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## **Foodborne disease**

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### **SUMMARY**

Foodborne disease takes a major toll on health. Thousands of millions of people fall ill and many die as a result of eating unsafe food. Foodborne disease have implications both on health and development. Numerous outbreaks of foodborne disease have attracted media attention and raised consumer concern. However, the major problems are hidden among huge amounts of sporadic cases and smaller outbreaks. Most countries do not have good reporting systems, and a realistic estimation of the true burden of disease is difficult. WHO estimates 2,1 million deaths from diarrhoea worldwide, mainly caused by contaminated food and/or water. It is estimated that annually up to one third of the population, even in developed countries, suffer from foodborne disease. WHO initiatives to develop better methods to evaluate the foodborne disease burden, including strengthening foodborne disease surveillance, will serve to address this issue in the future.

### **I. INTRODUCTION**

Trends in global food production, processing, distribution and preparation present new challenges to food safety. Food and feed are distributed over far greater distances than before, therefore foodborne disease outbreaks can also be widespread. In a recent crisis, more than 1500 farms in Europe received dioxin-contaminated feed from a single source over a two-week period. Food produced from animals given this contaminated fodder found its way onto every continent within weeks. The effects of exposure to dioxin from this source on public health may become known only after years of investigation. The international spread of meat and bone-meal prepared from cattle affected by Bovine Spongiform Encephalitis (BSE) needs no further description. The full economic consequences of such incidents and the anxiety raised among consumers are still being assessed.

Greater life expectancy and increasing numbers of immuno-compromised people mean a larger vulnerable population for whom unsafe food is often an even more serious threat. It is likely that the problems related to food safety will increase in the 21st century especially as several global changes including population growth, poverty, international trade in food and animal feed etc. continue to negatively influence the safety of food and drinking water.

Foodborne disease is a major public health problem. Deeply concerned by this, the Fifty-third World Health Assembly (WHA) in 2000 adopted a resolution calling upon the World Health Organization (WHO) and its Member States to recognize food safety as an essential public health function.

As most cases of foodborne disease are not reported, the true dimension of the problem is unknown. The absence of reliable data on the burden of food borne disease impedes understanding about its public health importance and prevents the development of risk-based solutions to its management. To address this issue, Resolution WHA 53.15 encourages the Member States "to implement and keep national and, when appropriate, regional mechanisms for foodborne disease surveillance".

In general terms food borne disease surveillance is essential for:

- Estimating the burden of food borne diseases, and monitor trends;
- Identifying priorities and setting policy in the control and prevention of food borne diseases;
- Detecting, controlling, and preventing food borne disease outbreaks;
- Identifying emerging food safety issues; and
- Evaluating food borne disease prevention and control strategies.

## **II. BACKGROUND: FOODBORNE DISEASE HAZARDS**

### **Microbiological Hazards**

Foodborne illness caused by microorganisms is a large and growing public health problem. The emergence of increased antimicrobial resistance in bacteria causing disease is aggravating this picture. Most countries with systems for reporting cases of foodborne illness have documented significant increases over the past few decades in the incidence of diseases caused by microorganisms in food, including pathogens like Salmonella, Campylobacter jejuni and enterohaemorrhagic Escherichia coli, and parasites like cryptosporidium, cryptospora, and trematodes.

The increased incidence of foodborne disease due to microbiological hazards is likely to be dependent on a multiplicity of factors. Demographic profiles are being altered, with increasing proportions of people who are more susceptible to microorganisms in food. Changes in farm practices, more extensive food distribution systems and the increasing preference for meat and poultry all have the potential to increase the incidence of foodborne illness. Extensive food distribution systems raise the potential for rapid, widespread distribution of contaminated food products. Intensive animal husbandry technologies, introduced to minimize production costs, have led to the emergence of new zoonotic diseases, which affect humans. Safe disposal of manure from large-scale animal and poultry production facilities is a growing food safety problem in much of the world, as manure frequently contains pathogens.

Changes in eating patterns, such as a preference for fresh and minimally processed foods, the increasingly longer interval between processing and consumption of foods and the increasing prevalence of eating food prepared outside the home all contribute to the increased incidences of foodborne illness ascribed to microbiological organisms. The emergence of new pathogens and pathogens not previously associated with food is a major public health concern. *E. coli* O157:H7 was identified for the first time in 1979 and has subsequently caused illness and deaths (especially among children) owing to its presence in ground beef, unpasteurized apple cider, milk, lettuce, alfalfa and other sprouts, and drinking-water in several countries. *Salmonella typhimurium* DT104 has developed resistance to five commonly prescribed antibiotics and is a major concern in many countries because of its rapid spread during the 1990s.

These changes in microbiological hazards in foods have been recognized by the World Health Assembly, by FAO and by Codex. The 22nd session of the Codex Alimentarius Commission and the 45th Codex Executive Committee requested FAO and WHO to convene an international expert advisory body similar to the Joint Expert Committee on Food Additives (JECFA) and the Joint Meeting on Pesticide Residues (JMPR) on the microbiological aspects of food safety to address in particular microbiological risk assessment. The results of these risk assessments will provide the scientific basis for measures to reduce illness from microbiological hazards in foods.

