

DISEASE PREVENTION AND CONTROL

General Principle of Prevention, Control, Elimination and Eradication of Communicable Diseases

II

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DISEASE PREVENTION AND CONTROL

Every disease has certain **weak points** susceptible to attack.

- ✓ The basic approach in controlling disease is
- ✓ **to identify these weak points** and break the weakest links in the chain of transmission
- ✓ This requires sound **epidemiological knowledge** of the disease - that is its
 - **magnitude,**
 - **distribution in time,**
 - **place and person,**
 - **multifactorial causation,**
 - **sources of infection and**
 - **dynamics of transmission.**
- ❖ Frequently it may be necessary to **institute more than one method of control simultaneously.**

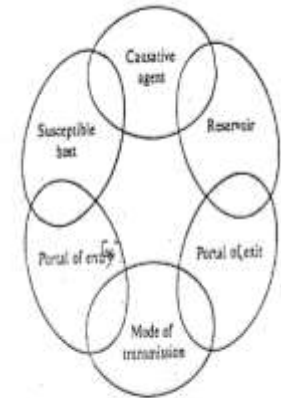


FIGURE 1.2 The chain of infection. Components of the infectious disease process.

- ❖ **The choice of methods will depend** upon factors such as
 - **Availability** of proper **tools** and **techniques**,
 - **Efficiency**
 - **Relative cost effectiveness**,
 - **Acceptability.**
- ❖ Although effective control of a disease **requires knowledge** of its **multifactorial causation**,
- ✓ **removal or elimination of a single known essential link or the weakest link may be sufficient to control a disease**, even if **complete knowledge about the aetiology of the disease in question is lacking**. *The classic example is that of **John Snow** controlling the cholera epidemic in London, by removing the handle of the incriminated water pump.*
- ❖ **Control measures should not be delayed because of**
- ❖ **incomplete or lack of accurate knowledge of the aetiological agent**



Disease control involves all the measures designed to **prevent or reduce as much as possible the**

- **Incidence,**
- **Prevalence and**
- **Consequences of disease**

The activities of disease prevention and control are required

- **Community Participation,**
- **Political Support And**
- **Intersectoral Coordination.**

❖ **Broadly these are measures, pending results of epidemiologic investigation**

- 1. The Agent**
- 2. The reservoir or source of infection**
- 3. The route(s) of transmission**
- 4. The susceptible host (people at risk).**

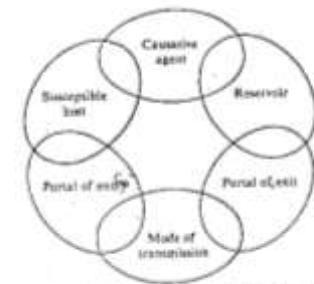
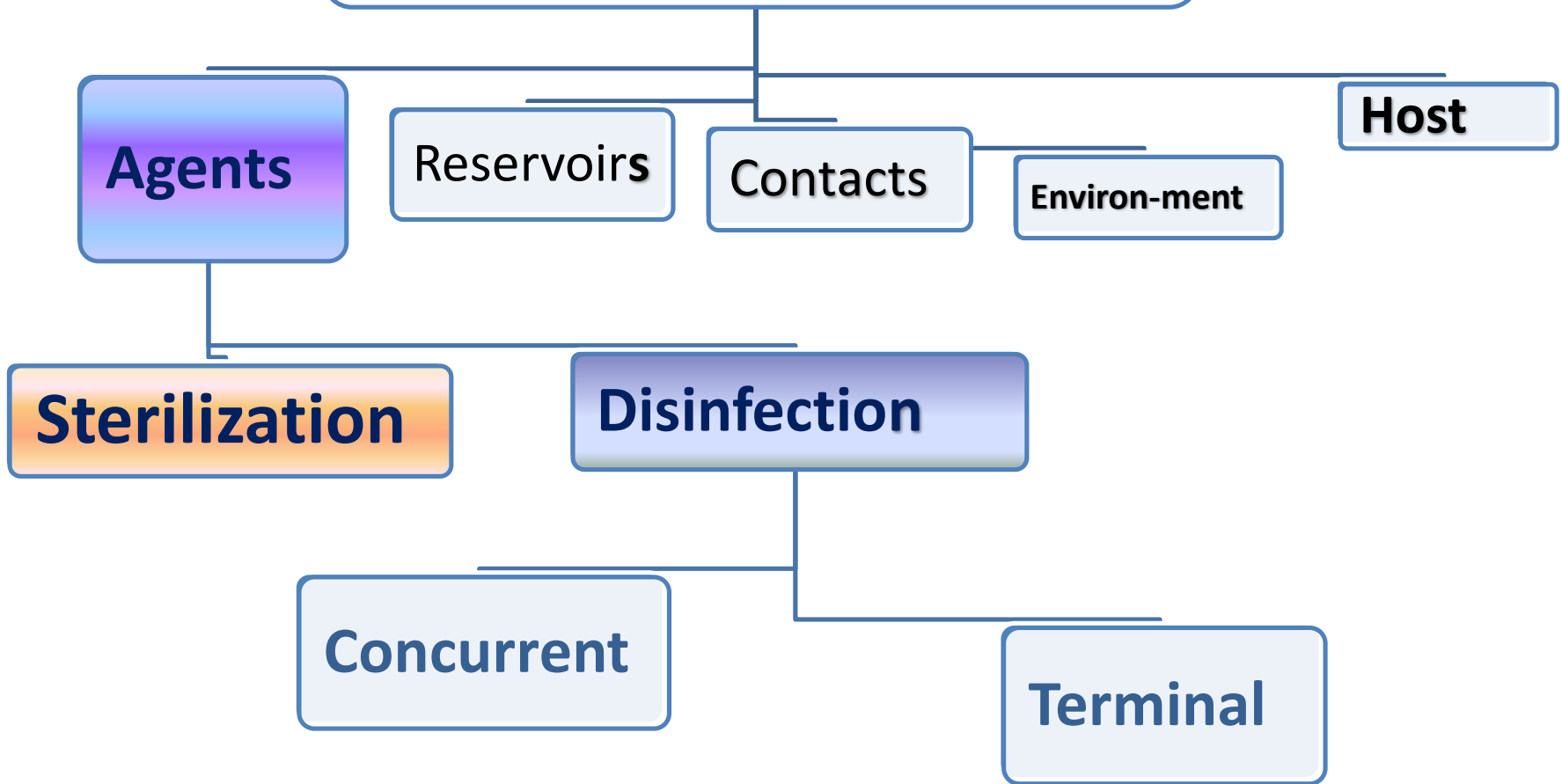


