Investigating foodborne disease outbreaks

Stage One Booklet
Strengthening surveillance of and response to foodborne diseases
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Investigating foodborne disease outbreaks
# Table of Contents

**Acronyms used in this module**

**Introduction**
- Purpose of this module  
- Who is this module for?  
- How to use this module

**Overview**
- What is a foodborne disease outbreak?  
- What causes foodborne disease outbreaks?  
- Why investigate foodborne outbreaks?  
- Steps in a foodborne disease outbreak investigation

**Section 1. What to do before leaving the office**
- Step 1. Confirm the existence of an outbreak  
- Step 2. Plan and prepare for the outbreak investigation  
- Step 3. Define, find and count suspect cases

**Section 2. What to do in the field**
- Step 4. Generate hypotheses and describe the outbreak in terms of person, time, and place  
- Step 5. Test hypotheses through analytical studies and food, environmental and laboratory investigations  
- Step 6. Identify the point of contamination and the original source of the outbreak  
- Step 7. Control the outbreak

**Section 3. What to do at the end of the initial investigation**
- Step 8. Decide an outbreak is over  
- Step 9. Plan more systematic studies
Step 10. Communicate the findings of the investigation  

Annex 1.  
Outbreak response team meeting: draft agenda  

Annex 2.  
Questionnaires  

Annex 3.  
Sample line-list  

Annex 4.  
Food frequency tables  

Annex 5.  
Outline of an outbreak investigation report  

References
Acronyms
used in this module

CDC
Centers for Disease Control and Prevention
(of the United States of America)

HACCP
hazard analysis and critical control points

HAV
hepatitis A virus

INFOSAN
International Food Safety Authorities Network

ORT
outbreak response team

STEC
Shiga-toxin-producing Escherichia coli

WHO
World Health Organization
Introduction
Purpose of this module

This module is intended for countries that are in stage 1 of strengthening their surveillance and response system for foodborne diseases, and summarizes the practical steps that may be required to investigate a foodborne disease outbreak. It is intended primarily as an introductory level guide for use in the field during outbreaks and in response to acute public health events. It can also be used for training purposes, particularly to build the capacity of outbreak response teams to investigate and respond to foodborne disease outbreaks.

This module is largely based on the WHO (2008) publication *Foodborne disease outbreaks: guidelines for investigation and control*, but also draws on the work by Plant & Watson (2008), *Communicable disease control: an introduction*. It uses the step-by-step approach to investigating foodborne disease outbreaks developed by the Centers for Disease Control and Prevention (CDC) in the USA.

Who is this module for?

This module is intended for public health practitioners, sanitary and food inspectors, health care workers, laboratory personnel, field epidemiology training students and others who may undertake or participate in the investigation and control of foodborne disease outbreaks. It is particularly aimed at low- and middle-income countries that are currently developing their capacities in foodborne disease surveillance and response.

How to use this module

Users of this module are encouraged to read first the introductory module of this manual, which sets the context for the guidance contained here and defines the scope and target audience. It also discusses the different risk-related terms used in the various disciplines involved in the prevention and control of foodborne diseases.
A glossary of terms contained at the back of the introductory module explains some of the technical terms used in the manual.

This module is structured around ten steps of outbreak investigation and is divided into three main sections.

- **Section 1** outlines the steps in an outbreak investigation that may be conducted in the office before leaving for the field.
- **Section 2** details the steps needed in the field to investigate and control an outbreak.
- **Section 3** lists the steps to be taken at the end of the investigation.

In real-life situations, the steps of an outbreak investigation may occur in a different order than that given here and often overlap.

It is important to remember that no general guide will fit each specific situation perfectly. It will always be necessary to modify the investigation process to account for local circumstances and the unique characteristics of the particular outbreak.
Overview
What is a foodborne disease outbreak?

A foodborne disease outbreak occurs when two or more people develop a similar illness after ingesting the same contaminated food or drink (WHO, 2008). In some countries, only one case of a rare but severe foodborne disease – like botulism or chemical intoxication – is also considered an outbreak.

What causes foodborne disease outbreaks?

Food and drinks may be contaminated by bacteria, viruses, parasites, chemicals or toxins. Contaminated food and drinks will be collectively referred to as contaminated food throughout this module. Food may be contaminated at any stage in the food production chain (Figure 1).

**FIGURE 1.**

*A simplified diagram showing the food production chain – production, processing, distribution, retail and preparation*
Why investigate foodborne outbreaks?

Contaminated foods commonly cause gastroenteritis, which is infection and inflammation of the digestive system. The symptoms of gastroenteritis include abdominal pain, diarrhoea and vomiting. For many people, symptoms settle within a few days. However, some people, particularly the very young, the elderly, pregnant women, and people with underlying health problems or a weakened immune system, may experience more severe disease and complications, including death.

A foodborne outbreak may mean that there is a problem in the food production chain. Investigating foodborne outbreaks can:

- help limit the spread of further illness; and
- explain what went wrong so that future outbreaks can be prevented.

It is important to remember that not all gastroenteritis is foodborne, and not all foodborne diseases cause gastroenteritis. Foodborne diseases may also cause many other symptoms, depending on the agent. For example, *Salmonella* infection may cause bloody diarrhoea, ciguatera fish poisoning may cause neurological symptoms, such as tingling sensations, muscle pain and weakness, while organochlorine pesticide consumption may cause difficulty breathing and headache.

In the initial stages, investigation of foodborne outbreaks usually centres on reports of gastrointestinal illness; the mode of transmission of the illness, i.e. how the disease is spread, may not be clear.
Steps in a foodborne disease outbreak investigation

At the beginning of a foodborne disease outbreak investigation, there are four main questions that need to be answered (Plant & Watson, 2008).

- What is the disease?
- What is the source?
- How is the disease being spread?
- How can the outbreak be stopped?

The steps in an outbreak investigation aim to answer these questions. These steps are presented in this module in a logical order (Figure 2). However, during an investigation they may not always occur in this order, and several steps may take place at the same time.

Other questions that should be asked during an investigation include the following.

- Who is getting sick?
- When did they get sick?
- Where did they get sick?
- Why did they get sick?

Finding the answers to these questions will help to limit further illness, control the outbreak and ultimately prevent similar outbreaks from occurring in the future.
FIGURE 2.
Steps in a foodborne outbreak investigation

In the office
- **Confirm** the existence of an outbreak
- **Plan** and **prepare** for the outbreak investigation
- **Define, find** and **count** cases in an outbreak

In the field
- **Generate hypotheses** through interviews and describe the outbreak in terms of person, time and place
- **Test hypotheses** through analytical studies, food, environmental and laboratory investigations
- **Identify** the point of contamination and the original source of the outbreak
- **Control** the outbreak by recalling food, improving facilities or collaborating with industry

At the end of the initial investigation
- **Decide** an outbreak is over
- **Plan** more systematic studies
- **Communicate** the findings of the investigation
Section 1

What to do before leaving the office
Section 1 outlines the steps of an outbreak investigation that can be undertaken in the office before leaving for the field.

Step 1. Confirm the existence of an outbreak

Before starting an outbreak investigation, it is essential to find out whether there really is an outbreak. In any community there is likely to be a background level of gastrointestinal symptoms, such as diarrhoea and vomiting.

Questions to ask to help decide if there is an outbreak

- Is there really more illness than usual or has there just been a change in reporting?
- Do the cases all have the same illness?
- Did all cases attend the same restaurant or social function?
- What information do I have about the background level of illness?
- What information do I have from health care workers?
- What information do I have from laboratories?
- What is happening now that suggests that there is an outbreak occurring?

Adapted from Plant & Watson (2008).
Information to answer these questions can come from the surveillance system and an initial rapid risk assessment.

Surveillance systems gather both formal and informal reports about illnesses all the time. Formal reports may come from health care workers and laboratories; informal reports may come from the media or from members of the public. The surveillance system can indicate how much illness to expect in a given area over a given period of time.

Surveillance system data need to be regularly analysed, so that any unusual levels of disease potentially transmitted through food, which might require a public health investigation or response, are detected and confirmed as soon as possible after being reported.

The initial rapid risk assessment for any public health event pulls together all the formal and informal information available and assigns a level of risk to help decide if a response should be mounted and how quickly. If the risk assessment is carried out early during an event, it may only be possible to decide if a response should be mounted, because the data will be limited. Later, as an event evolves, the risk assessment can also provide information to answer the question “is this a real outbreak?”. More information on how to perform a rapid risk assessment is given elsewhere (WHO, 2012).
Step 2. Plan and prepare for the outbreak investigation

Once the existence of an outbreak has been confirmed, the second step is to plan and prepare to carry out the investigation. It is important to act quickly, have a clear understanding of the investigation’s priorities and direction, and perform the investigation responsibly.

