ACM/953

ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

DISCUSSION PAPER

CHANGING AGE STRUCTURE OF HUMAN CAMPYLOBACTERIOSIS IN ENGLAND AND WALES

At the March 2009 ACMSF meeting the Health Protection Agency (HPA) briefed the Committee on the changing age structure of human campylobacteriosis in England and Wales. At this meeting the HPA agreed to provide further analysis of data sets from the study at a future ACMSF meeting.

Attached is the HPA's paper that provides additional analysis to ACM/935 presented in March. It gives information on factors that might have contributed to changes in the age-specific rates of human *Campylobacter* infection in England.

Members are invited to comment on the issues raised in this paper.

Secretariat
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ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

Changing age structure of human campylobacteriosis in England and Wales: refining hypotheses for infection.

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Purpose of this paper.

1. To brief the Committee on factors that might have contributed to changes in the age-specific rates of human *Campylobacter* infection in England.

Background.

2. Campylobacter is the most commonly reported bacterial cause of infectious intestinal disease in the United Kingdom. A provisional total of 55,726 laboratory-confirmed cases was reported in 2008, representing an eighth of the estimated 445,808 community cases thought to have occurred during that year. Infection with campylobacter is unpleasant, with most individuals experiencing acute and often bloody enteritis, and the public health burden is compounded by sequelae, such as irritable bowel disease, reactive arthritis and Guillain-Barré Syndrome, which can follow infection.

3. At their meeting in March 2009, members were apprised of a dramatic change in the epidemiology of *Campylobacter infection* in England and Wales, with the emergence of older people as the group at greatest risk on infection. This pattern, which was independent of gender, season and geography, was not observed for non-typhoidal salmonellosis or cryptosporidiosis, suggesting that it was less likely to be artefactual. In order to inform on the factors which might have contributed to the increased incidence of campylobacteriosis in the older population, a sub-set analysis of data

from the recent national case-control study of *Campylobacter* infection in England was performed.

Methods.

4. A case-control study was performed between 1 April 2005 and 30 June 2006 in five Health Protection Units (HPUs) in England. Cases were defined as individuals aged 18 years or above with laboratory-confirmed *Campylobacter* spp. infection, reported to one of the five HPUs and registered with a general practice clinic in that study area. Cases were excluded if they had travelled abroad in the 14 days prior to illness onset, or if they reported suffering from chronic gastrointestinal symptoms. Controls were frequency-matched to cases on the basis of HPU, age group (18 to 34 years, 35 to 54 years and 55+ years), sex and month of report. Individuals were selected at random from the local Primary Care Trust's Exeter list, which contains records of all individuals registered with general practice clinics in the area.

5. At each study site, cases were recruited either by the local Environmental Health Department (EHD) or HPU, whichever was routinely involved in the investigation of campylobacter enteritis cases. Controls were recruited by the Environmental and Enteric Diseases Department at the Health Protection Agency Centre for Infections. Signed, informed consent was obtained from participants, who were then requested to complete the questionnaire and return it in a reply paid envelope to the local EHD/HPU or to CDSC as appropriate.

6. Data were collected by means of a standard, 12-page, self-administered questionnaire enquiring about basic demographic and socio-economic information, clinical details, duration and severity of symptoms, hospitalisation and exposure to risk factors. Risk factors were grouped under eight broad exposure categories: heath details, occupational exposures, pet ownership, water, recreational exposures, food consumption, food preparation, and household details. Data were double-entered into an electronic database and extensively checked for errors and inconsistencies prior to analysis.

7. The sample size for the study was based on chicken consumption as the main exposure of interest. Assuming 87% prevalence of eating any chicken in the 10 days prior to interview in the control population, a study with a sample size of 1,500 cases and 1,500 controls would have 80% power to detect a minimum odds ratio of 1.39 at the 0.05 significance level. The corresponding population-attributable fraction for this exposure was 25%.

