UNIT 3 COMMUNICABLE DISEASES
2 – INFECTIOUS DISEASES

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3.0 INTRODUCTION
In the present unit we will outline the clinico-epidemiological features of Vaccine Preventable diseases; vaccines used against them; and the immunisation programme employing these vaccines.

The Vaccine Preventable Diseases (VPDs) are the diseases which can be prevented by giving the vaccine. There are many such diseases, but under the UIP the major killer or disabling diseases of childhood are included. These are Tuberculosis, Diphtheria, Pertussis, Tetanus, Poliomyelitis and Measles. This unit describes the salient epidemiological features of these VPDs under the National Programme as well as how the disease could be prevented.

3.1 OBJECTIVES
After reading this unit, you will be able to:
• enumerate vaccine preventable diseases;
• explain mode of spread of infectious diseases;
• identify symptoms and signs of infectious diseases; and
• describe preventive measures for control of infectious diseases.

3.2 TUBERCULOSIS
Tuberculosis is a communicable disease caused by a bacterium (Mycobacterium tuberculosis). It is one of the most frequent causes of death in the world. Annually, 3–4 million people are dying due to the disease, out of which 90% of these deaths occur in developing countries. It is highly prevalent in Asia and Africa. It usually attacks the lungs, but other parts of the body, including the bones, joints and brain might be affected.

3.2.1 Mode of Spread
Pulmonary tuberculosis is an air borne infection. When any infective case of tuberculosis coughs, large number of live bacilli is coughed in the air where they remain suspended for a variable period depending upon their size. A person inhaling air that containing TB bacilli becomes infected. Chance of spread of TB is more where people are living in overcrowded conditions, when they do not seek appropriate care in time and when a child is poorly nourished.

The risk of developing TB is highest in children under 3 years of age. Persons with weakened immune systems, such as those with HIV/AIDS, are most likely to develop the diseases than those with normal immune systems.

Incubation Period: The time from exposure to infection to the development of positive tuberculin test ranges from 3–6 weeks, and thereafter the development of disease depends upon
• Closeness and duration of contact
• Severity of disease in the index case
• Sputum positivity status of the index case
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- Defense status of the host
- Precipitating factor(s) in host; such as an attack of measles or pertussis.

Thus, the incubation period may vary from weeks to years.

**Infectivity**

As long as bacteria is present in the infective material and environment.

### 3.2.2 Symptoms and Signs

Tuberculosis is suspected when an ill child has a history of chronic illness that includes cough and fever for 3–4 weeks or more, chest pain and hemoptysis, are considered as cardinal features of the disease. Weight loss, an inability to return to normal health after measles or whooping cough and history of contact with an adult case of pulmonary tuberculosis are the other features.

Extra-pulmonary disease may also be present, with manifestations suggestive of tuberculosis in other organs including the skeletal system, central nervous system, gastrointestinal tract, genito-urinary system, eyes, ear, heart and skin.

In fact children are more likely to develop extra-pulmonary disease than adults. On examination there may be more than one symptoms, such as malnutrition, lymphadenopathy, chest pain, hepatomegaly and/or splenomegaly, meningeal signs and/or pleural effusion or ascites.

Among all forms of tuberculosis, Tubercular Meningitis (TBM), Miliary Tuberculosis and Disseminated Tuberculosis are the most dangerous forms. TBM is mostly seen in children between 6 months and 4 years of age and is characterised by signs of meningeal irritation, convulsions, cranial nerve paralysis and coma. In Miliary Tuberculosis, small discrete millet seed like shadows appear in all parts of the lungs. In Disseminated Tuberculosis, the bacilli spread to distant sites through lympho-haematogenous route and may reach liver, spleen, bones, joints etc.

### 3.2.3 Prevention

The best protection available for children against spread of tuberculosis infection is immunisation with BCG vaccine. Those having the disease should be promptly treated with appropriate anti-tubercular drugs. Early diagnosis and treatment under RNTCP will convert the patient to non-infectious type within 48 hours in majority of the cases and prevent further spread of the disease in the community.

**BCG Vaccine**

The letters B, C and G stand for Bacillus of Calmette and Guerin. “Bacillus” describes the shape of the bacterium. Calmette and Guerin are the names of the scientists who developed the vaccine. BCG vaccine comes in a powder form. Before use, it must be reconstituted with the accompanying diluent (Normal Saline). The reconstituted vaccine is even more sensitive to heat than the powder. Therefore, it must be used in the same session or within four hours whichever is earlier. During the session the vaccine should be kept in shadow or covered with black paper to prevent exposure to sunlight.

BCG vaccine protects the infants and young children against childhood tuberculosis. Its role in prevention of childhood miliary tuberculosis and tubercular meningitis is well documented.

**Time of administration**

BCG vaccine is given soon after birth, preferably, before the discharge of the patient from the hospital after delivery. As per UIP, it should be completed before the child
completes the first birthday. It should not be given to children who have signs and symptoms of AIDS. However, it is not contraindicated in HIV positive children.

**Storage Temperature**

BCG vaccine and diluent should be stored at a temperature between +2°C to +8°C in ILR.

**BCG Administration Guidelines**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>At birth If not given at birth, it can be given at 6 weeks of age with first dose of pentavalent and OPV, but at a different site. If missed at this age also, it must be given as a single dose any time before 12 months of age.</td>
</tr>
<tr>
<td><strong>Dose amount</strong></td>
<td>Newborn (upto 1 month of age): 0.05 ml Others (after 1 month): 0.1 ml</td>
</tr>
<tr>
<td><strong>Number of doses</strong></td>
<td>One</td>
</tr>
<tr>
<td><strong>Injection site, route</strong></td>
<td>Left upper arm at the insertion of deltoid, intra-dermal The vaccine site is prepared by cleaning with sterile wet swab. But in no case should spirit or antiseptic be used.</td>
</tr>
</tbody>
</table>

**Normal Reaction**

After successful vaccination with the BCG vaccine, a small elevation (wheel of 5 mm) appears at the injection site. This usually disappears within 30 to 90 minutes. After approximately 3 to 4 weeks, an induration develops followed by a lump or papule of 5–8 mm in diameter. The papule ulcerates leaving a scar at the site of vaccination within 10–12 weeks. Nothing should be applied on it. Presence of scar tells you that the child has been successfully immunised.

**Remember:**

- Tuberculosis is one of the most frequent cause of death in the world.
- Annually 3–4 million people are dying, with up to 90% in developing countries.
- Children are more likely to develop extra-pulmonary disease than adults.
- Immunising the child with the BCG vaccine at the right age, with the right dose and correct temperature prevents childhood tuberculosis.
- Reconstituted BCG should be used within 4 hours and should be protected from sunlight.
- Early diagnosis, prompt, appropriate and complete treatment under medical supervision makes the person bacteria free. Hence the patient becomes non-infectious to others.
- Defaulting in the treatment leads to multi-drug resistance cases which subsequently spread the resistant type of infection to others.
3.3 DIPHTHERIA

Diphtheria is a communicable disease caused by a bacterium known as Corynebacterium diphtheria. It tends to be a disease of the colder months and of temperate climatic zones. The bacteria produces a toxin, which causes local tissue necrosis. The bacteria and necrotic cells with serofibrinous material form a grayish white pseudomembrane. It bleeds when attempts are made to dislodge it. There is inflammation and oedema of the surrounding tissue. By its distal action, the toxin causes neuritis, myocarditis and renal damage. These complications have an important impact on the health of the affected individuals particularly myocarditis, which may lead to death.

