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**Control and Prevention of Campylobacter Infections.  
Suggestions for the Design, Conduct and Analysis of an  
Epidemiological Study aimed at Identification of Risk Factors  
for Campylobacter Infections in Humans**

**World Health Organization**  
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# CONTROL AND PREVENTION OF *CAMPYLOBACTER* INFECTIONS

## SUGGESTIONS FOR THE DESIGN, CONDUCT, AND ANALYSIS OF AN EPIDEMIOLOGICAL STUDY AIMED AT IDENTIFICATION OF RISK FACTORS FOR *CAMPYLOBACTER* INFECTIONS IN HUMANS

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*This document provides guidelines for the design, conduct, and analysis of a prospective case-control study to: (a) establish risk factors for Campylobacter infections in humans, (b) determine the relative importance of the risk factors, and (c) provide a basis for a specific control strategy.*

*The document is intended for research workers and public health authorities interested in identifying the factors that are likely to have the greatest impact on the incidence of campylobacteriosis under the prevailing local conditions.*

*This document aims also at providing researchers with a basic study concept, the use of which may be helpful in designing similar studies for identification of risk factors for other foodborne infections.*

*The study design proposed requires enrollment of a minimum of 50 recently diagnosed patients with acute, culture-confirmed Campylobacter enteritis, who are systematically identified over the study period. Each patient is compared with one or more healthy control persons matched by age, sex, and geographic area to the patient. The patients as well as their controls are questioned about exposure to suspected risk factors using a standardized questionnaire. Questionnaire data are entered into a computer database, and associations between each exposure variable and Campylobacter infection are assessed using statistical analysis of matched data sets.*

## 1. INTRODUCTION

Thermotolerant *Campylobacter* bacteria have been the focus of growing attention during the past decade due to the increasing frequency with which they have been isolated from humans, animals, foods, and water (1-3). The bacteria concerned are now recognized among the most important agents of enteritis in the world. *Campylobacter* infections are a frequent cause of morbidity both in developed and developing countries, and represent a considerable drain on economic and public health resources.

Although bacteriological surveys have identified a number of possible sources of infection, there is still much uncertainty about how many of the human cases are of foodborne origin and how many occur as a result of other exposures. The relative importance of these sources can only be determined through epidemiological investigations which entail statistical analysis of case-control studies. Several such studies have been conducted in Europe and North-America in order to determine risk factors and guide preventive efforts (4-14).

This document provides guidelines for design, conduct, and analysis of a prospective case-control study with the aim of:

- identifying the risk factors likely to have the greatest impact on the incidence of campylobacteriosis in the study area,
- determining the relative contribution of the risk factors on overall disease burden, and
- providing a basis for undertaking a specific control and prevention strategy aimed at reducing the incidence of *Campylobacter* infections in humans.

The importance of careful planning, protocol development, pilot testing, and attending to details at the outset cannot be overemphasized. Likewise, good management and organizing over the course of the study are critical for its success.

## 2. DEFINITION AND SELECTION OF CASE-PATIENTS

### 2.1 CASE DEFINITION

A case is defined as a person:

- inhabiting a geographically defined study area,
- ill with an acute, culture-confirmed *Campylobacter* infection,
- who has recently been diagnosed (incident case), and
- who is not part of an outbreak (sporadic case).

#### *Culture-confirmed cases:*

Select patients from whom *Campylobacter jejuni* or *Campylobacter coli* was recently isolated from a stool specimen as the sole enteric pathogen. Separate case-control studies of infections due to *C. upsaliensis* and *C. lari* may be conducted using the guidelines outlined in this article. The bacterial strain should be forwarded to a reference laboratory to confirm the identification and perform additional microbiological assessment if desired.

#### *Acute cases:*

Select patients suffering from acute gastroenteritis. Exclude carriers and patients suffering from recurrent diarrhea or other chronic intestinal complaints, as the onset of illness and the role of *Campylobacter* in producing symptoms would be difficult to assess.

#### *Sporadic cases:*

If more than one member of a household or other close contact has culture-confirmed *Campylobacter* infection, or if an outbreak occurs, only the first identified case should be enrolled.

All patients meeting these criteria are eligible for enrollment in the study. If it is not possible to include all eligible cases occurring within the study area, a predetermined sampling scheme should be established so that each eligible case has an equal chance of appearing in the study. This may involve a randomization process or sequential selection of every  $k$ -th patient (15).

