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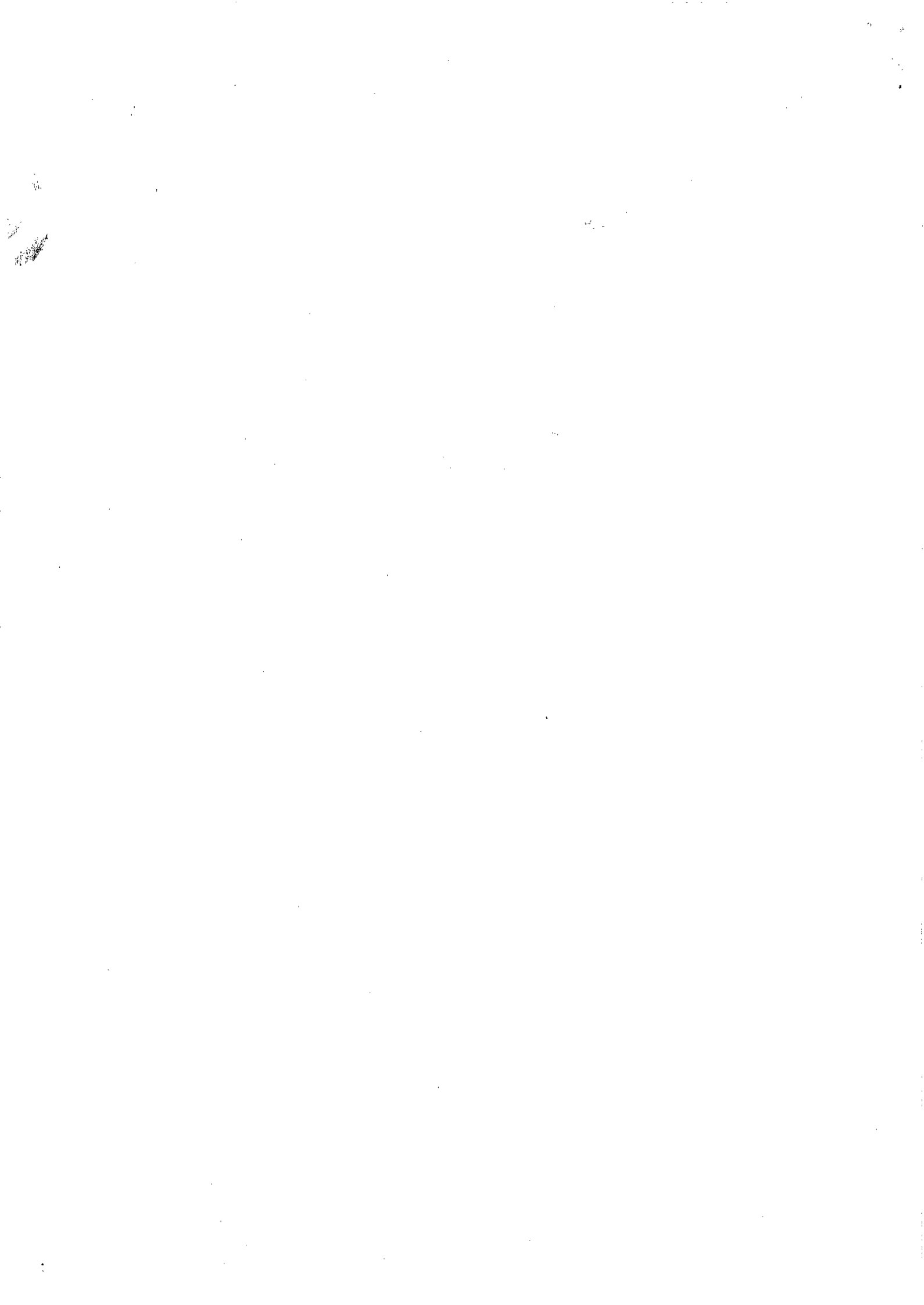
ENGLISH ONLY

MASTER DOCUMENT ✓

***GUIDELINES FOR  
ORGANIZATION AND  
MANAGEMENT OF  
SURVEILLANCE  
OF FOODBORNE DISEASES***

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EDITOR

Dr G. I. Forbes  
Scottish Home and Health Department, St Andrew's House, Edinburgh EH1 3DE, United Kingdom

COORDINATORS

Dr A. Koulikovskii  
Food Hygienist, Veterinary Public Health, Division of Communicable Diseases, World Health Organization (WHO), CH - 1211 Geneva 27

Dr Z. Matyas  
Chief, Veterinary Public Health, Division of Communicable Diseases, World Health Organization (WHO), CH - 1211 Geneva 27

Dr L. Reinius  
FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses, Wilski Strasse 55, Berlin (West)

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The World Health Organization acknowledges with gratitude the special contributions made by the following persons who provided written or other contributions:

Dr M. Abdussalam  
Director, International & Scientific Cooperation, Institute of Veterinary Medicine, R. von Ostertag Institute, FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses, Wilskistrasse 55, 1000 Berlin 37 (West)

Mrs B. Blomberg  
Regional Officer, Environmental Legislation and Food Safety, WHO Regional Office for Europe, Copenhagen, Denmark

Dr F. L. Bryan  
Chief, Foodborne Disease Training, Instructional Services Division, Bureau of Training, Center for Disease Control, Department of Health, Education, and Welfare, Public Health Service, Atlanta, Georgia 30333, USA

Dr I. D. Carter  
Chief, Epidemiological Surveillance of Communicable Diseases, Division of Communicable Diseases, WHO, Geneva, Switzerland

Dr G. I. Forbes  
Scottish Home and Health Department, St Andrew's House, Edinburgh, EH1 3DE, UK

Professor D. Grossklau  
Director, FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses, Institute for Veterinary Medicine, R. von Ostertag Institute, Thielallee 88/92, Berlin (West)

Dr Z. Matyas  
Chief, Veterinary Public Health, Division of Communicable Diseases, WHO, Geneva, Switzerland

Dr L. Reinius  
Institute of Veterinary Medicine, R. von Ostertag Institute, FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses, Wilskistrasse 55, 1000 Berlin 37 (West)

Dr P. Teufel  
Institute of Veterinary Medicine, R. von Ostertag Institute, FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses, Thielallee 88/92, 1000 Berlin 33 (West)

Dr B. Velimirovic  
Regional Adviser, Communicable Diseases, WHO Regional Office for Europe, Copenhagen,  
Denmark

Dr J. Wegener  
Institute of Veterinary Medicine, R. von Ostertag Institute, FAO/WHO Collaborating Centre  
for Research and Training in Food Hygiene and Zoonoses, Thielallee 88/92, 1000 Berlin 33  
(West)

and also -

Mrs P. Lonati,  
Veterinary Public Health Unit, Division of Communicable Diseases, World Health  
Organization, Geneva

Copies of the guide are available from the Veterinary Public Health  
Unit, Division of Communicable Diseases, World Health Organization, Geneva

## 1. INTRODUCTION

Data from various parts of the world show that foodborne diseases constitute an important cause of morbidity and mortality in man. In addition to the physical suffering of people, considerable other socioeconomic consequences occur, such as loss of time at work and the cost of hospitalization, rehabilitation and lost food. It is, therefore, in the interest of every country to take adequate measures to prevent and control these diseases.

The efficacy of these measures depends essentially on the availability of reliable information on foodborne diseases, but unfortunately this information is often collected by means of inadequately planned and imperfectly operated national surveillance programmes. Because of the potential international spread of foodborne diseases, there is also a need for surveillance at the international level and in particular for rapid analysis of the relevant data to make possible the swift application of measures for preventing spread. To meet this need the World Health Organization is establishing a worldwide surveillance programme for control of foodborne infections and intoxications, starting with activities in Europe.

Surveillance in this context means the collection and interpretation of data on epidemiology, including causation and incidence of foodborne diseases, to enable responsible authorities to concentrate on appropriate prevention and control measures.

Within the WHO programme, surveillance is not an isolated activity. It is a part of an effective control programme and it should be used to formulate and execute a disease control policy.

The principal components of a surveillance programme are the reporting of the occurrence of these diseases including: (1) the presence of corresponding pathogens in human beings, animals, food and the environment; (2) investigation of outbreaks and sporadic cases; (3) collation and interpretation of the data gathered; and (4) dissemination of information to facilitate speedy and efficient action. Systematic reporting, which is an integral part of any surveillance programme, permits prompt analysis of data for use in prevention and control programmes and also formulation of long-term plans for diminishing the effects of foodborne illnesses. In addition, a surveillance programme enables assessment of the impact of various control measures on the disease situation in question and thus furthers the development of methods for prevention and control of these diseases.