FIGURE 1.2 The chain of infection. Components of the infectious disease process



General principles of prevention and control of communicable diseases



❑ **Sterilization : 1.Measures Applied to The Agent**

- ❖ Validated process used to **render a product free of all forms of viable microorganisms including bacterial spores.**
- ❖ **killing all forms of living organisms,**
- ❖ **it is used for medical and surgical instruments by direct exposure to the sterilizing agent.**

❑ **Disinfection :**

- ❖ **killing the infectious agents outside the body**
- ❖ by direct exposure to **chemical or physical agents.**
- ❖ **Disinfection is less lethal than sterilization** because it
- ❖ **destroys most recognized pathogenic** microorganisms but
- ❖ **not necessarily all microbial forms** (e.g., bacterial spores).

Types of Disinfection

- 1 Concurrent disinfection**
- 2 Terminal disinfection**

(a) concurrent Disinfection

- ❖ application of disinfective measures **as soon as possible after the discharge of infectious material from the body** of an infected person, or **after the soiling of articles** with such infectious discharges
In other words, the **disease agent is destroyed as soon as it is released from the body**, and
- ❖ in this way further spread of the agent is stopped.
- ❖ **Concurrent disinfection consists of usually disinfection of urine, faeces, vomit, contaminated linen, clothes, hands, dressings, aprons,, etc throughout the course of an illness.**

(b) Terminal disinfection :

- ❖ application of disinfective measures **after the patient has been removed by death or to a hospital or has ceased to be a source of infection** (by treatment).
- ❖ Or after **other hospital isolation**

General principles of prevention and control of communicable diseases

Agents

Reservoirs

Contacts

Environment

Host

Cases

Carriers

Animal
reservoir

2. Controlling the reservoir

If the first link in the chain of causation (i.e., the disease agent) is deemed (consider) to be **the weakest link**, logically, the **most desirable** control measure would be to **eliminate the reservoir or source**, if that could be possible.

Elimination of the reservoir **may be easy** with the animal reservoir (e.g., bovine tuberculosis, brucellosis), but is **not possible** in humans in whom the general measures of

□ Reservoir control comprise :

- **early diagnosis,**
- **notification,**
- **isolation,**
- **treatment,**
- **quarantine,**
- **surveillance** and
- **disinfection –**

all directed to **reduce** the quantity of the **agent** available for dissemination.

(1) Early Diagnosis and Case finding

- ❖ **rapid identification is the first step** in the control of a communicable disease
 - It is the cornerstone on which the organization of disease control is built.
 - **laboratory** procedures may be required to **confirm the** diagnosis.
- ❖ Early diagnosis is needed for
 - (a) **the treatment of patients**
 - (b) **for epidemiological investigations**, e.g. to
 - * **trace the source** of infection from the
 - * **known or index** case to the unknown or
 - * **the primary source** of infection
 - (c) **to study the time, place and person distribution**
(**descriptive epidemiology**) and
 - (d) for the **Establishment of prevention and control measures**

(2) Notification

Notification is an important source of epidemiological information

- It enables early detection of **disease outbreaks**, which
- permits **immediate action** to be taken by the health authority to control their spread.

