Some water, food, sanitation and health numbers

1. Faecal-oral
    1. Diarrhoeal disease
        1. **2 million deaths/year from diarrhoea, mostly under 5 (Jumbo jet crash every hour and a half)**
        2. **One billion cases/year**
        3. **4.3% of Burden of Disease DALYs**
        4. **88% (?) attributable to inadequate WSH**
    2. 1/3 of developing world pop'n carry intestinal worms
    3. 200 million infected by schistosomiasis (bilharzia)

Classifications of disease

- Classification usually by organism (viral, bacterial, etc) or organ (diseases of head, heart, liver etc.)
- Classification by transmission route
  - If you know how it's spread, you know how to stop it

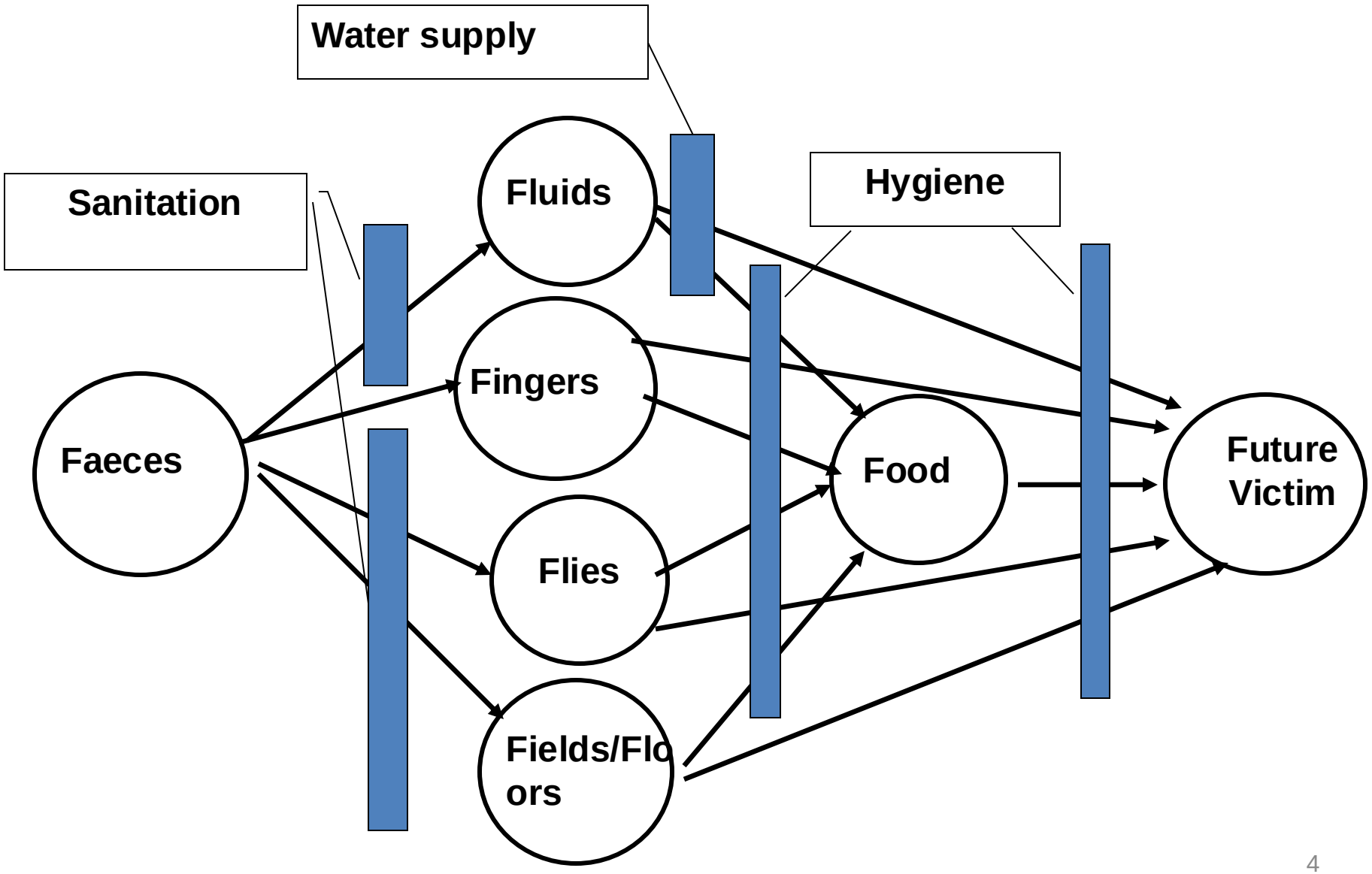
1. There is a direct impact of consuming contaminated water this is known as 'waterborne disease' and includes diarrhea , typhoid, viral hepatitis A, cholera, dysentery.