The study may be restricted to locally acquired infections by excluding cases and controls who have travelled outside of the study area in the last two weeks before onset of illness.

## 2.2 SELECTION OF CASES

Cases may be identified from any of the following sources:

- medical microbiological laboratories performing examination of stool specimens,
- reference laboratories receiving *Campylobacter* isolates for confirmation,
- surveillance or notification systems which record culture confirmed cases, or
- community health services or private practitioners.

The eligible cases should be successively identified over the study period. It is important to identify and contact new cases as quickly as possible after onset of illness so that they can be questioned before their memory fades. A long delay may adversely affect the quality of interview data (recall bias). To avoid this, cases should not be enrolled if the interview will occur more than 30 days after the onset of illness.

The sample size (number of cases enrolled) needed to conduct the study can be estimated based on: (i) anticipated differences in the prevalence of *Campylobacter* risk factors between enrolled cases and controls and (ii) the desired statistical power of the study to determine the significance of these differences. However, in practical terms, the minimum number of cases needed to perform a meaningful statistical analysis is not less than 50. If resources permit, the number should be higher since this will increase statistical power and enhance identification of pertinent risk factors.

The importance of risk factors may vary seasonally. The study period should therefore comprise at least one full year to enable estimation of the relative contribution of various factors. If initial data analysis detects trends which require further study, the study period can be extended beyond one year so that more cases can be entered into the protocol.

## 3. DEFINITION AND SELECTION OF CONTROLS

The purpose of the study is to identify risk factors that may be subject to prevention. This requires that other factors which may be associated with an increased risk of disease but are not amenable to prevention (such as age and sex), must be controlled for. Although this could potentially be achieved by the multivariate analysis, such a strategy would be difficult when low numbers of enrolled cases are anticipated. It is suggested that such factors are controlled for by matching cases and controls. Matching assures that cases and controls are comparable with respect to the variables used for matching and that no large imbalances occur. However, this approach precludes assessment of the risk factor status of the matching variables and may lead to underestimation of factors closely associated with them (15).

### 3.1 MATCHING CRITERIA

It is proposed that whenever a case has been enrolled, at least one healthy control person matched to the case by sex, age and geographic region, is selected. The number of controls enrolled for each case is to some degree dependent on the number of anticipated cases (15). When a low number of enrolled cases is expected, it is recommended that two controls be identified for each case. In studies with a large number of cases, a single control for each case may be acceptable. Enrollment of variable numbers of controls (i.e. one control for some cases and two controls for others) should be avoided whenever possible because data analysis is more difficult.

*Sex matching:* The patients and their matched controls should be of the same sex.

*Age matching:* Select controls according to the following scheme:

Case	Controls
< 1 year	< 1 year
1-2 years	1-2 years
3-4 years	3-4 years
5-9 years	5-9 years
10-14 years	10-14 years
15-19 years	15-19 years
20-29 years	20-29 years
30-39 years	30-39 years
40-49 years	40-49 years
50-59 years	50-59 years
60-69 years	60-69 years
≥ 70 years	≥ 70 years

*Geographic matching:* Select controls from the same geographic area (e.g. same or adjacent municipality) and the same type of community (urban, rural) as the case. Matching on geographic area may underestimate potential risk factors associated with location. One example is drinking water quality; it is likely that cases and controls living in the same area have the same or similar drinking water supply.

### 3.2 EXCLUSION CRITERIA

A person should not be used as a control for any of the following reasons:

- diarrhea during the previous 30 days,
- abdominal pain and fever during the previous 30 days,
- present or past history of *Campylobacter* infection,
- inability to complete questionnaire or interview (mentally retarded, senile, language problems etc.),
- chronic illness which precludes exposure to potential risk factors (terminal cancer, bedridden etc.), or
- non-resident of study area.

### 3.3 SELECTION OF CONTROLS

Persons meeting the criteria specified above are eligible for enrollment in the study. Ideally, all eligible controls should have an equal chance of being enrolled. It is proposed that one of the following strategies are employed to identify controls:

- Select controls at random (among those meeting the matching criteria) from the general population using a population registry.