At the present time, information available on the occurrence and epidemiology of foodborne diseases in many countries is scarce. Although possibilities exist for using national experience internationally or even across the border between neighbouring countries, these are restricted because of the variability of the methodologies used in the respective surveillance programmes. Problems connected to foodborne diseases do not, however, relate to national boundaries. Further development of national surveillance programmes and of international coordination in this field is needed.

The aim of the guidelines is to summarize general principles for organization of a surveillance system for foodborne diseases, including epidemiological investigation. The document is intended to be used by a wide variety of public health workers concerned with prevention and control of foodborne disease.

The contents of the booklet are restricted to guidelines on diseases caused by, or thought to be caused by, ingestion of food. Those actually dealing with waterborne diseases should refer to the already existing excellent manual.

## 2. ORGANIZATION OF A SURVEILLANCE PROGRAMME

### 2.1 The purpose of a surveillance programme

The purpose of a surveillance programme for foodborne diseases is to undertake the following using available resources:

- (1) collect epidemiological and other relevant information
- (2) identify the causes of foodborne diseases
- (3) classify and record collected data
- (4) analyze and evaluate data
- (5) formulate recommendations for decision-making; and
- (6) quick dissemination of information to those responsible for control or preventive action.

Surveillance of foodborne infections and intoxications is a part of overall disease surveillance and does not require a separate activity. However, it does add additional elements to a control programme inasmuch as it can include surveillance of food, of food production and processing, of the food environment and of other related factors, as well as collection of morbidity, mortality and laboratory data. This means that the investigation of episodes of foodborne illness as well as monitoring of actual and potential sources of pathogens and toxins requires the participation of staff employed in a much wider range of disciplines than is required for surveillance of most other diseases and who may be working in different government agencies and administrations. It is logical that the main focal point for the surveillance of foodborne diseases should be the service which is responsible for surveillance of other communicable diseases. It is important that these offices should have an effective and close working relationship with other related services, including the veterinary and food hygiene services, food control administrations, agricultural services and environmental health services. The lack of such liaison has been the principal weakness of many foodborne disease surveillance programmes in the past. One of the methods of assuring cooperation which has been found effective in many countries has been the creation of veterinary public health units in health administrations.<sup>2</sup>

The number of diseases included in a surveillance programme predetermines a programme's scope and level of activity.\* If only a single disease, e.g. shellfish poisoning, is included, the programme would be relatively simple, but surveillance of a disease like salmonellosis would require a more elaborate organization. If five or more diseases are included the programme will be large and would require extensive organization. The priorities which determine the scope and level of surveillance should be based not only on the seriousness and frequency of the disease, but also on the feasibility of control and on the economic implications. Also availability of trained manpower, laboratory services, communications and other resources have to be considered in determining the type of organization required. Some surveillance activity, nevertheless, is possible even in less-developed parts of the world.

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\* Annex 1 gives the list of agents included in the WHO Surveillance Programme for the Control of Foodborne Infections and Intoxications in Europe.

## 2.2 Organization of information collection

The type and scope of epidemiological information collection is determined by the various methods of reporting which constitute or are relevant to the surveillance of foodborne infections and intoxications.

Reporting of outbreaks is a most important element of disease surveillance. Sporadic cases of many foodborne diseases may be reported if severe, but mild cases are rarely notified. Outbreaks are, however, more frequently reported and may be detected by non-medical personnel such as school teachers, community and religious leaders, and the lay press. Incompleteness of morbidity reporting is well recognized and must be taken into account when interpreting data. Various methods to encourage prompt reporting which have been proposed are payment of a fee to the reporting physician, and provision of free communication facilities or other suitable services, but all are of limited value.

A measure which should be emphasized is that the form of the report should be as comprehensive as possible. For many diseases, the first report may contain only the name, age, sex and residence of the patient, the symptoms, signs or diagnosis, date of onset of symptoms and the suspected food. Other details will emerge in the following investigation. In the case of an epidemic or an outbreak the quickest means of reporting (telephone, telegram, etc.) should be used even if no final diagnosis has been made.

When implementing the programme care should be taken to ensure, as far as possible, that reporting does not result in restrictive measures, economic embargos or charges of negligence or malpractice.

Mortality registration is nearly complete in most European countries but the certified cause of death is partial or inaccurate in many cases. In acute and severe food poisoning, correlation of mortality with morbidity is not difficult, but in other cases certain indices may have to be worked out to interpret the significance of the findings.

Results of laboratory investigations carried out by public health, hospital and other clinical laboratories in connexion with sporadic or cluster cases are usually available along with or following morbidity reports. They are a very important part of surveillance data and confirmation of aetiology and diagnosis make the information more valuable. Sometimes laboratory examination of material carried out for other purposes provides information on the existence of foodborne disease and may be the starting point for further investigations. Close liaison between the laboratory and investigation teams is essential.

Emergencies such as: the appearance of a serious disease, or a new disease new to the area, or a large-scale intoxication or contamination of food, should be reported by the authorities in the affected region and dealt with by appropriate means.

Food and water supplies may be contaminated, or endangered of being so, during floods, earthquakes and other natural disasters.

Information concerning non-human sources of contamination. The main places of non-human sources of contamination are food producing and processing establishments (farms, dairies, slaughterhouses, fishing and shellfish gathering areas), the foodstuffs in commerce (including international trade) and stores, mills, bakeries, restaurants and other food establishments. The information from these sources comes mainly from the veterinary services (slaughterhouses, dairies, animal farms, fish and other food markets, feed processing plants, etc.), public health and environmental health services, wildlife and fisheries management agencies and food and drug administrations. These sources of information have to be identified locally and effective links for smooth and rapid flow of information to the surveillance centre established.

Special surveys. In addition to continuous surveillance of foodborne diseases, special surveys may be carried out for specific purposes. Surveillance activities may suggest the nature of surveys that should be undertaken. For example, socioeconomic and behavioural factors can be studied in order to fix priorities for control programmes and allocate

resources. Although epidemiological data collected in routine surveillance are useful for part of these studies, special investigations are required to get information on which decisions can be based.

For evaluation of economic factors, the losses caused by the disease and losses from condemnation of food and interference with the food trade have to be investigated and balanced with the benefits from the cost of surveillance and control programmes.

Food is of universal interest and outbreaks of food poisoning, for example, can cause considerable emotional reaction in the community. These effects are difficult to measure but have to be taken into consideration in addition to economic factors in determining priorities. Sometimes these community reactions get translated into political problems especially if badly or over-reported in the mass media.

Behavioural factors related to food are numerous and may have a cultural (mostly religious) or psychophysiological basis, or may result from popular beliefs about the health promoting or invigorating properties of certain types of food (e.g. raw meat or raw milk). A health education programme coupled with the surveillance programme is necessary to deal with these matters. All epidemiological and most special studies require basic data such as demographic information, geographical and climatic data, animal census and food production and environmental data. This information is usually available from a central statistical office or directly from the relevant agency in a country.

Organization of a notification system. The first reports of the occurrence of suspected foodborne illness are usually made by physicians, hospitals, or dispensaries or by affected persons or their relatives and should be received in the office of the health agency responsible for epidemiological work in the area. Such a centre may be the focal point for a city, rural district or other geographical division according to the size and administrative pattern of the country and of the health agency. The reports should be recorded and immediately passed on to the epidemiologist or other professional(s) responsible for the investigation and control work. They should also be passed on to those responsible for related disciplines; for example, to the veterinary agency if a zoonosis or food of animal origin are suspected, or the food control agency if mishandling within the food chain is a possibility.

After the initial report has been investigated, the results should be conveyed to the local offices of the food control, veterinary and environmental agencies, some of which may participate in the inquiry. At the same time, the provincial (state) or central authorities should be informed. A central epidemiological bureau in each country should be responsible for receiving, storing and analysing information and passing on the necessary summaries to other countries and international agencies.

The internal system of notification should be as simple as possible and should aim at speedy transmission of reports to all concerned in this multidisciplinary activity. Each country must develop its own system taking account of the principles mentioned above and in the light of prevailing conditions. The list of diseases which are notifiable may vary from country to country but mainly should include those diseases of medical or economic importance which can be adequately investigated and controlled with existing resources.

Dissemination of information. Reports of surveillance should be disseminated rapidly to those who are responsible for control action. These reports should contain not only factual information but, if possible, statistical data analysis of the situation that contributed to the outbreaks and recommendations for action to be taken.

The information should also be sent to various agencies which are concerned with food and especially to those who provided data or otherwise participated. Internationally, neighbouring countries and WHO/FAO should be informed.

The frequency of dissemination depends on the type of action expected (immediate or long-term) on the nature of the infection or intoxication and whether it is endemic or new to the area. The diseases selected for surveillance and relevant monitoring information can be classified into groups for immediate (telephone, telex, telegram) weekly, monthly, quarterly or yearly reporting.

