
**6th MEETING OF THE PAN-AMERICAN
COMMISSION ON FOOD SAFETY (COPAIA 6)**

Santiago, Chile, 24 July 2012

Provisional Agenda Item 4.1

COPAIA 6/4.1 (Eng.)
22 July 2012
ORIGINAL: ENGLISH

Food Safety challenges and opportunities: *Public Health approach*

Promoting Public Health by Preventing Food Borne Illness: *The Role of education*

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1. INTRODUCTION

An adequate and safe food supply is critical for normal growth and development and to maintain health across the life span. Unsafe food has been a human health problem since history was first recorded, and many food safety problems encountered today are not new. Although governments all over the world are doing their best to improve the safety of the food supply, the occurrence of foodborne disease remains a significant health issue in both developed and developing countries. The United States (U.S.) shares the world's food safety concerns. In the U.S. alone, it is estimated that 48 million illnesses, 128,000 hospitalizations and 3000 deaths are caused by foodborne diseases every year (1).

Although the true global incidence of foodborne diseases is difficult to measure, the World Health Organization (WHO) estimates that foodborne and waterborne diarrhoeal diseases taken together kill about 2.2 million people annually, 1.9 million of them children (2).

Unsafe food causes many acute and life-long diseases, ranging from diarrhoeal diseases to various forms of cancer. By virtue of the international nature of travel and trade, food safety increasingly has become a global issue. There have been many documented cases of contaminated food from one country causing significant health effects in other parts of the world (3). Added to the massive global trade in food and animal feeds are other factors affecting the global food supply and safety, such as population growth, poverty, adverse climatic and social event. It is clear that foodborne diseases and threats to food safety constitute a growing global public health problem which demands that countries strengthen their programs for improving the safety of food all the way from production to consumption (4).

2. MODERNIZATION OF THE US FOOD SAFETY SYSTEM

In the U.S., food is regulated by several governmental agencies including the Center for Food Safety and Applied Nutrition (CFSAN) of the U.S. Food and Drug Administration (FDA). CFSAN is responsible for promoting and protecting the public's health by ensuring that the nation's food supply is safe. CFSAN's food safety programs include risk assessments for food additives and contaminants, surveillance and monitoring of the food supply and development of education programs involving safe food practices for food handlers from workers on the farm to consumers at the table (5). Despite its long and successful history of food safety regulation, the U. S. recognized the need to overhaul and improve its current food safety system (6). By 2010, the system had become very complex and global, and as a public health organization, FDA was challenged in meeting the companion challenges of protecting the safety of food, and at the same time promoting good health (4).

Recognizing that the burden that foodborne illness places on the American people was too great, the American Congress passed, and President Barak Obama signed the Food Safety Modernization Act (FSMA) in January, 2011. This historic legislation directed the Food and Drug Administration (FDA) to work with a wide range of public and private partners, to build a new system of food safety oversight. The passage of FSMA provided FDA with crucial new authorities and tools to ensure the safety of imported food. These authorities create exciting opportunities for FDA. The core of this new food safety system is based on prevention. The new agenda is to shift the agency's emphasis away from mitigating public health harm by removing unsafe products from the market place to a new overriding objective - that objective is to PREVENT harm by keeping unsafe food from entering commerce in the first place (6).

The idea of prevention is not new. FDA has established prevention-oriented standards and rules for food products and many in the food industry have pioneered "best practices" for prevention. What's new is the recognition that, for all the strengths in the U.S. food system, a breakdown at any point on the farm-to-table spectrum can cause catastrophic harm to the health of consumers (6).

In light of the new legislative mandate, the U.S. is looking at its food system as a whole and clarifying the food safety responsibility of all its participants throughout the entire food system—domestically and internationally, from farm to table. The focus is on prioritizing prevention strategies, strengthening surveillance and enforcement, and improving response and recovery if prevention fails. Critical to a food system relying on prevention is identification of the food safety hazards and their control elements (6).

In addition, the FDA is strengthening existing collaborations among all food safety agencies whether they are Federal, state, local, or territorial. And, in an increasingly global world, FDA is looking beyond its borders to seek better cooperation and stronger collaboration with the Agency's international counterparts by harmonizing food safety standards, sharing information and approaches, and sharing responsibilities. For example, FSMA explicitly recognizes that food safety agencies around the world need to work together in an integrated way to achieve shared public health goals. FSMA encourages arrangements with foreign governments to leverage resources (6).