If a population registry is not available, any of the following approaches may be used:

- Ask the patients' physicians to nominate controls from their practice who meet the matching criteria and exclusion criteria.
- Select eligible controls by going into the patient's neighborhood selecting households using a predetermined search strategy.
- Ask the patients (or their parents) to nominate controls who meet the matching criteria. While this method is easy to accomplish, this type of friend control often has more similar eating and other potential risk factor habits than the general population, and such a strategy may therefore decrease the ability to detect important risk factors.
- In areas with extensive usage of telephones in households, controls may be selected by dialing a random selection of telephone numbers within the patient's exchange area.

If potential controls decline to participate in the study, additional eligible controls should be selected as above until the required number is enrolled.

The controls should be identified and contacted as soon as possible after enrollment of the case to whom they are matched.

## 4. CREATING THE QUESTIONNAIRE

### 4.1 DEFINING RESEARCH HYPOTHESES

The study should be carried out by using a standardized questionnaire based on specific hypotheses about sources of infection in the study area. Information about potential sources may be obtained from:

- bacteriological surveys of suspected animal, food, and environmental sources,
- descriptive epidemiological studies,
- surveillance data,
- outbreak investigations,
- subject experts,
- national and international literature, and
- pilot interviews of recent cases.

After having reviewed surveillance data and the results from previous bacteriological and epidemiological investigations, it is most helpful to continue by interviewing about ten recent cases in order to form some specific hypotheses about exposures of interest. These exploratory pilot interviews may be unstructured and are a critical part of the development of the questionnaire, both in terms of content and in the appropriate phrasing of questions.

### 4.2 FORMULATING QUESTIONS

Once specific hypotheses about relevant exposures have been formed, individual questions should be formulated based on the following principles (15):

- The questionnaire should consist mainly of closed (as opposed to open-ended), restricted choice questions which demand recognition by the respondents.
- The questions should be pre-categorized in such a way that the replies encouraged are mutually exclusive and exhaustive for the hypotheses they represent.
- The questions should be phrased in a manner that avoids ambiguity and is easily understood by the respondents.
- The questions should be properly sequenced to cover all important variables and avoid irrelevant items.
- Sensitive or embarrassing topics (e.g. kitchen hygiene, food handling practices) should be presented for the respondents in a manner which is non-judgemental, to encourage full revelation of such habits.
- Items of questionable importance and those that are unnecessarily redundant should be eliminated.

It is recommended that other research groups be contacted to obtain questionnaires used in previous case-control studies (4-14). However, the content and phrasing of questions should be individualized for each investigation in order to be compatible with local habits and customs, and should not blindly follow previously used questionnaires.

### 4.3 CHECKLIST FOR QUESTIONNAIRE DEVELOPMENT

The following checklist is designed to assist in developing the questionnaire. While some of the questions will not be appropriate to the particular investigation planned, most may be relevant:

*Personal and demographic data:*

- name,
- date of birth,

- address,
- telephone number,
- date questionnaire was completed,
- name of interviewer.

*Clinical information and economical impact data:* (deleted in control questionnaires)

- illness onset date,
- date first positive stool culture was collected,
- date *Campylobacter* was isolated,
- a checklist which includes presence and duration of various signs and symptoms,
- total duration of illness,
- antimicrobial and other treatment,
- hospitalization (duration),
- complications,
- number of medical visits,
- time lost from work or school.

*Food consumption:*

This part of the questionnaire should be adapted to the pattern of food consumption within the study area. Each main food category should be broken down into mutually exclusive questions about appropriate individual food items. For each question, record whether or not the respondent has eaten the item concerned ("yes", "no", or "unsure") and specify the number of meals eaten (frequency of exposure). For red meat and poultry, specify whether each item was raw or precooked when it was brought into the house. Exclude canned products. The list of main food categories to be considered includes:

- poultry,
- pork,
- beef,
- lamb/mutton,
- game,
- forcemeat and minced meat (including sausages and hamburgers),
- cold cuts, dried and cured meat,
- other meat and meat products,
- fish and shellfish,
- milk and milk products (including raw milk, soft cheeses, ice cream),
- egg and egg products,
- prepared salads, potato salad,
- green salad, raw vegetables, mushrooms, unpeeled fruits, berries.