3.3.1 Mode of Spread

The respiratory tract is the most common portal of entry. The secretions or discharge from an infected person/carrier is the source of infection. The disease spreads by droplet infection and direct contact as well as by fomites. The bacteria survive drying. Occasionally, vulva, conjunctiva, skin wound, internal ear are involved. People infected with diphtheria usually become ill within two to five days. Infected individuals can spread the disease to others for up to four weeks. During outbreaks and epidemics, some children may carry the germ without showing any signs or symptoms but can still spread the disease to other people (healthy carriers). The spread of the disease is facilitated in overcrowded and poor living conditions.

Incubation Period

The incubation period is 2–5 days.

Infectivity

The patient is infective till the virulent bacteria are present in the lesion which is usually 2–4 weeks.

3.3.2 Symptoms and Signs

The early symptoms are sore throat, loss of appetite, slight fever and cervical lymphadenitis when diphtheria affects the throat and tonsils. Within two to three days, a bluish-white or gray membrane forms in the throat and tonsils. If there is bleeding the membrane may become grayish-green or black. It sticks to the soft palate of the throat and bleeding may occur if attempts are made to remove it. In severe case, the membrane may obstruct airway. The patient may recover at this point or may develop severe weakness and die within six to ten days. Patients with severe disease may not necessarily develop high fever but may develop swelling of the neck and obstruction of the airway, which can cause death, if not managed properly.

In Laryngeal Diphtheria there is hoarseness of voice, croupy cough, inspiratory stridor with indrawing of chest, subcostal, suprasternal recession. Nasal diphtheria is characterised by serosanguinous/purulent rhinitis. It may be associated with shallow ulceration of nose and upper lip.

In cutaneous diphtheria, the lesions may be painful, red and swollen. Any chronic skin lesions may become infected with diphtheria.

Common Complications

- Myocarditis
- Toxic Neuropathy
- Palatal Palsy
• Facial or Laryngeal Nerve Palsy
• Polyneuritis
• Diaphragmatic Paralysis

3.3.3 Prevention

Early diagnosis and prompt treatment with antibiotic and Anti-diphtheria serum (ADS) may save the life and halt the spread of the disease.

The most effective way of preventing diphtheria is to actively immunise the child with the DPT containing “Pentavalent” Vaccine. Transplacentally acquired antibodies received from mother may protect the child for a short period (about six months maximum in majority of the cases).

Pentavalent vaccine is given at the age of 6 weeks, 10 weeks and 14 weeks followed by a DPT booster dose (First dose) at 16 months (16-24 months) under the Universal Immunisation Programme and a second booster dose is given at 5 years of age. The second dose is administered with a minimum gap of four weeks after the first dose.

How is it Stored?

Pentavalent and DPT vaccines should be stored at a temperature between +2° to +8°C. The diptheria and tetanus toxoid components and pertussis-killed bacilli of DPT vaccine are damaged by freezing and at a temperature above 8°C.

If DPT vaccine is kept for a long time, solid particles separate from the liquid and look like fine sand at the bottom of the vial. Shaking the vial mixes the vaccine and liquid again. However, if the vial was frozen any time, it will not mix-up and the floccules will be seen in the vaccine. This test is called the SHAKE TEST. A vial with positive Shake Test should not be used and should be discarded.

Adverse reaction of convulsion (though rare) is inherent in the ‘Pertussis’ component. Therefore, the DPT vaccine should NOT be given to children over 7 years of age or to the children who, suffered from convulsion in past following the dose of this vaccine.

Number and Amount of Doses

Three primary doses of Pentavalent vaccine at 6, 10 and 14 weeks and two booster doses are given, each containing 0.5 ml.

Where and How is it Given?

DPT is injected into the muscle (intra-muscular) on the antero-lateral side of thigh.

Side Effects: Reactions to DPT vaccine are usually mild which include:

• Fever: A child may have fever in the evening after receiving DPT vaccine. The fever should disappear within a day. Please note: fever that begins more than 24 hours after a DPT injection is unlikely to be a reaction due to the vaccine.

• Soreness: Some children may have pain, redness or swelling at the injection site.

• Abscess: An abscess may develop a week or more after a DPT injection. Please note that the abscess is not due to vaccine itself but due to error in technique of giving this vaccine. This is a programmatic error. Therefore, a close monitoring on the incidence of abscess is mandatory. The abscess can occur because:
  • An un-sterile needle or syringe was used
  • The vaccine was not injected into the muscle.
Abscess, following vaccination, is due to programmatic failure, which means due care is not taken at the time of sterilisation or due to faulty technique.

- **Convulsion** may occur rarely.

Pentavalent and DPT administration guidelines are given in the Box below:

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>Pentavalent vaccine</td>
<td>If a child is not given pentavalent vaccine at 6 weeks, it can be given as soon as possible thereafter. Wait 4 weeks between doses.</td>
</tr>
<tr>
<td>1st dose: 6 weeks</td>
<td></td>
</tr>
<tr>
<td>2nd dose: 10 weeks</td>
<td></td>
</tr>
<tr>
<td>3rd dose: 14 weeks</td>
<td></td>
</tr>
<tr>
<td>DPT vaccine</td>
<td></td>
</tr>
<tr>
<td>1st booster: 16-24 months</td>
<td></td>
</tr>
<tr>
<td>2nd booster: 5 years</td>
<td></td>
</tr>
<tr>
<td><strong>Dose amount</strong></td>
<td>Usually 0.5 ml for each dose</td>
</tr>
<tr>
<td><strong>Number of doses</strong></td>
<td>Three primary and two booster doses</td>
</tr>
<tr>
<td><strong>Injection site</strong></td>
<td>Muscle of antero-lateral side of thigh</td>
</tr>
<tr>
<td></td>
<td>Never immunise in the buttock.</td>
</tr>
</tbody>
</table>

### 3.4 PERTUSSIS

A highly communicable disease caused by a bacteria known as Bordetella pertussis and occasionally by Bordetella parapertussis. Pertussis is a Latin word which means intense cough (Per = intense and tussis = cough). It occurs mostly in children upto 5 years of age. The children suffering from pertussis have bouts (paroxysms) of coughing spells, characterised by a typical whoop sound for which the disease is also called Whooping Cough. The word Pertussis is preferred to whooping cough as most of the infants do not have whoop.

The non-immunised children were attacked more. The incidence is more in areas with low coverage of Pentavalent/DPT vaccine. The disease is most dangerous in children under one year of age and leaves long-term respiratory disabilities.

#### 3.4.1 Mode of Spread

The disease spreads by droplet infection with attack rate nearly 100%. It spreads very easily from person to person in droplets produced by coughing or sneezing. In many countries the disease occurs in regular epidemic cycles of three to five years.

**Incubation Period**

The incubation period is 3–12 days, and can be up to 21 days.

**Infectivity**

A week after the exposure to about 3 weeks after the onset of paroxysmal stage.

#### 3.4.2 Symptoms and Signs

There are usually three distinct phases of the disease which are catarrhal, paroxysmal and convalescence.

**Catarrhal phase**

- Common cold
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- Running nose
- Watery eyes
- Sneezing
- Fever
- Mild cough

The catarrhal phase lasts for two weeks.