3. A GLOBAL STRATEGY FOR FOOD SAFETY

U.S. consumers benefit from the globalization of food supplies. Regardless of the season, U.S. consumers choose from a wide variety of fruits and vegetables. As of 2011, about one-sixth of all food products consumed in the United States was imported. For certain food products the proportion of imports is much greater; the United States imports approximately 20 percent of fresh vegetables consumed, about 50 percent of fresh fruit and an estimated 80 percent of the seafood consumed (4).

FDA established international offices and posted staff in strategic locations around the world when several imported food and medical products caused a series of U.S. public health crises in 2007 and 2008. As of 2011, these international postings include: China Office, India Office, Europe Office, Asia-Pacific Office, Sub-Saharan Africa Post and Middle East and North African Post. A Latin American Office was opened in 2009 with posts in San Jose, Costa Rica; Santiago, Chile; and Mexico City, Mexico. The Latin American Office covers 44 countries and territories in Mexico, Central America, South America, and the Caribbean. These offices and posts have played and will continue to play an important role in building linkages with foreign counterparts to identify and champion system-based approaches and initiatives on food safety of mutual benefit to the U.S. and the host country/region (7).

With world commerce growing larger, more complex, and even more intricately interconnected, it is clear that FDA needs to partner with other organizations to protect public health both for US citizens and people around the globe. FDA participates in consumer education programs and in global networks of regulators and non-governmental public health organizations and continually monitors information from several international alert systems, including those of WHO/PAHO (7).

4. CONSUMER EDUCATION

Appropriate food preparation can prevent many foodborne diseases (8). As part of its global strategy to decrease the burden of foodborne diseases, WHO identified the need to communicate a simple global health message, rooted in scientific evidence, to educate all types of food handlers, including ordinary consumers. In 2001, the World Health Organization (WHO) developed the "Five Keys to Safe Food" a global health message on food safety. The Five Keys to Safer Food explains the basic principles that each individual all over the world should know to ensure safe food handling practices and prevent foodborne diseases are used in their homes (9).

The Five Keys to Safer Food poster presents the core messages of (1) keep clean; (2) separate raw and cooked; (3) cook thoroughly; (4) keep food at safe temperatures; and (5) use safe water and raw materials. The poster was

quickly adopted by Member States and translated into more than 50 languages. To provide further guidance on presenting safe food preparation information to consumers, WHO created a Five Keys to Safer Food manual. The Five Keys to Safer Food manual provides the core food safety information needed to teach food safety training and suggests ways to modify the information for presentation to different audiences (9).

These Five Keys to Safer Food materials have been adapted and adopted by over 90 countries and serve as the basis for educational programmes for health educators, food handlers, school-children, women and others target audiences involved in food preparation and handling. The Five Keys to Safer Food materials were also used in emergency situations to prevent outbreaks of cholera, outbreaks following the tsunami in South East Asia, and were incorporated into the FAO/UNICEF/WHO social mobilization campaign to combat Avian Influenza (9). They were also used at numerous international mass gathering events including the Beijing Olympics and the FIFA World Cup, both to train food handlers and educate consumers. The Five Keys messages were adapted for travellers and the concept was expanded to promote healthy lifestyles through incorporation into the 3 Fives (Fives Keys to Food Safety, Five Keys to a Healthy Diet and Five Keys to Appropriate Physical Activity) (9).

To promote the adaptation of the Five Keys food hygiene message to the local level, WHO collaborates with a wide range of partners in different fields of activities (national and international organizations, NGOs, public health institutions, the tourism sector, consumer associations, local communities, industries and academia). However, since lowering the burden of foodborne disease requires a renewed effort on the part of governments, scientists, food industry and consumers, WHO continues to offer materials, expertise, technical support and the credibility of an internationally recognized public health organization (9).

In response to the increasing number of requests from countries to assist in strengthening their food safety education programs for the prevention of foodborne diseases, WHO partnered with FDA's Office of Women's Health in the development of the Five Keys to Safer Food Train the Trainer course on the Five Keys to Safer Food which provides guidance on how to both educate and promote the adoption of safe food handling behaviors. The first module was designed for women preparing food in the home since women play an important role in the production and the preparation of safe food (women produce between 60% and 80% of the food in most developing countries and are responsible for half of the world's food production) (9). This training course was also developed in response to the WHO Director-General's priorities to promote the health of women, particularly in developing countries (9).