Authorization and responsibility to conduct an outbreak investigation

First, find out who has the authority and responsibility to carry out the investigation. Depending on the size and extent of the outbreak, different public health agencies may participate. For example, if the outbreak occurs within one local area, it may be the responsibility of the local public health authorities to investigate the outbreak. Sometimes it may be more appropriate for public health agencies at the district, state, provincial or national level to lead the investigation, particularly if cases occur over a wide area or if the investigation requires widespread coordination or collaboration with other authorities, such as the agencies responsible for food safety or for regulating the food industry.

Outbreak response team and reporting lines

Investigating foodborne disease outbreaks is a multidisciplinary task, requiring a range of knowledge and skills. Some situations require a team of people to help investigate and control the outbreak. This team is called an outbreak response team (ORT). The team may include the following professionals (WHO, 2008):

- public health practitioners
- epidemiologists;
- food safety officers and inspectors;
- microbiologists;
- toxicologists;
• clinicians;
• veterinarians (or animal health officers);
• environmental health specialists (also referred to as sanitary officers);
• media officers;
• other technical experts, as required by the investigation.

Each person in the ORT has a well-defined role. In addition, decisions should be made about:

✔️ who is the team leader?
✔️ who will make the decisions? And who will be responsible for the outcomes?
✔️ what are the reporting lines?

Resolving these questions during the planning stage of the investigation will help prevent difficult situations during the investigation. The ORT is responsible for coordinating all the activities involved in an outbreak investigation and the control of the outbreak. The ORT should have regular formal meetings until the outbreak is over, and the proceedings of these meetings should be recorded. An example of a draft agenda for an ORT meeting can be found in Annex 1.

**How to decide whether to bring together an outbreak response team**

Figure 3 shows a decision-tree that can help in deciding whether an outbreak response team is needed.
FIGURE 3.
Decision-tree for deciding whether an outbreak response team should be formed

Communication

Information about the outbreak, the investigation, interim results and actions taken to control the outbreak will need to be clearly communicated to:

- health authorities and other government stakeholders;
- health care providers;
- people directly affected by the outbreak;
- the public;
- the food industry;
- the media;
- international agencies, if required.
During the preparation stage of an outbreak investigation, consider how best to communicate with each of these groups. Suggestions about the purpose and method of communication with different groups are provided in Table 1.

**TABLE 1.**

Methods and purpose of communication with different groups during foodborne disease outbreak investigations

<table>
<thead>
<tr>
<th>Health authorities and other government stakeholders</th>
<th>Purpose of communication</th>
<th>Method of communication</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To ensure accurate case-finding</td>
<td>Establish communication channels and regular meetings</td>
</tr>
<tr>
<td></td>
<td>To facilitate the implementation of control measures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Colleagues in other administrative areas may benefit from information about the outbreak and may be able to provide additional information about similar outbreaks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To ensure that senior government officials are updated about the status and progress of the investigation</td>
<td></td>
</tr>
<tr>
<td>Health care providers</td>
<td>To ensure accurate case-finding</td>
<td>Established communication channels and regular meetings</td>
</tr>
<tr>
<td></td>
<td>To facilitate the implementation of control measures</td>
<td></td>
</tr>
<tr>
<td>People directly affected by the outbreak</td>
<td>To respond to concerns</td>
<td>Methods of communication will depend on the local situation, but may include contacting those affected by:</td>
</tr>
<tr>
<td></td>
<td>To provide advice on personal hygiene measures to reduce the risk of person-to-person spread</td>
<td>- telephone,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The public</td>
<td>To provide accurate information about the outbreak</td>
<td>Methods of communication will depend on the local situation, but may include:</td>
</tr>
<tr>
<td></td>
<td>To provide information on implicated food products and how they should be handled</td>
<td>- regular press releases via newspapers,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- radio or television announcements,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- public meetings,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- leaflets delivered to households and public gathering places,</td>
</tr>
</tbody>
</table>
(TABLE 1. Continue)

<table>
<thead>
<tr>
<th>Purpose of communication</th>
<th>Method of communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>To provide advice on personal hygiene measures to reduce the risk of person-to-person spread</td>
<td>- face-to-face advice in clinics, - messages displayed on notice boards and shared with consumer groups.</td>
</tr>
<tr>
<td>To identify additional cases</td>
<td></td>
</tr>
</tbody>
</table>

**The food industry**

- To ensure their ongoing cooperation with the investigation
- To facilitate the implementation of control measures

**The media**

- To facilitate case-finding through enhanced reporting of cases by the public and medical practitioners
- To inform the public about avoidance of risk factors for illness and about appropriate preventive measures
- To maintain public and political support for disease investigation and control
- To minimize the appearance of conflicting information from different authorities (which may undermine their credibility)

**International agencies**

- Colleagues in other countries may benefit from information about the outbreak and may be able to provide additional information about similar outbreaks

Adapted from WHO (2008).

**Contact the laboratory**

Before starting the investigation, contact laboratory colleagues to alert them to the existence of the outbreak and to ensure that appropriate specimens are correctly collected from cases during the investigation. Close collaboration with the laboratory will help ensure the rapid and appropriate transport, receipt and processing of specimens during the investigation.
Record-keeping

From the beginning of an outbreak, all information received and all decisions made by the ORT and others involved in the outbreak investigation should be accurately recorded, and the appropriate level of confidentiality should be respected. This means that:

- individual members of the ORT should keep records of all activities performed during the outbreak investigation;
- minutes of meetings should be kept and distributed to team members; the minutes should be marked “confidential – not for further distribution”;
- action notes and records of decisions made in ORT meetings are agreed on and distributed among the team immediately after the meeting;
- notes and other records from epidemiological, food, environmental and laboratory investigations should be maintained by the staff involved in the investigation and stored in files specific to the outbreak, in the relevant work areas (either hard copy or electronic);
- telephone logs, emails and other records made during an investigation should be maintained by the staff involved in the investigation and stored in an electronic file specific to the outbreak;
- copies should be kept of all communications with the public, including letters, fact sheets, public notices and media reports.

Good records are needed so that they can be reviewed in the future. This may be for legal reasons, to ensure accountability of the public health response, and for evaluation and audit purposes.
Step 3. Define, find and count suspect cases

Why should the outbreak investigation try to find more cases?

Often, the first cases that prompt an outbreak investigation represent only a small fraction of the total number. To understand the full extent of the problem and the population at risk of illness, an active search for additional cases should be undertaken.

How to identify cases that are part of the outbreak?

A case definition should be developed, to identify cases that should be included in the outbreak.

What is a case definition?

A case definition specifies the criteria that can be used to determine whether a person should or should not be included as having the disease under investigation. Case definitions may include details about:

- symptoms;
- laboratory results – for example, identification of the responsible pathogen or toxin, if it is known;
- when the illness occurred;
- where the illness occurred, for example among residents of a particular village or people who visited a particular restaurant;
- personal characteristics of the patient, such as age or sex;
At the beginning of an investigation, the case definition might be broad, to ensure that all possible cases are counted. Later in the investigation, it may become clear that some symptoms or other details in the case definition are not related to the outbreak. The case definition may then be narrowed to make sure that only people with the illness being investigated are included. For an example of a case definition, see Box 1.

**BOX 1.**

**Example of a case definition used in the investigation of a Shigella outbreak**

A case is defined as gastrointestinal illness in any resident of area A within four days of eating at restaurant B in May 2014. Cases may be further categorized as:

- **confirmed case**: gastrointestinal illness with microbiological confirmation of Shigella;
- **probable case**: bloody diarrhoea and fever without microbiological confirmation;
- **possible case**: non-bloody diarrhoea, fever and abdominal cramps without microbiological confirmation.

Once the case definition has been established, investigators can use this to find more cases, either by looking through previous surveillance and laboratory reports or by surveying groups that might have been exposed (for example, people who attended an implicated event, such as a wedding or birthday party). Investigators can ask health care providers and laboratories to be on the alert for cases. They may even alert the public directly through announcements in the media, depending on the situation.
Section 2
What to do in the field
Stage one

Step 4. Generate hypotheses and describe the outbreak in terms of person, time and place

This step involves interviewing the people identified as cases, analysing the data from these interviews and using the information to generate ideas (hypotheses) about the possible source or vehicle of the outbreak (for example, a particular food) and how the illness is spread (the mode of transmission). Foodborne illness can also be spread through contaminated water or through contact with an infected person or infected animal, so it is important that investigators keep an open mind, particularly in the early stages of an investigation.