**Paroxysmal Phase (2–4 weeks)**

The cough gradually worsens and involves numerous bouts of rapid coughing. At the end of these bouts, the child takes in air with a high-pitched whoop. During the bout of cough, child may get sub-conjunctival haemorrhage. The child may turn blue because of lack of oxygen during long bouts of coughing. Vomiting and exhaustion often follow the coughing attacks, which are particularly frequent at night. The findings on physical examination between the paroxysms may be normal. This stage usually lasts for one to six weeks but may continue upon ten weeks. The attacks become milder with the passage of time.

**Convalescence (2–4 weeks)**

In this phase when recovery takes place, the number, severity and duration of attacks decrease to come to an end.

**Complications**

Complications are most common in young infants.

- Respiratory: Pneumonia, apnoea, laryngospasm, pneumothorax, emphysema and reactivation of tuberculosis are the most important respiratory complications. Most of the deaths are due to bacterial pneumonia.
- Subconjunctival haemorrhage, epistaxis.
- CNS: Cerebral hypoxia resulting into seizures. There are reports of intra-cranial haemorrhage also.
- Others: Poor intake, malnutrition, frenular ulcer, inguinal hernia, rectal prolapse.

**3.4.3 Prevention**

Whooping Cough or Pertussis is prevented by immunisation by killed bacterial vaccine, which is combined with diphtheria and tetanus toxoid. Primary immunisation with Pentavalent/DPT vaccine and booster doses as per UIP prevent pertussis. Though it is rare, it must be kept in mind that the DPT vaccine, because of its pertussis component, may cause convulsions. Therefore, the attendant of the child should be asked to wait for about half-an-hour after administration of DPT vaccine. It must also be kept in mind that if the child develops convulsions after the first dose of pentavalent vaccine, then next dose should be withheld.

**Remember:**

- Pertussis is a bacterial infection, which spreads from person to person by sneezing and coughing as well as through fomites.
- The disease is extremely contagious, especially where people live in crowded conditions with poor sanitation and nutrition.
- Infants and very young children are most vulnerable to infections that have serious complications and die from complications of the disease.
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- The most effective way to prevent pertussis is to immunise all children below one ear of age with 3 doses of pentavalent vaccine as well as administering two booster doses.

### Check Your Progress 1

1) Fill in the blanks
   
   i) Causative organism for tuberculosis is................................................
   
   ii) In Miliary tuberculosis small discrete millet seed like shadows appears in.................................................................
   
   iii) BCG can be safely administered in ...................................... children also
   
   iv) A Pentavalent Vial with positive SHAKE TEST should be...................
   
   v) Route of administration for DPT is.....................................................

2) True/False
   
   i) Lymphadenopathy is one of the Extra-pulmonary symptoms of Tuberculosis.
   
   ii) BCG vaccine must be reconstituted with distilled water.
   
   iii) Presence of scar after BCG administration means infant has been successfully immunised.
   
   iv) Pentavalent vaccine contains DPT and OPV.
   
   v) Causative organism for Tetanus is spread through soil.

### 3.5 TETANUS

It is a communicable disease caused by an anaerobic organism, Clostridium tetani. The organism is present in soil, dust and alimentary tract of various animals. The organism forms spores, which may survive boiling but not autoclaving. It produces a toxin tetanospasmin, which is responsible for the spasm of muscles in affected persons. Because of the spasms, the face and body assume an abnormal condition.

It can affect any age but the disease in newborn, known as Neonatal Tetanus (NNT), is very fatal. The tetanus occurs due to contamination of wound by soil and dirt. A child with otitis media is also vulnerable to develop tetanus. NNT can occur due to cutting of cord by un-sterilised blade or application of dirty substance on umbilical stump of the newborn baby of a mother who did not receive proper immunisation against tetanus during pregnancy.

Tetanus is an important endemic infection in India. The goal is to eliminate NNT to the level below 1 case per 10,000 live births in every district. For all deliveries to be conducted by trained personnel.

Districts are classified in India into 3 categories:
Maternal and neonatal tetanus have been eliminated from India and South East Asian Region (SEAR) in 2016.

3.5.1 Mode of Spread

Tetanus is not transmitted from person to person. A person may become infected if soil or dung enters a wound. Tetanus germs are likely to grow in deep puncture wounds caused by dirty nails, needles, barbed wire, thorns, wood splinters and animal bites.

A newborn baby may become infected if the knife, razor or other instrument used to cut the umbilical cord is dirty or rusted and contains germs. Infection may also occur if cow dung or ash is applied to dress the cord or if soil enters the baby’s naval. Infants and children may also contract tetanus through dirty Instruments used for circumcision, scarification and skin piercing, tattooing and when dirt, charcoal or other unclean substances are rubbed into a wound.

Incubation Period

The NNT usually manifests between 3–12 days of birth. In older children and adults, the incubation period is usually between three to ten days, but may be as long as three weeks. The shorter the incubation period, more is the severity of disease and higher is the risk of death.

Infectivity

It is not transmitted from person to person.

3.5.2 Symptoms and Signs

In older children, there is masseter spasm leading to lockjaw (trismus) and difficulty in swallowing. This is followed by stiffness, difficulty in chewing, dysphagia, drooling of saliva and neck muscle spasm. There may be fever. Characteristically, the muscle spasm can be triggered by touch, light of sound. Sensorium remains normal. Newborn baby with tetanus (NNT) appears normal at birth but is unable to suck at the onset of disease after 3 days of birth. This is the presenting feature. Later, they develop typical face of tetanus (clenching of jaw, laterally drawn lips and raised eyebrows) with lockjaw; even contraction of muscles of the face is visible. The whole body becomes stiff, severe muscle contractions and convulsions occur, the body is bent backwards in a bow shape due to spasm of muscles of back and death follows in most cases.

3.5.3 Prevention

Neonatal Tetanus can be prevented by:

- Immunising pregnant women with two shots of Inj Tetanus Toxoid, which should be administered at the interval of 4 weeks each — 2nd dose/booster dose (in case two doses given in the earlier pregnancy) given at least 4 weeks before delivery
- Deliveries by trained personnel and training Traditional Birth Attendants (TBA)
- Conducting deliveries by following 5 Cleans
Encouraging institutional deliveries

Please refer in details of Universal precautions in Practical Course 3, Block 2, Unit 1.

**Five Cleans**
- Clean surface
- Clean Hands
- Clean razor blade
- Clean cord tie
- Clean cord stump without any applicant

Other measures of prevention of tetanus include –

**Passive Immunisation**
- Surgical cleaning of wound/ removal of foreign body or necrotic tissue should be done under cover of antibiotic and TIG.
- Tetanus immunoglobulin (TIG) 250–500 units I.M. should be given in high risk cases before the onset of symptoms.

**Active Immunisation**
- Tetanus is best prevented by active immunisation with tetanus toxoid.
- All pregnant women should receive two doses of tetanus toxoid. The first dose is given as soon as the pregnancy is detected followed by a second dose after a minimum gap of 4 weeks.
- This protects both the mother and the newborn from tetanus.
- The routine immunisation with pentavalent, DPT and TT at appropriate age (6, 10 and 14 weeks, 16–24 months, 5, 10 and 16 years) as per UIP schedule protects the child against tetanus for lifelong.