*Other questions:*

- foreign and domestic travels,
- drinking untreated water (including drinking directly from a surface source),
- eating out of the house (including hamburger bars, hot dog stands),
- eating at a barbecue (kinds of meat eaten),
- eating raw, rare, or undercooked meat, including poultry,
- preparing red meat or poultry dishes in the kitchen,
- tasting raw meat while preparing food,
- eating red meat or poultry heated in a microwave oven,
- specific food handling practices, cooking preferences, and kitchen hygiene,
- contact with animals (e.g. living in a household with a pet),
- visiting a farm,
- attending or working in a kindergarten or day-care center,
- contact with other persons with diarrheal illness,
- regular medication, and
- underlying medical conditions.

It may be helpful to add a calendar to the questionnaire as a reference to aid in recall of relevant dates.

#### **4.4 SEPARATE QUESTIONNAIRES FOR CASES AND CONTROLS**

Develop separate questionnaires for cases and controls. The questionnaire used for controls should be identical to that administered to the cases except for:

- clinical information about the *Campylobacter*-related illness and economical impact data (only cases),
- questions which ascertain that controls are eligible for enrollment according to the exclusion criteria (only controls),
- the time period covered by the interview (discussed below):
  - cases: last two weeks before illness,
  - controls: last two weeks before interview.

#### **4.5 PILOT STUDY**

The questionnaire as well as the procedures devised for case-finding and control selection should be tested in a small-scale feasibility study with a limited number of cases and controls to allow for last-minute alterations.

### **5. COLLECTING QUESTIONNAIRE DATA**

Once the questionnaire and study protocol have been developed and tested in a pilot study, the relevant information may be obtained from the cases and their controls through any of the following approaches (15):

- face-to-face interview,
- telephone interview,
- self-administered questionnaire, or
- self-administered questionnaire followed by an interview.

The self-administered questionnaire often produces less reliable information than one administered by an interviewer. It eliminates the ability to ensure that the questions are understood and to probe for subtleties and additional information. On the other hand, the self-administered questionnaire eliminates interview bias, reduces costs, and enables easy questioning of large numbers of persons. One combined approach which may improve the quality of interview data, is to forward the questionnaire to the respondents and subsequently conduct the interview after they have read the questionnaire and refreshed their memory.

Interviews should be conducted by a limited number of persons (preferentially one) who are motivated and trained for the study. If possible, each case and the matched controls should be queried by the same interviewer. Interviewers should be instructed not to probe more deeply when eliciting answers from the cases as compared with the controls, or to disclose the investigator's hypotheses. Interviewers should be routinely monitored to be sure the questionnaire text is followed.

It is proposed that cases are questioned about exposures in the 2-week period before onset of their *Campylobacter*-related illness. If cases are unable to specify an illness onset date, they should be queried about the 2-week period before the first stool specimen which yielded *Campylobacter*, was collected.

Ideally, the cases and their matched controls should be questioned about the same time period. However, this approach may introduce a systematic bias since controls usually have greater problems recalling past food consumption than cases. This is particularly critical if controls are identified and contacted more than a month after the case. To reduce recall problems, the controls may therefore be questioned about the 2-week period before the date of interview. It is important, however, that there are no significant differences in the time period between interview of the cases and their matched control(s).

If the respondent is less than 15 years of age, a parent or guardian may be questioned.

## 6. DATA ENTRY AND VALIDATION

Enter the questionnaire data into a computer database. While entering information, the consistency and quality of the data should be critically evaluated. If required, the respondents may be re-contacted to clarify illegible or ambiguous responses on the questionnaire.

The format of the database should be developed in cooperation with someone who is familiar with the statistical analyses and the computer programs to be used. Likewise, experience in statistical analysis may be helpful in the process of questionnaire development.

In addition to the variables defined by the questionnaire, the database must contain three variables which are essential for the analysis:

- a dichotomous variable specifying whether the respondent is a case or a control (the dependent variable),
- a numeric variable containing a figure which is unique for each respondent (unique identifier), and
- a numeric variable containing a figure identifying each matched case-control group (the set identifier).

## 7. STATISTICAL ANALYSES

The data analysis consists of the following steps (15):

- simple descriptive analyses,
- univariate analysis of associations between individual exposures and the disease, and
- multivariate analysis to examine which risk factors are independently related to illness and to evaluate interactions among variables.

It is recommended to start with simple descriptive analyses and summaries. Next, relationships between variables can be explored by means of simple cross-tabulations and measures of associations (i.e. odds

ratios). Finally, multivariate methods should be applied after full exploration has been conducted using univariate methods.