Talking with people identified as cases: the “hypothesis-generating interview”

“Hypothesis generation”

is the process of coming up with ideas about the possible causes of the outbreak. Good hypothesis generation involves refining the possible explanations for the outbreak as new information becomes available. Such information often comes from interviews with cases.
Talking with the people who meet the outbreak case definition may provide clues about the way an illness is transmitted or even about the source of the illness. If possible, always take the opportunity to talk with some of the people who meet the outbreak case definition and listen to them directly. If this is not possible, try to speak with their family or health care providers involved in their care. This will help provide a clearer

Hypothesis-generating interviews are a formal way of asking the people who meet the case definition about where they were, what they ate and what they did in the days and weeks before they became sick. The exact time period to be asked about will depend on the incubation period of the pathogen (if the pathogen is known). The incubation period is the time between a person's first contact with an infectious agent (when they ate or drank the contaminated food or drink) and the appearance of the first symptoms associated with the infection. The incubation periods and symptoms for common foodborne pathogens are given in Annex 1 of the Stage 1 module. Interviews should be conducted as soon as possible, since delays may mean that people no longer remember what they ate or did.

To make sure that, in each interview, the same questions are asked in a systematic way, investigators should use the same questionnaire. If investigators think that there is a common exposure, such as eating at the same restaurant, the questionnaire may use items on the menu to guide the interview. If, however, the people interviewed come from a wide geographical area and there is no obvious common exposure, investigators may need to ask them to list all their meals (and the ingredients) and where the meals were prepared and eaten in the days and weeks before they became sick. This is called a food history. Investigators could also show the people interviewed a list of food items and ask whether they ate any of them. Annex 2 contains examples of questionnaires that can be adapted for local use.
These interviews can be time-consuming, but by considering all the information provided, investigators will be able to make a list of foods that appear to have been eaten by many of the people who meet the outbreak case definition.

The interviews should also include questions about the following:

- **Demographic and general details of cases (age, sex, address, occupation/school, contact details);**
- **Clinical details (symptoms, when they started, severity of illness, duration of illness, visits to health care providers, treatment and outcome of illness);**
- **Specimen submission and laboratory test results (were clinical specimens, such as faecal samples, taken? If so, who ordered the test and which laboratory did the testing? This will allow results to be followed up.);**
- **Contact with other ill people;**
- **Thoughts on what caused the illness;**
- **Knowledge of other people with a similar illness and whether they had a common exposure (shared a meal or were at the same event);**
- **Personal risk factors for illness (chronic disease, immunosuppression, pregnancy, contact with animals, recent farm visits, recent travel, special diet or dietary requirements, e.g. vegetarian);**
- **Purchasing patterns (where they usually buy or get their food).**
Analysing the data

The data from interviews should be analysed with the aim of understanding who became ill, and when and where they became ill. This is called describing the outbreak in terms of person, time and place.

Describe the outbreak in terms of person: who is sick?

The purpose of describing an outbreak in terms of who is getting sick is to identify if cases have anything in common in their personal characteristics, such as age, sex, occupation, school or place of work. For example, if all cases are in newborn infants, then the source of the outbreak may be a hospital or an infant food product, such as powdered milk formula (Plant & Watson, 2008).

One way of examining the personal characteristics of cases is to develop a line-list. A line-list is a table, in which each row represents a case and each column gives an item of information. A line-list can also show if any information has not been collected or is unknown. For an example of a line-list that can be adapted for local use, see Annex 3.

If information is available on the total population that could have been exposed to a possible source of infection, then an attack rate can be calculated. An attack rate is the number of cases divided by the number of people exposed to the possible source. Attack rates can be calculated for different subgroups in a population and can therefore indicate who is more at risk of becoming sick (Table 2).
TABLE 2.
Example of attack rates for an outbreak showing the highest attack rate in Village F

<table>
<thead>
<tr>
<th>Area</th>
<th>No. of cases</th>
<th>Population</th>
<th>Attack rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village X</td>
<td>23</td>
<td>2051</td>
<td>1.1</td>
</tr>
<tr>
<td>Village W</td>
<td>456</td>
<td>8623</td>
<td>5.3</td>
</tr>
<tr>
<td>Village F</td>
<td>262</td>
<td>3672</td>
<td>7.1</td>
</tr>
<tr>
<td>Village P</td>
<td>98</td>
<td>2962</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Clinical information from cases may also be used to help determine whether the outbreak was caused by an intoxication, an enteric infection or a generalized illness (Table 3).

TABLE 3.
Frequency of signs and symptoms among cases (n=302)

<table>
<thead>
<tr>
<th>Signs and Symptoms</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td>299</td>
<td>99</td>
</tr>
<tr>
<td>Nausea</td>
<td>287</td>
<td>95</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>286</td>
<td>95</td>
</tr>
<tr>
<td>Body aches</td>
<td>180</td>
<td>60</td>
</tr>
<tr>
<td>Headache</td>
<td>171</td>
<td>57</td>
</tr>
<tr>
<td>Vomiting</td>
<td>102</td>
<td>34</td>
</tr>
<tr>
<td>Bloody diarrhoea</td>
<td>30</td>
<td>10</td>
</tr>
</tbody>
</table>
FIGURE 4.
Examples of different types of epicurves

Describe the outbreak in terms of time: when did cases get sick?

To help keep track of when cases became sick, an epidemic curve – or epicurve – can be drawn.

An epicurve is a graph of onset of illness against time.

To draw an epicurve, information is needed on when each case first became sick.

Epicurves have different patterns that can help determine whether cases were exposed to the source of the outbreak:

A. at one time point
   (all cases were exposed at the same time and it seems that there was no further exposure)

B. at several time points
   (cases were exposed at several time points)

C. over a continuous period of time
   (there is a sudden onset of illness and cases are spread over a long time, indicating that exposure is extended and continuing).

The epicurve can also reveal whether the illness is being transmitted from person to person:

D. some people are infected initially and then they infect others, who go on to infect more people.

Describe the outbreak in terms of place: where did cases get sick?

Drawing a map of where cases live can help investigators easily see whether there are any obvious clusters or patterns and how the outbreak may be spreading. Two kinds of map are commonly used in outbreak investigations: spot maps and area (density) maps.

Spot maps are produced by placing a dot (or other symbol) on a map to indicate where a case lives, works or was potentially exposed (Figure 5).

Area (density) maps show the number of cases in different areas in relation to the number of people living there. They are used when the density of the population varies between geographical areas (for example, between an urban and rural area) (Figure 6). Using spot maps in this situation would be misleading, as low-density areas would have fewer cases and high-density areas would have more cases.

FIGURE 5.
Example of a spot map

*Source: Snow, 1854.*
**FIGURE 6.**

Example of an area map

Area map of the distribution of suspected cholera cases, Kabupaten Pidie, Indonesia, July and August 1982

*Source: Reproduced with permission of the publisher, from Glass et al., 1984.*

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**Developing hypotheses**

Throughout this step, using all the information gathered, investigators will have been developing hypotheses about the source of the outbreak and how the illness is transmitted. Often, cases that are “outliers”, i.e. that are unusual in some way (the youngest case, the oldest, or one who lives far away from the others), can provide important clues for generating hypotheses. It is useful to keep a list of all the different hypotheses and rank them in order of likelihood. As more information emerges, some hypotheses will become more likely, while others will become less likely and may be discarded.

The food history information from the hypothesis-generating questionnaire should be summarized in a food frequency table (see Annex 4 for an example). In this way, all investigators can quickly see the food data that have been collected and start to develop hypotheses.
Step 5. Test hypotheses through analytical studies and food, environmental and laboratory investigations

In this step, the hypotheses that have been developed are tested.

Why should hypotheses be tested?

Hypotheses are tested to check whether the source of the outbreak and the mode of transmission of the illness have been correctly identified.

How can hypotheses be tested?

Hypotheses are tested by examining the evidence. Evidence can be gathered from all aspects of the investigation; some of the main areas are discussed below.

Analytical epidemiological studies

Analytical epidemiological studies are usually either cohort studies or case–control studies. Both types of studies involve using statistical methods to see whether sick people were more likely than well people to have eaten a certain food or had a specific exposure. Because most outbreak investigations are urgent, it may only be possible to undertake a limited study at first. However, a more detailed study may be undertaken at the end of the outbreak (see Step 9). More information about undertaking analytical epidemiological studies is given in the WHO outbreak guidelines (WHO, 2008).

Sample questionnaires for cohort and case–control studies are given in Annex 2. These can be adapted for local use.
Food and environmental investigations

Food and environmental investigations are often carried out at the same time as the other outbreak investigations. If staff from the food safety authority are involved in the outbreak investigation, they should ideally conduct and lead this part of the investigation.

