolates is strain dependent
  - no major spatiotemporal trends are observed among food and environmental isolates
- More than one strain type can be found in point-source outbreaks
- Host attribution - main reservoirs for infection identified:
  - retail chicken
  - ruminants

The final report for this project is now available on Foodbase:

http://www.foodbase.org.uk//admintools/reportdocuments/339-1-595_CaMPS_S14006_Final_Report.pdf

S14004 Identifying risks and explaining spatiotemporal patterns of human Campylobacteriosis across Scotland (*L. Matthews, P. Bessell , University of Glasgow, N. Strachan, University of Aberdeen*)

The distribution of *Campylobacter* cases varies widely across Health Boards in Scotland. This study aimed to identify the reasons for this geographic variation in the rates of human *Campylobacter* infection. Using the data obtained in the MLST project it also examined issues such as urban vs. rural environments, deprivation, travel and family and larger outbreaks.

Key Study Findings

- Differences in reporting of *Campylobacter* infections exist between health boards and can be explained with the exception of Ayrshire and Arran and Argyll
- Deprived areas report fewer *Campylobacter* cases compared to affluent areas. Possible explanations for this include: Acquired immunity through exposure, food consumption, lifestyle, health care access.
- Rural vs urban differences in incidence exist in children (0-14 yrs) where risk is greater in rural areas
- Fewer cases of campylobacteriosis in rural children are attributed to poultry than in urban areas
- *Campylobacter* infections are not associated with proximity to livestock overall but rural children may be susceptible
- The limited evidence for strong spatial or temporal associations suggests *Campylobacter* infections are very sporadic and unrelated
- Approximately 5% of cases were household outbreaks and up to a further 15% were clustered (SatScan data)
- Analysis of MLST Sequence Type 45 (ST45) indicated strain specific spatiotemporal differences
- The majority of cases in the study were attributed to retail chicken for all age groups
- Private water sources are a risk factor for *Campylobacter* infection
- Particular MLST types are associated with foreign travel (e.g. ST572)
- There is some evidence for common indigenous types (ST21, ST45 and ST257)

This project is expected to be published during early 2010.

Break-out session 1

Direction for future research on *Campylobacter* *(Chair – K. Forbes, University of Aberdeen)*

Discussion Objectives

To identify gaps in current knowledge and key recommendations to inform future research needs.

This session included representatives from academia and research institutes, FSA, HPS and HPA. Only one delegate in this group described themselves as a 'Government' representative. Suggestions were listed and at the end of the discussions each participant was given an opportunity to select three suggestions which are a top priority for research in their opinion and these were ranked according to the number of times it was selected by delegates.

Conclusions

The table overleaf presents the research areas identified by participants. The number at the right hand side is the score each suggestion received.

Three wider research areas were identified: (1) production/processing, (2) human/host and (3) *Campylobacter* (study of the organism itself). In each of these categories several more suggestions were made and the scoring by all participants highlighted the following priorities:

(a) Measuring outcomes of interventions (studies of host immunity - how developed, how long-lasting; who is the most at risk group; modelling outcomes of proposed interventions; monitoring changes in STs) (12 points), identifying best intervention strategies (9 points) - this would help with assessing the efficiency and outcomes of implemented intervention strategies or help predict the efficiency and outcomes of planned intervention strategies.

(b) Studies of host/human response (8 points), studies to establish why chicken can be colonised by any known ST (chicken as a 'perfect' host) and yet some STs are never found in chicken; identify characteristics of chicken-specific STs (5 points).

(c) Study strain specificity of disease and host attribution (6 points), studies to gain better understanding of pathogenecity or infectability of different STs, *C. jejuni* vs. *C. coli* (5 points).

