

# Food Safety

## Federal Inspection Programs

Council on Scientific Affairs, American Medical Association

**C**oncern about the safety of the US food supply has stimulated criticism of the present system for assuring safe food in American markets. This report was prepared in response to resolutions introduced at the American Medical Association House of Delegates' December 1990 Interim Meeting. The resolutions requested the AMA to study the plans and procedures needed to improve the federal inspection of meat, poultry, and shellfish. To put these issues into perspective, an overview of food safety is presented. This report is not intended, however, to be a broad review of the Food and Drug Administration's and the US Department of Agriculture's responsibilities for food safety. (Arch Fam Med. 1993;2:210-214)

Resolutions 76 and 77 (1-90), which were referred to the Board of Trustees, request the AMA to study the plans and procedures needed to improve the federal inspection of meat, poultry, and shellfish. To put these issues into perspective, an overview of food safety is presented. This report is not intended, however, to be a broad review of the Food and Drug Administration's (FDA) and the US Department of Agriculture's responsibilities for food safety.

Before the 20th century, there was little public knowledge or concern about the safety of the US food supply. Although many devastating outbreaks of disease occurred that were attributable to contaminated food and water, it was not until 1906 that the federal government responded to widespread publicity about economic cheating, unsafe constituents, and reprehensible practices that existed in the food-processing industry. In that year, Congress enacted the Pure Food and Drugs Act that outlawed the sale of adulterated or misbranded food in interstate commerce; however, Congress did not stop with that. In 1907, it passed the Meat Inspection Act,

which required continuous federal inspection in all establishments that slaughtered or processed meat for interstate commerce. A similar law covering poultry products was enacted in 1957.

In the ensuing years, a complex hodgepodge of organizations and structures have been developed that are intended to ensure safe food for the American people. The US FDA enforces the Food, Drug, and Cosmetics Act. The Food Safety and Inspection Service of the US Department of Agriculture enforces the terms of the Meat and Poultry Inspection Programs. Each state has counterparts of the FDA and the Food Safety and Inspection Service to regulate intrastate activity. The US Centers for Disease Control and Prevention (CDC) investigate food-borne disease incidents and keep records of disease outbreaks reported by state health departments. Defining the problem of food-borne illness depends on reporting all cases. Primary care physicians play a key role in identifying cases of food-borne diseases and reporting them to health agencies.

Safety of shellfish beds is under the jurisdiction of state health authorities. As with other food products regulated by the FDA, shellfish come under FDA control when they

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enter interstate commerce. The National Conference on Interstate Milk Shipments, made up of state health authorities, FDA officials, and industry representatives, establishes rules to ensure the safety of fluid milk in interstate commerce. Added to all this are the public health departments of municipalities and counties, which supervise food service, local milk processing, and retail food distribution. It is a complex system that often defies logic, but usually works.

Discontent with the safety assurance system and public concern about the safety of foods has grown during the past quarter century until now there is no question that food safety is a national issue. Congress is considering new legislation; the public press has been highly critical of the food safety assurance system and many citizen groups are demanding that something be done. The purpose of this report is to examine the facts and assess the role of additional federal inspection in reducing the likelihood of unsafe foods in the marketplace.

### WHAT MAKES A FOOD UNSAFE?

Most reasonable people will agree that a food is unsafe if it contains something that makes the consumer sick. The FDA has listed five types of substances that have been considered potential hazards<sup>1</sup>: (1) food additives, (2) pesticide residues, (3) environmental contaminants, (4) toxicants that occur naturally in food, and (5) pathogenic and toxigenic microorganisms. Animal drug residues may also present a potential hazard in foods. They are considered neither pesticides nor food additives under the Food, Drug, and Cosmetic Act and are handled under a separate provision of the law. Clearly, these hazards differ widely in their everyday importance.

#### Food Additives

Federal regulations prohibit the addition of anything to food except approved food additives and substances

that are generally recognized as safe (GRAS). Although legally different, food additives and GRAS substances are indistinguishable in the minds of the public. The FDA regulations require that anything added to food must be identified on the label. The agency can and does take legal action against manufacturers of a food that contains an unapproved ingredient.

The care used in regulating food additives and GRAS substances appears to give ample protection to the public. There has been no evidence of widespread harm from approved food ingredients in many decades.