8. For the purposes of this study, individual controls were retrospectively matched to cases on the basis of age, gender, study year/month and HPU. A Visual Basic algorithm was developed in Microsoft Access for the purpose. Each case was selected in turn and an attempt was made to identify one control who matched on gender, month, region and exact case age. If unsuccessful, the process was iterated for the same case, but with the control age range increasing by ±1 year each time to a maximum of the case's age ±10 years, after which time the case was temporarily lost. Once all cases had been investigated in this way the process was repeated, again attempting to match a single near-age control to an existing case-control set, until no more controls would match (figure 1).

9. Data manipulation and statistical analysis were undertaken using Stata version 10. Variables were created or grouped, as required to assist interpretation and/or presentation, using existing data. Comparisons of proportions and means were assessed using the chi-squared test and Student's t test respectively. Differences in exposure between cases and their matched controls were examined using conditional logistic regression controlling for age, with differences considered significant at the 95% level or greater (i.e. $P<0.05$). Matched Odds Ratios, 95% confidence intervals (CIs) and significance tests were presented.

Results.

Study population.

10. The dataset supplied included 1592 cases and 3983 controls, of whom 518 (33%) and 1184 (30%) respectively were aged 60 years and over (henceforth termed 'older'). It was possible to match 349 cases to 1067 controls within the older age group, using 67% of cases and 90% of controls in the process. This level of matching was similar to that achieved for participants aged <60 years (752/1074 cases (70%) and 2553/2799 controls (91%). Cases and controls aged <60 years were excluded from further analysis.

11. Case inclusion in the matched analysis was independent of gender (χ^2 P=0.6), season as defined by quarter (χ^2 P=0.1) and study area (χ^2 P=0.5), but not of age (mean 69.2 years vs. 70.8 years; Students *t* test P=0.01; table 1). Cases included in the matched analysis were intrinsically matched to controls on all these factors. The ability to match controls to cases in increasing increments of age as described above, however, meant that residual differences in age existed between cases and controls (paired *t* test for Ha: mean≠0 P<0.001). These differences were controlled for throughout the analysis. It was not possible to assess the representative of cases included in the study in relation to cases reported in the study areas during the study period.

12. Factors associated with being a case of *Campylobacter* infection are summarised in table 2 (the results for all exposures examined are provided in Appendix A). Cases were more likely than controls to report a diarrhoeal illness in the previous twelve months, to report a number of specific treatments which lead to the suppression of stomach acid (Omeprazole (Losec), Cimetidine (Tagamet) or Ranitidine (Zantac)), or to have irritable bowel disease or diabetes. No specific food, dairy, water or environmental exposures were associated with being a case, but a number of food handling practices increased the risk of infection: using a chopping board in the home to hold, cut or process raw chicken; using a knife or other utensil in the home for cutting raw chicken; failing to wash hands with soap and water after handling raw chicken; failing to change knife or chopping board after processing raw chicken.

Communal living, as defined by more than two people living in the same household, was also associated with an increased risk of being a case.

13. This study represents a subset analysis of a larger study of risk factors for *Campylobacter* infection in adults resident in England. It is possible, therefore, that there may have been insufficient statistical power in this smaller study to detect true risk differences which existed between older cases and controls. Whilst cases and controls lost in the matching process will have reduced the sample size further, the accuracy of the risk estimates will have increased for those remaining.

14. Cases and controls were asked mainly about general food consumption/handling patterns, or about exposures in the five days preceding interview. This minimises the likelihood of differential recall – a major bias in case-control studies where cases answer might questions more assiduously than controls – but increases the possibility that for cases, infection-causing exposures which occurred in the five days before illness, but not interview, might not have been measured.