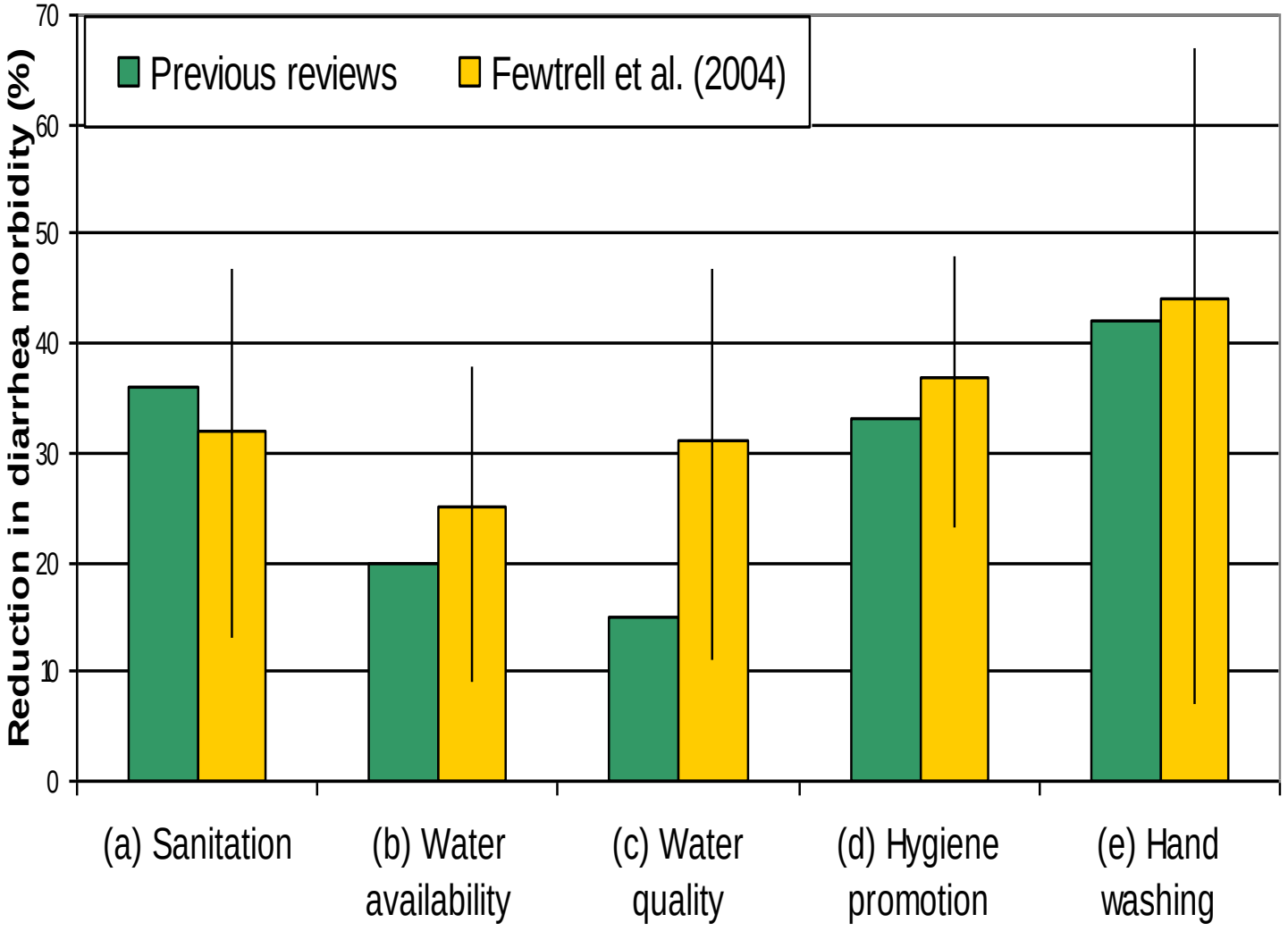
2. There is the effect of inadequate quantities of water being available for personal hygiene or the un-hygienic practices which contaminate water and cause diseases. Without enough water, skin and eye infections (including trachoma) are easily spread, as are the faecal–oral diseases. These diseases are known as 'water-washed diseases'