#### Pesticide Residues

A wide assortment of chemicals is used in the production and storage of food. Their purposes range from control of insects and fungi, through elimination of weeds and other undesirable plants in the field, to the acceleration of ripening and improved harvesting characteristics. Some useful chemicals are extremely toxic to humans. Therefore, any residues in the food must be inconsequential.

No pesticide can be used on a food crop or animal unless it is registered and approved for use by the US Environmental Protection Agency. Stringent limits have been established for each pesticide to assure the consumer of an ample margin of safety.

Control does not stop there. Both the FDA and state regulatory agen-

cies constantly sample and test food products on the market. In 1989, for example, the FDA analyzed 18 798 samples of domestic and imported food for pesticide residues.<sup>2</sup> Two thirds of the samples contained no detectable residues, and fewer than 1% contained residue levels that exceeded Environmental Protection Agency tolerances (which are deliberately set low to provide a generous margin of safety). These results are similar to the values obtained in 1987 and 1988. Thus, no evidence exists that pesticide residues in the US food supply constitute a significant health hazard to the public.

#### Environmental Contaminants

Food poisoning by environmental toxicants is a rare event. One outbreak of mercury poisoning in Japan was attributed to consumption of fish taken from water that received waste from a chemical plant.<sup>3</sup> Another incident resulted from contamination of cooking oil with polychlorinated biphenyls.<sup>4</sup> The rarity of events such as these suggests that contamination of food from its environment is not a common or significant problem.

#### Toxicants That Occur Naturally in Food

Many food sources contain toxic substances of one kind or another.<sup>3,5</sup> For example, certain mushrooms are poi-

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sonous. Cashew nuts, apricot kernels, and lima beans contain cyanide. Sassafras teas and many spices contain the carcinogen safrole. Nutmeg contains a potent hallucinogen, and potatoes contain low levels of solanine. People have learned to live with these toxicants by avoiding poisonous varieties (eg, mushrooms), cooking properly (eg, lima beans), limiting consumption to subtoxic levels (eg, nutmeg), or simply ignoring the toxicant (eg, safrole in several spices). Except for an occasional accident with poisonous mushrooms, we hear little about illnesses resulting from the consumption of poisonous plants.

Not all the naturally occurring toxicants are found in plants, however. The pufferfish, which is a prized delicacy in China and Japan, contains the heat-stable paralytic tetrodotoxin. This poison is concentrated in the ovaries, liver, intestine, and skin of the pufferfish. It is avoided by careful removal of these parts during preparation for eating.

Shellfish sometimes become dangerous when they ingest large numbers of toxic dinoflagellate organisms during or after periods of explosive growth or "bloom" in the ocean. Blooms of toxic dinoflagellates are seasonal and unpredictable. The most serious disease of this type is paralytic shellfish poisoning, which is caused by a potent neurotoxin. This poison can cause respiratory paralysis and sometimes death. Cooking will not inactivate the toxin; therefore, the shellfish beds must be carefully monitored and if toxins are found, these areas must be closed until nature corrects the situation. This can take months.

Another type of food animal poison, ciguatera toxin, involves primarily fish that live on reefs or near shore in tropical waters. At least 300 species of fish have been found to carry ciguatera poison, which they apparently obtain from smaller, reef-dwelling fish through the food chain. No test for ciguatera is currently available; avoidance of certain species is the current control measure.

Scombroid fish poisoning is caused by histamine in fish that is not properly handled after catching. Histamine results from the action of an enzyme, histidine decarboxylase, which is produced by several types of bacteria. This disease is prevented by handling the catch in a manner that prevents bacterial growth.

### Pathogenic and Toxicogenic Microorganisms

There is widespread agreement that pathogenic and toxigenic microorganisms are the primary causes of unsafe food. The bacterial agents now known to produce food-borne disease are as follows: (1) *Aeromonas hydrophila*, (2) *Bacillus cereus*, (3) *Campylobacter jejuni*, (4) *Clostridium botulinum*, (5) *Clostridium perfringens*, (6) *Escherichia coli*, (7) *Listeria monocytogenes*, (8) *Plesiomonas shigelloides*, (9) *Salmonella* spp, (10) *Shigella* spp, (11) *Staphylococcus aureus*, (12) *Vibrio cholerae*, (13) *Vibrio parahaemolyticus*, (14) *Vibrio vulnificus*, (15) *Yersinia enterocolitica*, and (16) less recognized or presumptive food-borne bacterial pathogens.<sup>6</sup> Interestingly, only three of these, *C botulinum*, *Salmonella* spp, and *S aureus*, were known 50 years ago to cause food poisoning.<sup>7</sup>

In addition to the bacterial agents, smaller numbers of food-borne disease outbreaks are attributed each year to viruses (usually hepatitis A and Norwalk agent) and to microscopic parasites (primarily *Trichinella spiralis* and *Giardia* spp).