15. A major limitation of the case-control study was that the participation rate amongst cases was relatively low (46.5%). This was lower than in the pilot study (65%) and in the Campylobacter Sentinel Surveillance System (80%), which preceded the study. A number of factors might have contributed to this. First, because of the greater level of detail required in obtaining exposure information, the questionnaire employed in the case-control study was considerably longer than that used in the sentinel surveillance scheme. Participation is reduced as questionnaire length increases, but nevertheless this was lower than anticipated, given the results of the pilot study. Secondly, there were insufficient resources at local level to enable a second questionnaire mailing after the initial questionnaires had been sent. Each potential case therefore received only a single mail shot. Multiple mailings increase participation (among controls, approximately 30% of those sent a reminder subsequently participated), but circumstances did not allow this. Thirdly, obtaining accurate denominator data at local level to monitor participation rates in an ongoing fashion proved much more difficult than expected. Indeed, adequate denominator data were never obtained from the north London site. One reason for this was that multiple laboratories served the population taking part and it proved impossible to

determine accurately the relevant denominators. A further problem is that there is no information regarding individuals for whom the address was incorrect and were thus not reached in the first place. Among controls, 10% of questionnaires were returned by the postal service because the address did not exist or the person no longer lived there. These were excluded from the calculation of participation rates, but the percentage of controls not actually reached is likely to be higher, as not all inadequately addressed questionnaires would have been returned. Among cases, the accuracy of addresses was likely to be higher, as these individuals recently used the health services and the address is collected for local surveillance purposes, but it is likely that the actual participation rates for cases and controls were higher than those reported here, as some individuals would never have been reached and should not appear in the denominator. With such relatively low response rates, there is the possibility that those who agreed to participate in the study differed in important ways from those who did not, which might have led to bias in our results.

Conclusion.

16. With these caveats in mind, this initial analysis suggests that for older residents of England, their general wellbeing and their food safety practices within the home govern their risk of *Campylobacter* infection. Further work is required, however, to tease out how the health exposures measured in this study interact with the specific food consumption exposures, and which food safety practices are most important when considered together.

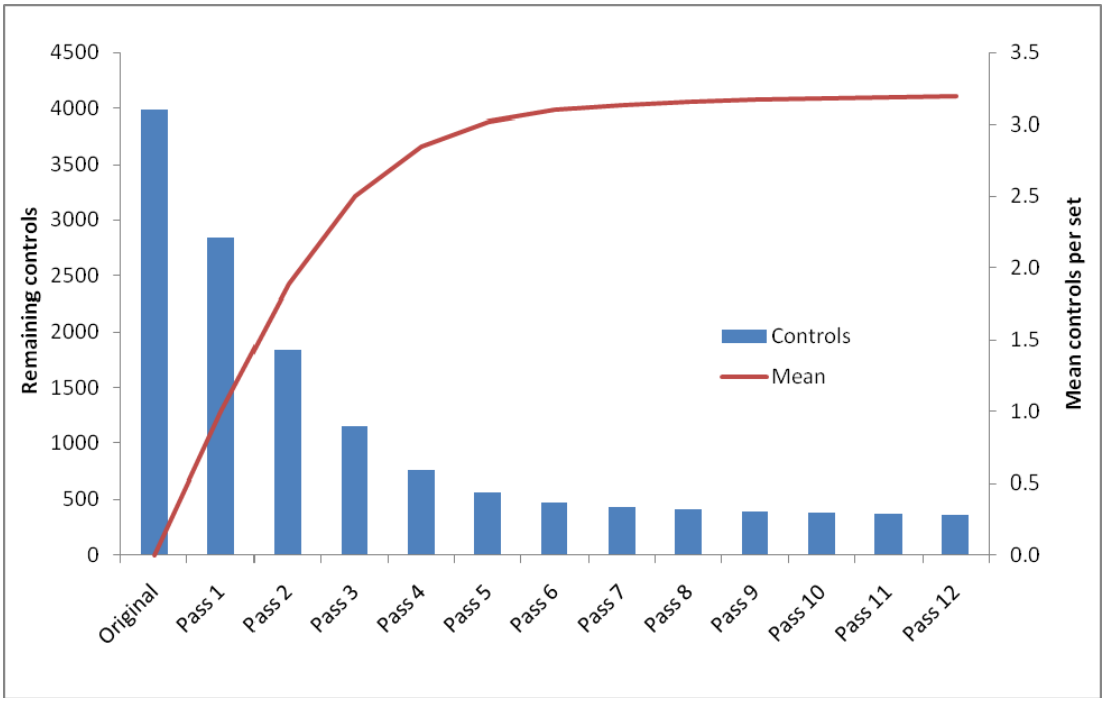

Figure 1. Control-matching process

Table 1. Characteristics of a) cases that matched and did not match to controls and b) cases and controls included in the matched analysis.

