# Principles of Prevention and Control of Infectious Diseases

### Concepts
- **Prevention:** Measures taken to healthy individuals before the onset of diseases.
- **Control (secondary prevention):** Measures taken after occurrence of the disease to treat the disease, prevent complication and prevent the spread of disease.

<table>
<thead>
<tr>
<th>General Preventive Measures to increase resistance to infection in general.</th>
<th>Specific preventive measures:</th>
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</thead>
<tbody>
<tr>
<td><strong>2. Health education:</strong> To educate the public about - Mode of transmission. - Methods of protection. - Importance of immunization.</td>
<td><strong>B- Chemoprophylaxis</strong></td>
</tr>
<tr>
<td><strong>3. Health promotion:</strong> Healthy life style. Adequate nutrition.</td>
<td></td>
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</tbody>
</table>

### Egyptian Schedule of Compulsory Vaccination of Infants and Children

<table>
<thead>
<tr>
<th>Time</th>
<th>Vaccine</th>
<th>Dose</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>At birth (zero dose)</td>
<td>OPV (Sabin)</td>
<td>2 drops</td>
<td>Oral Intradermal Upper left arm</td>
</tr>
<tr>
<td></td>
<td>BCG</td>
<td>0.05 ml</td>
<td></td>
</tr>
<tr>
<td>2nd, 4th, 6th months (1st, 2nd, 3rd doses)</td>
<td>OPV (Sabin), Penta vaccine: - DPT - HB vaccine &amp; hemophillus influenza.</td>
<td>2 drops</td>
<td>Oral IM, Outer left mid-thigh</td>
</tr>
<tr>
<td></td>
<td>0.5 ml</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9th month</td>
<td>Vitamin A</td>
<td>Capsule</td>
<td>Squeezed in mouth</td>
</tr>
<tr>
<td></td>
<td>OPV (Sabin), Booster dose</td>
<td>2 drops</td>
<td>Oral</td>
</tr>
<tr>
<td>12th month</td>
<td>MMR</td>
<td>0.5 ml</td>
<td>S.C upper right arm</td>
</tr>
<tr>
<td></td>
<td>OPV (Booster dose).</td>
<td>2 drops</td>
<td>Oral</td>
</tr>
<tr>
<td>18 month</td>
<td>OPV (Booster dose)</td>
<td>2 drops</td>
<td>Oral</td>
</tr>
<tr>
<td></td>
<td>DPT (Booster dose)</td>
<td>0.5ml,</td>
<td>I.M</td>
</tr>
<tr>
<td></td>
<td>MMR</td>
<td>0.5ml</td>
<td>S.C</td>
</tr>
<tr>
<td></td>
<td>Vitamin A</td>
<td>2 capsules</td>
<td>Squeezed in mouth</td>
</tr>
<tr>
<td>School entry Age (5-6 years)</td>
<td>OPV</td>
<td>2 drops</td>
<td>Oral</td>
</tr>
<tr>
<td></td>
<td>DT, (Booster dose)</td>
<td>0.5ml,</td>
<td>I.M</td>
</tr>
<tr>
<td></td>
<td>BCG (for tuberculin -ve)</td>
<td>0.05 ml</td>
<td>ID Upper left arm</td>
</tr>
<tr>
<td></td>
<td>Meningococcal vaccine</td>
<td>0.5ml</td>
<td>S.C</td>
</tr>
</tbody>
</table>

### Schedule of Non Compulsory Vaccinations

1. Pregnant women: Tetanus toxoid
2. Food handlers:
   - TAB vaccine against typhoid and paratyphoid.
   - Hepatitis A vaccine.
3. Military groups:
   - i. Tetanus toxoid
   - ii. Meningococcal polysaccharide vaccine
   - iii. BCG for non reactors.
4. International Immunization:
   - **Cholera vaccine:** for travelers coming from or going into endemic area & should have valid vaccination certificate (6 days-6months).
   - **Yellow fever vaccine:** for travelers coming from/ going to endemic area (Yellow fever belt) -validity (10days -10 years).
   - **Meningococcal vaccine for pilgrims**
1- Passive Immunization (Seroprophylaxis)

- It is the inoculation of the immune serum that contains already manufactured immunoglobulins, or lymphocytes, to induce humeral or cellular immunity.
- It gives rapid but temporary protection, without sensitization of memory cells.
- It is used in prophylaxis or in treatment, and before or after exposure to infection.
- Some cellular immunity is protective against intracellular bacteria, virus, fungi or protozoa.
- **Types:** Animal or human preparation