The CDC accumulates and publishes reports from time to time on the incidence of food-borne disease in the United States. The latest report, which covers the period from 1973 to 1987,<sup>8</sup> shows most of the bacteria listed above plus a few viral and parasitic agents and various naturally occurring toxicants described earlier.

During the 15-year period cov-

ered by the report there were 2841 outbreaks of disease with 124 994 cases for which the causal organism could be identified. Of these outbreaks, 66% were attributed to bacterial agents, 10% to viral and parasitic agents, and 25% to natural toxicants and other chemicals. The vast majority of the individual cases, however, were caused by bacterial (87%) and viral (9%) agents.

Percentages of cases attributable to individual agents were as follows: *Salmonella*, 45%; *Shigella*, 12%; *S aureus*, 14%; *C perfringens*, 10%; Norwalk virus, 5%; and hepatitis virus, 3%.

The report listed 247 deaths due to food-borne disease, including 88 due to *Salmonella* infections, 70 due

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to *L monocytogenes*, 47 due to *C botulinum*, 12 due to *V cholerae*, 12 due to *C perfringens*, four each due to *E coli*, *Shigella*, and *S aureus*; three due to *Streptococcus* spp; two due to *Campylobacter* spp; and one due to *Brucella* spp. Deaths per 1000 cases with known outcomes were highest for *L monocytogenes* (317), *C botulinum* (192), *Brucella* (23), *Streptococcus* (15), and *V cholerae* (13).

The food vehicles were identifiable in 3699 outbreaks (164 695 cases) reported in the 1973-1987 survey. Almost half (44%) of the outbreaks were attributed to animal products, such as beef, pork, chicken, turkey, finfish, and shellfish.

There is no question that microbial agents were the main threats to food safety in the United States, but there is no solid information on the extent of the hazard. The figures reported by the CDC<sup>8</sup> suggest that about 200 outbreaks of food-borne disease affect 9000 to 11 000 people

each year in this country. It must be recognized, however, that these figures are taken from reports of state and local health authorities, which vary a great deal in investigating and reporting disease outbreaks to the CDC. Consequently, the published figures are certain to be well below the true incidence.

Numerous attempts have been made to develop more realistic incidence figures for food-borne disease in the United States. These estimates require extrapolation from certain assumed figures, which frequently are based on postoutbreak surveys by questionnaire. Whatever the mechanism, the published estimates of numbers of food-borne disease cases in the United States each year range from 5 million<sup>9</sup> through 6.5 million<sup>10</sup> to as high as 24 to 81 million.<sup>11</sup> The higher figures are based on reasonable estimates and are difficult to dismiss.

### WILL MORE FEDERAL INSPECTION REDUCE THE INCIDENCE OF FOOD-BORNE DISEASE IN THE UNITED STATES?

Concern about food poisoning in the United States has stimulated criticism of the present system for assuring safe food in American markets. Some people seem to think that more and better inspection is the answer. Meat products have been under continuous inspection since 1907, poultry since 1957. Inspection was begun to detect diseased and unwholesome animals that were unfit for human food. However, an inspector cannot see a *Salmonella* or a *Campylobacter* or a *Listeria* organism. Protecting the consumer from infection by these organisms on animal products must come in other ways, ie, sanitary handling, refrigeration, and proper cooking.

According to the CDC,<sup>12</sup> for each year from 1983 to 1987 the most commonly reported food preparation practice that contributed to food-borne disease was improper storage

or holding temperatures, followed by poor personal hygiene of the food handler. Food obtained from an unsafe source was the least commonly reported factor for all 5 years. Inadequate cooking and contaminated equipment ranked third and fourth, respectively, in each of the 5 years. In most outbreaks caused by bacterial pathogens, the food was stored at improper holding temperatures.