Legislation. Legal traditions and administrative systems vary in different countries. The proposed legislation must fit in with the national system. It is also important that in each country experience from a system already in existence be taken into account and that this system be amended and improved rather than be substituted by something radically new. A certain degree of uniformity is desired, however, in order to make it possible to compare results between countries participating in the programme and to plan action to prevent outbreaks of foodborne disease.

The main points of surveillance that could be covered by legislation include:

- (a) notification of persons suffering from food poisoning;
- (b) fees for notification;
- (c) examination of infected persons;
- (d) discontinuation of an infected person's employment;
- (e) compensation for loss of employment;
- (f) examination and detention or treatment of food;
- (g) compensation for detention/destruction/treatment of food, and
- (h) control and inspection of food premises.

International cooperation. International cooperation between countries for the control of foodborne disease should include rapid exchange of information concerning outbreaks to enable appropriate preventive and control measures to be taken. Of special importance in this connexion are epidemiological and laboratory data as well as information on procedures used in the investigation.

The distribution of information from one country to another is sometimes withheld if the outbreaks of disease are of unknown or uncertain aetiology or if the outbreaks could effect export trade or the tourist industry. However, these constraints can, to a large extent, be overcome by appropriate measures and every effort should be made to ensure that the international surveillance system provides the necessary information.

Those responsible for prevention and control of foodborne disease will be in a better position to react on often distorted and inaccurate press reports or radio and television broadcasts, if a surveillance system is extended over a whole region. Each of the participating countries will have information on the extent and mode of spread of important foodborne infections and intoxications.

International surveillance should preferably be based on a uniform reporting system which greatly facilitates evaluation and collation. Action in this direction is presently being taken in some of the regions of the world in collaboration with relevant international organizations, in particular FAO and WHO. An optimal surveillance system would obviously have to comprise all regions thus making it possible for all countries to benefit from the knowledge, skills and experiences of others. Establishing a world-wide system of surveillance

is greatly facilitated by the development of modern and rapid procedures for the automatic handling of data. This development has enlarged the possibilities for international disease reporting in general and thus also for reporting of foodborne diseases, which in most of the countries in the world has been inadequate when taken into account with the great public health importance of these diseases.

### 2.3 Surveillance of food, food premises and food processing

In any surveillance programme for foodborne diseases it is important to monitor suspect foodstuffs and inspect food premises as well as food processing. Such surveillance can identify the importance of the various types of food, food habits of those who prepare and eat it, and food preparation and hygiene in food processing establishments. It is possible that no one officer is responsible for all types of food premises and responsibility may be divided, e.g. veterinarians responsible for slaughterhouses, dairies and meat packing establishments, and health officers responsible for restaurants, bakeries and other premises where food is sold or consumed. Whatever the division of responsibility, the officer in charge must be aware of:

- (a) diseases that are likely to occur from foods processed or prepared on the premises he is responsible for;
- (b) pathogens or toxins that are likely to be transmitted by particular foods;
- (c) processing or preparation procedures which were causal factors of the outbreak, and
- (d) control measures that are applicable for a specific type of food establishment or a type of food.

The regular sampling of high-risk food, e.g. milk, can do much to maintain standards and detect hazards and periodic inspection can aid in establishing and maintaining a high level of hygiene and cleanliness.

It should always be kept in mind that new and modified technologies may introduce additional opportunities for the entry of microbiological contaminants and for their survival or proliferation along the food chain. This may require a new approach to hazard control. In this connexion, the Report of the WHO/ICMSF Meeting on Hazard Analysis: Critical Control Point System in Food Hygiene, may be useful.<sup>3</sup>

Food. Epidemiological features of various types of food are given below:

Food of animal origin. In most countries that conduct foodborne disease surveillance, the majority of foods of animal origin are identified as vehicles of most outbreaks. Therefore it is important that these products receive stringent inspection and examination and be sampled during outbreak investigations.

Meat, meat products, poultry and mixed food containing meat and poultry are common sources of Salmonella, Clostridium perfringens, Campylobacter jejuni, and Staphylococcus aureus, while Clostridium botulinum can be an important public health problem in areas where home canning or curing of hams is a common practice. Parasites (Trichinella and Taenia) are common e.g. in areas where there is no adequate meat inspection programme. Investigation of meat- or poultry-associated outbreaks of foodborne disease usually indicates time-temperature abuse after cooking. Also, many cases of foodborne diseases are due to faulty handling (thawing, heating, storage) of food of animal origin.

Fish and shellfish are implicated in bacterial, viral and parasitic infestations. They may also carry biotoxins and heavy metals. Regional variations in these conditions are great and must be taken into account in the surveillance programme. For example, Vibrio parahaemolyticus is a common cause of foodborne illness in countries with temperate or warm

climates where raw fish or shellfish are eaten. Outbreaks of cholera, hepatitis A and heavy metal intoxication have followed the harvesting of aquatic food from estuaries and polluted coastal waters. Another problem for certain regions is the accumulation of dinoflagellate toxins (saxitoxin) in shellfish which make them poisonous. Thermoresistant histamine or histamine-like products can form in certain fish (tuna, mackerel, dolphin) that are improperly refrigerated. Clostridium botulinum type E poses a special problem in smoked, vacuum-packed fresh water fish and fermented fish eggs and meat from marine mammals.

Eggs and egg products are vehicles of Salmonella outbreaks. Duck eggs are commonly contaminated with Salmonella and therefore special attention should be paid to them. Bulk egg products such as liquid, frozen or dried egg whites or yolks must always be viewed with suspicion unless they have undergone a heat treatment process (pasteurization).

Milk can be a very important source of outbreaks of salmonellosis unless it has been heat treated. Tuberculosis, brucellosis and campylobacteriosis can also be spread by raw milk. Dried milk products have been sources of Salmonella and staphylococcal enterotoxin. Cheese made from unpasteurized milk is a well-known vehicle of Brucella and has been the vehicle of S. aureus enterotoxin and Salmonella. In short, any milk or milk product which has not been heat treated must be considered as a prime suspect in any outbreak investigation where it is recorded they have been consumed.

Food of plant origin. Food of non-animal origin is not so often implicated in foodborne diseases, but the risks can be significant and thus should not be neglected in a surveillance programme.

Vegetables and fruit, eaten raw, unwashed or without peeling must be suspected as carriers of enteric microorganisms or pesticides.

Fields and crops fertilized or irrigated by sewage may be contaminated by organisms such as Shigella, Salmonella, pathogenic E. coli, viruses and parasites. Improper application of pesticides and herbicides to fields and crops can lead to contamination of the harvested food. Some vegetables and pulses have natural poisons which can cause acute disease or chronic illness (e.g. lathyrism).

Cereals, particularly rice, and foods containing corn starch are often contaminated with Bacillus cereus. Mouldy grains and nuts can contain mycotoxins.

Cream filled foods, desserts and sweets, and soft ice-cream are known as important vehicles in outbreaks of salmonellosis and staphylococcal food poisoning. Careful attention should be paid in addition to the contamination of the raw materials and the risk of recontamination during subsequent handling and of subsequent storage.

Canned food, particularly canned vegetables, if insufficiently heated as sometimes occurs during homecanning have been incriminated in outbreaks of botulism. Canning procedures should be inspected with special emphasis on the technique of the canning procedure including heat treatment, leakage and cooling water control.

Surveillance of food premises and food processing. Food premises range from establishments where only one process is carried out to establishments where many processes are performed. The problems associated with each type of establishment can be many and varied and therefore an investigator must have a detailed knowledge of the various types of premises and processes. Inspection and control of food premises which is a usual part of food hygiene programmes are also a part of the surveillance system and require: a) adequate and regular inspection of the buildings in which the food process is being carried out and b) regular monitoring of the actual food process whether it be processing, storage or preparing.

Food premises. Besides processing two aspects need consideration: structure of the premises, and utensils, including equipment.

The location of food premises should be given due attention. Dust, water, drainage effluent and waste disposal systems can serve as vehicles in the spread of foodborne disease pathogens. Many of the problems associated with dirty or poorly run, unhygienic food premises can be traced to an inadequate understanding of foodborne disease both by management and workers alike. Much can be done in the field by a properly conducted health education programme.

In routine inspection of food premises, attention should be given to the following potential problem areas:

- a) the mode of construction and design of working areas and facilities provided
- b) possibilities for access and harbouring of pests
- c) separation of working areas from other rooms or premises by partition, location or other effective means
- d) the possibilities for cross contamination
- e) floors and working surfaces which are broken or cracked
- f) walls which are difficult to clean or have broken surfaces
- g) dirty or flaking ceilings
- h) windows which are dirty or give inadequate light
- i) doors with rough surfaces or loose fittings
- j) dirty stairs and passageways
- k) disposal of waste products
- l) well-maintained toilets, urinals, wash basins and hand-drying facilities, and
- m) a wholesome water supply.