**Remember:**
- Neonatal tetanus remains a serious health problem in areas with poor immunisation coverage and unclean delivery practices, which are followed during the childbirth.
- If untreated, tetanus is a very fatal disease at any age.
- The mortality is very high.
- Tetanus is caused by Clostridium tetani found in the natural environment.
- All pregnant women should receive at least two doses of TT at the interval of 4 weeks each. The last one should be at least 4 weeks before the expected date of delivery.
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- Infection occurs due to injury by an unclean objects or cutting umbilical cord with un-sterile blade during unclean delivery practices.
- Remember 5 clean. i.e. clean surface, clean hands, clean blade. clean cord tie and clean umbilical cord.
- Majority of newborns with tetanus die i.e. NNT has nearly 100% mortality rate.

**TT Vaccine**

It is a Toxoid capable of inducing immunity against tetanus. When given to a woman who is pregnant, the antibodies that form in her body cross the placenta to the foetus. These antibodies protect the baby against tetanus during birth (Neonatal Tetanus or NNT) and for a few months thereafter. They also protect the woman against tetanus. The shake test is performed in case of TT vaccine also.

**How is it Stored?**

Tetanus toxoid should be stored at a temperature between +2°C and +8°C. It should never be frozen or exposed to temperature above +8°C.

**When is it Given?**

Under the UIP, a pregnant woman is given two doses of TT. First dose is given as soon as pregnancy is detected and the second dose is given four weeks after the first dose. It should also be ensured that the last dose is given at least 4 weeks before the expected date of delivery. If the woman has received two doses of TT within the last 3 years, then only one booster dose needs to be given during present pregnancy.

<table>
<thead>
<tr>
<th>National Immunisation Schedule for Pregnant Women</th>
<th>Vaccine</th>
<th>When to give</th>
<th>Dose</th>
<th>Route</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT-1</td>
<td>Early in pregnancy- including first trimester</td>
<td>0.5 ml</td>
<td>IM</td>
<td>Upper arm</td>
<td></td>
</tr>
<tr>
<td>TT-2</td>
<td>After minimum 4 weeks of TT-1 but before 36 completed weeks</td>
<td>0.5 ml</td>
<td>IM</td>
<td>Upper arm</td>
<td></td>
</tr>
<tr>
<td>TT-Booster</td>
<td>If received 2 TT doses in last 3 years, then only a booster dose is required</td>
<td>0.5 ml</td>
<td>IM</td>
<td>Upper arm</td>
<td></td>
</tr>
<tr>
<td>TT</td>
<td>10 &amp; 16 years</td>
<td>0.5 ml</td>
<td>IM</td>
<td>Upper arm</td>
<td></td>
</tr>
</tbody>
</table>

TT is also given to all children at 10 and 16 years of age under routine immunisation programme.

**Number and Amount of doses**

Two doses are given, each of 0.5 ml, given at least 4 weeks apart.

**TT – periods of protection**

<table>
<thead>
<tr>
<th>Beneficiary</th>
<th>When given</th>
<th>Period of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnant women</td>
<td>TT1 : as early as possible in pregnancy</td>
<td></td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Beneficiary</th>
<th>When given</th>
<th>Period of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT2 : atleast 4 weeks after TT1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td>At 10 years of age (2 doses if not given before)</td>
<td>3 years</td>
</tr>
<tr>
<td></td>
<td>At 16 years of age (2 doses if not given earlier)</td>
<td>3 years</td>
</tr>
<tr>
<td>(5+2) doses schedule</td>
<td>Pentavalent at 6, 10 and 14 weeks DPT booster doses at 16-24 months and 5 years of age TT at 10 and 16 years of age</td>
<td>Long term immunity</td>
</tr>
</tbody>
</table>

Where and How is it Given?
TT is injected into the muscle of the upper arm.

Side Effects
After injection a woman may have mild pain, redness, warmth and swelling for one to three days at the injection site. This is very mild and does not require any treatment.

Prevention of Tetanus after Injury

<table>
<thead>
<tr>
<th>Surgical Toilet in all Wounds</th>
<th>Other Wounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wounds &lt; 6 hrs, Clean, non-penetrating with negligible damage</td>
<td>Immunity category &amp; Tx</td>
</tr>
<tr>
<td></td>
<td>Immunity category &amp; Tx</td>
</tr>
<tr>
<td>A</td>
<td>Nothing more required</td>
</tr>
<tr>
<td>B</td>
<td>Toxoid 1 dose</td>
</tr>
<tr>
<td>C</td>
<td>Toxoid 1 dose</td>
</tr>
<tr>
<td>D</td>
<td>Toxoid complete course</td>
</tr>
</tbody>
</table>

A- Those who have completed the full course of Tetanus toxoid with in past 5 years
B- Those who have completed the full course of Tetanus toxoid >5 years but <10 years ago
C- Those who have completed the full course of Tetanus toxoid >10 years ago
D- Those who have not completed the full course of Tetanus toxoid or in whom the immunisation status is unknown

3.6 POLIOMYELITIS
Poliomyelitis is a communicable disease due to an acute viral infection caused by an RNA virus, known as Poliovirus. It has three sero-types — 1, 2 and 3. All of these sero-types can cause paralysis. However, most outbreaks of paralytic poliomyelitis are due to type-I virus. Paralytic poliomyelitis is the most common cause of acute
flaccid paralysis in the country. However, with the intensified pulse polio immunisation programme, its incidence rate has substantially declined.

The last case of Polio in India was reported in 2011 and finally in 2014 the SEAR was declared as “POLIO FREE”. However, the present challenge in the post elimination era is to maintain the same status and to guard against importation of cases.

The poliomyelitis is a crippling disease, which can affect any age but was more common in children below 15 years of age. In India, the median age of onset of paralysis is 18 months with a range from 3 months to 5 years with maximum occurrence—between 6 months and 2 years of age. There is a seasonal variation. Maximum number of cases occurs in the hot and humid season.

Man is the only reservoir. Infection spreads from person to person. It is difficult to trace the source of a case, as there are a large number of inapparent infections. A long-term carrier state was not known to occur. Polio is a candidate for eradication.

### 3.6.1 Mode of Spread

Main route of transmission of virus is faeco-oral route. It is excreted in stool of patients for 6–8 weeks after illness and enters the body through the mouth with contaminated food and drinks as a result of poor personal hygiene, flies or filth. The disease may be waterborne due to sewage contamination of drinking water. Thus, the disease is most likely to spread in areas of poor sanitation. The virus enters the blood stream and invades anterior horn cells of Spinal Cord, bulbar nuclei and motor cortex. Hot humid climate, in summer months, helps viral proliferation while rainy season helps in its spread.

The disease spreads very easily. Nearly all children-living in households of index case get infected. Affected person can spread the virus seven to ten days before and after onset of symptoms.

**Incubation Period**

Incubation period is 7–10 days (ranges from 3 to 35 days)

**Infectivity**

In the faeces, the virus is excreted commonly for 6–8 weeks, sometimes longer up to 4 months. Infected persons, without any symptoms, can also spread the disease.

### 3.6.2 Symptoms and Signs

Some people infected with the virus may not show any sign or symptom while others may have influenza–like symptoms such as fever, loose stools, sore throat, stomach upset, or headache. Sometimes, there may be pain or stiffness in the neck, back and legs.

In the typical paralytic poliomyelitis, the child develops fever, which is soon followed by asymmetrical loser motor neuron flaccid paralysis. The muscles of one or more limbs may be paralysed. Sometimes, paralysis of the muscles of respiration makes breathing impossible without the help of a mechanical ventilator. Sensory loss does not occur. Diagnosis is confirmed by isolation of wild poliovirus from the stool specimen.