Research targeted at:	Score
PRODUCTION/PROCESSING	
Measuring outcomes of interventions (4) ▪ Studies of host immunity (how developed, how long-lasting, what is the most at risk group) (6) ▪ Modelling outcomes of proposed interventions (2) ▪ Monitoring changes in STs (0)	12
Identify best intervention strategies on farms	9
Assessing economic feasibility and effectiveness of implemented strategies *	3
Study prevalence of *Campylobacter* in home-grown vs. imported chicken meat or in frozen vs. chilled	1
Study survivability of food processing by *Campylobacter*	1
HOST/HUMAN	
Studies of host/human response *	8
Studies to establish why chicken can be colonised by any known ST (chicken as a 'perfect' host) and yet some STs are never found in chicken; identify characteristics of chicken-specific STs	5
Campylobacter colonisation patterns in chicken gut: mechanisms of transmission, genetic components of pathogen	2
Competitive exclusion of STs	1
Establish *Camyplobacter* infectious dose	0
Establish whether the same chicken-specific STs are found globally and if so - why	0
Studies of specific chicken lines reared	0
***CAMPYLOBACTER* – STUDIES OF THE ORGANISM**	
Study strain specificity of disease and host attribution	6
Studies to gain better understanding of pathogenecity or infectability of different STs, *C. jejuni* vs. *C. coli* *	5
Study the seasonality of *Campylobacter* infection – explain the peak (what is the source of infection in the peak period, hypothesis being that chicken is a source at the same level throughout the year and peak must be due to other sources)	3
Establish good model of disease	2
Comparative genetics	2
Comparison of clinical isolates with STs isolated from other reservoirs genetics and pathogenecity	1
Pan-European study to look at influence of ethnicity, age and other factors in human *Campylobacter* infection	0
Validation of the UK data from studies conducted elsewhere in the world (re: STs, etc.)	0
Fundamental studies of the *Campylobacter*	0

* an asterisk indicates research areas selected by the 'Government' representative.

Break-out session 2

Intervention Strategies for reducing *Campylobacter* infection in Scotland

(Chair - N. Strachan, University of Aberdeen)

Discussion objectives

To identify suitable interventions for reducing *Campylobacter* at all stages throughout the foodchain (on-farm, at slaughter, distribution and processing, at retail, and those aimed at consumers) based on efficacy, cost-effectiveness, and acceptability.

This session included representatives from academia and research institutes, FSA, Scottish Government, Scottish Local Authorities, NFUS and the poultry industry. A representative from the New Zealand Food Safety Authority also participated to provide an overview of the success of strategies implemented in New Zealand to control *Campylobacter* in the poultry food chain.

Following the discussion, delegates were asked to consider all of the interventions highlighted and select the three strategies that they considered would have the greatest impact on reducing *Campylobacter* in the UK. At the end of the session, each intervention strategy was ranked according to the number of times it was selected by delegates.

It should be noted that discussions focussed on the poultry food chain as the key exposure route for human infection. Whilst the Chair invited discussion on non-poultry/environmental routes of exposure, none were highlighted by delegates, with the exception of a potential role for domestic pets in the transmission of *Campylobacter* infection to humans.

Conclusions

The suggestions put forward by delegates as having potential to assist the UK to achieve a significant reduction in *Campylobacter* infection are detailed in the Table below. The scoring of each of the suggestions made in the discussion group highlighted the following priority areas:

1. Ensuring effective implementation of biosecurity messages (21 points), and promoting good hygiene practices in slaughterhouses (11 points). This requires the Agency to work with the UK poultry industry to re-enforce biosecurity messages through campaigns and training packages. It also requires the Industry to ensure farms and

processing facilities are adequately equipped to allow effective measures to be implemented, and to ensure measures are adhered to through audit and QA schemes.

2. Improved incentives for production of *Campylobacter* free poultry through implementation of mandatory targets for acceptable levels of contamination (4 points), and a financial premium for *Campylobacter* free poultry (5 points). The setting of mandatory targets in the processing plant is an approach that has proven successful in New Zealand, and the Agency should consider the possibility of taking this forward with the UK industry. The supermarkets could also play a role in inducing the Industry to work towards a reduction by placing a premium on *Campylobacter* free chicken at retail.