3. There are 'water based diseases' and "water-related vector-borne diseases" in which the aquatic environment provides an essential habitat for the mosquito vectors and intermediate snail hosts of parasites that cause human diseases.

4. There is chemically contaminated water such as water containing excessive amounts of arsenic or fluoride. Some contaminants are added to drinking water as a result of natural processes and some due to human activities such as industry and mining.

The F-Diagramme




Previous reviews
Fewtrell et al. (2004)
Reduction in diarrhea morbidity (%)
70
60
50
40
30
20
10
0
(a) Sanitation
(b) Water availability
(c) Water quality
(d) Hygiene promotion
(e) Hand washing

COMPONENTS OF ENVIRNOMENTAL SANITATION

1. WATER SANITATION
2. FOOD AND MILK SANITATION
3. EXCRETA DISPOSAL
4. SEWAGE DISPOSAL
5. REFUSE DISPOSAL
6. VECTOR AND VERMIN CONTROL
7. HOUSING
8. AIR SANITATION

WATER SANITATION

WATER ANALYSIS CONSISTS OF:

1. PHYSICAL
2. CHEMICAL
3. RADIOLOGICAL
4. BIOLOGICAL
5. BACTERIOLOGICAL

WATER SANITATION

- **PUBLIC WATER SUPPLY MUST BE-**
  1. SAFE
  2. REASONABLY SOFT
  3. PLENTIFUL
  4. CHEAP

WATER SANITATION

- **HOUSEHOLD TREATMENT OF WATER**
  1. BOILING, i.e., beyond 2 minutes
  2. CHLORINATION- 1-5ppm
  3. IODINE TREATMENT- 10 drops per gallon
  4. FILTRATION
  5. AERATION

FOOD AND MILK SANITATION

The GOLDEN RULE of food sanitation is:

“Keep it cold or hot, and keep it covered”

- 3 Enemies Of Food Storage:
  1. High Temperature
  2. High Humidity
  3. Contamination By Strong Odors

MILK SANITATION

- STERILIZATION- The application of high temperature for the purpose of destroying all types of microorganisms.
- PASTEURIZATION- The application of heat to milk for the purpose of destroying pathogenic microorganisms with minimum injury to the substance

REFUSE/WASTE DISPOSAL

- **Refuse** Is A General Term Applied To Solid And Semi Solid Waste Materials Other Than Human Excreta

REFUSE DISPOSAL

- Public Health Reasons For Proper Disposal Of Wastes
  1. Breeding Place For Insects And Rats
  2. Gives Out Foul Smell
  3. “Eye Sore”
  4. Fire Hazard

REFUSE DISPOSAL

- Types Of Refuse
  - **Garbage**: Left-over Vegetables, Animal And Fish Material From Kitchens And Food Establishments.
  - **Rubbish**: Waste Material Such As Bottles, Broken Glass, Tin Cans, Waste Papers, Discarded Porcelainware, Pieces Of Metal, Wrapping Papers Etc.

VERMIN CONTROL
[RODENT AND INSECTS]

- Types
  1. Physical Or Mechanical
  2. Chemical
  3. Biological
  4. Environmental
  5. Educational

Sanitation Requirements In Emergency Situations

Water

- Minimum Demand Per Person Per Day: 50 Lts
- Quality Control

  -To Preserve Public Health, A Large Amount Of Reasonably Safe Water Is Preferred Over A Small Amount Of Purified Water.