A wholesome water supply coupled with adequate sanitary facilities which are well designed, maintained and properly used are important means for prevention of foodborne diseases. Equipment should be subject to routine inspection particularly with respect to:

- a) cleanliness of surfaces including cutting blocks and boards which come into contact with cooked food
- b) ease of taking apart, cleansing and reassembling any machinery used for manufacture or preparation of food
- c) adequate and well maintained facilities for cold storage
- d) good shallow construction of food storage containers, and
- e) proper labelling of utensils used for inedible or discarded material.

If any of the above aspects are found to be defective on routine inspection, a programme for their immediate rectification should be established and subsequently the premises should be reinspected to ensure the improvements have been made. Hygienic practices in food premises must be checked regularly and routinely both by management and the inspecting or licensing authority.

Food processing. The process by which foods are processed and prepared is of such a nature and magnitude that errors can occur and foodborne diseases result. The simplest form of processing may entail putting raw vegetables into boxes while very complicated food processing and technology may be required for the canning of meat and fish. Process failures which usually involve critical temperature controls can result in major outbreaks of bacterial disease.

In general, the quality of the raw material used in a food process must be the responsibility of the manufacturer as should be the food process but the end product could also involve the responsibility of the controlling authority. Depending on the type of food that is

processed, samples should be taken at various stages of the procedure, e.g. milk should be bacteriologically sampled before and after heat treatment and packing to determine if it is of a satisfactory standard quality. Sampling programmes for raw and processed foods are essential as one measure to ensure continuing safe handling of food.

The following points should be considered in a surveillance programme as they relate to food processing:

- a) Raw materials should come from known safe sources. If necessary, laboratory tests should be carried out before raw materials enter the food processing plant. When stored on the premises raw material and ingredients should be routinely checked regularly for spoilage.
- b) As a general principle only potable water should be used in food processing. Water which is recirculated for use within the premises should be treated and maintained in such a condition that no health hazard can result from its use and such use should be kept under regular surveillance by the competent authority.
- c) Proper measures should be taken to prevent contamination of food material by direct or indirect contact with raw material. Persons handling raw material or semi-processed material capable of contaminating the end-product should not come into contact with that end-product. If there is a risk of contamination, hands should be washed thoroughly between handling products at different stages of processing and all equipment which has been in contact with raw materials or contaminated material should be thoroughly cleansed and disinfected prior to being used for contact with products after heat processing.
- d) Processing should be supervised by technically competent persons and steps in the process should be undertaken with a minimum of delay. Methods of preservation should be such as to protect against contamination.
- e) The end-product should be packaged in such a way as to prevent contamination. The product should be labelled or numbered in such a way as to be easily identifiable.

#### 2.4 Surveillance of food handlers

Reported data indicated that foodborne diseases are most often caused by faults in the handling and preparation of food in the home, in institutions, catering, and food establishments. Commercial processing usually involves less direct contact and plays a much smaller role as a cause of foodborne illness. For prevention and control of foodborne diseases it is important that manual food handling of cooked food is minimized, that adequate personnel hygiene of all those who handle food is maintained and that hygienic working techniques are used,

A well planned programme for the surveillance of foodborne diseases should also deal with the hygiene and practices of the food handler. Attention should be given to the standard of their personal hygiene, their food handling techniques and the training they receive in the hygienic handling of food. Health education programmes for both the professional food handler and the housewife are essential.

Professional food handlers. The most important means of achieving and maintaining a satisfactory level of personal hygiene in food handlers is an adequately run training programme leading to a good understanding of the reasons why certain precautions have to be taken to prevent harmful contamination of food and thus to lessen the risk of foodborne disease. The information on the extent, quality and efficacy of the training activities collected through a surveillance programme form a useful basis for further improvement of the training and consequently the personal hygiene of the food handlers.

Particular attention in the training programme should be given to handwashing, cleanliness, personal behaviour and habits, food storage and reheating practices, and general compliance with relevant health legislation.

The necessity for medical examination of food handlers has been thoroughly discussed at the international level for many years. A recommended International Code of Practice - General Principles of Food Hygiene<sup>4</sup> has been published by FAO/WHO and contains generally acceptable but still tentative proposals. The relevant section on medical examination reads as follows:

"Medical examination - persons who come in contact with food in the course of their work should have a medical examination prior to their employment if the official agency having jurisdiction, acting on medical advice, considers that this is necessary either because of epidemiological considerations, the nature of the food prepared in a particular establishment, or the medical history of the prospective food handler. Medical examination of a food handler should be carried out at other times when clinically or epidemiologically indicated".

This recommendation leaves the options open for individual health authorities to undertake or not a) pre-employment medical examinations; b) routine medical examinations; and c) special medical examinations where indicated. Whether any or all these examinations are carried out must be carefully assessed in relation to other health priorities and the existing epidemiological situation.

Some countries have enacted legislation concerning medical examination of food handlers while others have not. The countries which have passed legislation on this matter deal with such things as a) extent of examination; b) categories of persons to be examined; c) times and places when the examination is to be carried out.

The national legislation in some countries requires that food handlers be medically examined when starting employment and at regular intervals later on. Considerable variations between countries are encountered as to the frequency of re-examination.

To what extent routine medical examinations of food handlers contribute to the control of foodborne disease is debatable. It remains to be shown that routine examinations add extra safeguards to what could be achieved through proper training and adequate supervision of the personal hygiene and of the work of the food handlers.

Domestic food handlers. The collection, evaluation and distribution of relevant data on food handling in the home should be a component of a surveillance programme. These data will aid investigations into the source and epidemiology of actual outbreaks of foodborne disease and will form a useful basis for programmes on consumer education.

It is important that the housewife as the one principally concerned in the purchase, storage and preparation of food in the home, is well informed about the health hazards encountered in her work.

Typical conditions which contribute to outbreaks caused by foods in the home are:

- inadequate refrigeration
- ingesting contaminated raw food or ingredients
- inadequate cooking, heating, or reheating
- contamination of cooked food by raw materials
- preparation of food too far in advance of consumption
- holding food in warming devices at too low a temperature
- poor personal hygiene
- obtaining foods from unsafe sources
- inadequate cleaning of equipment

Attention should also be given to unusual food habits in a particular area and if these are considered to increase the risk of foodborne disease they should be the subject of a health education programme. Conversely, if habits decrease the likelihood of spread of disease, they should be promoted.

Factors which tend to increase the incidence of foodborne disease should receive particular attention. These include:

- a) consumption of raw or undercooked meat, poultry or fish
- b) consumption of meat from uninspected wild animals
- c) consumption of non-heat treated milk or milk products
- d) Improper homecanning of foods, and
- e) consumption of certain traditional food delicacies.

One of the means of improving food handling in the home is an adequately run educational programme for housewives which deals specifically with domestic food handling problems.

Health education. A well planned and successfully implemented health education programme for the public in the hygienic handling of food is an important means of prevention of foodborne diseases. The effectiveness of this type of educational activity is, however, often seriously hampered by a number of factors such as: lack of motivation, ignorance, superstition, low literacy rate and communication or language difficulties. It is particularly difficult to raise interest in those who are apathetic because of malnutrition or have a very low standard of living. In these cases special approaches are needed to create a constructive message. It is best to work through established village or tribal leaders or, as appropriate through cooperatives, unions or similar local organizations.

In setting up a health education programme, the first step is to determine and accurately define the educational objectives of the undertaking. Examples of subjects, which could usefully be considered are those conditions which have been listed as contributing to outbreaks or increasing the incidence of outbreaks.

The health education programme should aim at teaching the basic concepts and techniques for hygienic handling of foods during all stages from purchase of raw materials to consumption. The health education programme should stress why the recommended precautions are necessary for the effective prevention of disease. If this understanding is achieved changes in habits and attitudes will take place. Education of the public should start with the pre-school or school child if possible.

The ways and means of implementing health education programmes will vary depending on the availability of various forms of communication including the mass media, newspapers, radio and television. It is important that health education is an ongoing activity and that imaginative and varied approaches are used including posters and a hygiene message placed on important pieces of food preparation equipment, etc.

Evaluation, which is an essential component of any educational programme, should include finding out which of the objectives have been obtained. It should also assess the quality of the teaching techniques and the teachers themselves.

### 3. GENERAL PRINCIPLES OF INVESTIGATION AND CONTROL OF OUTBREAKS OF FOODBORNE DISEASE\*

The number of aetiological agents (infectious or toxic) which can cause foodborne disease is considerable and a partial list of diseases caused by them is given in Annex 2. The annex lists incubation periods, clinical features, specimens required and laboratory or epidemiological criteria needed for confirmation of outbreaks. The list is rather comprehensive but some of the conditions listed are very rare, refer to a particular type of food, or occur in localised geographical areas only, while others - mainly bacteriological diseases - are common and occur worldwide.