Factor	a) Cases (%)		b) Matched cases and controls (%)	
	Matched	Unmatched	Cases	Controls
Age group				
55-64	100 (29)	53 (31)	100 (29)	328 (31)
65+	249 (71)	116 (69)	249 (71)	739 (69)
Gender				
Male	183 (52)	99 (59)	183 (52)	578 (54)
Female	166 (48)	70 (41)	166 (48)	489 (46)
Study quarter				
1	110 (32)	3 (2)	110 (32)	302 (28)
2	102 (29)	49 (29)	102 (29)	265 (25)
3	79 (23)	77 (46)	79 (23)	298 (28)
4	58 (17)	31 (18)	58 (17)	202 (19)
Unknown	0	9 (5)	0	0
Study area				
1	187 (54)	68 (40)	187 (54)	614 (58)
2	96 (28)	15 (9)	96 (28)	277 (26)
3	22 (6)	5 (3)	22 (6)	64 (6)
4	8 (2)	22 (13)	8 (2)	13 (1)
5	36 (10)	59 (35)	36 (10)	99 (9)

Table 2. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis.

Exposure	Exposed		mOR[a] [95% CI[b]]	P value
	Cases (%)	Controls (%)		
Health Factors				
Diarrhoeal illness in the previous 12 months	49 (10)	50 (4)	3.1 [1.9-5.2]	<0.001
Omeprazole (Losec), Cimetidine (Tagamet) or Ranitidine (Zantac)	109 (28)	108 (11)	3.0 [2.0-4.4]	<0.001
IBD/diabetes	71 (14)	99 (9)	1.8 [1.2-2.7]	0.01
Food consumption exposures				
None	-	-	-	-
Food safety practices				
Chicken prepared in the home:				
- none prepared in the home	159 (31)	381 (32)	1	
- prepared in the home but not whole chicken	116 (22)	407 (34)	0.7 [0.5-0.9]	0.02
- whole chicken prepared in the home	243 (47)	396 (33)	1.3 [0.9-1.8]	0.11
Chopping board used in the home to hold, cut or process raw chicken	259 (61)	574 (53)	1.4 [1.1-1.9]	0.02
Knife or other utensil used in the home for cutting raw chicken	265 (64)	599 (55)	1.6 [1.2-2.3]	<0.001
After handling raw chicken:				
- wash their hands with soap and water	250 (57)	621 (61)	1.00	
- rinse their hands with water	144 (33)	345 (34)	1.0 [0.7-1.4]	0.96
- wipe their hands with a cloth/apron	21 (5)	35 (3)	1.7 [0.9-3.2]	0.11
- continue cooking as normal	23 (5)	19 (2)	3.3 [1.5-7.0]	<0.001

[a], matched Odds Ratio; [b], Confidence Interval

Table 2 continued. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis.

Exposure	Exposed		mOR[a] [95% CI[b]]	P value
	Cases (%)	Controls (%)		
Food safety practices (cont'd)				
After using a cutting board or plate for processing raw chicken:				
- use a separate chopping board[c]	55 (14)	204 (21)	1.00	
- wash the chopping board[c] with detergent	236 (59)	566 (59)	1.7 [1.1-2.6]	0.01
- rinse the chopping board[c] with water	55 (14)	104 (11)	2.4 [1.3-4.4]	<0.001
- wipe the chopping board[c] with a cloth	47 (12)	84 (9)	2.9 [1.5-5.6]	<0.001
- continue using the chopping board[c] as normal	5 (1)	8 (1)	2.8 [0.7-11.4]	0.15
After using a knife for cutting raw chicken				
- use a separate knife	72 (18)	222 (23)	1.00	
- wash the knife with detergent	252 (62)	599 (61)	1.4 [0.9-2.0]	0.13
- rinse the knife with water	54 (13)	98 (10)	2.1 [1.2-3.7]	0.01
- wash the knife with detergent	19 (5)	48 (5)	1.7 [0.8-3.7]	0.19
- continue using the knife as normal	7 (2)	7 (1)	3.6 [1.0-13.1]	0.05
People sharing house				
- single person	123 (25)	273 (24)	1	
- couple	303 (61)	733 (64)	1 [0.7-1.4]	0.93
- >2 people	71 (14)	133 (12)	1.7 [1.1-2.7]	0.03

[a], matched Odds Ratio; [b], Confidence Interval; [c], Chopping board, plate or other surface

Appendix A: Complete single variable analysis.