  -Bacteriological, Biological, Chemical, Physical And Radiological Quality Of Water Must Be Deemed Safe.
- Water

- There Must Be No Fecal Coliforms Per 100 ml. At The Point Of Delivery

The Most Widely Practiced Sanitary Control Measure For Milk Quality

1. Bacterial Count
2. Coliform Count
3. Pasteurization
4. Chlorination

Chlorination Of Water Removes

1. Odor
2. Bacteria
3. Bad Taste
4. Turbidity

Turbidity Of Water Can Be Removed By

A. Boiling
B. Coagulation
C. Chlorination
D. Filtration

The Control Of The Environment To Prevent Communicable Disease Is

1. Disinfection
2. Sterilization
3. Sanitation
4. Surveillance

Food borne diseases

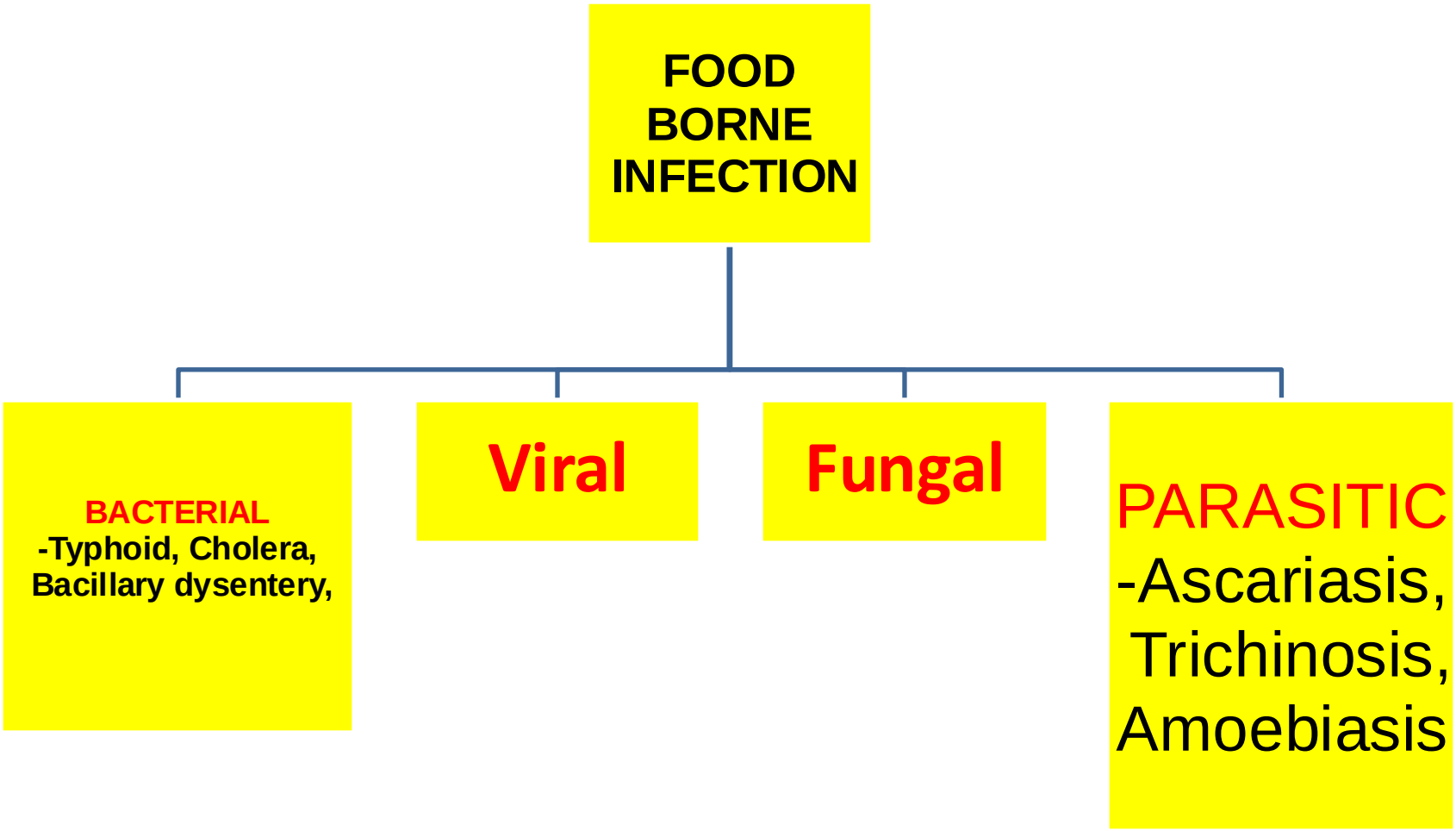
- Food borne diseases (FBD) are acute illnesses associated with the recent consumption of food
- The food involved is usually contaminated with a disease **pathogen or toxicant**.
- Such food contains enough pathogens or toxicant necessary to make a person sick.