Depending on what type of disease is suspected, various food samples are required. It is essential that these samples are collected, preserved, packed and shipped correctly and the acceptable methods for doing this are given in Annex 3. Also important in any investigation of foodborne disease is the use of proper equipment for collecting samples. A list of suggested equipment as well as a detailed form for collection of data during outbreaks which have been tested in the field and found to be very successful could be adopted from the "Procedure to Investigate Foodborne Illness". Annex 4 is an abbreviated form which is recommended by WHO for use in those countries which are participating in the European Surveillance Programme for the Control of Foodborne Infections and Intoxications. Notes on the back of this form give explanations of what should be entered in the space provided. These notes are considered very important to encourage uniform reporting.

Investigation of an outbreak. The following is a concise practical approach to the investigation of outbreaks of foodborne disease. However, the approach may need to be adapted according to circumstances. Certain techniques of investigation may be required for different types of incident and these include a) calculation of a food specific attack rate; b) designing an epidemic curve; c) locating the geographical distribution of cases; d) considering alternative explanations to apparent findings and e) the value of phage typing.

In an explosive outbreak it is often useful to try to estimate the incubation period from the symptomatology (probably under 4 hours if the predominant symptom is vomiting and more than 8 hours if it is diarrhoea) and thus determine which meal was the probable vehicle of infection. It may be possible to limit the investigation to one, or perhaps two, meals by a consideration of the probable incubation period (see Annex 2) or because they were the only meals taken in common, but it is unwise to jump to hasty conclusions.

When a sporadic case comes to notice shortly after onset, consideration of the probable incubation period may suggest investigation of a particular meal, but it is important to record particulars of all food consumed in the preceding 48 hours. Such cases may be due to gastro-intestinal upsets other than food poisoning and while bacteriological or other laboratory results are awaited, or if they prove to be negative, it may be difficult to decide if they are, in fact, cases of food poisoning. A sporadic case may only come to notice after a delay of several days when the results of bacteriological investigations become available. A community outbreak due to infection conveyed by a widely distributed contaminated food may give rise to cases (at first sight apparently sporadic) occurring over a period of days or weeks. In such cases it may be difficult to obtain details of a particular suspected meal, but the patient should be asked what he is accustomed to eat and the usual source of supply. It is worth asking about special dietary restrictions, religious or otherwise.

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\* For detailed information on this topic please see the already existing guidelines (5,6,7).

The investigation of an outbreak should begin by obtaining clinical and epidemiological histories for all the reported cases. It is clearly important to record the hour and the date of the first symptoms. Also it is important to obtain details on occupation particularly if a patient, or any member of his household, is a food worker. At the same time, arrangements should be made for the collection of specimens of faeces and vomitus from affected persons. Methods of collecting specimens are given in Annex 3. Specimens of vomitus are particularly important when staphylococcal or chemical food poisoning is suspected. When a person is suffering from a communicable form of foodborne disease and he, or in some cases any member of his household, is a food worker, it may be necessary for all members of the household to be cleared bacteriologically before the food worker is allowed to return to work and delay may be avoided if the necessary bacteriological examination is commenced at an early stage. An attempt should be made to identify all those at risk in an outbreak so that appropriate action may be taken in respect of any food workers or nursery staff.

It is vital, that at the earliest possible stage in the investigation, every effort is made to obtain samples of the suspected foods. These samples should be accompanied by as much information as possible about the origin, methods of manufacture, preparation, handling, storage and serving of the food. When canned or other packaged foods are suspected, any remaining contents should be submitted for examination together with unopened specimens of the same production batch. The brand name, the code number, date markings and other relevant details should be recorded. When following up suspect imported foodstuffs it is particularly important to ascertain the names of the importers, suppliers and distributors concerned, and the country of origin.

Special attention should be paid to the possibility of cross-contamination. This requires laboratory examination of raw and cooked foods and may require the laboratory examination of packages, bags and containers in which the food has been transported, and of cooking utensils and working surfaces associated with its preparation.

The investigation of outbreaks of food poisoning would be assisted if catering establishments and institutions, such as schools and hospitals, retained for a reasonable period (e.g. 48 hours), in a refrigerator where possible, samples of meals or of products which they provide.

The epidemiological and the laboratory aspects of the investigation of an outbreak should proceed concurrently. Epidemiological information may assist laboratory workers in detecting the causative agent, the identification of which may help to determine the source and mode of its transmission. The appropriate laboratory should be alerted as early as possible in the investigation so that preparations may be made to deal with the extra work likely to be generated.

It is recommended that the officer coordinating the investigation should at an early stage convene a meeting with other persons engaged in the enquiries. These will usually include an epidemiologist, a health officer (hygienist), a microbiologist (or an analyst if chemical poisoning is suspected) and a veterinary officer. If the outbreak is large or unusual the epidemiological agency for the territory should be invited to participate. At the meeting the information available should be pooled, the situation reviewed and further lines of enquiry considered and coordinated. Information arising from the investigation, including sporadic cases\*, of food poisoning should be collated at regional level by the officer in charge of communicable disease control who may observe an association with a particular food or supplier, the significance of which may not be apparent to those involved with more local aspects of the investigation. For the same reason, close liaison between the regional officer and the national epidemiological agency should be maintained so that a useful two-way flow of information takes place.

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\* An outbreak which affects several discrete areas is termed multifocal.

In most outbreaks laboratory examination of food samples and the faeces of patients may readily provide the definitive link in establishing the causative agent and the food by which it was transmitted. In some instances, however, it may be necessary to apply other epidemiological techniques in order to elucidate the aetiology of the outbreaks.

Control of outbreaks. Swift and effective control of outbreaks will depend upon the extent to which all concerned are accustomed to working together, and it should not require an actual outbreak to initiate the necessary liaison. Local liaison groups have an important role to play in fostering cooperation between interested professionals.

In certain cases, particularly those involving unprocessed animal products, contact should also be established with veterinary services since there may be a link with infection in animals or poultry. If particular livestock is found to be associated with an outbreak, the veterinary officer may wish to undertake an investigation at the farm or elsewhere in an attempt to control the infection.

Food incriminated in an outbreak or a contaminated food which is likely to cause food poisoning may need to be withdrawn from the market. Any arrangements made through the trade for withdrawing suspected food cannot be guaranteed to be entirely effective and cannot in any case deal with food already sold to the public. Where it is considered that eating such food may carry a significant risk to health, consideration should be given to issuing a public warning. The nature of the warning will depend upon such local factors as the number and groups of people at risk (e.g. the elderly, infants, hospital patients), the quantity of food concerned and the need to distinguish it from other similar food. When it is intended to issue a public warning this should be undertaken by the competent national authority.

Where a suspected food has been widely distributed control measures by other local authorities and by government departments may be necessary, including, in the case of imported food, discussions with the importers and with representatives of exporting countries. In such cases the national epidemiological agency should contact the relevant central government authority.

Outbreaks of disease due to contaminated water supplies will require special and urgent measures such as: a) discontinuing the use of the supply and providing a separate source of wholesome chlorinated water; b) extra facilities may be required at hospitals as the number of persons affected is likely to be high, and c) rapid laboratory confirmation of the aetiological agent so that effective treatment can be started.

#### 4. LABORATORY PROCEDURES

Laboratory examinations made in the course of the investigation of an outbreak of food-borne disease are an essential part of a surveillance programme. Examinations carried out by a laboratory must be within the financial capability of the territory concerned and should, if possible, be undertaken by well-trained staff. The types of examinations required, e.g. organoleptic, bacteriological, virological, parasitological, serological, mycological, toxicological, chemical, biochemical, physical and radiological, could be determined by a good knowledge of the main types of foodborne disease which occur locally. Even the most sophisticated laboratory investigations neither replace a thorough investigation of an outbreak nor assist to any great extent in the control measures which may be required.

One of the main functions of a good laboratory is to analyze specimens and samples submitted in the shortest practical time, and the laboratory must ensure that the reports are sent to the persons and/or organizations that are concerned with the investigation and control of the outbreak. Coordination between food laboratories to use standard methods for examination and reporting of results is a priority which is often overlooked and for this reason a Laboratories Coordination Committee covering the whole territory can be a useful asset.

The data from laboratory examinations should be routinely collated with a view to obtaining an overall picture of foodborne disease in the area concerned. If finance and organization permit, a well run quality control programme between laboratories should be maintained. This programme could cover public health, epidemiological, veterinarian and other relevant laboratories and could act as a focus for exchange of information.

Laboratory examinations. Useful guidelines on the establishing of food laboratories are given in the FAO/UNEP/WHO publication.<sup>8</sup>

Laboratory examinations carried out as part of the surveillance programme could be limited by: a) finance, b) prevalence of disease, c) manpower, d) facilities, and e) national legislation.