Table A1. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis. Health factors

Exposure	Enquiry Period[a]	Exposed		mOR[b] [95% CI[c]]	P value
		Cases (%)	Controls (%)		
Diarrhoeal illness in the previous 12 months	I	49 (10)	50 (4)	3.1 [1.9-5.2]	<0.001
Previous *Campylobacter* infection	I	23 (5)	31 (3)	1.6 [0.7-3.3]	0.24
Antacids	O	77 (17)	171 (16)	1.0 [0.7-1.5]	0.84
Antibiotics	O	27 (6)	57 (6)	0.9 [0.5-1.8]	1.15
Omeprazole (Losec), Cimetidine (Tagamet) or Ranitidine (Zantac)	O	109 (28)	108 (11)	3.0 [2.0-4.4]	<0.001
Irritable Bowel Disease/diabetes	G	71 (14)	99 (9)	1.8 [1.2-2.7]	0.01

[a], O=28 days before onset; I=5 days before interview; G=general enquiry; b, matched Odds Ratio; c, Confidence Interval

Table A2. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis. Occupational and Pet Factors

Exposure	Enquiry Period[a]	Exposed		mOR[b] [95% CI[c]]	P value
		Cases (%)	Controls (%)		
Occupational animal contact	G	2 (0)	19 (2)	0.5 [0.1-2.4]	1.60
Occupational contact with sick animals	G	0 (0)	2 (0)	-	-
Occupational contact with animal faeces	G	5 (1)	14 (2)	0.7 [0.2-2.8]	1.37
Occupational contact with raw meat	G	2 (0)	7 (1)	0.8 [0.1-5.6]	1.15
Animals at home	I	162 (32)	336 (29)	1.3 [1.0-1.7]	0.08
- dog	I	100 (20)	201 (17)	1.3 [1.0-1.9]	0.09
- puppy	I	6 (1)	17 (1)	0.9 [0.3-2.7]	1.11
- cat	I	63 (13)	129 (11)	1.2 [0.8-1.8]	0.42
- kitten	I	1 (0)	3 (0)	0.6 [0.1-5.6]	1.38
- bird	I	14 (3)	36 (3)	1.3 [0.6-2.8]	0.50
Clean up/touch animals' faeces	I	43 (9)	142 (12)	0.7 [0.4-1.1]	1.91
Pets ill with D&V	I	7 (1)	8 (1)	2.2 [0.7-7.2]	0.20
Other pets	G	1 (0)	1 (0)	2.1 [0.1-35.2]	0.61
- rodents	G	1 (0)	8 (1)	0.4 [0.1-3.5]	1.58
- reptiles	G	1 (0)	4 (0)	-	-
- fish	G	1 (0)	7 (1)	0.7 [0.1-6.1]	1.28

[a], O=28 days before onset; I=5 days before interview; G=general enquiry; b, matched Odds Ratio; c, Confidence Interval

Table A3. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis. Drinking water exposures