Preliminary analysis at an early stage in data collection may allow discovery and correction of design errors or coding errors. The questionnaire may also be revised or supplemented at an early stage if preliminary analyses indicate trends which suggest that insufficient details are being acquired on important risk factors.

To address the issue of representativeness, the enrolled cases should be compared to non-enrollees with respect to age, sex, and geographic distributions.

A study with matched cases and controls must be accompanied by an analysis that corresponds to the matched design. Univariate analysis of dichotomous variables should be performed using standard procedures for matched data sets (15). It is recommended that univariate analysis of continuous variables is carried out using conditional logistic regression analysis (15, 16). Conditional logistic regression should also be implemented in the multivariate analysis. The multivariate analysis will require the assistance of an experienced statistician.

All results should be expressed as matched odds ratios with 95% confidence intervals and two-tailed *p* values.

## 8. COMPUTER PROGRAMS

The microcomputer programs Epi Info are produced at the Centers for Disease Control and Prevention, Atlanta, and the World Health Organization, Geneva, and are provided for use by the public health community. Epi Info is not copyrighted; both the programs as well as the manual may be freely copied. Among the facilities provided in Epi Info are:

- creating a questionnaire,
- entering questionnaire data in a database,
- analyzing data,
- developing customized reports, and
- a number of more advanced features.

Epi Info can perform descriptive analyses and matched univariate analyses of case-control studies. However, multivariate analysis by conditional logistic regression will require a more advanced computer program. (Epi Info may be ordered for approx. \$ 40 from USD, Incorporated, 2075-A West Park Place, Stone Mountain, GA 30087, USA. Fax: (404) 469-0681. Phone: (404) 469-4098.)

## 9. INFORMED CONSENT AND CONFIDENTIALITY

The case-control study includes collection of personal information and consequently involves ethical issues related to informed consent and confidentiality (15). The investigators must obtain an individual's consent before entering him or her into the study. The individual should understand the general nature and purpose of the study and his or her right to withdraw from the study. In many countries, the investigators are not allowed to contact the case-patients directly; informed consent or permission to contact the patients must be obtained through the medical institutions or physicians responsible for the patient's care. Some countries also require that the research protocol and questionnaire are approved by an ethical committee.

The importance of confidentiality of the information entrusted to the interviewers and other personnel having access to questionnaire data should be stressed. Likewise, completed questionnaires and computer databases should be stored and coded in a manner which ensures confidentiality and safety. A system should be devised whereby each individual's identity will remain confidential throughout the analysis and reporting of study results.

## 10. AN EXAMPLE: CASE-CONTROL STUDY OF *CAMPYLOBACTER* INFECTIONS IN

## NORWAY

**Identification of cases.** The study was conducted from May 1989 to November 1990 in the counties of Oslo, Akershus, and southern Buskerud in southeastern Norway, an area with a combined 1990 census of 1,098,000 (26 % of Norway's population) (8). When a bacteriologically verified case of *Campylobacter* infection was identified at one of the medical microbiological laboratories in the study area, the laboratory contacted the patient's physician and requested an interview with the patient. If the physician and patient consented, investigators at the National Institute of Public Health (NIPH) contacted the patient by telephone and conducted a brief preliminary interview concerning travel activity and clinical manifestations of the infection. Patients who had travelled abroad during the two weeks before onset of illness, were excluded from the study. If stool cultures from more than one member of a household yielded *Campylobacter* or the case was outbreak-related, only the first identified case was enrolled. *Campylobacter* isolates were forwarded to the Reference Laboratory at the NIPH for verification and biotyping according to established criteria.

**Identification of controls.** Once enrolled, a case-patient's name was located on the Norsk Folkeregister, a government registry of all Norwegian residents (arranged chronologically by date of birth), which is updated on a quarterly basis. The names and addresses of five sex-matched persons, closest in age to the case and living in the same or adjacent postal code area, were recorded as potential controls. The cases and their controls were rarely more than two weeks apart in age. These persons were mailed information about the investigation and then sequentially contacted by telephone until two agreed to be interviewed. Criteria for exclusion of potential controls were: (i) a past history of *Campylobacter* infection, (ii) diarrhea or abdominal pain with fever in the preceding month, or (iii) travel abroad in the last two weeks.