**Complications**

About 1% of the total infected children become paralysed and a larger percentage of these children have some permanent paralysis. Death may occur in case of bulbar poliomyelitis if the muscles used for breathing are paralysed.
3.6.3 Prevention

Polio prevention involves immunisation with Oral Polio Vaccine (OPV). Antibodies from the mother provide protection to the infant for two to three months or even less after birth. Infected people who recover can develop natural immunity against the particular type of poliovirus only.

Remember:
- Polio is caused by a virus and can lead to severe lifelong disability.
- It affects mainly children between 7 months to 2 years.
- Main route of transmission of virus is faeco-oral route.
- Most outbreaks of paralytic poliomyelitis are due to type-I virus.
- Many people who contract polio do not necessarily develop paralysis but may continue to spread infection.
- About one in every 100 to 1000 children, with symptoms, develops paralysis.
- In the faeces, the virus is excreted commonly for 6–8 weeks, sometimes longer up to 4 months.
- OPV is an effective vaccine for prevention of poliomyelitis provided cold chain is properly maintained at a temperature of +2°C to +8°C.
- OPV is very heat sensitive vaccine.

Polio Vaccine

It is a live attenuated vaccine-containing 3 of sero-types of Poliovirus Oral polio vaccine (OPV) gives protection against the three-serotypes of virus that cause poliomyelitis. The colour of the vaccine may either be pink or yellow or colourless. All are good for use so long as the date of expiry has not passed and the Vaccine Vial Monitor (VVM) on the label of the vial shows it to be potent.

What Type of Immunity it Offers

OPV produces both local and circulating antibody while injectable polio vaccine offers only circulating antibody. In addition, it also multiplies in the gut and released in the environment as vaccine virus and community members through faeco-oral contamination.

Storage Temperature

OPV should be stored at a temperature of –20°C in the stores of manufacturers, MSDs, States and districts. It should be transported from manufacturers/MSD to State/regional/district stores preferably at this temperature. However with MgCl₂ as stabiliser it could be stored at +2°C to +8°C for shorter period (120 days). But in no case, PHC should preserve this vaccine for more than one month.

When is it Given?

OPV should be given:
- At birth (ZERO DOSE) in case of institutional delivery
- 1st Dose at 6 weeks of age
- 2nd Dose at 10 weeks of age
- 3rd Dose at 14 weeks of age
- Booster Dose at 16 months (16 –24 months)
• In addition, it is also given to all children under 5 years of age on National Immunisation Days as PULSE POLIO Campaign.

• The interval between the doses must be at least four weeks.

**Now also one dose of IPV has been included to be given along with third dose of OPV at 14 weeks of age.**

**Number and Amount of Doses?**

Three primary doses and one booster dose are given each of two drops. If a child has diarrhoea, give OPV as usual but administer an extra dose i.e. a dose, at least four weeks after he or she has received the last dose in the schedule.

One dose of IPV is given at 14 weeks along with third dose of OPV.

**Where and How is it Given?**

OPV is dropped in the mouth with the dropper that comes with the vaccine.

IPV is given intramuscular on the antero-lateral aspect of the thigh.

**Side Effects**

OPV has no side effects.

**Remember:**

- OPV is recommended for the eradication of polio under the UIP.
- It is cheap, easy to administer, highly effective and safe.
- The UIP schedule comprises of 3 doses, given at interval of 4 weeks, starting at 6 weeks of age. A dose at birth, if it is an institutional delivery is also recommended. This is known as the zero dose.
- IPV is also now recommended to be given as a single dose at 14 weeks along with the third dose of OPV.

**Polio Eradication**

Important strategies under the polio eradication programme are:

- **Supplementary Immunisation:** (Mass immunisation) through National Immunisation days (Pulse Polio Programme and Intensified Pulse Polio Programme) for the children aged 0–59 months and Sub-National Immunisation days (SNID) for the high-risk areas. Normally, two rounds targeting to cover 100% children of target age group and additional rounds varies from 2–4 rounds for SNIDs.

- **Strengthening routine Immunisations** so as to reach very high coverage among the target groups of beneficiaries as infant for primary immunisation and children in 1–2 year’s age group for the booster.

- **Enhanced surveillance of Acute Flaccid Paralysis:** The reporting of the occurrence of Acute Flaccid Paralysis has been made mandatory by the government.

**Remember:**

All cases of ATP in children under 15 years of age are to be reported immediately and to be investigated within 48 hours of reporting. Stool collected after 14 days has less chances of virus isolation though it could be collected up to 60 days. Sensitivity of AFP reporting means — rate of Non-polio AFP should be 1 case per 100,000 or more.
3.7 MEASLES (RUBEOLA)

The word Rubeola means red spots. Measles is an acute infectious disease of childhood caused by a virus known as the Measles virus and characterised clinically by fever, cough, coryza, conjunctivitis and Koplik’s spots followed by generalised skin rashes, which appear on the 4th day of the illness. It causes high morbidity and mortality in developing countries.

In India, measles is a major cause of morbidity and a major contributor to childhood mortality. The case fatality rate in hospitalised cases of measles alone is 4–8%. In developing countries, the case fatality rate ranges from 200 to 1500 as compared to less than 0.2 per 10,000 in developed countries. Studies in some parts of the country found out measles prevalence in under five population to the extent of 4–7%.

It is a highly contagious disease. It spreads very easily, constantly present in some populations and often occur in epidemic proportions. In conditions of crowding and poverty, where large numbers of non-immunised people are in close contact, it is easy to have outbreaks. The disease is more common between 9 months to 3 years of age. Newborns and young infants are protected by maternal antibody transferred through placenta. Humans are the only reservoirs.

Measles vaccine coverage is comparatively poor amongst the UIP vaccines. Measles shows cyclic trend.

After an attack of Measles, malnutrition of the child occurs and if Measles occurs in malnourished child, it will be very dangerous.

3.7.1 Mode of Spread

Measles is an airborne disease transmitted by droplet infection. When a patient suffering from measles sneezes or coughs, large numbers of airborne droplets are released in
the air. Inhalation of these droplets spreads disease to others. Such transmission by airborne droplets can occur even two hours after an infected person has left a room or closed area. The portal of entry is respiratory tract. The disease spreads easily wherever infants and children gather together.

**Incubation Period is 10 days.**

**Period of Infectivity**

An infected person can infect others from 4 days before onset of rash to 5 days after appearance of rash.

**3.7.2 Symptoms and Signs**

The incubation period is 10 days (ranges from 7 to 18 days). The first sign of infection is high fever lasting one to seven days. During this period there may be running nose, cough, red and watery eyes and also small white spots inside the cheeks (Koplik’s spots). After a few days, usually 4th day, a slightly raised rash develops which spreads from the face and upper neck down to the body, then to the hands and feet over a period of about three days. It lasts for five to six days and fades successively from the same areas. There may also be loss of appetite and loose stools, especially in infants.

**Need of Special Attention**

The following points need special attention:

- Measles is notorious for its complications, which occur particularly in children under 5 years.
- Immediate post-measles complications are diarrhoea, pneumonia, malnutrition and signs of vitamin A deficiency (acute depletion may lead to keratomalacia and blindness), otitis media, encephalitis and deaths.
- Pneumonia is the commonest cause of death associated with measles. This is usually because the measles virus weakens the immune system. The pneumonia may be caused by the measles virus itself or by other germs.
- The most serious complications are the neurological complications, which include Febrile Convulsion, Encephalitis and Sub-acute Sclerosing Pan-encephalitis (SSPE).
- An attack of measles reactivates dormant tuberculosis.
- Measles is an important contributor to incidence of malnutrition.
- Measles is a major cause of blindness among children because of development of acute deficiency of Vitamin A during an attack of Measles. Malnourished children are more prone to develop this complication.
- People who recover from measles are immune for the rest of their lives. Infants born to mothers, who have had measles, are usually immune for six to eight months.