The principal aims of the food and environmental investigations during a foodborne disease outbreak are to:

- identify the source, mode and extent of the food contamination;
- assess the likelihood that pathogens survived processes designed to kill them or to reduce their numbers;
- assess the potential for growth of pathogens during food processing, handling or storage;
- identify and implement ways to fix the issues identified.

Environmental investigations during an outbreak try to find out what the conditions were at the time the suspected foods were prepared (i.e. before the outbreak), rather than simply observing the current conditions. Each suspect food item – and its ingredients – that has been or may be implicated in the outbreak should be thoroughly investigated.

Examples of records that may be useful in an environmental investigation include:

- menus, recipes or product formulations;
- processing records;
- purchasing and inventory records;
- shipping records and other documentation relating to the source of an implicated product;
hazard analysis and critical control points (HACCP) plans and records;

records of corrective action;

flow diagrams of how the food moves through the processing plant/business from raw ingredients to finished product;

floor plans of the establishment;

complaint records;

cleaning records;

food laboratory testing results;

past inspection records;

personnel records (including who was working when, and absenteeism).

The amount of physical evidence may decrease quickly once an outbreak has been identified, so it is important that food and environmental investigations are carried out as soon as possible.

**Investigation of food businesses**

Investigation of a food business will often include the following activities:

- interviews with managers;

- interviews with any employees who may have had a role in the processing or preparation of suspected foods (potentially all employees);

- a review of employee records (to determine whether some were sick and away from work during the period of interest);

- a review of overall operations and hygiene;

- a full process review for specific foods suspected of being the source of the outbreak;
- food and environmental sampling;
- a review of food worker health and hygiene, including collection and analysis of clinical specimens from food handlers with symptoms of illness;
- an assessment of the water system and supply;
- an assessment of the toilet facilities and sewage disposal systems;
- measurement of temperatures in refrigerators or of food and pH and water activity of food, with appropriate equipment.

If a particular food is suspected to be the source or vehicle of the outbreak, efforts should focus on how this particular food was prepared (full process review) and how it may have become contaminated. If laboratory investigations have identified a pathogen, efforts may focus on foods and conditions known to be associated with the particular pathogen. However, be careful not to narrow the focus too much.

Food investigations that lack a clear focus can be expensive, time-consuming and of limited value. The following questions may help to focus an efficient food investigation.

What are the known reservoirs or common sources of the suspected pathogen?

What type of environment does it survive in?

Where and how could the food have been contaminated?

What environmental conditions support the growth and proliferation of the suspected pathogen?
Where are the opportunities for cross-contamination, survival or growth of the pathogen in this environment or establishment?

Investigation of suspect foods

When a specific food is suspected, the investigation should include a complete review of the processing and preparation history, including sources and ingredients, persons involved in the preparation, the procedures and equipment used, potential sources of contamination, and time-and-temperature conditions to which foods were exposed.

Product description

The suspect food should be fully described in terms of:

- all raw materials and ingredients used (menus, recipes, formulations);
- sources of the ingredients;
- physical and chemical characteristics, e.g. pH, water activity;
- use of returned, reworked or leftover foods in processing;
- intended use (e.g. home use, catering, for immediate consumption, for vulnerable groups).

Food process review

The entire range of procedures should be observed, with a focus on the actual processes and work practices, including cleaning methods, schedules, personal hygiene of food-handlers and other relevant information. The temperature history (temperature and duration) of the suspect food should be recorded as completely as possible, including the conditions in which the food was stored, transported,
prepared, cooked, heat-processed, held warm, chilled or reheated. Observation of food-handling practices may be valuable for small-scale operations, in the domestic setting as well as in commercial operations.

**Interviewing food-handlers**

All food-handlers should be interviewed. Information should be obtained about the exact flow of the suspect food, its condition when received by each food-handler, the manner in which it was prepared or handled, and any unusual circumstances or practices during the relevant period. Any recent illnesses among food-handlers (before, during and after the date of the outbreak exposure) and any absences from work should also be noted. Specimens for laboratory analysis should be obtained from any food-handlers who are ill. Depending on the pathogen causing the outbreak, it may be important to try to determine whether food-handlers with a confirmed case of the illness are the potential source of the problem or have been infected after eating contaminated food.

A specific questionnaire for employees should be developed, and all employees should be interviewed regarding their observations and recollections of specific days implicated in the outbreak. Questions may include the following.

- What were each employee's specific duties that day?
- What foods did each person prepare?
- What foods prepared on the premises were eaten (or tasted during preparation) by each staff member?
- Were there any unusual working conditions that day?
Did deliveries arrive on time?

Was all equipment working properly?

Was anyone absent from work because of illness?

Was the food business short-staffed?

Were unusual quantities of food being prepared?

Food and environmental sampling

If laboratory facilities are available, appropriate food and environmental samples should be taken as early as possible, since the amount of physical evidence will decrease with time. The laboratory should be alerted before samples are collected. The laboratory can then provide advice about the types of specimens to collect, how to collect them, and requirements for storage, packing and transport (including the sampling request forms that should accompany each sample).

Food samples

Laboratory analysis of foods for microbial or chemical contamination is time- and resource-intensive and liable to a number of sampling and handling errors. Targeted sampling and laboratory analysis of foods should be directed by epidemiological and environmental investigations. If an implicated food has not
been identified at the time of sampling, a number of specimens may be collected and stored for future laboratory testing, as additional information becomes available.

Food samples that may be appropriate for collection and testing include, in order of importance:

- leftover foods from a suspect meal;
- ingredients used to prepare implicated foods;
- foods from a menu that has been implicated by epidemiological studies;
- foods known to be associated with the pathogen in question;
- foods in an environment that may have permitted the survival or growth of microorganisms.

If a packaged food item is suspected of being the source of an outbreak, it is particularly important to collect unopened packages of that food – ideally, from the same batch. This can help establish whether the food was contaminated before it arrived at the site of preparation. If no foods are left from a suspect meal, samples of the same food made at a different time may be collected instead, although findings from these tests must be interpreted with care. Any ingredients and raw items used in the preparation of the suspect meal that are still available should be sampled. Storage areas, including refrigerators and freezers, should
be checked for items that may have been overlooked; even food retrieved from garbage containers may be useful in an investigation, provided that the testing laboratory is aware of this, so that they can interpret the results appropriately.

The conditions under which samples were collected, the names of the suppliers and distributors, and coding information on packaged foods should be recorded, so that the distribution channels of the product can be determined, if necessary. It is useful to take photographs of any samples taken, as well as any labels and coding information on packaged food products. The team should keep in regular contact with the laboratory staff to ensure that food samples are the correct size, that sampling strategies are agreed where there is a large volume of the implicated foods, and that the correct sample collection, storage, and transportation methods are used.

**Environmental samples**

The purpose of collecting environmental samples is to trace the sources, and evaluate the extent, of contamination that may have led to the outbreak. Samples may be taken from work surfaces, food contact surfaces of equipment, containers, and other surfaces, such as refrigerators and door handles. Environmental samples may also include water used for food processing.

Raw poultry, pork, beef and other meats may be contaminated with *Salmonella*, *Campylobacter*, *Yersinia enterocolitica*, *Clostridium perfringens*, toxigenic *Escherichia coli* and other pathogens when they arrive in kitchens. If any of these agents is suspected in an outbreak, meat scraps, drippings on refrigerator floors and deposits on saws or other equipment can be helpful in tracing the source of contamination. Swabs can also be taken from tables, cutting boards, grinders, slicing machines and other utensils that came into contact with the suspect food. However, as these pathogens are often present in raw products, their detection does not automatically imply that they were the cause of the outbreak.
Food-handlers

Food-handlers can be a source of foodborne contamination; however, indiscriminate sampling of healthy food-handlers (without first having a suspicion that a food-handler was the source of the contamination) is unhelpful. Stool specimens or rectal swabs may be collected from food-handlers for laboratory analysis to identify potential carriers or sources of contamination. Toxin-producing strains of *S. aureus* are carried in the nostrils, on the skin and occasionally in the faeces of many healthy persons. If *S. aureus* intoxication is suspected, the nasopharynx of food-handlers may be swabbed. Swabs should also be taken from skin lesions (pimples, boils, infected cuts, burns, etc.) on unclothed areas of the body. Arrangements should be made for workers to be examined by a medical practitioner if appropriate. If hepatitis A virus (HAV) is suspected, blood from food-handlers can be tested for IgM antibodies against HAV, which are an indication of acute infection.

If ill food-handlers are identified, an immediate decision is needed on whether to exclude those people from work until their symptoms have resolved or until additional investigations have been completed. Local jurisdictions may have different policies and rules regarding exclusion of food-handlers, and different criteria for allowing them to return to work.