**Interviews.** All cases and controls were interviewed in person using a structured questionnaire, by technicians from the NIPH or the Norwegian College of Veterinary Medicine, who were trained as interviewers. A parent or guardian was interviewed if the patient was under 15 years of age. Each interview covered demographic and clinical information and specific exposures including food consumption, contact with animals, kitchen hygiene, and medications. Patients were questioned about exposures in the two weeks before the onset of their *Campylobacter* illness. In order to reduce recall bias, controls were asked about the two-week period before the interview. If patients could not specify an illness onset date, they were questioned about the two-week period before the first stool sample, which yielded *Campylobacter*, was submitted.

**Statistical analyses.** Univariate analyses of dichotomous variables were performed using the procedure for matched data sets (15) in the computer program Epi Info (Centers for Disease Control, Atlanta, GA). Conditional logistic regression was implemented for univariate analysis of continuous variables and for multivariate analyses (15) using the computer program Egret (Statistics and Epidemiology Research Corporation, Seattle, WA). The results were reported as matched odds ratios with 95 confidence intervals and two-tailed *p* values.

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## APPENDIX I

## CASE-CONTROL STUDY OF CAMPYLOBACTERIOSIS PATIENT QUESTIONNAIRE

Name of patient \_\_\_\_\_ Date of birth \_\_\_\_\_

Address \_\_\_\_\_

Telephone \_\_\_\_\_

Date of interview \_\_\_\_\_ Interviewer (name) \_\_\_\_\_

1. **When did you become ill (illness onset date) ?** \_\_\_\_\_

2. **Did you have any of the following symptoms ?** (Specify when the symptoms started and their duration)

	Yes	No	Unsure	When started:	Duration (days):
Nausea	___	___	___	_____	_____
Vomiting	___	___	___	_____	_____
Abdominal pain	___	___	___	_____	_____
Diarrhoea	___	___	___	_____	_____
Blood in stool	___	___	___	_____	_____
Tenesmae	___	___	___	_____	_____
Fever	___	___	___	_____	_____
Other symptoms	___	___	___	_____	_____

3. **Do you know any other person who had similar symptoms *in the 2 weeks before or in the 2 weeks after* you became ill ?**

Yes \_\_\_ No \_\_\_ Unsure \_\_\_ Date of illness onset \_\_\_\_\_

Is this person(s) a member of your household ? Yes \_\_\_ No \_\_\_

4. **How many days were you ill (total duration of illness) ?** \_\_\_\_\_

5. **Have you presently recovered from your illness ?** Yes \_\_\_ No \_\_\_ Unsure \_\_\_

6. **How many days were lost from work or school due to this illness ?**

(If the patient is a child, how many days of work did parent or other adult miss to stay home with the sick child ?) No. of days lost \_\_\_\_\_

7. **How many visits/consults to the doctor were made for this illness ?** \_\_\_\_\_

8. **Did you receive antibiotics for this illness ?**

Yes \_\_\_ No \_\_\_ Unsure \_\_\_ Date started \_\_\_\_\_ Duration \_\_\_\_\_

Name of antibiotic(s) \_\_\_\_\_

**9. Were you hospitalized ?**

Yes \_\_\_ No \_\_\_ Date started \_\_\_\_\_ Duration \_\_\_\_\_

**10. Were you operated upon ? Yes \_\_\_ No \_\_\_****11. Do you have any chronic diseases ?**

	Yes	No	Unsure	Comments:
Anemia	___	___	___	_____
Gastrointestinal disorder	___	___	___	_____
Recurrent diarrhoea	___	___	___	_____
Liver disorder	___	___	___	_____
Other chronic disease	___	___	___	_____

**12. In the month before the onset of illness, did you take:**

Antibiotics	___	___	___	_____
Antacids, regularly	___	___	___	_____
Ulcer medication, regularly	___	___	___	_____
Other regular medication	___	___	___	_____

***THE REMAINING QUESTIONS DEALS WITH WHAT YOU DID AND WHAT YOU ATE  
IN THE LAST TWO WEEKS BEFORE ILLNESS ONSET***

**13. Did you travel abroad during this period ?**

Yes \_\_\_ No \_\_\_ If yes, please specify country and dates ?

Country:	Dates (from - to):
_____	_____
_____	_____

**14. Are there other persons in your household who travelled abroad *during the last month* before you became ill ?**

Yes \_\_\_ No \_\_\_ Unsure \_\_\_ When and where \_\_\_\_\_

Did this person develop diarrhoeal illness ?