classification of food borne diseases

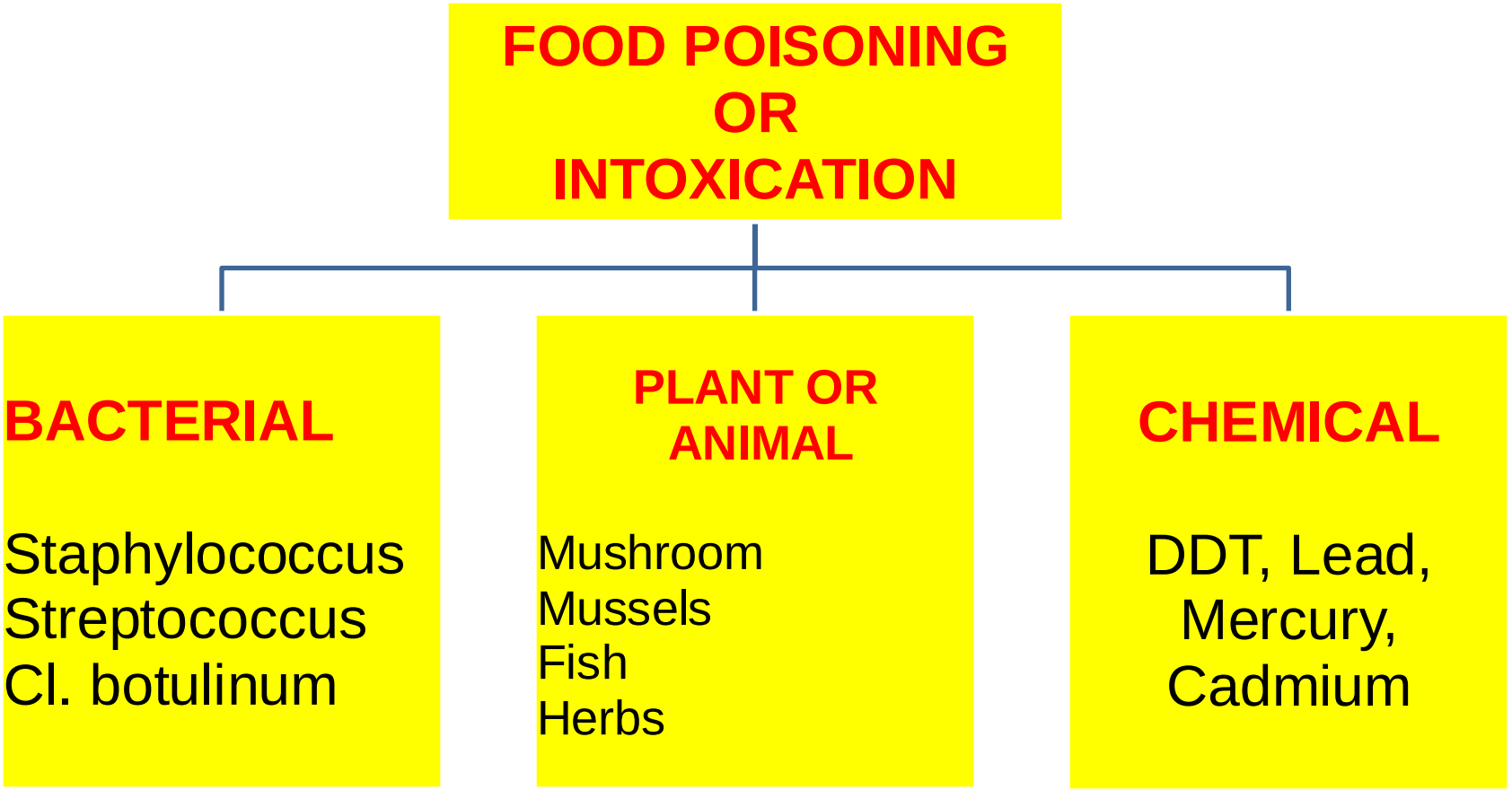
Food borne diseases are classified into:

1. Food borne infections and
2. Food borne intoxications

FOOD BORNE DISEASES



FOOD BORNE DISASE



Food borne infections

- Food borne infections are caused by the **entrance of pathogenic microorganisms contaminating food into the body**, and the reaction of the body tissues to their presence.
- These can either be fungal, bacterial, viral or parasitic
- Food borne infections tend to have **long incubation periods** and are usually characterized by **fever**

SALMONELLA
food poisoning outbreaks

Outbreaks occur in different forms:

1. Sporadic cases involving only one or two persons in a household
2. Family outbreaks in which several members of the family are affected
3. Large outbreaks caused by a widely distributed infective food item
4. Institutional outbreaks which may be caused by a contaminated single food item.

Factors associated with Salmonella food poisoning outbreaks

1. Consumption of inadequately cooked or thawed meat or poultry,
2. Cross-contamination of food from infected food handlers.
3. Presence of flies, cockroaches, rats, in the food environment that act as vectors of the disease.

Control measures

1. Efficient refrigeration and hygienic handling of food.
2. Consumption of properly cooked meat,
3. Complete thawing of frozen meats and adequate cooking.
4. Heat processing of meat, milk , fish and poultry to destroy salmonella organisms in food

CHOLERA

- Cholera is caused by *Vibrio cholera* bacterium.
- Cholera vibrios are ingested in drink or food. In natural infection, the dosage is usually very small.
- The organism multiply in the small intestine to produce a very potent enterotoxin, which stimulates a persistent out pouring of isotonic fluid by the gut mucosal cells.

Transmission

- Man is the only natural host of the cholera vibrios
- Spread of infection is from person-to-person, through contaminated water or foods.
- Shrimps and vegetables are the most frequent carriers.
- Cholera is an infection of crowded poor class communities and it tends to persist in such areas.
- Cholera outbreaks occur either as explosive epidemics usually in non-endemic areas or as protracted epidemic waves in endemic areas

Diagnosis

- *A vibrio immobilization test with dark field microscopy. In the acute stage, vibrios are abundantly present in watery stool (upto 10^7 to 10^9 organisms per ml).*
- *Bacteriological examination can be done in stool, suspect water and food.*
- *Precise identification of biotype and serotype done using serological (e.g. CFT) and phage sensitivity tests.*

Control measures

1. Provision of potable water
2. Proper sewage disposal
3. Proper cooking and hygienic handling of food
4. Observation of personal hygiene
5. Vaccination -The heat killed, phenol preserved vaccine has protection that lasts for 3 to 6 months.

VIRAL FOODBORNE INFECTIONS

- Viruses are common pathogens transmitted through food.
- Hepatitis A and Norwalk-like virus (Novovirus) are the most important viral food borne pathogens.
- These viruses are highly infectious and may lead to widespread outbreaks

Infectious hepatitis A

- The incubation period is long, being an average of 30 days (range 15-50 days).
- It is a systemic infection characterized by gastrointestinal manifestations and liver injury, fever, malaise anorexia, nausea, abdominal discomfort, bile in urine and jaundice.
- The duration of the disease could be from a few weeks to several months.

FOOD BORNE INTOXICATIONS

These are diseases caused by consumption of food containing:

1. **Biotoxicants** which are found in tissues of certain plants and animals.
2. **Metabolic products (toxins)** formed and excreted by microorganisms (such as bacteria, fungi and algae), while they multiply in food, or in gastrointestinal tract of man.
3. **Poisonous substances**, which may be intentionally or unintentionally added to food during production, processing, transportation or storage.

Food borne intoxications……

Food borne intoxications have **short incubation** periods (minutes to hours) and are characterized by **lack of fever**.