3. Education for consumers on food safety (12 points). FSA should focus campaigns on school children through home economics education, use of positive role models and exploiting current resources such as the FSA cooking bus. It was suggested that instilling good food safety habits in children may actively feed through to parents.

Intervention	Score			
	Government	Industry	Research	TOTAL
On Farm				
Implementation of effective biosecurity measures Implementation of effective biosecurity measures was considered to be the most effective intervention strategy for reducing *Campylobacter* in the poultry foodchain. It was noted that many poultry plants were not equipped to accommodate effective biosecurity measures. Examples provided were; out dated buildings, difficulties in washing vehicles and location and replenishment of boot dips. The need to re-enforce messages and provide on-going training to staff was also highlighted.	**11**	**5**	**5**	**21**
Audit of biosecurity measures Tighter enforcement of biosecurity by industry through Quality Assurance Schemes and Audit	**2**	**2**	**1**	**5**
Maintenance of *Campylobacter*-free flocks Through selection of resistant genetic lines or use of phage therapies	**0**	**0**	**0**	**0**
Distribution and processing				
Crate washing	**0**	**0**	**0**	**0**
Ensuring *Campylobacter* free chicken are processed first	**0**	**2**	**0**	**2**
Cleaning of lines between flocks	**1**	**0**	**0**	**1**
Stapling or bunging of cloacae	**0**	**0**	**0**	**0**
Promotion of Good Hygiene Practice (GHP) in processing-designing best practice for different processing systems. Work is already underway through CODEX to develop guidelines for control of *Campylobacter* and Salmonella in chicken meat. The control measures identified in the guidelines will be those based on good hygienic practice (GHP), those based on hazard control, and those based on risk assessment. The relative risk impacts of the identified controls will be quantified using a web-based generic risk assessment model. It is intended that industry use the guidelines and web-based tool to inform decisions on control measures for reducing *Campylobacter* that are suited to their particular production/processing systems.	**8**	**1**	**2**	**11**
Setting of targets for acceptable level of contamination As part of the New Zealand Food Safety Authority's strategy on *Campylobacter*, Industry performance targets have been set for chicken carcasses which apply at the end of primary processing. These targets were piloted over a 1 year period to give the Industry time to ensure compliance. At the end of this period, compliance with targets became mandatory for the sale of fresh chicken. Producers found to be non-compliant with the 1 log reduction target are free to choose a measure to achieve that reduction e.g. use of chemical decontamination agents (see below), freezing of carcasses, prior to sale.	**2**	**1**	**1**	**4**

Intervention	Score			
	Government	Industry	Research	TOTAL
Use of decontamination treatments (e.g. steaming, chemical agents, radiation) It was noted that the use of chemical decontamination agents (which are permitted for use in New Zealand) is not permitted under EU law. Further concerns were raised over consumer acceptability of radiation in the UK.	**0**	**0**	**0**	**0**
Freezing of contaminated birds It was noted that it would be extremely difficult in practice for processors to identify contaminated birds from the whole flock.	**0**	**0**	**0**	**0**
Retail				
Apply premium to *Campylobacter* free chicken-a financial reward for producers	**3**	**2**	**0**	**5**
Keep carcasses dry to reduce the risk of cross-contamination/improve drip free packaging	**0**	**0**	**0**	**0**
Modified atmosphere packaging	**0**	**0**	**0**	**0**
Consumers				
Catering policy in the public sector Introducing measures which would restrict the handling of raw chicken within institutions such as schools and hospitals	**1**	**0**	**0**	**1**
Education on food safety A variety of routes for improving education were discussed: • Home economics in primary schools • Elementary food hygiene courses (successfully rolled out by FSAS in secondary schools) • Use of positive role models to re-inforce messages (eg FSAS Hygiene, Healthy Eating and Activities in Primary Schools initiative) Use existing resources (e.g. the FSA cooking bus) to emphasise food safety messages to children	**7**	**2**	**3**	**12**

Break-out session 3

Practical approaches for improving surveillance, investigation and reporting of *Campylobacter* infection in Scotland. *(Chair – J. Cowden, Health Protection Scotland)*

Discussion objectives

To determine the efficiency of current reporting strategies for *Campylobacter* infection and the role of EHO in reporting *Campylobacter* infection: what is the current process and how can this be improved to identify potential outbreaks?