Yes \_\_\_ No \_\_\_ Unsure \_\_\_ Date of illness onset \_\_\_\_\_

**15. Did you travel overnight within your own country ?**

Yes \_\_\_ No \_\_\_ Unsure \_\_\_ If yes, please specify place and dates ?

Place: \_\_\_\_\_ Dates (from - to): \_\_\_\_\_

**16. Did you eat at a restaurant, hotel etc. ?**

	Yes	No	Unsure	No. of meals
Restaurant	___	___	___	_____
Hotel	___	___	___	_____
Fast food restaurant	___	___	___	_____
Sausage stand	___	___	___	_____
Café, cafeteria	___	___	___	_____
Canteen	___	___	___	_____
Hospital	___	___	___	_____
Airline, train, ferry	___	___	___	_____
Other	___	___	___	_____

**17. Did you eat any poultry or poultry products ?**

Please specify whether it was bought: (1) raw and fresh, (2) raw and frozen, or (3) precooked.

	Yes	No	Unsure	No. of meals	Specify how it was bought (1,2,3)
Hen	___	___	___	_____	_____
Turkey	___	___	___	_____	_____
Chicken	___	___	___	_____	_____
Chicken wings	___	___	___	_____	_____
Ducks or goose	___	___	___	_____	_____
Grouse etc.	___	___	___	_____	_____
Other poultry items	___	___	___	_____	_____

**18. Did you eat any of the following meat products ?** (Do not include canned products).

Please specify whether it was bought: (1) raw and fresh, (2) raw and frozen, or (3) precooked.

	Yes	No	Unsure	No. of meals	Specify how it was bought (1,2,3)
Roast beef	___	___	___	_____	_____
Beef steak or entrecôte	___	___	___	_____	_____
Calf liver	___	___	___	_____	_____
Other beef items	___	___	___	_____	_____
Pork/ham steak	___	___	___	_____	_____
Pork cutlets, pork chops	___	___	___	_____	_____
Spare ribs (pork)	___	___	___	_____	_____
Swine liver	___	___	___	_____	_____
Other pork items	___	___	___	_____	_____
Lamb or mutton	___	___	___	_____	_____
Game	___	___	___	_____	_____
"Beef tartar"	___	___	___	_____	_____
Hamburgers	___	___	___	_____	_____
Pasta with minced meat	___	___	___	_____	_____
Other minced meat items	___	___	___	_____	_____
Sausages	___	___	___	_____	_____
Other meat items	___	___	___	_____	_____

**19. Did you eat at a barbecue ?**

Yes \_\_\_ No \_\_\_ Unsure \_\_\_ No. of meals eaten \_\_\_\_\_

What kind of food was served ?

	Yes	No	Unsure	No. of meals	Comments:
Poultry	___	___	___	_____	_____
Pork	___	___	___	_____	_____
Beef	___	___	___	_____	_____
Lamb or mutton	___	___	___	_____	_____
Hamburgers	___	___	___	_____	_____
Sausages	___	___	___	_____	_____
Fish	___	___	___	_____	_____
Lettuce, raw vegetables	___	___	___	_____	_____
Other food (specify)	___	___	___	_____	_____

**20. Did you prepare meat items, including poultry, in a microwave oven ?**

	Yes	No	Unsure	No. of meals	Comments:
Poultry	___	___	___	_____	_____
Red meat products	___	___	___	_____	_____
Other food items (specify)	___	___	___	_____	_____

**21. Did you eat any meat product, including poultry, which was raw, rare, or undercooked?**

	Yes	No	Unsure	No. of meals	Comments:
Poultry	—	—	—	_____	_____
Pork	—	—	—	_____	_____
Beef *	—	—	—	_____	_____
Lamb or mutton	—	—	—	_____	_____
Game	—	—	—	_____	_____
Hamburgers	—	—	—	_____	_____
Other minced meat items **	—	—	—	_____	_____
Sausages	—	—	—	_____	_____
Fish	—	—	—	_____	_____
Other meat (specify)	—	—	—	_____	_____

\* Including roast beef. \*\* Including tartar.

