

Food Safety

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- Frumkin H [Ed.] (2010) Environmental Health: From Global to Local, 2nd Ed. Chapter 18 "Food Safety" pp.635-688.
- **KEY CONCEPTS**
 - Foodborne illness can threaten public health
 - Three classes of hazard (biological, chemical, physical) can cause foodborne illness
 - Especially susceptible people to foodborne illness
 - Potentially hazardous foods escaping from time-temperature safety control
 - Interventions including HACCP
 - The "food environment" refers to the availability in schools, communities, and other settings, of both nutritious foods and unhealthy foods; complementing traditional food safety approaches
- Other reference web pages
 - [WHO/Food safety] <http://www.who.int/foodsafety/en/>
 - [Online course] http://www.sp-lab.net/fao/MRA/mra_en/index.html
 - <http://extension.psu.edu/food/safety/courses>
 - [USMEF HACCP video] https://www.youtube.com/watch?v=50e_lc2rPK4

The extent of food borne illness

- Food borne illness: the sickness which people experience after consuming food and beverages contaminated with pathogenic (disease-causing) microorganisms, chemicals, or physical agents
- Common symptoms: nausea, vomiting, diarrhea, abdominal pain, headache, fever, dehydration and those combinations
- Common and mild, so under-reported
- Annual burden in USA: 10 - 80 million cases
 - The wide range of the estimate comes from under-reporting and the fact that the same pathogen can transmit via water
 - CDC estimate in 1999: 76 million cases, 325000 hospitalization, 5000 deaths
- Natural / organic foods are not always safe
 - less human origin chemical hazards
 - equal biological hazards

Annual incidences of food poisoning in Japan

<http://www.mhlw.go.jp/english/policy/health-medical/food/dl/pamphlet.pdf>
http://www.mhlw.go.jp/stf/seisakunitsuite/bunya/kenkou_iryuu/shokuhin/syokuchu/04.html

Trend of Food Poisoning Prevalence

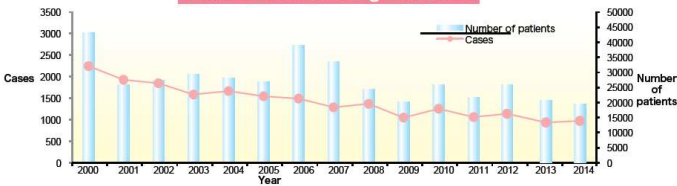


Fig.2-1 Annual variation in the percentage of incidents from food poisoning by serving place and preparing facility

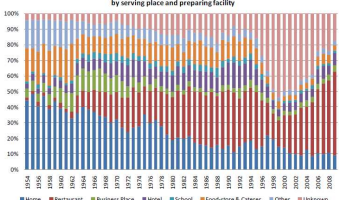
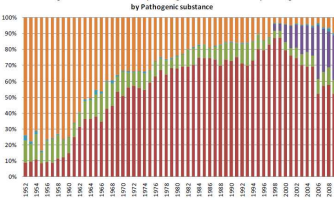


Fig.3 Annual variation in the percentage of incidents from food poisoning by Pathogenic substance

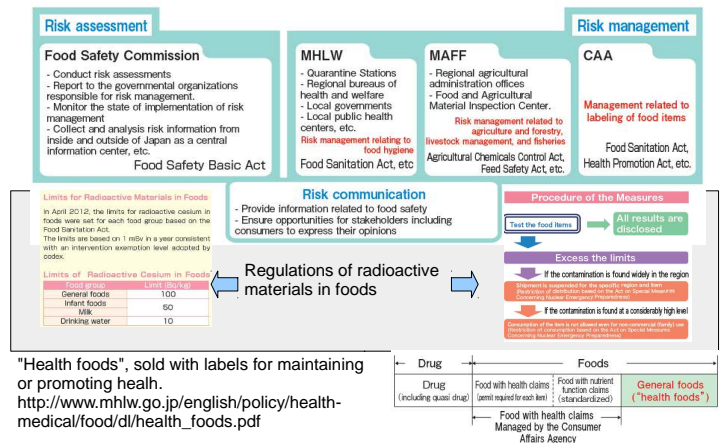


- Detailed information in 2009 is given by http://www.mhlw.go.jp/english/topics/foodsafety/poisoning/dl/Food_Poisoning_Statistics_2009.pdf

Food regulations in Japan

<http://www.mhlw.go.jp/english/policy/health-medical/food/dl/pamphlet.pdf>

Measures to Ensure Food Safety (risk analysis)



Japan imports huge amount of foods

<http://www.mhlw.go.jp/english/policy/health-medical/food/dl/pamphlet.pdf>

- Regulations to confirm the safety of imported foods are important.