The Five Keys to Safer Food Train The Trainer course, which complements the package of the Five Keys to Safer Food Poster and Manual, builds upon the concepts of Communications for Behavioural Impact (COMBI), a communication method developed by WHO, and is designed to go beyond education and foster the adoption of safe food handling behaviors. The course was piloted in three countries, South Africa, Tunisia and Belize and is available on-line at The Five Keys to Safer Food web site, and associated training materials were developed to provide countries with materials that are easy to use, reproduce and adapt to different target audiences (9).

WHO Headquarters is now partnering with FDA's CFSAN to develop a program of outreach, information, and training that addresses farmworker sanitation and personal hygiene to promote health by decreasing microbial contamination when growing fruits and vegetables for themselves and for sale in local markets. Training of farmworkers and consumers in rural communities is now included in the WHO global food safety education program (10).

The importance of uncooked fruits and vegetables in a healthy and nutritious diet demands that these products be considered of highest priority for safe handling from primary production to consumption. In 2008, the FAO and WHO convened an Expert Meeting on the microbiological hazards in fresh leafy vegetables and herbs to review the scientific data and make recommendations for limiting the risks associated with microbial contamination of these products (11). A principal recommendation of the meeting was for the WHO to develop training and education for growers and handlers as a primary preventive control measure. The report goes on to recommend that WHO include the training as part of the Five keys to safer food global education framework.

The Five Keys to Growing Safer Fruits and Vegetables Training Course, developed in response to the Expert Meeting held in 2008, begins to extend the Five Keys to safer food educational framework across the farm to fork continuum. The course is designed for community educators who are in position to share this information and promote behavioral change with rural workers who are growing fruits or vegetables for themselves or others (10). Promoting safe handling behaviors in the rural community will not only prevent disease in rural areas but provide all consumers with a safer food supply.

The concept of the Five Keys to Growing Safer Fruits and Vegetables Training Course was initially presented to health educators in Belize and the manual was subsequently pilot-tested in Guatemala in collaboration with the Pan-American Health Organization (PAHO) country office and the Institute of Nutrition of Central America and Panama (INCAP).

The trial edition for field testing is currently being used in El Salvador as part of a joint UN program “Protecting children: towards a coordinated food security and nutrition program.” The program is available on line at (10). This program is part of the MDG Achievement Fund’s efforts to help El Salvador achieve the Millennium Development Goals of reducing poverty and inequality.

As part of this field test, FDA is working with WHO and PAHO in the Department of Morazán on a formal evaluation of the train the trainer program and on an assessment of health outcomes from the training program. In brief, the protocol calls for agronomists to use the FIVE KEYS training materials to train 1200 families in the safe growing of fruits and vegetables and complete survey data on the results of the training over a period of seven months on two hundred families. “Promotoras” from the health department will secure gastrointestinal illness data from the same 1200 families over the same period. Data will be analyzed to see if the training on growing fruits and vegetables safety results in any change in illness rates.

This cooperative effort between the U.S. and WHO/PAHO on the FIVE KEYS TO GROWING SAFER FRUITS AND VEGETABLES program will help improve the sanitation and personal hygiene of food handlers across the farm to fork continuum from farmworkers to homemakers.

5. THE NEED FOR GLOBAL SURVEILLANCE

Countries differ in their public health systems, giving rise to wide variability in national food safety programs (12). Addressing the global nature of food safety risks, however, requires a Global strategy which includes:

- Promoting the development of risk-based, sustainable, integrated food safety systems;
- Developing science-based measures along the entire food production chain that will lower the risk from exposure to unacceptable levels of microbiological agents and chemicals in food; and
- Enabling assessment, communication and management of foodborne risks, in cooperation with other sectors and partners.

Promoting the development of risk-based, sustainable, integrated food safety systems and developing science-based measures along the entire food production chain can best be addressed through strong surveillance systems, renewed commitment to public health, and strong international partnerships that strengthen national foodborne disease prevention and control efforts. In view of the disparity among national surveillance systems, partnerships in global surveillance are a logical starting point. In order to engender the political will required to initiate and sustain a strategy to reduce food borne disease, the magnitude of the problem must be determined. Global

surveillance information can also be used by countries to perform rapid risk assessments, prioritize food safety needs and evaluate the impact of training programs and other interventions.