The examinations commonly carried out by food laboratories are included in the following categories: a) specific examinations prescribed by national public health legislation, b) microbiological and other laboratory examinations carried out as part of an epidemiological investigation, c) microbiological and other laboratory examinations to ascertain whether licensing requirements have been met, d) examinations carried out as part of an official meat inspection system, e) examinations of milk as part of a national zoonoses programme, f) examinations to ascertain the presence and quantity of biotoxins in food, g) examinations for approving the use or licensing of new food products or production and processing techniques.

In addition to undertaking specific required examinations, laboratories can be used as a source of monitoring environmental and other factors which affect the hygienic quality of food. The factors can include the modes of transmission of zoonoses in wild and domestic animals, the presence of radionuclides, biotoxins or pesticide residues in foods, the microbiological status of animal feeds and the contamination, both microbiological and chemical, of food circulating within a territory. With regard to the appropriate laboratory methods, reference should be made to the work of ICMSF<sup>9</sup> and the existing compendium of these methods.<sup>10</sup>

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ANNEX I

AGENTS INCLUDED IN THE WHO SURVEILLANCE PROGRAMME  
FOR CONTROL OF FOODBORNE INFECTIONS AND INTOXICATIONS IN EUROPE <sup>12</sup>

Bacteria including their toxins:

Bacillus cereus  
Clostridium botulinum  
Clostridium perfringens  
Salmonella typhi and Salmonella paratyphi A, B, C  
Salmonella (other than S. typhi and S. paratyphi)  
Shigella  
Staphylococcus aureus  
Vibrio cholerae and related vibrios  
Other bacteria, e.g. Brucella  
Campylobacter  
Escherichia coli  
Francisella tularensis  
Mycobacteria  
Vibrio parahaemolyticus  
Yersinia enterocolitica

Parasites and protozoa:

Cysticercus/Taenia  
Echinococcus  
Trichinella  
Other parasites, e.g. Entamoeba histolytica  
Giardia  
Toxoplasma

Viruses and rickettsia:

Non-A Hepatitis  
Rotavirus  
Other viruses, e.g. Echovirus  
Polio virus  
Norwalk agent

Coxiella burnetii

Toxic animals:

Fish  
Shellfish, e.g. paralytic shellfish poison  
Other animals

Toxic plants:

Mushrooms, e.g. Amanita toxin  
Other plant poisons

Mycotoxins:

Aflatoxins  
Other mycotoxins

Chemical contaminants:

Heavy metals, e.g. copper, lead, mercury, zinc

Organochlorine compounds, e.g. polychlorinated biphenyls (PCBs)

Organophosphorus compounds, e.g. parathion

Other chemical compounds, e.g. monosodium glutamate, polybrominated biphenyls (PBBs), nitrites

So-far unknown aetiological agents:

There will also be incidents in which the aetiological agent is not identified at all; this is to be expected, as not all foodborne disease agents have been identified.

CRITERIA CONFIRMING AN OUTBREAK OF FOODBORNE DISEASE 11

Disease	Incubation period	Main clinical features	Specimens from ill/food samples/specimens from workers	Laboratory or epidemiological criteria				
				Isolation of pathogen	Serotype association	Titre increase	Numbers recovered	Toxin detection
<u>Bacillus cereus</u> gastroenteritis	1-6 h	Vomiting	Vomit/suspect food/-	Same serotype of <u>B. cereus</u> from specimens from most ill persons but not from controls	$\geq 10^5$ <u>B. cereus</u> per gram from epidemiologically incriminated foods	Demonstration of culture or filtrate to be enterotoxigenic by gut loop, or other accepted biologic technique	Frequently a history of eating home-canned food	
Botulism	2 h to 8 days, usually 12-18 h	Visual disturbances, abnormality in speech, respiratory paralysis	Blood and faeces/suspect food/-	<u>Clostridium botulinum</u> from stool of ill persons or from epidemiologically implicated food	Same serotype of <u>C. perfringens</u> from specimens from most ill persons but not from controls	Detection of botulinum toxin in sera, faeces, or food		
<u>Clostridium perfringens</u> gastroenteritis	7-20 h, usually 8-12 h	Diarrhoea, abdominal pain	Stool or rectal swab/suspect food/-	Same serotype of <u>C. perfringens</u> from specimens from most ill persons but not from controls	$\geq 10^5$ <u>C. perfringens</u> per gram in epidemiologically implicated food or from stools of patients	Demonstration of toxin in faeces		
Brucellosis	Several days to several months	Fever, malaise, lassitude	Blood during acute stage and again later/suspect food/-	<u>Brucella</u> spp. in blood of ill persons	$\geq 4$ -fold increase in agglutination titre between blood specimens taken during acute illness and 3-6 weeks after onset of illness			
Salmonellosis	6-72 h	Diarrhoea, abdominal pain, sometimes fever	Stool or rectal swab/suspect food/stool or rectal swab	<u>Salmonella</u> serotype from stool, rectal swab (urine or blood if septicaemic symptoms occur) of ill persons or epidemiologically implicated food				

CRITERIA CONFIRMING AN OUTBREAK OF FOODBORNE DISEASE<sup>11</sup> (continued)

Disease	Incubation period	Main clinical features	Specimens from ill/food samples/specimens from workers	Laboratory or epidemiological criteria					
				Isolation of pathogen	Serotype association	Titre increase	Numbers recovered	Toxin detection	Other criteria
Yersiniosis	1-3 days	Diarrhoea	Stool, rectal swab, blood during acute stage and during convalescence/suspect food/-	Isolation of <u>Y. enterocolyticus</u> or <u>Y. pseudotuberculosis</u> from stool of most ill persons or from epidemiologically implicated food		> 4-fold rise of agglutination titre between blood specimens taken during acute illness and 2-4 weeks after onset of illness			
Campylobacter jejuni infection	1-3 days	Diarrhoea	Stool or rectal swab, blood during acute stage and during convalescence/suspect food/-	Isolation of <u>C. fetus</u> subsp. <u>jejuni</u> from stools of most ill persons or from epidemiologically implicated food	Same serotype from specimen from most ill persons but not from controls	> 4-fold rise of agglutination titre between blood specimens taken during acute illness and 2-4 weeks after onset of illness			
Vibrio parahaemolyticus gastroenteritis	6-36 h	Diarrhoea, abdominal pain	Stool or rectal swab/suspect food/-	Isolation of <u>Kanagawa-positive V. parahaemolyticus</u> of same serotype from stool of most ill persons		> 10 <sup>5</sup> <u>V. parahaemolyticus</u> from epidemiologically implicated food			Frequently a history of eating raw fish, shellfish, or marine crustacea
Cholera	1-3 days	Diarrhoea (rice-water stools)	Stool or rectal swab/suspect food/stool or rectal swab	Isolation of <u>V. cholera</u> from vomitus or stool of ill persons or from epidemiologically implicated food		Rise of serum titre during acute or early convalescent phases of illness and fall of titre during late convalescent phase in unimmunized persons		Demonstration of culture or filtrate to be enterotoxigenic by gut loop, infant mouse, tissue culture, or other biological technique to be invasive by production of conjunctivitis in guinea pig eye or other technique	

CRITERIA CONFIRMING AN OUTBREAK OF FOODBORNE DISEASE<sup>11</sup> (continued)

Disease	Incubation period	Main clinical features	Specimens from ill/food samples/specimens from workers	Laboratory or epidemiological criteria <sup>1</sup>					Toxin detection	Other criteria
				Isolation of pathogen	Serotype association	Titre increase	Numbers recovered	Other criteria		
Shigellosis	12-18 h	Diarrhoea, sometimes containing blood and mucus, fever common	Stool or rectal swab/suspect food/stool or rectal swab	Shigella serotype from stool or rectal swab of ill persons or epidemiologically implicated food	Same serotype from ill persons and from epidemiologically implicated food (and from stool of food worker)					
<u>Escherichia coli</u> diarrhoeas	6-36 h	Diarrhoea	Stool or rectal swab/suspect food/stool or rectal swab		Same serotype of <u>E. coli</u> from most ill persons but not from controls					Demonstration of culture to be enterotoxigenic, by gut loop, infant mouse, tissue culture, or other biological technique to be invasive by production of conjunctivitis in guinea-pig eye or other technique
Staphylococcal enterotoxiosis (food poisoning)	1/2-8 h, usually 2-4 h	Vomiting, diarrhoea	Vomit or stool/suspect food/nasal swab and purulent lesion		Same phage type from ill persons and from epidemiologically implicated food (and skin, nose, or lesion of food worker)		Isolation of $\geq 10^5$ <u>S. aureus</u> per gram from epidemiologically implicated food			Detection of enterotoxin in epidemiologically implicated food
Streptococcal sore throat or scarlet fever	1-4 days	Fever, sore throat	Throat swab/suspect food/throat swab and purulent lesion		Same M and T types of group A or G streptococci from throats of most ill persons					
Other bacterial diseases					Same M and T types of group A or G streptococci from ill persons and epidemiologically implicated food					
										Variable depends on clinical and laboratory appraisal of individual circumstances.

