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/
  - http://www.icd-online.org/an/html/coursesfood.html
  - http://www.icd-online.org/an/html/courseshaccp.html

The extent of foodborne illness

- Foodborne 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 underreported
- Annual burden in USA: 10 - 80 million cases
  - The wide range of the estimate comes from underreporting 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

The 3 major reasons

- Known pathogens are found in a growing number of foods
  - Salmonella bacteria: Commonly found in raw poultry and eggs / caused foodborne illness for many years. Recently linked to large outbreaks and "product recalls" of peanut butter and raw produce. More than 1440 cases caused foodborne 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

Biological, Chemical and Physical Hazards

- Biological hazards
  - microscopic organisms: bacteria, viruses, parasites
  - 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, jewery
  - originated from poor handling, processing

PHF/TCS foods and potentially contaminating bacterias

- 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: HAV, Noro (increasing in Japan, rapid diagnostic test become available in insurance-covered since 2012)
- Parasites: Anisakis, Cyclospora cayetanensis

Investigation of foodborne 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

Foodborne illness caused by chemicals

- Biomagnification
- Food allergens
- Ciguatoxins
- Scombrotoxin
- Mercury
- Polychlorinated biphenyls
- Bisphenol A
- Pesticides

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 foodborne 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), 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, bioterrorism, industrial production of food