Exposure	Enquiry Period[a]	Exposed		mOR[b] [95% CI[c]]	P value
		Cases (%)	Controls (%)		
Private water supply	G	4 (1)	7 (1)	1.7 [0.3-10]	0.54
Changes in water supply	I	12 (2)	28 (2)	0.9 [0.4-2.1]	1.28
- bad taste	I	9 (2)	17 (1)	1.5 [0.6-3.8]	0.44
- bad smell	I	7 (1)	12 (1)	1.3 [0.4-4.1]	0.63
- water dirty	I	4 (1)	6 (1)	1.7 [0.4-8.6]	0.51
Any bottled water	O	138 (27)	350 (30)	0.9 [0.6-1.2]	1.69
- still bottled water	O	100 (20)	265 (23)	0.8 [0.6-1.2]	1.73
- fizzy bottled water	O	53 (11)	131 (11)	0.9 [0.6-1.4]	1.27
Any raw tap water	O	334 (66)	802 (69)	1.0 [0.8-1.3]	0.97
- unfiltered tap water	O	234 (47)	604 (52)	0.8 [0.6-1.1]	1.88
- filtered tap water	O	122 (24)	252 (22)	1.3 [0.9-1.7]	0.14
Boiled tap water	O	129 (26)	308 (27)	1.0 [0.8-1.4]	0.95

[a], O=28 days before onset; I=5 days before interview; G=general enquiry; b, matched Odds Ratio; c, Confidence Interval

Table A4. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis. Recreational exposures

Exposure	Enquiry Period[a]	Exposed		mOR[b] [95% CI[c]]	P value
		Cases (%)	Controls (%)		
Any recreational water activity	I	14 (3)	30 (3)	0.6 [0.2-1.5]	1.75
- freshwater	I	14 (3)	30 (3)	0.6 [0.2-1.5]	0.29
- sea water	I	1 (0)	5 (0)	0.8 [0.1-8.0]	1.15
- water sports	I	14 (3)	30 (3)	0.6 [0.2-1.5]	1.75
- swallowed water	I	0 (0)	1 (0)	-	-
Any recreational animal contact	I	22 (4)	51 (4)	1.3 [0.7-2.4]	0.35
- farm visit	I	16 (3)	38 (3)	1.3 [0.6-2.7]	0.46
- zoos or wildlife parks	I	0 (0)	7 (1)	-	-
- wild animals	I	6 (1)	9 (1)	2.3 [0.7-7.9]	0.19

[a], O=28 days before onset; I=5 days before interview; G=general enquiry; b, matched Odds Ratio; c, Confidence Interval

Table A5. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis. Food consumption exposures I

Exposure	Enquiry Period[a]	Exposed		mOR[b] [95% CI[c]]	P value
		Cases (%)	Controls (%)		
Vegetarian	G	4 (1)	25 (2)	0.5 [0.2-1.5]	1.78
Salads or raw vegetables (increasing consumption)	G	408 (86)	999 (91)	0.6 [0.4-0.8]	1.99
Pulses (increasing consumption)	G	276 (66)	807 (80)	0.5 [0.3-0.6]	2.00
Cooked vegetables (increasing consumption)	G	491 (99)	1123 (99)	2.2 [0.3-18.9]	0.47
Raw fresh fruit (increasing consumption)	G	454 (94)	1073 (96)	0.6 [0.3-1.1]	1.91
Freshly cooked boiled rice (increasing consumption)	G	237 (56)	617 (64)	0.7 [0.5-0.9]	1.98
Fish (not shellfish; increasing consumption)	G	443 (92)	1018 (93)	0.9 [0.6-1.5]	1.27
Beef, lamb or pork (increasing consumption)	G	465 (95)	1054 (93)	1.4 [0.8-2.6]	0.21
Chicken (increasing consumption)	G	451 (92)	1018 (92)	1.1 [0.7-1.8]	0.68
Any raw dairy	I	39 (8)	108 (9)	0.8 [0.5-1.3]	1.71
- raw milk	I	14 (3)	55 (5)	0.6 [0.3-1.3]	1.81
- raw dairy	I	26 (7)	75 (9)	0.7 [0.4-1.3]	1.74
Doorstep-delivered milk	G	131 (26)	341 (29)	1.1 [0.8-1.5]	0.45
- bird-attacked	I	4 (3)	7 (2)	2.4 [0.4-15.4]	0.37

[a], O=28 days before onset; I=5 days before interview; G=general enquiry; b, matched Odds Ratio; c, Confidence Interval

Table A5. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis. Food consumption exposures II