Number of notification	2,216,012
Amount of import	32,411,715 tons (based on notifications)
Number of inspections conducted	195,390
Number of violations	877 (gross number 913)
• Violation concerning standards and criteria	245
• Violation concerning sanitation criteria for foods	539
• Violation concerning food additives	54
• Other violation	75

The 3 major reasons to focus on food-safety issues

- Known pathogens are found in a growing number of foods
 - Salmonella bacteria: Commonly found in raw poultry and eggs / caused food borne illness for many years. Recently linked to large outbreaks and "product recalls" of peanut butter and raw produce. More than 1440 cases caused food borne outbreak (FDA and CDC)
- New pathogens are being discovered
 - Listeria monocytogenes in soft cheeses
 - Cyclospora cayetanensis in fresh fruits and vegetables
- Number of immunocompromised people is growing
 - Healthy adults remain asymptomatic or mild
 - Infants, young children, elderly, pregnant women, nursing mothers, impaired immune function due to HIV, cancer, diabetes may have heavy symptoms

Common sources of food contamination

- Air
- Water
- Soil
- Food handlers
- Packaging materials
- Animals, rodents, and insects
- Food contact surfaces
- Ingredients
 - Food additives

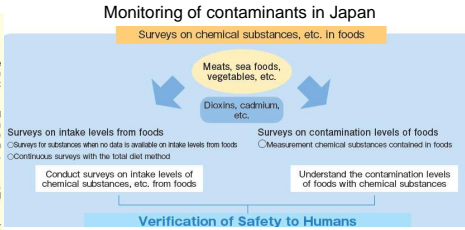
Classification of food additives (as of September 18, 2015)

① Designated additives (449 items)
Substances that have been designated by the Minister of Health, Labour and Welfare to authorize the use of them, based on the safety assessment (e.g. ascorbic acid and xylitol).

② Existing food additives (365 items)
Substances that have been permitted for use and distribution without having gone through the designation process specified by the Food Sanitation Act for the reason that they had had a long history of consumption at the time of the revision of the act in 1995 (e.g. gardenia coloring agent, Japanese persimmon tannin).

③ Natural flavoring agents (approx. 620 items)
Substances that are derived from natural origins, including animals and plants, and used for flavoring food (e.g. vanilla flavoring and crab flavoring).

④ Ordinary foods used as food additives (approx. 100 items)
Substances that are generally provided for eating or drinking as food and also used as food additives (e.g. strawberry juice and agar).



Biological, Chemical and Physical Hazards

- Biological hazards
 - microscopic organisms: bacteria, viruses, parasites
 - bacteria origin: 2 types (caused by live bacteria proliferation within gut vs by toxins)
 - invisible challenges to food safety
 - Controlling biological hazards is a primary goal of every food safety program
- Chemical hazards
 - harmful substances
 - naturally occurring like food allergens, toxins associated with molds, plants (incl. fungi), fish, shellfish
 - human origin like pesticides, cleaning agents, metals, PCB
- Physical hazards
 - foreign objects like stones, bone fragments from animals, pieces of glass, staples, jewelry
 - originated from poor handling, processing

Examples of food borne illness

- Biomagnification (Concentration of toxic chemicals, esp. organic chemicals increases with ascending trophic levels)
- Chemical (anthropogenic) origin
 - Mercury
 - Poly-chlorinated biphenyls (PCB)
 - Bisphenol A
 - Pesticides
- Biological origin
 - Food allergens
 - Ciguatera toxins
 - Scombroid toxins

PHF/TCS foods and potential contamination by microorganisms

- Potentially hazardous foods and time/temperature control for safety foods
 - Foods of animal origin that are raw or heat-treated
 - Foods of plant origin that are heat-treated or consist of raw seed sprouts
 - Cut melons (for example, cantaloupe)
 - Garlic and oil mixtures that are not modified in a way to inhibit the growth of pathogenic microorganisms
 - Cut tomatoes
- Spore-forming bacteria
 - *Clostridium perfringens*: anaerobic
- Non-spore-forming bacteria: Shiga-toxin producing E. coli O157, Listeria Monocytogens, Salmonella, Staphylococcus aureus
- Viruses: Hepatitis A, Noro (increasing in Japan, rapid diagnostic test become available in insurance-covered since 2012)
- Parasites: Anisakis, Cyclospora cayetanensis

Investigation of food borne disease outbreaks

- Purpose
 - Determine the cause of outbreak
 - Detect all cases, the foods and the beverages
 - Control the outbreak
 - Document foodborne disease occurrence
 - Correct poor handling
 - Revise HACCP plan
 - Foster public confidence in the food safety
- 9 steps (IAFP, 2007)
 - Obtain a description of food items and secure any leftover food items
 - Gather basic data
 - Formulate an initial hypothesis and case definition
 - Collect clinical specimens for testing
 - Develop a questionnaire
 - Analyze the questionnaires
 - Conduct an environmental investigation
 - Implement control measures
 - Summarize the investigation

Prevention

- Avoid risk factors listed below
 - improper holding temperatures
 - poor personal hygiene
 - improper cooking temperatures
 - foods from unsafe sources
 - contaminated equipment and cross-contamination
- HACCP (Hazard Analysis and Critical Control Point) approach is a central paradigm of food safety
 - The concept has been developed by NASA in 1971 to avoid food borne illness in the space
 - Hazard analysis / Determine CCP / Establish Critical Limit / Establish monitoring system / Establish corrective action / Verify that the HACCP system is working effectively / Establish effective record keeping
- Food safety agencies and initiatives in USA
 - USDA (cf. HACCP advertisement for exporting meat, see Movie on https://www.youtube.com/watch?v=50e_lC2rPK4), FDA (Good Agricultural Practices, Good Manufacturing Practices, 2005 Food Code), CDC, EPA
 - PulseNet, Fight BAC! Campaign, Consumer Advisories, Food Irradiation
- Emerging threats: Mad cow disease (Bovine-Sponge-form Encephalitis), bioterrorism, industrial production of food
- WHO 5 keys:
 - http://www.who.int/foodsafety/areas_work/food-hygiene/5keys/en/