Food borne intoxications can be classified into:

a. Bacterial intoxications
b. Fungal intoxications
c. Chemical intoxication
d. Plant toxicants, and
e. Poisonous animals.

BACTERIAL FOOD BORNE INTOXICATIONS

1. *Staphylococcus aureus* intoxication
2. *Bacillus cereus* food borne intoxication
3. *Clostridium perfringens* food borne intoxication
4. *Clostridium botulinum* food borne intoxication

Clostridium botulinum foodborne Intoxication

- *Clostridium botulinum* food borne intoxication (botulism) is a type of food poisoning caused by consumption of enterotoxins produced by strains of *Clostridium botulinum.*
- *C. botulinum* is an obligate, spore-forming anaerobe, and Gram positive bacilli
- The strains are divided into proteolytic and non-proteolytic types according to whether they hydrolyze proteins or not.

- The intoxication is caused by botulinal toxins A, B, E, F and G, produced by *C. botulinum* type A, B, E, F and G, while the organism grows in food. *C. botulinum* types C and D produce toxins C and D that cause disease in animals
- Type E strains are non-proteolytic while the rest are proteolytic.
- Spores of *C. botulinum* type A can survive temperatures of 120^{o}C.
- Toxin production occurs at temperature range between 25-30^{o}C.

Characteristic of Botulinal toxins

- These toxins are neurotoxins, that are highly toxic, heat labile (inactivated by heating at 80^{o}c for 10 min), unstable at alkaline pH (but stable below pH 7.0) but resistant to pepsin and acidic environment.
- The toxins can resist the action of the gastric and intestinal juices.
- Botulinus toxin is one of the most lethal poisons known. The calculated lethal dose for an adult person is 10 µg.

Types of foods implicated

- Foods associated with anaerobic conditions such as spoiled canned meat, or hams and bacon stacked without air access, are particularly liable to be infective.
- Home made fermented foods have been incriminated, together with smoked, pickled and canned foods that are allowed to stand and then eaten without adequate cooking.
- Uncooked fresh foods are safe because they are eaten before the toxin has had time to develop, while, if foods are cooked, the toxin is destroyed.

Role of preservatives in meat

- Nitrates/nitrites are used in canned meat as preservatives. The salts reduce chances of growth of *C. botulinun* and inhibit toxin production.
- The danger of botulism has been the deciding factor in the formulation of food processing techniques, especially canned meat .

Mode of transmission

1. Contamination of food due to improper handling.
2. Insufficient heating of food to destroy spores.
3. Spores present in animal tissues e.g. meat and fish.

Preventive measures

- Ensuring proper manufacturing practices e.g. ensure proper sterilization and preservation of canned meat
- Preserved foods possessing rancid or other odors should be rejected
- Proper heating of food before consumption to destroy heat labile neurotoxins. Food should be heated to 80^{o}C and temperature maintained for at least 10 min before eating.
- Picked foods are rendered safe if the brine used contain not less than 10 % common salt, in weaker brines, microorganisms can continue to multiply.

Prevention cont…

- Ensuring fast cooling of food. This will ensure that spores that may be remaining do not germinate in food.
- Utmost care should be taken in the manufacture of cans, their transport, handling, storage and subsequent use during packaging of product.

CHEMICAL FOODBORNE INTOXICATION

- This is a type of food borne intoxication arising from consumption of food containing poisonous chemicals,
- These may be intentionally or unintentionally added to foods as a result of producing, processing, transporting or storage.
- A number of substances can enter the food chain from the environment and through their use as growth promoters or veterinary therapeutics giving rise to chemical residues.

Chemical substances involved

Chemical food borne intoxication involve the following substances:

- Heavy metals e.g. antimony, mercury, arsenic, flouride, lead, cadmium, cyanide etc.
- Pesticides and insecticides e.g. DDT, BHC Organochlorines and organophosphates.
- Herbicides
- Fungicides e.g. organomercurials

Chemical substances involved..

- Preservatives e.g. nitrites, nicotinate, etc
- Antibiotics e.g. pencillin, tetracyclines, chloramphenicol etc.
- Radionuclides e.g. cesium, strontium, radium, molybdenum, barium, ruthenium, lanthanum, iodine isotopes etc.