Laboratory investigations

General

There are two types of laboratories that are used during foodborne disease investigations: the clinical laboratory, which processes specimens collected from humans, and the food laboratory, which processes food and environmental samples collected by food safety staff.

Most outbreaks of foodborne disease are microbiological in origin and their investigation will usually require laboratories that are proficient at testing for
microbiological agents in human and food samples. If a chemical cause seems likely, it is important to involve chemical laboratories from the beginning.

The role of the clinical laboratory in foodborne disease outbreak investigations includes:

- ensuring that appropriate clinical specimens are collected, stored and transported;
- performing appropriate tests and laboratory investigations of clinical samples;
- advising on further clinical tests and sampling;
- working with other members of the investigation team to identify and characterize the pathogen involved in the outbreak.
- liaising with a Reference Laboratory or Regional Laboratory for further testing or pathogen characterization.

The role of the food laboratory in foodborne disease outbreak investigations includes:

- ensuring that appropriate samples are taken from food and that the samples are stored and transported correctly;
- performing appropriate tests and laboratory investigations of the food to identify the suspect pathogens, toxins or chemicals;
- advising on further testing and sampling when a specific agent is found in the food;
- supporting epidemiological and environmental investigations to detect the pathogen in the implicated food and understand how the outbreak occurred.
- liaising with a Reference Laboratory or Regional Laboratory for further testing or pathogen characterization.
**Microbiological analyses**

In any outbreak of suspected foodborne disease, a microbiologist should be consulted as soon as possible. This person may be a member of the investigating team and may make a site visit to provide technical expertise and take samples.

**Clinical samples**

Faecal samples are the most commonly collected clinical specimens; other samples may include vomit, urine, blood and other clinical specimens (e.g. swabs from rectum, nostrils, skin or nasopharynx) obtained from food-handlers during the food investigations. Detailed information on the collection, storage and transport of clinical specimens is provided in WHO guidelines (2008).

The optimal clinical specimens are those taken from cases who have symptoms. Whenever possible, samples should be taken from individuals who have not received antibiotic treatment for their illness. In large outbreaks, specimens should be obtained from at least 10–20 individuals with illness typical of the outbreak, and from some exposed, but not ill, persons. Once the outbreak etiology has been confirmed (usually two or more samples positive for the same organism), there is usually no need to obtain additional samples from people with characteristic symptoms. In smaller outbreaks, specimens should be collected from as many cases as practicable.

Specimens should be collected from people who have been interviewed, so that a link can be made between the laboratory results and the epidemiological investigations.

Before or immediately after specimen collection, containers should be labelled with a waterproof marking pen with the case's name, identification number, date and time of specimen collection, and any other information required by the
Laboratory. Specimens should be submitted to the laboratory with a completed request form, with an outbreak identification name or code.

**Molecular typing**

Recent advances in laboratory methods have contributed substantially to improvements in the detection and investigation of foodborne disease outbreaks. Molecular microbiology technology has markedly changed the nature of many acute disease epidemiology investigations. Many subtyping and molecular microbiology tests are available only at specialized reference laboratories, and coordination with the primary laboratory involved in an outbreak investigation may be needed.

**Chemical investigations**

The features of important chemical foodborne illnesses are summarized in the WHO guidelines (WHO, 2008). In acute chemical exposures, most toxins or their metabolites are rapidly cleared from easily accessible specimens, such as blood; prompt collection and shipment of specimens are therefore of critical importance.

When collecting samples for chemical analyses, it is important to collaborate closely with the analytical laboratory, make arrangements in advance for chemical samples to be analysed and seek advice about what specimens should be collected and how. The types of specimens to be collected will depend on the suspected chemicals. In an emergency, if it is impossible to contact the laboratory, biological specimens (whole blood, serum, urine and vomit) should be collected as soon as possible, sealed in clean containers and sent to the laboratory promptly. Substances from the ambient air or the collector’s skin or clothes, or interfering substances in collection and storage supplies, may contaminate the specimens, making the results inaccurate. Special care must be taken to avoid cross-contamination; contaminant-free materials (such as special collection containers) may be provided by the laboratory to ensure that external contamination is kept to a minimum. Consultation with the testing laboratory is important to allow accurate interpretation of the results.
Step 6. Identify the point of contamination and the original source of the outbreak

Identifying the point of contamination and the original source of the outbreak may be done by a process called “trace-back” (Figure 7).

**Trace-back**

If a food investigation fails to identify a definite source of contamination at the place of preparation (e.g. infected food-handler or cross-contamination), it may be that contamination occurred at an earlier stage in the food production chain. If multiple outbreaks due to the same pathogen occur at different sites, this provides further evidence of primary contamination at an earlier stage in the food production process. In this case, investigators can perform a trace-back to find out where and how contamination occurred. Trace-back starts with sick people or with the place where the food was prepared, and the implicated food is then traced backwards through its distribution and production networks to its place of origin.

Trace-backs may have the following aims:

- to identify the source and distribution of foods in order to alert the public and remove the contaminated product from the marketplace (food recall);
- to compare the distribution of illnesses and of the product in order to strengthen a suspected epidemiological association (sometimes referred to as an epi trace-back);
- to determine the potential route or source of contamination by evaluating common distribution sites, processors or growers.
Many foods are so commonly contaminated (e.g. Salmonella in poultry) that trace-back has little point. In this case, subsequent procedures, such as thorough cooking, will ensure that the food is safe for consumption.

Food trace-backs are resource-intensive investigations requiring the coordination of many investigators from different agencies and organizations, often spread across different jurisdictions. Trace-backs frequently require the review of detailed data on dates, quantities, sources and conditions of foods received, collection of original shipping containers and labels or other documentation, and information on lot numbers, facilities involved and production dates.
However, in some situations, tracing contamination may be important and should be considered when:

- the pathogen is uncommon, newly emerging or re-emerging or causes serious disease;
- it can be expected that foods will be eaten raw or lightly heated (e.g. shellfish, fresh vegetables, shell eggs);
- little is known about the pathogen;
- unlicensed or illegally sold foods were involved;
- it is suspected that foods were deliberately adulterated;
- the source of contamination is unusual;
- a new or unusual food vehicle is involved.

**Step 7. Control the outbreak**

The ultimate goal of an outbreak investigation is to limit the spread of further illness and prevent similar outbreaks in the future. If a specific food is found to be the source of the outbreak, control measures should be initiated immediately.

This step is perhaps the most critical of the whole investigation, and should not be delayed by waiting for all the results to be confirmed.

**Controlling the source**

Controlling the source of the outbreak may involve the following actions.

1. Remove the food product from shops, markets, restaurant kitchens and homes, through:
   - a food recall, in which businesses involved in the production or distribution of food voluntarily remove products from sale; this may
be initiated by the business itself or undertaken at the request of the appropriate authorities;

- a food seizure, in which authorities forcibly remove food products, if businesses have failed to comply with the recall request; or

- instructing the public to throw away food items already purchased.


2. Temporarily close restaurants, food processing sites or other food premises, until the problem has been resolved. This may be done with the cooperation of the business or may be enforced by law. Once a business has been closed, it should be monitored by the responsible authorities and remain closed until approval is given to reopen.

3. Modify a food production or preparation process.
If faults that may have contributed to the outbreak are discovered in production and preparation processes during the investigation, corrective action must be taken immediately to prevent a recurrence. Examples of corrective action include: modification of a recipe or a process, reorganization of working practices, change in storage temperatures, or modification of instructions to consumers.

Controlling transmission

Public advice
If a contaminated food product cannot be controlled at its source, steps need to be taken to eliminate or minimize opportunities for further transmission of the pathogen. Depending on the situation, appropriate public advice may need to be issued, for example:

to boil microbiologically contaminated water and avoid chemically contaminated water;
how to prepare foods properly;

how to dispose of foods safely;

to cook or avoid unpasteurized products;

to pay attention to personal hygiene measures, such as handwashing.

Exclusion of infected people from work and school

The risk that the infection will be spread by infected people depends on the illness and on standards of hygiene. People with diarrhoea are far more likely to spread infection than asymptomatic individuals with subclinical illness.

Decisions about excluding sick people in specific occupational groups from work should be made by the health authorities, in accordance with local laws and regulations. In general, if the following people have diarrhoea or vomiting, they should stay away from work, school or child care until they are no longer infectious:

- food-handlers whose duties involve touching unwrapped foods to be consumed raw or without further cooking or other forms of treatment;

- people who have direct contact with cases or people in whom gastrointestinal infection would have particularly serious consequences (e.g. the young, the elderly, the immunosuppressed and pregnant women);

- children aged under 5 years;
older children and adults with poor personal hygiene or with unsatisfactory toilet, handwashing or hand-drying facilities at home, work or school.