If any parent reports with child with the above mentioned common complications, history of measles within last 2 months should be asked.

**Management of a Case**

- There is no specific anti-viral drug against measles virus.
- Patients are managed symptomatically with supportive measures only.
- Vitamin A, two lakh international units for > 1 year and one lakh international units for < 1 year, reduces severity of the disease and prevents further deficient of
Communicable Diseases and Management Under National Health Programme

Vitamin A. This helps in prevention of blindness. All children with measles should receive vitamin A supplementation as soon as they are seen at a health facility.
- Feeding should be continued as there is a tendency to withheld food during and after the attack of Measles.
- The treatment of dehydration with oral rehydration solution for diarrhoea is necessary.
- For pneumonia, antibiotics may be necessary.

3.7.3 Prevention

The prevention of measles involves immunisation with measles vaccine. Children should receive one dose of the vaccine at the age of 9 months (9–12 months).

Remember:
- Measles related illnesses are one of the main causes of death among young children.
- It kills about one million children a year worldwide.
- Infants and adults are especially likely to have severe complications resulting from measles.
- It is very important to encourage children with measles to eat and drink to prevent malnutrition.

Measles Vaccine

It is a live attenuated viral vaccine. Measles vaccine comes in powder form together with a diluent. Before it can be used, it must be reconstituted. Reconstituted measles vaccine must be used within four hours or disposed off.

Note: Vitamin A is given at the same time as measles vaccine.

How is it Stored?

Measles vaccine should be stored at a temperature between 2°C and +8°C. Freeze dried measles vaccine is not damaged by freezing, but damaged by temperature persistently above 8°C.

When is it Given?

Measles vaccine is usually given as soon as possible after completion of 9 months of age. Maternal antibodies against measles last longer than other antibodies. So, immunisation with measles vaccine is often not effective before 9 months of age.

Number and Amount of Doses

One dose of 0.5 ml vaccine is given.

Where and How is it Given?

Measles vaccine is injected into the subcutaneous layer of skin, in the upper right arm (conventionally BCG is given in left arm).

Side Effects

A mild fever and rash lasting one to three days may occur approximately a week after immunisation.

Notes
- Measles vaccine is very safe if reconstituted vaccine is used within 4 hours and one sterilised syringe and needle is used for each injection. However, severe
complications like convulsions have occurred in 0.02 to 190 per 1 lakh vaccinated individuals, compared with 500 to 4,000 per 1 lakh measles cases. Similarly, encephalitis has been observed in 1 per 10 lakh vaccinated individuals, compared to 500 to 4,000 per 10 lakh measles cases.

- There is always risk of Toxic Shock Syndrome (TSS) due to growth of Staphylococcus aureus. If the process of sterilisation is not followed strictly during measles vaccination or if vaccine is used beyond 4 hours after reconstitution. This is a programmatic error. All efforts should be made to ensure that such programmatic errors do not occur. You should know that programmatic error is responsible for 58% of the adverse events following immunisation.

For details please refer Practical Course 3, Block 6, Unit 6 about immunisation and safe injection practices.

### 3.8 HEPATITIS-B

There are different types of Hepatitis virus, namely, A, B, C, E & delta Hepatitis etc. These antigenically different viruses have different modes of transmission. The extent of complications and fatality are also different. Among these groups of virus, Hepatitis B needs special attention. It is different from Hepatitis A & C.

- A major public health problem
- 200 crore people exposed globally
- WHO recommends HB vaccine for all children, worldwide
- Hepatitis B is different from Hepatitis A and Hepatitis C
- Hepatitis B is also transmitted like HIV (blood, sex) but it is 100 times more infectious
- Virus can survive for weeks outside body.

Hepatitis B (also known as Serum Hepatitis) is an acute systemic infection with major pathology in the liver caused by Hepatitis B virus (HBV). The usual route of transmission is parenteral route. Usually it is an acute self-limiting infection, which may be either sub-clinical or symptomatic. In approximately 5 to 15 per cent of cases, HBV infection fails to resolve and the affected individuals then become persistent carriers of the virus. Persistent HBV infection may cause progressive liver disease including active hepatitis and primary liver cancer.

- Persons first infected as adults become ill, but seldom become chronic carriers (less than 15%)
- Infants infected may not show symptoms, but high risk of chronic carriage (more than 90%)
- Chronic carriers at high risk of deadly liver disease later in life, including liver cancer.

Hepatitis B is a major public health problem in India. Out of the total burden of viral hepatitis, 30–40% is because of Hepatitis B. Since many cases go unreported or unrecognised, the actual number of Hepatitis B cases would be difficult to ascertain.

The chronic carrier rate in India varies between 2–7% and it also does not have any seasonal pattern.
3.8.1 Mode of Spread

The Hepatitis B is present in high concentration in blood, serum, serous exudates, saliva, semen, vaginal fluids and most other body fluids. However, it is usually spread by contact in the following ways:

- Perinatal transmission from carrier mother to newborn.
- Cracked nipples of carrier mother may help to spread infection during feeding by ingestion of contaminated blood.
- Transfusion of infected blood or blood products.
- Injections with un-sterilised needles or syringes containing Hepatitis-B virus from an infected person.
- Transmission between children during social contact through cuts, scrapes and scratches.
- Transmission during sexual intercourse with infected person or carrier.

**Remember:**

It is not spread by air, food or water. It is not transmitted through breast milk, tears, sweat, urine, stool and droplet nuclei.

The disease occurs all over the world and can affect all age groups. Most chronic carriers are in China, South-East Asia and Africa.

**Incubation Period**

The incubation period varies between 6 weeks to 6 months.

**Period of Infectivity**

Between one and two months before and after the detection of symptoms.

3.8.2 Symptoms and Signs

- **Asymptomatic:** Sufferers of chronic carriers of HBV infections are often asymptomatic.
- **Acute Viral Hepatitis:** Features are same as in other forms of viral hepatitis—i.e. Fever, Abdominal discomfort, vomiting, passing of high colour urine, pain abdomen, hepatomegaly etc. The duration of jaundice is usually longer than in other viral hepatitis (> 14 days).

**Chronic Viral Hepatitis**

- **Chronic Persistent Hepatitis:** Liver enlargement and elevation of SGPT. It can progress to Chronic Active Hepatitis. Diagnosis is confirmed by liver biopsy.
- **Chronic Active Hepatitis:** Variable constitutional symptoms especially fatigue, persistent or intermittent jaundice, arthralgia, arthritis, purpura, nephritis and generalised vasculitis (polyarteritis nodosa). SGPT level is high. Like Chronic Persistent Hepatitis, the diagnosis is confirmed by liver biopsy.

**Complications**

The consequences of acute infection can be severe. Death occurs in a small percentage of adults. In most serious complications, including chronic hepatitis, liver failure and liver cancer occur in persons with chronic infection.
3.8.3 Prevention

There is no treatment for Hepatitis B.