Exposure	Enquiry Period[a]	Exposed		mOR[b] [95% CI[c]]	P value
		Cases (%)	Controls (%)		
Any poultry or poultry products	I	372 (75)	896 (77)	1.0 [0.7-1.3]	1.22
- chicken	I	341 (69)	840 (73)	0.8 [0.6-1.1]	1.79
- at home	I	274 (79)	748 (84)	0.7 [0.4-1.1]	1.92
- at someone else's home	I	47 (10)	100 (9)	1.4 [0.8-2.2]	0.22
- at a barbecue	I	21 (6)	35 (4)	2.1 [0.9-4.9]	0.09
- outside the home	I	89 (18)	204 (18)	1.1 [0.8-1.5]	0.64
- restaurant	I	49 (13)	84 (9)	1.3 [0.8-2.1]	0.32
- function	I	13 (3)	29 (3)	1.5 [0.7-3.2]	0.34
- sandwich	I	9 (2)	34 (4)	0.8 [0.3-1.9]	1.43
- café	I	8 (2)	15 (2)	1.0 [0.2-4.0]	1.04
- takeaway	I	31 (9)	75 (8)	0.9 [0.5-1.6]	1.29
- mobile vendor	I	3 (1)	6 (1)	1.4 [0.3-8.4]	0.69
- canteen	I	4 (1)	10 (1)	1.3 [0.3-6.8]	0.76
- poultry other than chicken	I	30 (20)	54 (17)	2.6 [1.0-7.0]	0.06

[a], O=28 days before onset; I=5 days before interview; G=general enquiry; b, matched Odds Ratio; c, Confidence Interval

Table A6. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis. Food safety practices I

Exposure	Enquiry Period[a]	Exposed		mOR[b] [95% CI[c]]	P value
		Cases (%)	Controls (%)		
Cook main meals most of the time vs. occasionally/rarely/never	G	312 (62)	697 (60)	1.0 [0.7-1.4]	0.88
Raw chicken preparation frequency:	G				
- never		40 (8)	110 (10)	1	
- once a month/fortnightly/weekly		307 (63)	659 (58)	1.4 [0.8-2.3]	0.20
- 2-5+ times a week		140 (29)	362 (32)	1.2 [0.7-2]	0.60
Any raw fresh/frozen chicken in the home	I	271 (99)	733 (99)	1.0 [0.1-6.8]	1.02
Raw chicken storage:	I				
- freezer		138 (51)	361 (49)	1	
- fridge		124 (46)	355 (48)	0.9 [0.6-1.4]	0.62
- other		9 (3)	17 (2)	1.7 [0.5-5.6]	0.42
Frozen chicken thawed:	G				
- fridge		188 (69)	456 (64)	1	
- sink		7 (3)	34 (5)	0.3 [0.1-1.2]	0.09
- microwave		45 (16)	114 (16)	0.8 [0.5-1.5]	0.54
- other		33 (12)	104 (15)	1.0 [0.5-2.0]	0.89

[a], O=28 days before onset; I=5 days before interview; G=general enquiry; b, matched Odds Ratio; c, Confidence Interval

Table A6. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis. Food safety practices II

Exposure	Enquiry Period[a]	Exposed		mOR[b] [95% CI[c]]	P value
		Cases (%)	Controls (%)		
Any raw fresh or frozen chicken prepared in the home	I	259 (62)	703 (65)	0.8 [0.6-1.1]	1.90
Chicken prepared in the home:	I				
- none prepared in the home		159 (31)	381 (32)	1	
- prepared in the home but not whole chicken		116 (22)	407 (34)	0.7 [0.5-0.9]	0.02
- whole chicken prepared in the home		243 (47)	396 (33)	1.3 [0.9-1.8]	0.11
Chicken prepared in the home:	I				
- none prepared in the home		159 (31)	381 (32)	1	
- prepared in the home but not chicken pieces		101 (19)	190 (16)	1.0 [0.7-1.5]	1.00
- chicken pieces prepared in the home		258 (50)	613 (52)	1.0 [0.7-1.3]	0.75
Raw chicken prepared in the home with non-cook[d] foods	I	56 (14)	196 (18)	0.7 [0.5-1.1]	1.88
Chopping board used in the home to hold, cut or process raw chicken	I	259 (61)	574 (53)	1.4 [1.1-1.9]	0.02
Knife or other utensil used in the home for cutting raw chicken	I	265 (64)	599 (55)	1.6 [1.2-2.3]	<0.001
Non-cook[d] foods on surfaces which held raw chicken trays/wrapping	I	17 (4)	81 (8)	0.5 [0.2-0.9]	1.97