Similarly, some people are demanding seafood inspection, presumably because seafood can be dangerous and a system does not exist for routine examination of these products before they are offered for sale. To address these concerns, the FDA created an Office of Seafood<sup>13</sup> to conduct enforcement, research, educational, and training activities. Its activities include overseeing various seafood inspection programs undertaken by the FDA in conjunction with other federal and state agencies; developing training programs in seafood safety for FDA, state, and local inspectors; and administering the National Shellfish Sanitation Program, which governs the growing, harvesting, and interstate transportation of shellfish. According to a study conducted by the Committee on Evaluation of the Safety of Fishery Products,<sup>14</sup> improved monitoring to prevent the harvest of shellfish from polluted waters would offer the greatest reduction in the risk of disease.

State regulations also play an important role in ensuring the safety of seafood. According to the study on seafood safety<sup>14</sup>:

Because seafood diversity poses region-specific concerns in monitoring coastal waters, in addressing species unique to local harvests and process settings, and in accessing point-of-sale transactions and recreational fishing, state regulations have played the more immediate and dominant role in surveillance of seafood safety and quality. However, federal cooperation and support is essential. All pertinent federal authorities are represented by an equivalent agency at the state level

that, in most states, models and adopts regulations in accordance with its federal counterpart.

In most states, the primary enforcing agency for seafood safety is the state department of health equivalent to the US FDA. In some states, this authority is shared across species or commercial settings by the departments of health, agriculture, and equivalent divisions within a department of natural resources. In a few states, the department of agriculture maintains the sole authority over all seafood, usually in a division or bureau of health. This diversity among states reflects the unique attributes of seafood and the challenge for state-federal liaisons.

As with meat and poultry, seafood inspectors cannot see hepatitis A virus in an oyster, *Vibrio vulnificus* in a crab, or ciguatera toxin in a fish. Protection from hazards like these must come from proper cooking, sanitary handling, adequate refrigeration, and control of the source. Cooking alone will not protect against the heat-resistant seafood toxins.

None of this is intended to argue against more and better raw product inspection, whether it be meat, poultry, seafood, edible plants, or manufactured products. However, sanitary handling, refrigeration, and proper cooking will help reduce food-borne disease.

### CONCLUSIONS

The Council on Scientific Affairs believes that the FDA and the US Department of Agriculture should be encouraged to continue their efforts to ensure the safety of the food supply. The development of an Office of Seafood to enhance seafood inspection is appropriate. Inspection of meat, poultry, and seafood should be viewed as one component of an overall program for improving food safety. The CDC reported that in determining causes of microbial food poisoning during the 5-year period from 1983 through 1987, food obtained from

an unsafe source was the least commonly reported factor for all 5 years. Inadequate cooking and contaminated equipment ranked third and fourth, respectively, in each of the 5 years. In most outbreaks caused by bacterial pathogens, the food was stored at improper holding temperatures.

Therefore, the areas in the food chain in which better control is most likely to result in a reduction in food-borne illness are food storage and food preparation, such as those found in retail stores, restaurants, institutions, and homes. Increased local inspection of commercial and public facilities and education of the public in food safety are essential, positive actions that would reduce the incidence of food-borne illness. Primary care physicians can help by identifying cases of food-borne diseases and reporting them to health agencies.

## RECOMMENDATIONS

The Council on Scientific Affairs recommends that the following statement be adopted in lieu of Resolutions 76 and 77 (I-90) and that the remainder of this report be filed:

That the American Medical Association encourage the Food and Drug Administration and the US Department of Ag-

riculture to continue their efforts to assure the safety of the food supply. Inspection of meat, poultry and seafood should be viewed as one component of an overall program for improving food safety.

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*This report is not intended to be construed or to serve as a standard of medical care. Standards of medical care are determined on the basis of all the facts and circumstances involved in an individual case and are subject to change as scientific knowledge and technology advance and patterns of practice evolve. This report reflects the scientific literature as of December 1991.*

*This report was presented at the December 1991 Interim Meeting of the House of Delegates as Report L of the Council on Scientific Affairs. The recommendations of this report were adopted in lieu of Resolutions 76 and 77 (I-90) and the remainder of this report was filed.*

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