Once an infectious disease has been detected (or even suspected),

- ❖ **it should be notified** to the **Local health** authority.
- The diseases to be notified vary from country to country;
- and even within the same country.
- ❖ Usually, diseases which are considered to be serious Dangers to public health are included in the list of notifiable diseases.
- **Notifiable diseases may also include non-communicable diseases**

early diagnosis,
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Under the International Health Regulations (IHR), WHO. Reporting:

- diseases in man are reported to the local health authority.
- in animals are reported to **veterinary or agricultural authority**
- Zoonotic diseases** are reported to **both** authorities.
- Diseases under international regulations are reported to WHO

(3) Isolation

Isolation is the oldest communicable disease control measure.

It is defined as

"separation, for the period of communicability of infected persons or animals from others in such and under such conditions, as places

- **To prevent or limit the direct or indirect transmission of the infectious agent from those infected to those who are susceptible, or who may spread the agent to others" .**
- ❖ In general, infections from human/animal can be done by
 - **Physical Isolation of the case or carrier, and if necessary, treatment until free from infection,**
 - **provided cases and carriers can be easily identified and**
 - **carrier rates are low.**

□ **The purpose of isolation is**

To Protect the community by preventing transfer of infection from the reservoir to the possible susceptible hosts



The **type** of isolation **varies** with the **mode of spread** and **severity** of the disease.

There are several types of isolation - **standard isolation**, **strict isolation**, **protective isolation**, **high security isolation**.

Place of isolation:

- Isolation in a **hospital** or in separate **quarter** is required *for cholera, plague*.
- Isolation **at home**: if home is suitable for patients of *typhoid, meningitis, whooping cough, poliomyelitis and hepatitis A*.
- ❖ **Hospital isolation**, wherever possible, **is better than** Home isolation.

The duration of isolation

- determined by the **duration of communicability** of the disease and
- the **effect of chemotherapy** on infectivity

□ Isolation is of limited value due to:

- Many diseases are **highly communicable** during the early stage.
- The **exact period of communicability is not known** in many diseases.
- **Carriers** of infective agents may go **undetected**.
- Many **mild cases of infection spread disease without being detected**

Today, isolation is recommended only when the risk of transmission of the infection is exceptionally serious.

- **isolation is in most cases replaced by surveillance** because of improvements in epidemiological and disease control technologies.

1. Surveillance:

- it is the **collection, analysis, interpretation and dissemination** of information about a selected health event.
- This information is important to **plan, implement and evaluate** a health program

(4) **Treatment Chemoprophylaxis**

- ❖ Many communicable diseases have been controlled by
- ❖ effective drugs. The use of drugs to
- **Cure** clinically recognizable disease or **to limit its progress**
 - **to kill the infectious agent when it is still in the reservoir, i.e., before it is disseminated**
 - ❖ It is for the **sake of the patient** and
 - ❖ to **reduce the period** of communicability and
 - ❖ **to limit the transmission** to the contacts.
- **prevents development of secondary cases.**

early diagnosis
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- ❖ Treatment is also extended to carriers.
- ❖ Treatment can take the form of individual treatment or mass treatment.
- ❖ In the latter all the people in the community are administered the drugs whether they have the disease or not (e.g., trachoma).
- ❖ If the treatment is inadequate or inappropriate, it may induce drug resistance in the infectious agent and may frustrate attempts to control the disease by chemotherapy

(5) Quarantine

- ❖ defined as "the limitation of freedom of movement of such well persons or domestic animals exposed to communicable disease for a period of time not longer than the longest usual incubation period of the disease, in such manner as to prevent effective contact with those not so exposed" .
- ❖ Quarantine measures are also "applied by a health authority to a ship, an aircraft, a train, road vehicle, other means of transport or container, to prevent the spread of disease, reservoirs of disease or vectors of disease"

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- ❖ In contrast to isolation, quarantine applies to restrictions on the healthy contacts of an infectious disease.