CRITERIA CONFIRMING AN OUTBREAK OF FOODBORNE DISEASE<sup>11</sup> (continued)

Disease	Incubation period	Main clinical features	Specimens from ill/food samples/specimens from workers	Laboratory or epidemiological criteria					Other criteria
				Isolation of pathogen	Serotype association	Titre increase	Numbers recovered	Toxin detection	
Hepatitis A	10-45 days, usually 28-30 days	Jaundice, gastroenteritis, dark urine	Blood/-/blood						liver function tests
Trichinellosis	3-30 days	Fever, high eosinophile count, orbital oedema, myalgia	Muscle biopsy, blood/pork or other meat/-	Demonstration of larva in food Identification of trichinella cyst from muscle biopsy	Serological evidence of infection				History of eating pork, bear, or arctic mammals
Paralytic shellfish poisoning	1/2-3 h	Paraesthesia of lips, mouth, and face; gastroenteritis	-/suspect shellfish/-	Detection of large numbers of toxicogenic species of dinoflagellates in water from which epidemiologically incriminated molluscs harvested					History of eating shellfish; red tides
Ciguatera	1-36 h, usually 2-8 h	Gastroenteritis; dry mouth; paraesthesia of lips, tongue, throat, or extremities	-/suspect fish/-						History of eating ciguatera-associated fish
Puffer fish poisoning	10 min to 3 h, usually 10-45 min	Paraesthesia of lips, tongue, face, or extremities; numbness; floating sensation	-/suspect puffer fish/-						History of eating puffer fish
Scombroid	1 min to 3 h, usually less than 1 h	Flushing, headache, dizziness, burning mouth and throat, nausea, vomiting, urticaria, pruritus	-/suspect scombroid fish/-						History of eating scombroid fish (tuna, mackerel)
Gastroenteritis - mushroom poisoning	1/2-2 h	Gastroenteritis	-/suspect mushrooms/-						Demonstration of toxin, chemical, or epidemiological link to mushroom

CRITERIA CONFIRMING AN OUTBREAK OF FOODBORNE DISEASE 11 (continued)

Laboratory or epidemiological criteria <sup>1</sup>									
Disease	Incubation period	Main clinical features	Specimens from ill/food samples/specimens from workers	Isolation of pathogen	Serotype association	Titre increase	Numbers recovered	Toxin detection	Other criteria
Mushroom-alcohol intolerance	1/2-2 h	Flushing, metallic taste, paraesthesia, hyperventilation, sensation of swollen hands, vomiting after ingestion of alcohol	-/suspect mushrooms/-					Demonstration of toxic chemical in epidemiologically implicated mushrooms	History of eating species of mushrooms which have a disulfiram-like effect and drinking alcohol
Muscarine-group mushroom poisoning	1/4-2 h	Excessive salivation, perspiration, tearing, reduced blood pressure, constricted pupils, and asthmatic breathing	-/suspect mushrooms/-					Demonstration of muscarine in epidemiologically implicated mushrooms	History of eating toxic species of mushrooms
Ibotenic acid and muscimol groups of mushroom poisoning	1/2-2 h	Lightheadedness, drowsiness followed by state of excitement, confusion, delirium, visual disturbances	-/suspect mushrooms/-					Demonstration of ibotenic acid or muscimol in epidemiologically implicated mushrooms	History of eating toxic species of mushrooms
Amatoxin, phallotoxin, or Gyromitrin groups of mushroom poisoning	6-24 h	Gastroenteritis, hepatic or renal failure	-/suspect mushrooms/-					Demonstration of amanita toxin, phalloidin, phalloin, amantin in epidemiologically implicated mushrooms	History of eating toxic species of mushrooms
Plant poisonings	Variable, usually < 1 h	Variable, depending on poisonous species	-/suspect plant/-					Demonstration of toxic chemical in epidemiologically implicated plant	History of eating toxic species of plant

CRITERIA CONFIRMING AN OUTBREAK OF FOODBORNE DISEASE<sup>1</sup> (continued)

Disease	Incubation period	Main clinical features	Specimens from ill/food samples/specimens from workers	Laboratory or epidemiological criteria <sup>1</sup>					
				Isolation of pathogen	Serotype association	Titre increase	Numbers recovered	Toxin detection	Other criteria
Heavy metal poisoning	< 1 h	Gastroenteritis	Variable, often vomitus, urine/suspect food/-					Demonstration of high concentration of metallic ion in epidemiologically implicated food or beverage	History of storing high-acid food or beverage in metal container or pipeline
Other chemical poisoning	Variable, frequently < 1 h	Variable, depending on poisonous substances	Variable, depending on substance/suspect food/-					Demonstration of high concentration of chemical substances in epidemiologically implicated food or beverage	History of use of storage of suspect chemical in food environment

<sup>1</sup> One or more of these criteria are demonstrated.

METHODS OF COLLECTING, PRESERVING, PACKING, AND SHIPPING SAMPLES (FOOD AND OTHER MATERIAL)<sup>1</sup>

Sample	Methods of collecting and preserving	Methods of packing and shipping
Solid or mixed food	Cut or separate portions of food with sterile knife or other implement if necessary. Aseptically collect sample with sterile implement and transfer to a sterile, plastic bag or wide-mouth glass jar. Take different samples from top, centre, and other locations as deemed necessary. Refrigerate sample.	Label. Pack refrigerant around sample container. Do not freeze or use dry ice. Take sample to laboratory or ship by most rapid means.
Liquid food	Stir or shake. Take sample in one of the following ways: (1) Pour or ladle, with sterile implement, at least 200 ml into sterile container. Refrigerate sample. (2) Immerse Moore swab into vat of liquid food, or insert into pipeline and allow liquid to flow through. Keep in place several hours if possible. Transfer swab to a jar containing enrichment broth. (3) If liquid is not viscous, pass 1-2 litres through membrane filter. Transfer filter pad aseptically into a jar of enrichment broth.	As above.
Frozen food	Use one of the following procedures: (1) Ship or take small volumes of frozen food to the laboratory without thawing or opening. (2) Drill with large diameter, sterile auger from top of container diagonally through centre to bottom at opposite side. Repeat from other side until at least 200 g is collected. (3) Chip frozen material with hammer and sterile chisel and collect chips with sterile implement; transfer chips to sterile container.	Keep frozen. Take or ship in insulated leakproof container. If dry ice is used, the outer packaging must permit release of carbon dioxide gas.
Dehydrated food	Insert sterile, hollow tube from top of one side of container, diagonally through centre to bottom of opposite side. Repeat from opposite side until at least 200 g is collected. An alternative method is to scoop material with a sterile spoon, spatula, tongue blade, or similar implement. Transfer material to sterile container.	Place in tightly sealed, moisture-resistant container. Take or ship to laboratory.
Raw meat or poultry	Sample in one of the following ways: (1) Moisten swab with buffered, distilled water or 0.1% peptone water. Swab large portion of carcass or cut of meat. Put swab into enrichment broth for pathogen sought. (2) With sterile, plastic glove, wipe carcass with sterile gauze squares; place gauze into bottle of enrichment broth. (3) Aseptically cut portion of meat or skin from different portion of carcass or cut of meat, or remove portion of carcass. Place at least 200 g sample into sterile, plastic bag or glass jar. Refrigerate. (4) Place poultry carcass, poultry part, or large portion of cut of meat into large, sterile, plastic bag. Add 300 ml enrichment broth and shake. Remove sample and close bag.	Same as with solid or liquid food, or put in enrichment broth.
Scrap material, air filters, sweepings, dust, etc.	Cut or collect at least 200 g of material with sterile tongue blade, spatula, spoon, or tongs and place in sterile, plastic bags or wide-mouth jars.	Same as above, depending on material.
Environmental or equipment-surface swab	Moisten swab with sterile, 0.1% peptone water or buffered distilled water and swab contact surfaces of equipment or environmental surfaces. Place swab into enrichment broth.	Package, label, and ship as faecal swab.
Air	Impinge on plate or in liquid with air sampling device or allow to settle in broth or on plates.	Tape closed, label, and take to laboratory.
Water	Take historical samples, including water in bottles in refrigerators, ice cubes, and water in tanks. Take line-water samples after 10 seconds of turning on tap. Take water-source samples after running water for 5 minutes. Hold sterile bottle under tap and fill to one inch below tip. Collect 1-5 litres. Membrane filters can be used alternatively. More swabs can be used to sample water in streams or pipelines by immersing them in the fluid and keeping them there for 48 hrs. Afterwards transfer them to jars of enrichment broth.	Tape closed, label. Pack with absorbent material. Box and take or ship to laboratory. Refrigeration normally not required.