[a], O=28 days before onset; I=5 days before interview; G=general enquiry; b, matched Odds Ratio; c, Confidence Interval; [d], foods that did not require cooking; [e], Chopping board, plate or other surface

Table A6. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis. Food safety practices III

Exposure	Enquiry Period[a]	Exposed		mOR[b] [95% CI[c]]	P value
		Cases (%)	Controls (%)		
After handling raw chicken:	G				
- wash their hands with soap and water		250 (57)	621 (61)	1.00	
- rinse their hands with water		144 (33)	345 (34)	1.0 [0.7-1.4]	0.96
- wipe their hands with a cloth/apron		21 (5)	35 (3)	1.7 [0.9-3.2]	0.11
- continue cooking as normal		23 (5)	19 (2)	3.3 [1.5-7.0]	<0.001
After using a cutting board or plate for processing raw chicken:	G				
- use a separate chopping board [d]		55 (14)	204 (21)	1.00	
- wash the chopping board [d] with detergent		236 (59)	566 (59)	1.7 [1.1-2.6]	0.01
- rinse the chopping board [d] with water		55 (14)	104 (11)	2.4 [1.3-4.4]	<0.001
- wipe the chopping board [d] with a cloth		47 (12)	84 (9)	2.9 [1.5-5.6]	<0.001
- continue using the chopping board [d] as normal		5 (1)	8 (1)	2.8 [0.7-11.4]	0.15
After using a knife for cutting raw chicken	G				
- use a separate knife		72 (18)	222 (23)	1.00	
- wash the knife with detergent		252 (62)	599 (61)	1.4 [0.9-2.0]	0.13
- rinse the knife with water		54 (13)	98 (10)	2.1 [1.2-3.7]	0.01
- wash the knife with detergent		19 (5)	48 (5)	1.7 [0.8-3.7]	0.19
- continue using the knife as normal		7 (2)	7 (1)	3.6 [1.0-13.1]	0.05

[a], O=28 days before onset; I=5 days before interview; G=general enquiry; b, matched Odds Ratio; c, Confidence Interval; [d], Chopping board, plate or other surface

Table A7. Factors associated with being a case of *Campylobacter* infection at ≥95% significance level. Single variable analysis. Food safety practices IV

Exposure	Enquiry Period[a]	Exposed		mOR[b] [95% CI[c]]	P value
		Cases (%)	Controls (%)		
Total length of kitchen work surface:	G				
- Less than 1 metre		68 (15)	101 (9)	1	
- 1-2 metres		218 (48)	566 (52)	0.6 [0.4-1.0]	0.05
- More than 2 metres		169 (37)	412 (38)	0.9 [0.5-1.4]	0.51
Separate cloths used for drying hands and dishes:	G				
- yes		420 (84)	982 (85)	1	
- no		40 (8)	66 (6)	1.7 [1.0-2.8]	0.05
- dishes left to dry		41 (8)	109 (9)	0.9 [0.6-1.4]	0.60
Same vs. different cloth used to wipe all kitchen surfaces	G	265 (54)	549 (48)	0.8 [0.6-1.0]	1.95
People sharing house	G				
- single person		123 (25)	273 (24)	1	
- couple		303 (61)	733 (64)	1 [0.7-1.4]	0.93
- >2 people		71 (14)	133 (12)	1.7 [1.1-2.7]	0.03
Share kitchen facilities with non-family	G	8 (2)	20 (2)	0.7 [0.2-2.2]	1.42

[a], O=28 days before onset; I=5 days before interview; G=general enquiry; b, matched Odds Ratio; c, Confidence Interval