- By following the measures of Universal Precautions like hand washing, wearing gloves etc. For details please refer Practical Course 3, Block 2, Unit 1 about Universal Precautions.

Further, occurrence of Hepatitis B could be brought down by:

- Universal immunisation of infants with Hepatitis B vaccine: In India, 9th Five Year Plan approach paper recommended introduction of Hepatitis B immunisation in UIP.

- Universal screening of pregnant mothers for HbsAg and appropriate management of newborns.

- Use of safe blood and blood products.

- Use of sterile separate needle and syringe for each injection. For details please refer Practical Course 3, Block 6, Unit 6 about safe injection practices.

- Prevent drug addiction and sexual promiscuity.

- Use of condoms.

- Careful handling of blood and blood products by health care personnel.

- Careful handling of secretions of patients while nursing or examining a patient.

Remember:

- Pertussis is a bacterial infection
- Globally, there are about 2,000 million people who are exposed to the risk of Hepatitis B
- One in every 20 Indian is a carrier of Hepatitis B
- Children below seven years have the highest infection rates
- Most babies born to mothers who are carriers also become carriers
- About 25% of babies who are infected with Hepatitis B virus subsequently develop severe chronic liver disease or even liver cancer
- One per cent of the total deaths in India is due to Hepatitis B virus

Hepatitis-B Vaccine

The Hepatitis B vaccine is available in two varieties:

- Plasma derived
- Recombinant vaccine

It is given as a birth dose and it is also a component of the Pentavalent vaccine for which 3 doses are given at 6, 10 and 14 weeks. For details please refer Practical Course 3, Block 6, Unit 6 about immunisation and safe injection practices.

Hepatitis B Vaccine is a cloudy liquid that comes in a ten-dose vial. If Hepatitis B Vaccine kept stationary for a long time it separates front the liquid and looks like fine sand particle at the bottom of the vial.

Storage Temperature

Hepatitis B Vaccine should be stored at a temperature between +2°C and +8°C. Both
heat and freezing damage. Use the shake test to find out if it has been frozen as in case of DPT and TT.

**When is it Given?**

Govt of India, at present, follows this schedule

- Zero dose given at birth
- At 6 weeks – dose 1 of the pentavalent vaccine
- At 10 weeks – dose 2 of the pentavalent vaccine
- At 14 weeks – dose 3 of the pentavalent vaccine.

**Where and How is it Given?**

Hepatitis B vaccine is injected in the muscle of the antero-lateral side of the upper thigh.

**Hepatitis B immunoglobulin (HBIG)**

For immediate protection, HBIG is used for those acutely exposed to HBsAg-positive blood, for example

(a) surgeons, nurses or laboratory workers
(b) newborn infants of carrier mothers
(c) sexual contacts of acute hepatitis B patients, etc.

The HBIG should be given as soon as possible after an accidental inoculation (ideally within 6 hours and preferably not later than 48 hours).

**Check Your Progress 3**

1) List symptoms and signs of Measles.

2) Explain management of a case of Measles.

3) Describe preventive measures for Hepatitis-B

4) Fill in the blanks
   i) Vitamin ____ is given at the same time as Measles vaccine.
   ii) Measles vaccine is given after completion of ____ months.
   iii) Measles vaccine is injected into ______________ layer of skin.
   iv) Hepatitis is transmitted through ______________ route.
## 3.9 JAPANESE ENCEPHALITIS (JE)

JE is a viral zoonotic disease Agent: group B arbovirus (Flavivirus). Several extrahuman hosts, e.g., animals and birds.

### 3.9.1 Mode of Spread

Basic cycles of transmission are:

(a) Pig - Mosquito - Pig  
(b) The Ardeid bird - Mosquito - Ardeid bird

Man is an incidental “dead-end” host and Pig is amplifier host.

- Horse is the only animal to manifest the disease.
- **Extrinsic Incubation Period** in vector mosquitoes: 9–12 days
- **Incubation Period**: about 5–15 days.
- Primarily a disease of rural, semi urban, agricultural areas.

### 3.9.2 Clinical Features

- Majority infections are in-apparent (only 1 in 250 infections are symptomatic)
- Young children (under 10 years) are more likely to die.

### 3.9.3 Control of JE

- Early Case Detection and Treatment
- Vector Control – using ULV insecticides e.g. Malathion, fenitrothion etc.

**JE vaccination:** This vaccination is available in three types:

a) Mouse brain derived (Nakyama or Beijing strain)
   - **Dose:** 2 doses (4 weeks apart), 0.5 ml among children < 3yr while 1 ml to those above 3 years, Booster after 1 year and subsequently every 3 year interval until the age of 10–15 years
   - **Route:** Subcutaneously
   - **Immunity:** - 1 month after 2nd dose

b) Cell culture derived inactivated vaccine (Beijing P3 strain)

c) Live attenuated vaccine SA 14-14-2: Single dose followed by a single booster at an interval of 1 year. Now available in India.
   - JE is reconstituted with manufacturer-provided diluent. It should be used within 2 hours of reconstitution.
   - If a child 16-24 months of age has been already immunised with JE vaccine during an Supplementary immunisation activity (SIA), it should not be repeated. Currently this is a single dose vaccine and should not be repeated.
   - If a child above 2 years of age has not received the JE vaccine through either routine immunisation (RI) or an SIA. The child is eligible to receive a dose of the JE vaccine, through RI, till the age of 15 years.
### National Immunisation Schedule for Infants and Children

<table>
<thead>
<tr>
<th>Dose</th>
<th>When to give</th>
<th>Dose</th>
<th>Route</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td>At birth- within 1 year</td>
<td>0.05 ml till 1 year of age 0.1 ml thereafter</td>
<td>Intra-dermal</td>
<td>Left upper arm</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>At birth- within 24 hours</td>
<td>0.5 ml</td>
<td>Intra-muscular</td>
<td>Right thigh</td>
</tr>
<tr>
<td>OPV-0</td>
<td>At birth- within 15 days</td>
<td>2 drops</td>
<td>Oral</td>
<td>Oral</td>
</tr>
<tr>
<td>OPV – 1,2,3</td>
<td>6,10,14 weeks</td>
<td>2 drops</td>
<td>Oral</td>
<td>Oral</td>
</tr>
<tr>
<td>Pentavalent – 1,2,3</td>
<td>6,10,14 weeks</td>
<td>0.5 ml</td>
<td>Intra-muscular</td>
<td>Left thigh</td>
</tr>
<tr>
<td>Measles</td>
<td>9 months</td>
<td>0.5 ml</td>
<td>Sub-cutaneous</td>
<td>Right upper arm</td>
</tr>
<tr>
<td>DPT Booster</td>
<td>16 months</td>
<td>0.5 ml</td>
<td>Intra-muscular</td>
<td>Left thigh</td>
</tr>
<tr>
<td>Measles 2nd dose</td>
<td>16 months</td>
<td>0.5 ml</td>
<td>Sub-cutaneous</td>
<td>Right upper arm</td>
</tr>
<tr>
<td>DPT Booster</td>
<td>16 months</td>
<td>0.5 ml</td>
<td>Intra-muscular</td>
<td>Left Thigh</td>
</tr>
<tr>
<td>OPV Booster</td>
<td>16 months</td>
<td>2 drops</td>
<td>Oral</td>
<td>Oral</td>
</tr>
<tr>
<td>Japanese encephalitis</td>
<td>16 months</td>
<td>0.5 ml</td>
<td>Sub-cutaneous</td>
<td>Left upper arm</td>
</tr>
<tr>
<td>DPT Booster</td>
<td>5 years</td>
<td>0.5 ml</td>
<td>Intra-muscular</td>
<td>upper arm</td>
</tr>
</tbody>
</table>

**ALL VACCINES**

- **If a child who has never been vaccinated** is brought at 9 months of age, all the due vaccines can be given during the same session but at different injection sites using separate syringes. It is safe and effective to give BCG, DPT, Hepatitis B, OPV and Measles vaccines and Vitamin A at the same time to a 9 months old child who has never been vaccinated.