### **Chemical Hazards**

Chemicals are a significant source of foodborne illness, although effects are often difficult to link with a particular food. Chemical contaminants in food include natural toxicants such as mycotoxins and marine toxins, environmental contaminants such as mercury, lead, radionuclides and dioxins, and naturally occurring chemicals in plants, such as glycoalkaloids in potatoes. Several chemicals occur in food due to their deliberate use to increase/improve food supply. They include chemicals deliberately added to food, such as food additives and nutrients (e.g. vitamins and essential minerals), as well as residues of pesticides and veterinary drugs used in agriculture. In all these cases, assurance must first be obtained that all such uses are safe.

Chemical contamination of food can affect health after a single exposure or, more often, after long-term exposure; however, the health consequences of exposure to chemicals in food are often inadequately understood. While assessments of the risks associated with exposure to pesticides, veterinary drugs and food additives are usually supported by extensive information, fewer data are available on the toxicology of contaminants in food. The challenges

include consideration of susceptible populations such as children, pregnant women and the elderly, cumulative low-level exposure to multiple chemicals and effects on fetal neural development.

Public awareness about chemicals in food is relatively high, and consumers continue to express concern about the risks to health due to the deliberate addition of chemicals to food. Increasing concern is also being expressed about the introduction of contaminants into the food chain from industrial pollution of the environment. Recognition that some pesticide residues and other chemicals may affect the hormonal system has further heightened public concern about persistent organic pollutants (POPs).

Work is needed to develop and validate methods to evaluate these potential risks adequately. An expansion of the Global Environment Monitoring System - Food Contamination Monitoring and Assessment Programme (GEMS/Food) including more countries and more comprehensive data on the food intake of subpopulations and on the concentrations of contaminants in food commodities would provide significantly improved information. Improved risk assessments with minimized uncertainty will provide a better, more acceptable basis for international and national standard setting and reduce concern about the safety of food.

### **III. THE BURDEN: IMPACT OF FOODBORNE DISEASE**

Up to one third of the populations of developed countries are affected by foodborne illness each year, and the problem is likely to be even more widespread in developing countries. The poor are the most susceptible to ill health. Food and waterborne diarrhoeal diseases, for example, are leading causes of illness and death in less developed countries, killing an estimated 2.1 million people annually, most of whom are children. Diarrhoea is the most common symptom of foodborne illness, but other serious consequences include kidney and liver failure, brain and neural disorders, and death. The debilitating long-term complications of foodborne disease include reactive arthritis and paralysis. Foodborne diseases most seriously affect children, pregnant women, the elderly and people already affected by other diseases.

Serious outbreaks of foodborne disease have been documented on every continent in the past decade, illustrating both the public health and social significance of these diseases. Consumers everywhere view foodborne disease outbreaks with ever-increasing concern. Outbreaks are likely, however, to be only the most visible aspect of a much broader, more persistent problem.

The availability of safe food improves the health of people and is a basic human right. Safe food contributes to health and productivity and provides an effective platform for development and poverty alleviation. Foodborne diseases not only significantly affect people's health and well being, but they also have economic consequences for individuals, families, communities, businesses and countries. These diseases impose a substantial burden on health-care systems and markedly reduce economic productivity. The loss of income due to foodborne illness perpetuates the cycle of poverty.

There are only limited data on the economic consequences of food contamination and foodborne disease. In studies in the USA in 1995, it was estimated that the annual cost of the 3.3-12 million cases of foodborne illness

caused by seven pathogens was US \$6.5-35 billion. The medical costs and the value of the lives lost during just five foodborne outbreaks in England and Wales in 1996 were estimated at UK£ 300-700 million. The cost of the estimated 11 500 daily cases of food poisoning in Australia was calculated at AU\$ 2.6 billion annually.

#### **IV. THE PROCESS: DATA GATHERING**

Data can be collected through surveillance activities, outbreak investigations and conducting special studies.

Routine surveillance of human illness provides information about illnesses possibly due to food and is conducted only on persons who become ill. Routine surveillance provides information on trends in illness and therefore facilitates detection of outbreaks and the estimation of the burden of illness. Enhanced surveillance, e.g. routine follow-up of people who are infected to determine rates of exposure and illness outcomes, can provide more complete information such as burden of illness with regards to hospitalization, sequelae and deaths, etc. Integrated surveillance represents the ideal situation with an integration of human, animal, and food surveillance activities. This involves collecting consistent and validated information from processes throughout the food continuum from farm to patient.

Outbreak investigations represent a natural source of useful data even though in the majority of foodborne disease outbreaks, the contaminated food is no longer available for testing. However, certain outbreaks provide very valuable information for characterization of the hazard as well as future prevention. Some countries have been able to increase the frequency of useful information from outbreak investigations through additional measures for retention of food.