WHO has implemented a number of sentinel site programs to develop special studies in regions currently lacking good data on foodborne illnesses and has created a network connecting countries involved in these surveillance activities related to acute gastrointestinal illnesses. One of the global programmes designed to strengthen surveillance of foodborne disease is Global Food Net (GFN), previously known as Global Salm-Surv. The program is a laboratory based surveillance system that has been operational since January 2000. It is an integrated surveillance system of foodborne and other enteric infections with an emphasis on capacity building and consists of a network of institutions. This program, initiated by the WHO as a surveillance system for Salmonella infections, the Danish Veterinary Laboratory (DVL) and the Centers for Disease Control and Prevention (CDC) and now also supported by the Institute Pasteur, United States Food and Drug Administration, Health Canada and Wageningen University; endeavors to reduce the global burden of foodborne disease by strengthening national and regional surveillance and response activities (12). The WHO GFN external quality assurance system (EQAS) is an important step toward improving the quality of Salmonella serotyping and antimicrobial susceptibility testing worldwide (13). The core elements of the GFN program include regional training workshops, a moderated electronic discussion group, an external quality assurance system, a country databank of annual Salmonella surveillance summaries, a web site, <http://www.who.int/emc/diseases/zoo/SALM-SURV/index.html>, and reference testing services. Training workshops for microbiologists and epidemiologists have involved numerous representatives from almost 100 countries within all six WHO designated regions.

WHO also monitors and performs exposure assessments of chemical contaminants in food. The WHO Global Environmental Monitoring System/Food Contamination Monitoring and Assessment Programme (GEMS/Food) provides information on the concentration of chemical contaminants in food, their contribution to total human exposure and their significance for public health and trade. GEMS/Food provides baselines of chemical contaminants in food that may be used to assess contamination. The Programme is an important component of the global risk assessment of chemicals in food and provides exposure assessments that form part of the basis for setting national and international food safety standards. GEMS/Food maintains a network of WHO Collaborating Centres, national focal points and participating institutions located in over 70 countries. It maintains links with international organizations such as the Food and Agricultural Organization (FAO), International Atomic Energy Agency (IAEA), the United Nations Environment Programme (UNEP), and nongovernmental organizations such as the International Union of Food Science and Technology (IUFoST) and the International Union of Pure and Applied Chemistry (IUPAC) (11). The WHO Global Outbreak Alert and Response Network (GOARN) provides immediate public health assistance for the containment of disease outbreaks. The Network provides a coordinated mechanism for outbreak alert and response. It consists of a technical partnership between institutions and networks and complements existing systems. Its role is to combat the international spread of outbreaks by rapid identification, verification and communication of threats, leading to a coordinated response. It ensures that appropriate technical assistance reaches the affected Member State rapidly, minimizing the health impact of the outbreak and preventing further spread of disease. WHO responds to requests from Member States for assistance in outbreak management by fielding special teams of experts. Recent examples of outbreaks in which WHO participated directly in the field include: Rift Valley fever in Kenya and Somalia, monkey pox in the Democratic Republic of Congo, avian influenza (H5N1) in Hong Kong (China) (12).

6. THE ROLE OF SURVEILLANCE IN ASSESSING THE SUCCESS OF INTERVENTIONS AND EMERGING RISKS

Many countries have well-developed, established surveillance systems for monitoring food and the environment for chemical contaminants such as dioxins, PCBs, heavy metals, and residues of pesticides and veterinary drugs. Surveillance systems directed at foodborne pathogens are more recent as are microbiological risk assessments and

pathogen reduction programs. The development of a comprehensive food safety surveillance framework not only enables the continued assurance of food safety regarding known chemicals and pathogens, but provides a mechanism to assess the impact of interventions such as prevention strategies and consumer education programs as well as protect against emerging hazards.

Antimicrobial agents are essential medicines for human and animal health and welfare. The development of antimicrobial resistance is a global public and animal health concern that is impacted by both human and non-human antimicrobial usage. A comprehensive food safety surveillance framework will not only be capable of monitoring foodborne pathogens, but also of determining the development of antimicrobial resistance in these pathogens when resistance is associated with the use of antimicrobials in agriculture and veterinary medicine. This information is critical for determining risks associated with the development of antimicrobial resistance for specific microorganism-antimicrobial combinations and for developing risk management options aimed at reducing the risk associated with the use of antimicrobials in agriculture and veterinary medicine.

7. CONCLUSION

The new global marketplace demands a common high standard of food safety to protect consumers locally, nationally and worldwide. Both industrialized and developing countries can best address concerns about foodborne disease, including those from new processes and intentional acts of adulteration, through strong educational programs coupled to advanced food and health surveillance systems. Consumer awareness of the risks of foodborne disease can result in safer consumer food handling practices and increased awareness of food contamination problems (8). Consumer training programs in safe food handling practices can serve as a tool for the prevention of foodborne illness and improve the safety of the global food supply

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