Current chain of events for reporting suspected *Campylobacter* infection

Under the new Public Health Act, suspected *Campylobacter* infection will be notifiable by in the UK, and the identification of the pathogen will be notifiable by the laboratory.

- GP (or other medical practitioner) suspects Campy infection and may take patient stool sample and complete lab form with case's personal details (name, age, sex, address etc.) and scanty non-standardised clinical and epidemiological data (e.g. foreign travel.

- Lab notifies Health Protection Team (HPT) of positive result

- HPT informs LA and EHOs who may investigate the case themselves

- EHO options for *Campylobacter* data collection following positive result notification are:

    1- No further information sought (usual)

    2- Postal questionnaire sent (now rare due to low uptake, late return, incomplete fields; lack of reward/data from questionnaire does not merit initial effort)

    3- Telephone questionnaire (rare)

    4- Case visit (rare)

Obtaining detailed food history from sporadic cases (using postal questionnaires) was deemed useful locally for control purposes but not for epidemiological surveillance purposes as the data obtained is not sufficient to identify potential outbreaks.

Consequently, obtaining information from the GP would be the quickest and most reliable point in the chain for obtaining case details and additional data concerning potential outbreaks and risk factors associated with cases e.g. circumstances, travel, private water supply.

Suggestions for improvement of *Campylobacter* infection reporting

GPs should be given better guidance on whom they should obtain stool samples from. The following criteria were thought to be a good starting point:

Patients with blood in stool and/or severe/persistent symptoms (GP's judgement) **AND** who

1) recently returned from travel abroad

2) attended a function/ social/work gathering e.g. conference, BBQ

3) know others with similar symptoms

4) belong to a high risk social/occupational group e.g. food handler

5) are vulnerable (young/elderly/pregnant/immunocompromised)

6) have a private water supply

- Upon suspicion of *Campylobacter* (or other gastro-intestinal) infection, GP should ask patients the above six questions and record answers to each on an amended version of the lab form for submission of stool specimens. The questions could be printed on the lab request form and in most instances only require a tick box answer, If the answer is "yes" then details should be either provided by the GP or sought by the EHO.

- For lab confirmed cases of *Campylobacter* (or other GI pathogen) infection, the lab passes the information on the lab form to LA and EHOs who record and evaluate the data in context with other reports to identify trends within the LA area and act accordingly if an outbreak is suspected.

Proposed Sentinel Surveillance Pilot Study

In order to estimate the true burden of *Campylobacter* infection and to be sensitive in identifying outbreaks, all GP practices in Scotland would collect stool samples from every case of suspected *Campylobacter* infection. Practically however, the volume of work required would not be feasible and would result in a strain on lab resources, both human and financial. The group therefore proposed a pilot sentinel surveillance study. The pilot study would involve a small number of Scottish GP practices where **ALL** patients with presumed infective bloody diarrhoea (and perhaps other defined clinical and/or epidemiological criteria) would be asked for a specimen to be sent to the lab for culture. All GPs in each practice would participate in the study and would complete the new proposed lab form asking each patient the questions described above. The information would be collated and evaluated by each LA to identify potential outbreaks and used by the health boards to investigate long-term trends in *Campylobacter* (and other GI) infection.

If successful, the pilot could then be extended.

Acknowledgements

FSAS would like to thank all the contractors for participating in the dissemination day and presenting the findings of the projects.

FSAS would also like to thank all the delegates for attending the event and contributing to the discussions during the break-out sessions.