For more specific exclusion criteria, see the WHO disease outbreak guidelines (WHO, 2008).

Advice on personal hygiene for those with gastrointestinal illness

Advice on personal hygiene should be issued to all individuals with gastrointestinal disease and should include the following specific instructions.

- Avoid preparing food for other people until free from diarrhoea or vomiting.

- Thorough wash hands after defecating or urinating and before meals. Thorough handwashing, with soap in warm running water, and drying are the most important factors in preventing the spread of illness.

- Use your own separate towel to dry your hands. Institutions, particularly schools, should use liquid soap and disposable towels or hand-dryers.

- Clean toilet seats, flush handles, hand-basin taps and toilet door handles with disinfectant after use. If young children are infected, these cleaning procedures must be undertaken on their behalf. Similar arrangements may be necessary in schools and residential institutions (if temporary exclusion is not possible).
Section 3
What to do at the end of the initial investigation
Section 3 lists the steps to be taken at the end of the initial investigation. This phase provides an opportunity for investigators to review the actions taken during the outbreak, identify any particular issues that arose, share the results of the initial investigation and prepare for the next outbreak investigation.

Step 8. Decide an outbreak is over

How do you know when an outbreak has ended?

An outbreak is over when the number of new cases of the illness falls back to the number usually expected, i.e. the background rate of illness. The epicurve will help investigators to see when the number of cases is declining.

The investigators or the ORT (if one was formed) should formally decide when an outbreak is over and issue a statement. However, surveillance for the illness should continue. This is to ensure that there is no subsequent increase in cases, which would indicate that the outbreak was not controlled or that a new, and possibly linked, outbreak has started.

After the outbreak, there should be a structured review, including a formal debriefing meeting with all parties involved in the investigation. The aims of the debriefing are to:

- ensure that control measures for the outbreak have been effective;
assess whether further scientific studies should be conducted;

identify resource needs, structural changes, improvements in surveillance and control practices, or training needs to optimize the response to future outbreaks;

identify factors that compromised the investigations and seek solutions;

update current guidelines and develop new materials as required;

discuss legal issues that may have arisen.

A separate informal discussion session can be held between investigators, which may produce additional insights into the performance of the investigation.

Step 9. Plan more systematic studies

This step considers the need for, and plans, more systematic studies, such as survivor serosurveys, molecular characterization, and environmental and animal reservoir studies.

Once the immediate pressure of the investigation is over, there may be more time to consider the outbreak in more detail. Further studies may be useful, particularly
if new or unusual pathogens were involved or if additional information is needed for risk assessment of a particular pathogen.

Economic evaluations of outbreaks and associated control efforts can be important in assessing the cost-effectiveness of outbreak investigations and food safety measures. Costs associated with outbreaks can be enormous, and quantifying them may help to increase the commitment of the food industry and other agencies to food safety.

Step 10. Communicate the findings of the investigation

The final step of the outbreak investigation is to prepare the outbreak report.

For every outbreak, a brief summary should be completed describing the key outbreak data, findings, conclusions, control measures and recommendations for responses to future outbreaks.

For complex outbreaks, a comprehensive document should be completed as soon as possible after the end of the investigation.

The purpose of the report is to:

- serve as a record of the investigation;
- make recommendations for control and prevention actions;
- serve as a supporting document for potential medical or legal issues;
help reflect on the performance of the investigation and improve the quality of future investigations.

The report should be made available to all investigators and agencies involved in the outbreak, while maintaining confidentiality where necessary and protecting the privacy of cases.

Versions of the report may also be made available to the public, planners and policy-makers in government; a scientific report may be published aimed at the scientific community.

For an example of an outline of an outbreak investigation report, see Annex 5.
Annex 1
Outbreak response team meeting: draft agenda

*Source: WHO (2008)
1. Introduction

2. Minutes of last meeting (if applicable)

3. Outbreak update
   - General situation
   - Epidemiological report
   - Microbiological report
   - Environmental health report
   - Other relevant reports (veterinarians, toxicologist, etc.)

4. Management of outbreak
   - Control measures: cases, general, public health
   - Care of cases: hospital, community
   - Microbiological aspects: specimens and resources

5. Advice to public and to professionals

6. Agree on content of press releases and press arrangements

7. Arrangements for enquiries from the public

8. Obtain contact details of all key personnel during and after working hours

9. Actions to be taken

10. Date and time of next meeting
Annex 2
Questionnaires
Below are two standard questionnaires that can be adapted for use in suspected foodborne disease outbreaks.

**Questionnaire 1. Generating a hypothesis**

This type of questionnaire is useful if there is a cluster of illnesses and there appears to be no common event linking the ill people. The questionnaire is broad to help generate hypotheses about the possible source of the illness.

<table>
<thead>
<tr>
<th>Interviewer’s name:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Date and time of interview:</td>
<td></td>
</tr>
<tr>
<td>Location of interview:</td>
<td></td>
</tr>
</tbody>
</table>
| Person interviewed: | ☐ Suspected case  
☐ Next of kin: specify relationship |

### Section 1. Demographic information

<table>
<thead>
<tr>
<th>Surname:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First name:</td>
<td></td>
</tr>
<tr>
<td>Address:</td>
<td></td>
</tr>
<tr>
<td>Phone number:</td>
<td></td>
</tr>
</tbody>
</table>
| Sex: | ☐ Male  
☐ Female |
| Date of birth: | DD/MM/YYYY |
| Age: |  |
| Occupation:  
*(discuss exclusions, if the case is a food-handler or health care worker)* |  |
### Section 2. Clinical information

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>When did your symptoms begin?</td>
<td>DD/MM/YYYY</td>
</tr>
<tr>
<td>Did you have any of the following symptoms:</td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>☐ Yes ☐ No ☐ Don’t know</td>
</tr>
<tr>
<td>Blood in stool</td>
<td>☐ Yes ☐ No ☐ Don’t know</td>
</tr>
<tr>
<td>Nausea (feeling sick)</td>
<td>☐ Yes ☐ No ☐ Don’t know</td>
</tr>
<tr>
<td>Vomiting (being sick)</td>
<td>☐ Yes ☐ No ☐ Don’t know</td>
</tr>
<tr>
<td>Fever</td>
<td>☐ Yes ☐ No ☐ Don’t know</td>
</tr>
<tr>
<td>Body aches and pain</td>
<td>☐ Yes ☐ No ☐ Don’t know</td>
</tr>
<tr>
<td>Other symptoms Please describe:</td>
<td></td>
</tr>
<tr>
<td>Are you still unwell?</td>
<td>☐ Yes ☐ No ☐ Don’t know</td>
</tr>
<tr>
<td>Duration of diarrhoea</td>
<td>Days:</td>
</tr>
<tr>
<td>Did you see a doctor about this illness?</td>
<td>☐ Yes ☐ No ☐ Don’t know</td>
</tr>
<tr>
<td>Were you admitted to hospital because of this illness?</td>
<td>☐ Yes ☐ No ☐ Don’t know</td>
</tr>
<tr>
<td>Were you given any treatment?</td>
<td>☐ Yes ☐ No ☐ Don’t know</td>
</tr>
<tr>
<td>Did you see a doctor about this illness?</td>
<td>If yes, record name and location of doctor:</td>
</tr>
<tr>
<td>Were you admitted to hospital because of this illness?</td>
<td>Location of hospital:</td>
</tr>
<tr>
<td>Date of admission to hospital: DD/MM/YYYY</td>
<td></td>
</tr>
<tr>
<td>Date of discharge from hospital: DD/MM/YYYY</td>
<td></td>
</tr>
<tr>
<td>Were you given any treatment?</td>
<td>If yes, please describe the medication given:</td>
</tr>
</tbody>
</table>
## Section 3. Exposure information

In the $x$ days ($x$ will depend on the incubation period for the agent involved) before the beginning of your illness, did you:

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have contact with a family member with a similar illness?</td>
<td>□ Yes</td>
<td>□ No</td>
<td>□ Don’t know</td>
</tr>
<tr>
<td>If yes, please give name, contact information and relationship to the case:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have contact with a friend or work colleague with a similar illness?</td>
<td>□ Yes</td>
<td>□ No</td>
<td>□ Don’t know</td>
</tr>
<tr>
<td>If yes, please give name, contact information and relationship to the case:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td>□ Yes</td>
<td>□ No</td>
<td>□ Don’t know</td>
</tr>
<tr>
<td>If yes: Destination of travel: Dates of travel: Where did you stay?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have contact with any animals? (this includes farm animals and pets)</td>
<td>□ Yes</td>
<td>□ No</td>
<td>□ Don’t know</td>
</tr>
<tr>
<td>If yes, please list the animals you were in contact with:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Section 4. Food history

Complete the x-day food history on the following pages. If a detailed food history cannot be recalled, request information on what is usually eaten at each meal.