Measures applied to the carriers

1. Detection:

- detection of carriers is **important** in diseases in which carriers are an **important reservoir of infection**, e.g. **Enteric fever**,
- ❑ **The value of detection of carrier depends on:**
 - ❖ **Proportion** of carriers in the community.
 - ❖ **Occupation of the carrier** and its intimacy to contacts as **food handlers** and those **working in closed community** (*school or day care centers*)
- 2. **Exclusion from work:** must be done if his occupation is a **food handlers** (e.g. Typhoid carrier) or a teacher (diphtheria carrier).
- 3. **Treatment applied to the carrier state**

3. Interruption of transmission

- ❖ A major aspect of communicable disease control relates to
- ❖ breaking the chain of transmission "or interruption of transmission
- ❖ This may mean changing some components of man's environment
- ✓ to prevent the infective agent from a patient or carrier from
- ✓ entering the body of susceptible person. *For example,*
- *water can be a medium for the transmission of many diseases such as typhoid, dysentery, hepatitis A, cholera and gastroenteritis.*
- **Water treatment** will eliminate these diseases.
- ❖ *Depending upon the level of pollution, this may vary from simple chlorination to complex treatment.*

□ Foodborne disease

is particularly prevalent in areas having low standards of sanitation.

- ❖ **Clean practices** such as hand washing, adequate cooking, prompt refrigeration of prepared foods and
- ❖ withdrawal of contaminated foods will prevent most food-borne illnesses

□ When the **disease is vector-borne**, control measures should be directed **primarily at the**

❖ **vector and its breeding places.**

Vector control also includes

destruction of stray dogs,

control of cattle, pets and other animals

to minimize spread of infection among them, and from them to man.

□ **droplets or droplet nuclei infection** are **not usually controlled effectively** by attempting to **interrupt their mode of spread**; reliance is

➤ **placed on early diagnosis and treatment** of patients,

➤ **personal hygiene** and

➤ **proper handling of secretions and excretions.**

❖ In short, **blocking the routes of transmission imply an attack on environmental factors,**

4. The Susceptible Host

The third link in the chain of transmission is the **susceptible host** or people at risk.

They may be protected **by one or more of the** following strategies.

1. Non-specific measures:

- health education,
- good nutrition,
- personal hygiene and
- protection against accidents.
- adequate housing,
- recreational facilities,
- suitable working conditions,
- periodic selective examination,
- **legislative measures** to formulate integrated programme and permit effective programme **implementation.**

2. Specific measures:

Use of specific immunization
active
passive and
chemoprophylaxis.

(1) Active Immunization

- ❖ is one of the **most powerful** and **cost-effective weapons** of modern medicine
 - ❖ One effective way of strengthen the host defences and controlling the spread of infection.
 - ❖ There are some infectious diseases whose control is solely based on **active immunization, e.g.,**
 - ❖ *polio,*
 - ❖ *tetanus,*
 - ❖ *diphtheria*
 - ❖ *measles.*
- Vaccination against these diseases is given as a routine
- **during infancy & early childhood** with **periodic boosters** to maintain adequate levels of immunity.

By **reducing** the number of **susceptible** in the community, it augments "**herd immunity**"

- ❖ Unfortunately we do not have vaccines for every infectious disease (e.g., malaria, diarrhoeal diseases).

4) **Chemoprophylaxis**

Chemoprophylaxis implies the

- **protection from, or**
- **prevention of, disease.**

This may be achieved by

- ✓ **Causal Prophylaxis, or by**
- ✓ **Clinical Prophylaxis :**

(i) Causal prophylaxis implies the complete prevention of infection by the early elimination of the invading or migrating causal agent.

(ii) Clinical prophylaxis implies the prevention of clinical symptoms; it does not necessarily mean elimination of infection.



5) Non-specific Measures

Most of the non-specific measures to interrupt pathways of transmission are of general applicability.

❖ **Improvements in the quality of life** (e.g., better housing, water supply, sanitation, nutrition, education) Nonspecific measures will also include

❖ "**legislative measures**", wherever needed, to formulate integrated programme and permit effective programme implementation.

□ In fact, these non-specific factors **have played a dominant role** in the **decline** of *tuberculosis, cholera, leprosy and child mortality* the industrialized world, long before the introduction of specific control measures.

Another important non-specific measure is

❖ **community involvement** in disease surveillance, disease control and other public health activities. If community involvement is not an integral part of public health programmes, they are unlikely to succeed. Laws, regulations and policy measures alone will not bring the desired results

Non-specific Measures Cont. .

It is well worth considering some obstacles and new developments in the control of infectious diseases in developing countries.

First and foremost is the **scarcity of funds**, **lack of an effective health infrastructure**, **public health laboratory facilities**, **equipment**, **supplies**, **trained personnel** (e.g., epidemiologists) and **public awareness** needed for the investigation and control of communicable diseases.

This handicap is shared by all developing countries.

. Finally a major obstacle to disease control is **human behaviour**.

Medical technology is often ineffective in changing behaviour.

In this regard, **health education** remains the only approach to enlist public co-operation and to induce relevant **changes in the behaviour and life-styles of people**.

Such changes could, in themselves, be powerful methods of disease control.