<table>
<thead>
<tr>
<th>Animal (equine) preparation(heterologous)</th>
<th>Human immunoglobulin (Homologous)</th>
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<tr>
<td>Antisera prepared in animal (horses) against some diseases. Types: antitoxic sera e.g. in diphtheria, tetanus, antisnake sera, and antiviral sera as antirabies serum.</td>
<td>prepared from human sources</td>
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<table>
<thead>
<tr>
<th>Disadvantages</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Advantages</th>
</tr>
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<tr>
<td>Given in large doses. Gives short protection (1-2 weeks), It may lead to sever hypersensitivity reaction, due to exposure to animal protein.</td>
<td>relatively cheap &amp; usually available.</td>
<td>relatively expensive and not constantly available.</td>
<td>Used in small doses. Gives immediate immunity for longer period 30-50 days. Safe, as it does not lead to hypersensitivity reactions.</td>
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**Types:**

<table>
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<tr>
<th>1- Normal human immunoglobulins (NHI):</th>
<th>2- Specific human immunoglobulins (SHI): or specific hyperimmunoglobulins:</th>
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<tr>
<td>Prepared from large pool of plasma volunteers in endemic area. The donor should be free from hepatitis B and C and HIV viruses. <strong>Uses:</strong> It is effective in prophylaxis of measles, rubella, poliomyelitis and viral A hepatitis and rubella. 1. Seroprevention; if given on early exposure and proper dose. 2. Seroattenuation; if late exposure or smaller dose.</td>
<td>Prepared from donors who have been vaccinated against communicable diseases or carriers of specific infections. <strong>Uses:</strong> It is used in prevention of viral disease 1. Hepatitis B virus (HBIG) 0.5-5 mL/kg to be repeated after 1 month and 3 months 2. In prevention of varicella zoster infection (VZIG) 3. In prevention of rabies 20u/kg unit. 4. In prevention of tetanus 250 units for prophylaxis and 3000 - 6000 units for therapy instead of antitoxic sera of animals to reduce complications.</td>
</tr>
</tbody>
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**Definition**
It is a specific protection of individuals by giving them antimicrobial drug which may be specific antibiotics, antimalarial, antituberculous, antileprotic, antityrpanosomiasis giving just before exposure or immediately after exposure to infection.

**Chemoprophylaxis:**

1. **Tetracyclin:** for household contact of cholera.
2. **Isonicotinic acid hydrazide:** Tuberculin positive house hold contacts
3. **Sulphadiazine** for house hold contact (4 days) in case of meningitis
4. **Rifampicin** replace sulphadiazine in resistant strains of meningitis to the contacts of cases
5. **Long acting penicillin** for secondary prevention of cases of Rheumatic fever and Rheumatic heart diseases
6. **Chloroquine, Mefloquine, Doxycychline, Malarone and primaquine** for prevention of malaria
Disadvantages of chemoprophylaxis:
1. Temporary protection as it is effective only during the use of the drug.
2. Highly expensive in relation to value and protection (cost benefit).
3. It cannot be applied on large scale as a mass preventive measure but it is given only on limited scale to at risk groups.
4. Drug toxicity if prolonged use.
5. Drug resistance strain due to massive drug abuse.
6. Drug allergy as in case of penicillin.
7. Suppress the immune response as it kills the antigen and normal intestinal flora.

CONTROL OF INFECTIOUS DISEASES (THE 4 Cs)

1) Control of Cases:

1) Early case finding
- The most important control measure of diseases.
- Case finding by clinical examination and confirmed by laboratory investigation.

2) Proper and specific treatment:
- For the sake of the patient to shorten the course of the disease.
- For the sake of the community to minimize the period of communicability.

3) Notification
- To local health authorities is necessary for all infectious disease.
- To the world Health Organization. In case of quarantinable diseases (Cholera, yellow fever and plague)
- Notification is important to trace the source and channel of transmission and also for statistical purposes, it should follow the surveillance system followed by MOH

4) Isolation of cases:
Separation of infected persons from those not infected for the period of communicability.
It is done for the sake of the patients and to eliminate the probability of spread of infection to others.

5) Disinfection
- Disinfection of the infective discharge of the patient or the solid articles in order to destroy the pathogenic organisms outside the body.
- It comprises concurrent (bedside) and terminal disinfection.