An example of international recording of official national information on foodborne diseases is the WHO Surveillance Programme for Control of Foodborne Diseases in Europe, coordinated by the BgVV, FAO/WHO Collaborating Centre in Berlin, and the WHO Regional Office for Europe. This Programme was launched 20 years ago and currently 50 countries participate. Although some standardization has been achieved, the figures reported are still not always fully comparable. Nevertheless, the trend since 1985 is a significant increase in the incidence of salmonellosis, for some countries with a peak in 1992, whereas campylobacteriosis cases have been continuously increasing in the region.

Special epidemiological studies are often costly and require intense planning. These studies generally focus on sporadic illness and include cross-sectional, case control, cohort or experimental designs.

#### **V. THE PROBLEM: LACKING, INCOMPLETE, OR UNUSED DATA**

##### **The lack of data**

With the exception of cholera (which is subject to the WHO International Health Regulations), there is no obligation to report foodborne disease internationally. In most countries, only a few diseases which are or may be of foodborne origin appear on the list of notifiable diseases. In addition, the reported diseases are not presented in a uniform manner, for example, while one country may report

the incidence of shigellosis and amoebiasis separately, another may report them jointly under the term dysentery. Again, several foodborne diseases are sometimes reported collectively under the term food poisoning. However, the meaning of the term food poisoning varies from country to country, and not infrequently it is used to represent different groups of diseases.

Some countries report the total number of cases of a foodborne disease, including sporadic cases, while others mainly collect information on the number of outbreaks and the number of cases involved in the outbreaks. As a result, information on sporadic cases is not collected in many countries and data from different countries are difficult to compare. Few epidemiological estimations of the national underreporting factor (factor between reported and real cases) have been made, but the factors used vary from 3 to more than 100.

Another constraint in collecting information at the international level relates to the repercussions that information on foodborne disease epidemics may have on food trade and tourism. Concern about the possibility of food export being rejected and/or loss of tourism have been a disincentive for many governments to release information on foodborne disease epidemics.

In most countries the surveillance infrastructure for foodborne diseases of both, microbiological or chemical etiology, is weak or non-existent. Furthermore, in many countries, particularly in the developing world, laboratory resources and skills to identify pathogens are scarce, and etiology-specific surveillance is often not possible. Even in the developed countries, laboratory-based surveillance is not well developed. In addition, for some agents, e.g. enteric viruses, the absence of a simple and reliable diagnostic test makes surveillance difficult. Also, analytical methods for some common chemical contaminants, notably dioxins and PCBs, are very costly and difficult to perform.

#### **Better use of existing data**

In many cases data already exist on diarrhoeal disease, although these data may be of poor quality, use non-specific case definitions and come from poorly defined populations. Even in the absence of laboratory services, these kind of data can be developed more systematically in selected areas and can be expanded to include information about the severity and impact of disease: work loss, medical visits, costs of treatment, hospital admission, death, etc.

In the absence of local information, data from neighbouring countries or surveys that may have already been done, including published studies, may provide an adequate estimate. Basic laboratory services are required to develop a more sophisticated profile. These resources should be focused in selected sentinel sites, using appropriate sampling strategies to assess the prevalence of various pathogens in patients with diarrheal disease. Ideally, such surveys would include methods to identify common bacterial, parasitic, and viral enteric pathogens. Data about the relative prevalence of specific pathogens may provide some clues to dominant modes of transmission. It is noted that the prevalence of AIDS may have a very significant impact on the incidence of diarrheal or other foodborne disease.

## **VI. ADDRESSING THE PROBLEM**

### **New initiatives to evaluate foodborne disease burden**

WHO is in the process of developing better methods to estimate the burden of foodborne disease. The approach uses Microbiological Risk Assessment techniques based on prevalence of pathogens in food to evaluate the global number of cases of food borne diseases.

WHO is also looking into ways of improving direct disease data? One important focus area is sentinel studies in selected countries. Such data can be used through extrapolation to get a better worldwide overview.

### **Strengthening foodborne disease surveillance**

The overall goal of strengthening foodborne disease surveillance is to provide countries with the necessary data to reduce the foodborne disease burden by providing information, which allows the food safety system to be improved. To design public health policies and identify appropriate food safety measures, data from foodborne disease surveillance need to be analysed together with data from food monitoring systems. The FAO Conference Room Document will address food monitoring systems.

## **VII. CONCLUSION**

Weaknesses and variations in foodborne disease surveillance systems, where such programmes exist, make a global estimation of foodborne diseases difficult. However, such data are essential for raising awareness about existing problems, setting priority food safety measures, using resources in a cost-effective way, and evaluating the impact of measures. At the national level, countries should consider developing or strengthening their foodborne disease investigation and surveillance system. At the international level, there is need to provide further guidance in investigation and surveillance and to harmonize reporting systems.