<sup>1</sup> Individual laboratories or special samples may require modifications in these methods. Check with the supporting laboratory for procedures.

Figure 1

WHO Surveillance Programme for Control of Food-borne Infections and Intoxications in Europe

REPORT OF INCIDENT<sup>(a)</sup>

1. Place of incident:<sup>(b)</sup> \_\_\_\_\_
2. Date and hour of onset of illness: first person \_\_\_\_\_ last person \_\_\_\_\_
3. Number of people: ill \_\_\_\_\_, at risk \_\_\_\_\_, hospitalized \_\_\_\_\_, died \_\_\_\_\_
4. Symptoms: per cent of total ill: nausea \_\_\_\_\_, vomiting \_\_\_\_\_, diarrhoea \_\_\_\_\_, abdominal pain \_\_\_\_\_, fever \_\_\_\_\_, others (specify) \_\_\_\_\_
5. Incubation times: shortest \_\_\_\_\_, longest \_\_\_\_\_, median \_\_\_\_\_
6. Duration of illness: shortest \_\_\_\_\_, longest \_\_\_\_\_, median \_\_\_\_\_
7. Food/vehicle involved: \_\_\_\_\_  
Confirmation:<sup>(c)</sup> epidemiological , lab test , unconfirmed
8. Place where food processed/prepared: \_\_\_\_\_ date and time: \_\_\_\_\_
9. Methods of processing and preparation: \_\_\_\_\_
10. Place where food was contaminated:<sup>(d)</sup> \_\_\_\_\_
11. Place where food was eaten:<sup>(e)</sup> \_\_\_\_\_ and time: \_\_\_\_\_
12. Source of water, if applicable:<sup>(f)</sup> \_\_\_\_\_
13. Factors contributing to incident:<sup>(g,h)</sup> \_\_\_\_\_  
Interpretations: \_\_\_\_\_
14. Results of lab tests: (testing laboratory \_\_\_\_\_)

Specimens/Samples from:	Number		Details/comments (agent, count, concentration, types, etc.)
	Tested	Positive	
Ill people			
Well people			
Food handlers			
Suspect food			
Other foods (specify)			
Environment (specify)			

15. Causative agent: \_\_\_\_\_ ICD<sup>(i)</sup> code no. \_\_\_\_\_  
 confirmed  unconfirmed
16. Name of reporting centre: \_\_\_\_\_ date: \_\_\_\_\_  
Name of reporting officer: \_\_\_\_\_ telephone no.: \_\_\_\_\_

Signature \_\_\_\_\_

Explanation of notations

- (a) Attach narrative report and other national forms, if appropriate.
- (b) Indicate country, province/district and municipality (city, town, community, etc., as appropriate).
- (c) Confirmation of food/vehicle is based on epidemiological evidence, e.g., food specific attack rates, or laboratory analysis, e.g., counts, toxin levels.
- (d) Example entries: farms, streams, food processing plant (specify, e.g., canning establishment), warehouse, vending machine, retail store, home, food service establishment (specify, e.g., restaurant, cafeteria). More than one establishment may be listed, if applicable.
- (e) Example entries: restaurant, canteen, school, medical care facility, home, camp, picnic, in-transit carrier (airline, train, ship).
- (f) Sources of water may include: community supply, semi-public supply, individual household supply, institutions, bottled water, camp or recreation area supply, spring, stream.
- (g) Example entries for foodborne outbreaks: improper refrigeration, improper hot holding, preparing food day or more before serving, inadequate cooling after heat processing, inadequate reheating, obtaining food from unsafe source, using contaminated ingredient in uncooked product, contamination by infected person, improper cleaning of equipment, toxic container or pipe line, addition of toxic chemical or natural toxicant. In case more than one factor may have contributed, list all that are applicable.
- (h) Example entries for waterborne outbreaks: overflow of sewage, seepage of sewage, flooding, use of untreated water, use of supplementary source, water inadequately treated, interruption of disinfection, inadequate disinfection, deficiencies in other treatment, processing, cross-connection, backsiphoning, contamination of mains during construction or repair, improper location of well or spring, use of water not intended for drinking, contamination of storage facility, contamination through creviced or fissured rock. In case more than one factor may have contributed, list all that are applicable.
- (i) ICD = International Classification of Diseases (Revision, WHO, Geneva, 1975).

SOME EXAMPLES OF EPIDEMIOLOGICAL TECHNIQUES THAT ARE USEFUL IN  
THE INVESTIGATION OF OUTBREAKS OF FOODBORNE DISEASES

Example 1 - Food specific attack rates

Initial questioning pinpointed the meal which was the likely cause of the outbreak. A detailed history was taken from persons who had eaten the meal and became ill and those who remained well. From this information a food specific attack rate table was prepared with respect to individual items of food eaten or not eaten. See Table 1.

TABLE 1

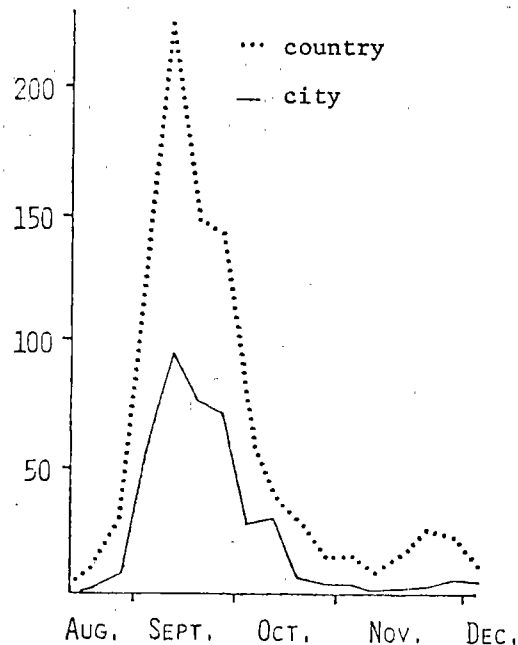
	Number of persons who ate specified food			Number who did not eat specified food		
	Ill	Total	% Ill	Ill	Total	% Ill
Shrimp cocktail	106	157	67.5	13	73	17.8
Turkey	105	210	50.0	15	20	70.5
Baked ham	16	37	43.2	94	193	48.7
Dressing	88	172	51.0	33	58	56.9
Gravy	63	152	41.5	56	79	70.9
Mashed potatoes	73	158	46.2	46	76	60.5
Pumpkin pie and cream	39	93	41.9	80	137	58.4

The suspected food responsible for the outbreak is the one with the greatest number of cases amongst those persons who ate it and conversely the lowest number amongst those who did not eat it. When the attack rates of the specific foods are calculated, it is seen that the food showing the greatest difference in the attack rates between those who ate and those who did not eat it was shrimp cocktail - viz, 67.5% of those who ate and 17.8% only of those who did not eat this food. Statistical testing showed that illness was significantly related ( $P = 0.001$ ) with eating shrimp cocktail. The occurrence of illness affecting 13 of the persons who reported not having eaten shrimp cocktail may be due to faulty recollection of what was eaten, possible contamination of other foods, or to symptoms due to other causes.

Example 2 - An epidemic curve

An epidemic curve is constructed by plotting the dates of onset of the disease in all the known cases. The initial explosive nature of the outbreak suggested a common source outbreak and wide-scale distribution of a particular food supply in the area (Fig. 1).

FIG. 1. OUTBREAK OF GASTROENTERITIS -  
BY DATES OF ONSET



The epidemiological evidence suggesting pork as the vehicle of infection was obtained from the observed absence of Jewish and Moslem families among the infected households. Further laboratory evidence identified pigs which had been slaughtered in the city abattoir as the likeliest source of infection.

Example 3 - Value of national disease surveillance and serotyping

Following a wedding reception 14 persons developed symptoms of food poisoning caused by Salmonella enteritidis phage-type 8. Inquiries revealed that all 14 victims and one person who remained well had eaten cold roast pork (attack rate = 93%), while the other 45 guests who ate hot roast turkey were not affected (attack rate = 0%).

It appeared therefore that the vehicle of infection was most likely to have been pork, but information held in the national Salmonella surveillance file indicated that S. enteritidis type 8 was usually associated with infection in poultry, and seldom in pigs.

A search in the hotel's deep freeze revealed frozen turkeys which, on laboratory examination, were shown to be contaminated by S. enteritidis type 8, as were other samples taken at the breeding farm. Over a period of several months, several other persons in the region had also been infected with the same organism. On questioning they stated that they had eaten turkeys obtained from the same source.

The outbreak emphasized three important epidemiological points:

- (1) the dangers of raw meats introducing infection into a kitchen, and by cross-contamination contaminating other cooked foods, which then act as the vehicle of infection;
- (2) the extent to which the deep freeze and a wide distribution of food supplies can result in an outbreak;
- (3) the value of phage-typing.

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