6) Release:
- Isolation of cases is usually done for a period of communicability.
- Patients may be released after clinical cure as in measles or laboratory cure with repeated release cultures as in. diseases with convalescent carriers e.g. (Diphtheria, cholera, typhoid).
- In some disease release occur after 1-2 days of specific proper antibiotics as in meningitis and streptococci.

7) Follow up for disability limitation and rehabilitation.

II) Carriers

- Measures which should be taken for carrier.
- Try to recognize the carriers by bacteriologic diagnosis during
- Employment examination of different groups especially food handlers, teachers and hospital workers.
- Survey studies and research works.
- Examination of contacts For early case finding as in cholera.
- Trace the source of infection as in case of investigation of out breaks of food poisoning.
- Exclusion from work till cure: in certain occupations for example food handler (e.g. Typhoid carrier) or a teacher (e.g. Diphtheria carrier).
- Treatment of carriers by chemotherapy.
- Periodic laboratory investigation and release after bacteriologic cultures.
- Health education for the carrier to follow sanitary habits, disinfections of their discharges.
- In chronic resistant carrier as in chronic cholecystitis surgical cholecystectomy may be of value if indicated.
III.) Animals

Control measures applied to animal reservoir in case of zoonotic diseases:

• Control of cattle and sheep by sanitary environment, good nutrition, veterinary care, immunization, milk and meat sanitation
• Eradication of stray dogs, cats and rodents.
• Quarantine measures for imported animal.
• Protective clothes and precaution for those who are working with animal.
• Destruction of infected animals (in rabies, plague),
• Inspection or slaughtering (in bovine tuberculosis),
• Testing and Immunization (in brucellosis),

II. Contacts

The following measures should be taken for the close contacts of cases.

1) Enlistment, name, age, sex address, past history of vaccination.

2) Investigation of contacts for case finding or carrier state.

3) Specific protection either by immunization or chemoprophylaxis:
   • Contact who immunized before, booster dose of vaccine is given as diphtheria and tetanus toxoid.
   • Primary vaccination if early exposure as in small pox where immunity occur (8 days) before I.P (14 days). It is also of value in early exposure to measles in the first 3 days immunity develops after 7 days before the I.P (10days).
   • Immunoglobulin in case of exposure to viral disease as in measles or chicken pox.
   • Chemoprophylaxis as in contacts of meningococcal meningitis, gonorrhea and cholera.

4) Surveillance: contacts observed daily for maximum IP for manifestation of diseases.

5) Segregation where contacts are excluded from work for maximum IP to prevent spread of infection to others as food handlers in diphtheria.

6) Isolation of contacts of pneumonic anthrax and pneumonic plague for maximum I.P.

7) Health education

8) Release after examination clinically and laboratory to be sure that they are free from infection.

III. Immediate environment:

Control of infection in a community should include control of environmental factors according to the mode of transmission in order to block the chain of infection which lead to endemicity of diseases.

Control of droplet infection

• Adequate ventilation, prevention of over crowdness.
• Air sanitation and disinfection of air if needed.
• Dust control
• Health education
• Mass immunization: It is important to raise the vaccination coverage 90-100% in order to achieve disease eradication as in small pox.

<table>
<thead>
<tr>
<th>Control of food borne infection</th>
<th>Control of Arthropod infection</th>
<th>Control of contact infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Sanitary water supply and storage.</td>
<td>2. Eradication of breeding places of the insects.</td>
<td>2. Health education about personal cleaning washing hands, not to use clothes of others.</td>
</tr>
<tr>
<td>3. Sanitary sewage disposal and refuse control.</td>
<td>3. Eradication of rodents.</td>
<td>3. Control of flies</td>
</tr>
<tr>
<td>4. Insect and rodent control</td>
<td>4. Control the animals as a combined reservoir with man</td>
<td>4. Control of STD, skin and eye infection.</td>
</tr>
</tbody>
</table>

Epidemic measures It is large scale control to be followed during epidemics or outbreaks:

- General sanitary environment or additional measures during epidemics.
- Specific protection e.g. mass immunization or chemoprophylaxis.
- Epidemic investigation to trace source of infection.
- Health awareness of the public about mode of transmission and protection.
- Drastic measures: this is required in case of epidemics or outbreaks e.g. closure of operating theatre in hospital in case of tetanus or gas gangrene and closure of schools or any public places as in meningococcal meningitis.
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