Collect as much detail as possible for each meal (e.g. for a salad, list all the ingredients; for a meal cooked at home, list everything eaten).

For food eaten outside of the home, obtain information about what food was eaten and where (name and address of place where the person ate).

<table>
<thead>
<tr>
<th>Meal</th>
<th>List all food eaten with as much detail as possible, including ingredients and brands (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Snack between breakfast and lunch</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Lunch</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Snack between lunch and dinner</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Dinner</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Any food after dinner</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Meal</td>
<td>List all food eaten with as much detail as possible, including ingredients and brands (if applicable)</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Breakfast</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Snack between breakfast and lunch</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Lunch</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Snack between lunch and dinner</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Dinner</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
<tr>
<td>Any food after dinner</td>
<td>□ Yes □ No □ Don’t know</td>
</tr>
</tbody>
</table>
Day before onset of illness: day –2  
Date: DD/MM/YYYY  
Day of the week:

<table>
<thead>
<tr>
<th>Meal</th>
<th>List all food eaten with as much detail as possible, including ingredients and brands (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>□ Yes  □ No  □ Don’t know</td>
</tr>
<tr>
<td>Snack between breakfast and lunch</td>
<td>□ Yes  □ No  □ Don’t know</td>
</tr>
<tr>
<td>Lunch</td>
<td>□ Yes  □ No  □ Don’t know</td>
</tr>
<tr>
<td>Snack between lunch and dinner</td>
<td>□ Yes  □ No  □ Don’t know</td>
</tr>
<tr>
<td>Dinner</td>
<td>□ Yes  □ No  □ Don’t know</td>
</tr>
<tr>
<td>Any food after dinner</td>
<td>□ Yes  □ No  □ Don’t know</td>
</tr>
</tbody>
</table>

Continue for as many days as are relevant, based on the incubation period of the suspected pathogen. Generally, 5–7 days would be the maximum expected level of recall to obtain good quality information in this format.
**Section 5. Source of food**

Where does the household normally obtain the following food items?

<table>
<thead>
<tr>
<th>Food item</th>
<th>Name and address of where the food item came from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td></td>
</tr>
<tr>
<td>Chicken and other poultry</td>
<td></td>
</tr>
<tr>
<td>Fruit and vegetables</td>
<td></td>
</tr>
<tr>
<td>Fish and seafood</td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
</tr>
<tr>
<td>General groceries</td>
<td></td>
</tr>
<tr>
<td>(e.g. spices, cooking oil, etc.)</td>
<td></td>
</tr>
</tbody>
</table>
## Section 6. Eating outside the home

### Did you eat any food from the following?

<table>
<thead>
<tr>
<th></th>
<th>Name and address</th>
<th>Food eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Restaurant</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Don’t know</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cafeteria (e.g. at school or work)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Don’t know</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Party or function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Don’t know</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Street stall</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Don’t know</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you ate food outside the home, was there anyone else who was unwell with similar symptoms to you?

<table>
<thead>
<tr>
<th></th>
<th>Name of person and relationship to the case</th>
<th>Name and address of common eating place</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Don’t know</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time. Do you have any questions?

**NOTES:**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Questionnaire 2. Testing the hypothesis

Cohort study

If there was a common event that was attended by multiple cases (e.g. a wedding party), it is possible to consider a cohort study design to identify the possible food item associated with illness. If a cohort study design is appropriate, then a menu of the food served at the event should be obtained. Replace “Food item 1”, “Food item 2”, etc. with each of the food items on the menu. In this example all people who attended the event are considered part of the cohort. Regardless of whether they were sick or not, all of the people in the cohort should be interviewed using the questionnaire below.

<table>
<thead>
<tr>
<th>Interviewer’s name:</th>
<th>Person interviewed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date and time of interview:</td>
<td>Person who attended the wedding party</td>
</tr>
<tr>
<td>Location of interview:</td>
<td>Next of kin: specify relationship</td>
</tr>
</tbody>
</table>

Section 1. Demographic information

<table>
<thead>
<tr>
<th>Surname:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First name:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Address:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone number:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex:</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Date of birth:</td>
<td>DD/MM/YYYY</td>
<td></td>
</tr>
<tr>
<td>Age:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupation:</td>
<td>(discuss exclusions, if the case is a food-handler or health care worker)</td>
<td></td>
</tr>
</tbody>
</table>
**Section 2: Preliminary exposure information**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you attend event x on [date]?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the week before event x, did you attend any parties or functions?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you experience any gastrointestinal illness in the week BEFORE event x on [date]?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you experience any gastrointestinal illness AFTER event x on [date]?</td>
<td></td>
<td></td>
<td>[continue to Section 3: Clinical information]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[skip to Section 5: Food history]</td>
</tr>
</tbody>
</table>

If no, end questionnaire and thank the person for their time.

If yes, describe:

If yes, please indicate when the illness began and its duration:
### Section 3. Clinical information

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>When did your symptoms begin?</td>
<td>DD/MM/YYYY</td>
</tr>
<tr>
<td>Did you have any of the following symptoms?</td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Blood in stool</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Nausea (feeling sick)</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Vomiting (being sick)</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Fever</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Body aches and pain</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Other symptoms Please describe:</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Are you still unwell?</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Duration of diarrhoea</td>
<td>Days:</td>
</tr>
<tr>
<td>Did you see a doctor about this illness?</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>If yes, record name and location of doctor:</td>
<td></td>
</tr>
<tr>
<td>Were you admitted to hospital because of this illness?</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Location of hospital:</td>
<td></td>
</tr>
<tr>
<td>Date of admission to hospital: DD/MM/YYYY</td>
<td></td>
</tr>
<tr>
<td>Date of discharge from hospital: DD/MM/YYYY</td>
<td></td>
</tr>
<tr>
<td>Were you given any treatment?</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>If yes, please describe the medication given:</td>
<td></td>
</tr>
</tbody>
</table>
### Section 4. Exposure information

In the \( x \) days (\( x \) will depend on the incubation period for the agent involved) before the beginning of your illness, did you:

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have contact with a family member with a similar illness?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Have contact with a friend or work colleague with a similar illness?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

If yes, please give name, contact information and relationship to the case:

### Section 5. Food history

Complete this section for testing the hypothesis.

<table>
<thead>
<tr>
<th>Food item</th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food item 1</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Food item 2</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Food item 3</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Food item 4</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Food item 5</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Continue adding food items, until all of the food on the menu has been included

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Were there any other foods from event ( x ) that you ate that I have not mentioned?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

If yes, please describe:
Thank you for your time. Do you have any questions?

**NOTES:**


---

*Case-control study*

If certain food items were found, in the preliminary hypothesis-generating interviews, to have been frequently consumed by cases, they should be included in section 4 of this questionnaire. Replace “Food item 1”, “Food item 2”, etc. by the suspected food items.

<table>
<thead>
<tr>
<th>Interviewer’s name:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Date and time of interview:</td>
<td></td>
</tr>
<tr>
<td>Location of interview:</td>
<td></td>
</tr>
<tr>
<td>Person interviewed:</td>
<td></td>
</tr>
</tbody>
</table>

- Case
- Next of kin of a case: specify relationship
- Control
- Next of kin of a control: specify relationship
### Section 1. Demographic information

<table>
<thead>
<tr>
<th>Surname:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First name:</td>
<td></td>
</tr>
<tr>
<td>Address:</td>
<td></td>
</tr>
<tr>
<td>Phone number:</td>
<td></td>
</tr>
<tr>
<td>Sex:</td>
<td>Male □ Female □</td>
</tr>
<tr>
<td>Date of birth:</td>
<td>DD/MM/YYYY</td>
</tr>
<tr>
<td>Age:</td>
<td></td>
</tr>
<tr>
<td>Occupation:</td>
<td>(discuss exclusions, if the case is a food-handler or health care worker)</td>
</tr>
</tbody>
</table>

### Section 2: Preliminary exposure information

<table>
<thead>
<tr>
<th>Have you experienced any gastrointestinal illness since [date-insert the beginning of the exposure period you are interested in]?</th>
<th>□ Yes [continue to Section 3: Clinical information]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>□ No [skip to Section 4: Exposure information]</td>
</tr>
</tbody>
</table>
## Section 3. Clinical information