**22. How do you prefer the following meat to be cooked ?**

	Raw	Rare	Medium	Well
Poultry	—	—	—	—
Beef	—	—	—	—
Pork	—	—	—	—
Hamburgers	—	—	—	—
Minced meat	—	—	—	—

**23. Did you handle or prepare raw meat, including raw poultry, in the kitchen ?**

	Yes	No	Unsure	No. of times	
Raw poultry	—	—	—	_____	_____
Raw red meat	—	—	—	_____	_____
Raw minced meat	—	—	—	_____	_____

**24. Did you nibble or taste raw meat or raw minced meat while preparing food ?**

Yes \_\_\_ No \_\_\_ Unsure \_\_\_ No. of times \_\_\_\_\_

If yes, specify what kind of meat \_\_\_\_\_

**25. During meat preparation, how are the following items usually handled after contact with raw meat, before preparation of other foods ?**

	Hands	Chopping Knives	Countertop	Board
Not used with other items	—	—	—	—
Washed with soap and water	—	—	—	—
Washed with water	—	—	—	—
Wiped with a cloth	—	—	—	—
Not cleaned between items	—	—	—	—
Do not know	—	—	—	—

**26. Did you eat any of the following food items ?**

	Yes	No	Unsure	No. of meals	Comments:
Fresh fish	—	—	—	_____	_____
Frozen fish	—	—	—	_____	_____
Shellfish, mussels, squid	—	—	—	_____	_____
Prepared salad	—	—	—	_____	_____
Potato salad	—	—	—	_____	_____
Paté	—	—	—	_____	_____
Unpasteurized milk	—	—	—	_____	_____
Pasteurized milk	—	—	—	_____	_____
Milkshake	—	—	—	_____	_____
Soft ice cream	—	—	—	_____	_____
Other ice cream	—	—	—	_____	_____
Yoghurt	—	—	—	_____	_____
Cream filled cake	—	—	—	_____	_____
Soft cheese	—	—	—	_____	_____

**27. Did you eat raw vegetables, mushrooms, unpeeled fruits or berries ?**

	Yes	No	Unsure	No. of meals	Comments:
Lettuce	—	—	—	_____	_____
Raw carrots	—	—	—	_____	_____
Bean sprouts	—	—	—	_____	_____
Other raw vegetables	—	—	—	_____	_____
Raw mushrooms	—	—	—	_____	_____
Strawberries	—	—	—	_____	_____
Other berries	—	—	—	_____	_____
Unpeeled fruit	—	—	—	_____	_____

**28. Did you eat any kind of food *purchased abroad* ? (Do **not** include canned food!)**

	Yes	No	Unsure	No. of meals	From what country?
Poultry	—	—	—	_____	_____
Red meat products	—	—	—	_____	_____
Other food items (specify)	—	—	—	_____	_____

**29. Were you in contact with animals or birds ?**

Please specify number of days or times with contact.

	Yes	No	Unsure	No. of days	Comments:
Dog	—	—	—	_____	_____
Cat	—	—	—	_____	_____
Other pets	—	—	—	_____	_____
Cattle	—	—	—	_____	_____
Pig	—	—	—	_____	_____
Sheep or goat	—	—	—	_____	_____
Horse	—	—	—	_____	_____
Poultry	—	—	—	_____	_____
Wild birds	—	—	—	_____	_____
Wild animals or game	—	—	—	_____	_____
Other animals or birds	—	—	—	_____	_____

30. **Did you attend or work in a kindergarten or day-care center ?** Yes \_\_\_ No \_\_\_ Unsure \_

31. **What kind of drinking water supply do you have at home ?**

Supply:

Source:

Public supply

Surface source (lake, river, etc.)

Private waterwork

Ground water, bore hole

Other private supply

Dug-out well

Unknown

Unknown

32. **Is your drinking water treated (e.g. chlorinated) ?** Yes \_\_\_ No \_\_\_ Unsure \_\_\_

33. **Did you drink water any other places ?**

Yes \_\_\_ No \_\_\_ Unsure \_\_\_

If yes, specify where, what kind of water supply, and whether it was treated:

\_\_\_\_\_

34. **Did you drink water directly from a lake, river, brook etc. ?**

(For example at a holiday cabin or while hiking): Yes \_\_\_ No \_\_\_ Unsure \_\_\_ No. of times \_\_\_

35. **Do you recall any particular meals or foods you believe may have caused the illness?**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

***THANK YOU FOR YOUR HELP***