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>When did your symptoms begin?</td>
<td>DD/MM/YYYY</td>
</tr>
<tr>
<td>Time:</td>
<td></td>
</tr>
<tr>
<td>Did you have any of the following symptoms:</td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Blood in stool</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Nausea (feeling sick)</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Vomiting (being sick)</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Fever</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Body aches and pain</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Other symptoms Please describe:</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Are you still unwell?</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>Duration of diarrhoea</td>
<td>Days:</td>
</tr>
<tr>
<td>Did you see a doctor about this illness?</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>If yes, record name and location of doctor:</td>
<td></td>
</tr>
<tr>
<td>Were you admitted to hospital because of this illness?</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>If yes, record: Location of hospital:</td>
<td></td>
</tr>
<tr>
<td>Date of admission to hospital: DD/MM/YYYY</td>
<td></td>
</tr>
<tr>
<td>Date of discharge from hospital: DD/MM/YYYY</td>
<td></td>
</tr>
<tr>
<td>Were you given any treatment?</td>
<td>Yes/No/Don’t know</td>
</tr>
<tr>
<td>If yes, please describe the medication given:</td>
<td></td>
</tr>
</tbody>
</table>
Section 4. Exposure information

For cases: In the \( x \) days (\( x \) will depend on the incubation period for the agent involved) before the beginning of your illness, did you:

For controls: In the \( x \) days before today, did you:

<table>
<thead>
<tr>
<th>Have contact with a family member with diarrhoea?</th>
<th>□ Yes □ No □ Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>If yes, please give name, contact information and relationship to the case:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Have contact with a friend or work colleague with diarrhoea?</th>
<th>□ Yes □ No □ Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>If yes, please give name, contact information and relationship to the case:</td>
<td></td>
</tr>
</tbody>
</table>
## Section 5. Food history

Complete this section for testing the hypothesis.

<table>
<thead>
<tr>
<th>Food item 1</th>
<th>Place of purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food item 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food item 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food item 4</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food item 5</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

*Continue adding food items, until all of the frequently eaten food items mentioned in the hypothesis-generating interviews have been included.*

Thank you for your time. Do you have any questions?

**NOTES:**

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Annex 3

Sample line-list
Below is an example of a line-list. Each person who meets the case definition should be included in the list.

<table>
<thead>
<tr>
<th>ID</th>
<th>Family name</th>
<th>Given name</th>
<th>Age</th>
<th>Sex</th>
<th>Date of onset of illness</th>
<th>Time of onset of illness</th>
<th>Symptoms</th>
<th>Information about possible exposure (e.g. attended event x)</th>
<th>Specimen collected (Y/N)</th>
<th>Laboratory results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smith</td>
<td>Lee</td>
<td>12</td>
<td>F</td>
<td>12/3/2015</td>
<td>0900</td>
<td>Diarrhoea, vomiting</td>
<td>Y</td>
<td>Y pending</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Khut</td>
<td>Bee Lee</td>
<td>56</td>
<td>M</td>
<td>12/3/2015</td>
<td>1300</td>
<td>Diarrhoea</td>
<td>Y</td>
<td>Y Salmonella</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Otsu</td>
<td>Reiko</td>
<td>45</td>
<td>F</td>
<td>13/3/2015</td>
<td>0100</td>
<td>Diarrhoea</td>
<td>Still to interview</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Annex 4
Food frequency tables
Everyone with an illness that meets the case definition should be interviewed, and a food history should be obtained using a standard questionnaire. The information from the questionnaire can then be entered into a food frequency table, to help identify food items that have been commonly consumed by each of the cases. An example of a food frequency table is given below.

Here are some tips for completing and interpreting a food frequency table:

- In the interviews, obtain as much detail as possible about the foods that were consumed. For example, if a person reports eating fresh fish, find out what type of fish it was, where it was purchased and how it was prepared (e.g. eaten raw, grilled, battered and fried).

- When entering data into the food frequency table, keep the food categories generally broad. If all the detail from the interview is included, the table will become complicated and difficult to interpret. In the example below, the most frequently eaten food items were fresh fish, cucumber, garlic and rice. Interestingly, three of the cases also ate food at a wedding party in village x on 23 March 2015.

- Generally, only food prepared at home is included in the food frequency table. Food eaten outside the home environment is listed in a separate section. This approach allows the investigators to assess whether the food item causing the illness is distributed in the food chain for consumption by the general population, or if there was a common event where contaminated food may have been served.
When interpreting the results in a food frequency table, it is important to have some understanding of which foods are frequently consumed in the affected community. Using the food frequency table below, the high consumption of fresh fish may be related to the fact that villages x and y are fishing villages on a river and most people eat fresh fish every day. It is, therefore, not unusual for fresh fish to be frequently consumed. However, if villages x and y are inland and fish is not commonly consumed in these communities, this may provide an indication of a possible source of the illness and may warrant further investigation (e.g. checking to see what type of fresh fish was consumed and where it was purchased).
<table>
<thead>
<tr>
<th>ID</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>23</td>
<td>52</td>
<td>12</td>
<td>43</td>
</tr>
<tr>
<td>Sex</td>
<td>M</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Location</td>
<td>Village x</td>
<td>Village x</td>
<td>Village y</td>
<td>Village x</td>
</tr>
<tr>
<td><strong>Food Items</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
</tr>
<tr>
<td><strong>Meat</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Pork</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Beef</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fresh fish</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Dried fish</td>
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<tr>
<td>Jackfruit</td>
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<td><strong>Cereals</strong></td>
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<td>Rice</td>
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<td><strong>Eating outside home</strong></td>
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<td>Cafe Y</td>
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Annex 5
Outline of an outbreak investigation report
Cover page

Title of report

Indicate whether this is a preliminary or a final report. Keep the title short and memorable, but include information on the type of problem under investigation, the location and date.

Date of report

Names and affiliations of the main authors and investigators

Abstract

The abstract should be written after the report has been completed. It should stand alone and contain the most relevant data and conclusions. All data mentioned in the abstract must also appear in the main report.

Report

Introduction

☐ Statement of the problem and its public health importance.

☐ Details and timeframe of the initial source of information.

☐ Reasons for investigating event.

☐ Types of investigation conducted.

☐ Agencies involved.

Background

Generally available information to help the reader interpret the epidemiology and data presented in the report (population size, socioeconomic status of community, ethnicity, etc.). If the outbreak occurred in a food premises, include a description of the premises (size of restaurant, usual practices and operations, etc.).
The background includes:

- a description of the problem;
- the sequence of events leading to the study or investigation;
- a brief statement of the working hypothesis.

Objectives

Specify the targets of the investigations. Keep the objectives concise and follow a logical, sequential pattern. The objectives may include the hypotheses, if any, to be tested.

Methods

Epidemiology:

- description of study population;
- type of study conducted;
- case definition;
- procedures for case-ascertainment and selection of controls (if any);
- methods of data collection, including questionnaire design, administration and contents;
- methods of data analysis.

Medical laboratory testing:

- methods of specimen collection and processing;
- name of laboratory carrying out tests;
- laboratory techniques employed and methods of data analysis.
Food and food testing:

- description of inspection process;
- methods of food and environmental sampling;
- name of laboratory carrying out tests;
- laboratory techniques employed and methods of data analysis.

Results

Present all pertinent results from clinical, laboratory, epidemiological and environmental studies. Present the results in the same order as described in the methods section. Do not interpret or discuss the data in this section.

Epidemiology:

- number of cases, overall attack rate;
- clinical details of illness (symptoms, duration, hospitalization, outcome, etc.);
- descriptive epidemiology by time (epidemic curve), place and person (age, sex, specific characteristics) expressed as rates;
- further data analysis and data presentation depending on specific studies undertaken (e.g. cohort or case–control study).

Laboratory (microbiological, chemical, toxicological):

- number of specimens collected;
- findings by type of laboratory analysis.

Food investigation and food testing:

- findings of food inspections;
- results of laboratory tests performed on food and environmental samples.
Discussion

The discussion is the most important part of the report and should cover:

- a summary of the major findings;
- the likely accuracy of the results;
- conclusions, with justification of those conclusions and explanation of why alternative explanations were rejected;
- the relationship of the results to other studies and the literature;
- the implications of the findings;
- an assessment of control measures;
- needs for future research.

Recommendations

Initial recommendations and those for future prevention and control should be listed numerically.

References

Select appropriate references, including reviews in major scientific journals. Follow a standard style of referencing (e.g. Vancouver style), numbering the references in the order in which they appear in the text.

Appendices

- Questionnaires and/or other survey forms.
- Appropriate field report.
- Any other relevant documents, including press releases.
References


• CDC (2013c) *Finding the point of contamination and source of the food*. Atlanta, GA, Centers for Disease Control and Prevention [http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/investigations/contamination.html; accessed 1 April 2015].