- **A child between 1–5 years of age, who has never been vaccinated**, should be given DPT1, OPV-1, Measles and 2 ml of Vitamin A solution. It should then be given the second and third doses of DPT and OPV at one-month intervals. Measles second dose is also to be given as per the schedule. The Booster dose of OPV/DPT can be given at a minimum of 6 months after administering OPV3/DPT3.

- **A child between 5–7 years of age, who has never been vaccinated**, should be given first, second and third doses of DPT at one-month intervals. The booster dose of DPT can be given at a minimum of 6 months after administering DPT3 up to 7 years of age.
Ages by which vaccines should be administered under National Immunisation schedule is given in the Box below:

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td>1 year</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>1 year</td>
</tr>
<tr>
<td>OPV</td>
<td>5 years</td>
</tr>
<tr>
<td>Measles / MMR</td>
<td>5 years; Measles is given up to 10 years under catch-up phase of Measles Elimination campaign</td>
</tr>
<tr>
<td>DPT</td>
<td>7 years</td>
</tr>
<tr>
<td>Japanese Encephalitis</td>
<td>15 years</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Heat and Light Sensitivity</th>
<th>Freezing</th>
<th>Storage Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td>Light sensitive, not so heat sensitive</td>
<td>No effect of freezing</td>
<td>2-8°C</td>
</tr>
<tr>
<td>OPV, Measles</td>
<td>Sensitive to heat and light</td>
<td>No effect of freezing</td>
<td>2-8°C</td>
</tr>
<tr>
<td>DPT, Hepatitis B, DT, TT</td>
<td>Not sensitive to heat and light</td>
<td>Freezing decreases efficiency</td>
<td>2-8°C</td>
</tr>
</tbody>
</table>

In the order of most sensitive to least sensitive

**Heat-sensitive Vaccines**          **Freeze Sensitive Vaccines**
- OPV
- Measles
- BCG
- Hepatitis B
- DPT
- DT
- TT

**Vaccine Vial Monitor**
- VVM may be present on the vial label (on Hepatitis B) or cap BCG Measles.
- It indicates exposure to high temperature by change in the colour of the indicator.
3.11 TYPHOID FEVER

Typhoid fever is the result of systemic infection mainly by *S. typhi* found only in man. The disease is clinically characterised by a typical continuous fever for 3 to 4 weeks, relative bradycardia with involvement of lymphoid tissues and considerable constitutional symptoms. The term “enteric fever” includes both typhoid and paratyphoid fevers.

Typhoid fever is endemic in India. Reported data for the year 2013 shows 1.53 million cases and 361 deaths. *S. typhi* is the major cause of enteric fever. The factors which influence the onset of typhoid fever in man are the infecting dose and virulence of the organism.

Man is the only known reservoir of infection, viz cases and carriers. The case may be mild, missed or severe. The primary sources of infection are faeces and urine of cases or carriers; the secondary sources contaminated water, food, fingers and flies. There is no evidence that typhoid bacilli are excreted in sputum or milk.

3.11.1 Mode of Spread

Typhoid fever is transmitted via the faecal – oral route or urine – oral routes. This may take place directly through soiled hands contaminated with faeces or urine of cases or carriers, or indirectly by the ingestion of contaminated water, milk and/or food, or through flies.

**Incubation period**

Usually 10–14 days. But it may be as short as 3 days or as long as three weeks depending upon the dose of the bacilli ingested.

3.11.2 Clinical Features

- The onset is usually insidious but in children may be abrupt, with chills and high fever. During the prodromal stage, there is malaise, headache, cough and sore throat, often with abdominal pain and constipation.
- The fever ascends (rise) in a step ladder fashion. After about 7–10 days, the fever reaches a plateau and the patient looks toxic, appearing exhausted and often prostrated. (Note: Check it)
- There may be marked constipation, especially in early stage or “pea soup” diarrhoea.
- The rash (rose spots) commonly appears during the second week of disease. The individual spot, found principally on the trunk, is a pink papule 2–3 mm in diameter that fades on pressure. It disappears in 3–4 days.
- Serious complications occur in up to 10 per cent of typhoid fever patients, especially in those who have been ill longer than 2 weeks, and who have not received proper treatment. Intestinal haemorrhage is manifested by a sudden drop in temperature and signs of shock, followed by dark or fresh blood in the stool.

**Remember:**

Man is the only known reservoir of infection, viz cases and carriers.

3.11.3 Control of Typhoid Fever

**Early diagnosis:** This is of vital importance as the early symptoms are non-specific. Culture of blood and stools are important. Please refer Practical Course 3, Block 2, Unit 2 for stool sample collection procedure.
**Treatment**

The fluoroquinolones are widely regarded as the drug of choice for the treatment of typhoid fever. They are relatively inexpensive, well tolerated and more rapidly and reliably effective than the former first-line drugs, viz. chloramphenicol, ampicillin, amoxicillin and trimethoprim—sulfamethoxazole.

**Immunisation**

While ultimately, control of typhoid fever must take the form of improved sanitation and domestic and personal hygiene; these are long-term objectives in many developing countries. A complementary approach to prevention is immunisation, which is the only specific preventive measure, likely to yield the highest benefit for the money spent.

**ANTI-TYPHID VACCINES**

The old parenteral killed whole-cell vaccine was effective but produced strong side-effects. Two safe and effective vaccines are now licensed and available. One is based on defined subunit antigens, the other on whole-cell live attenuated bacteria.

**The Vi polysaccharide vaccine**

It is composed of purified Vi capsular polysaccharide from the Ty2 S. The vaccine is administered subcutaneously or intramuscularly.

**Schedule**

The vaccine is licensed for individuals aged > 2 years. Only 1 dose is required, and the vaccine confers protection 7 days after injection. To maintain protection, revaccination is recommended every 3 years.

**The Ty21a vaccine**

This vaccine, which was first licensed in Europe in 1983 and in the USA in 1989, is an orally administered, live-attenuated Ty2 strain of S. Typhi in which multiple genes, including the genes responsible for the production of this vaccine.

**Schedule**

The vaccine is administered every other day; on 1, 3, and 5th day; a 3-dose regimen is recommended. The recommendation is to repeat this series every 3 years for people living in endemic areas.

**3.12 HEPATITIS-A**

The causative agent, the hepatitis A virus, is an enterovirus. Faecal shedding of the virus is at its highest during the later part of the incubation period and early acute phase of illness. Only one serotype is known.

The virus is fairly resistant to low pH, heat and chemicals. Formalin is stated to be an effective disinfectant. The virus is inactivated by ultraviolet rays and by boiling for 5 minutes or autoclaving.

**Reservoir of Infection:** The human cases are the only reservoir of infection. The cases range from asymptomatic infections to severe infections.

**3.12.1 Modes of Transmission**

**FAECAL—ORAL ROUTE:** This is the major route of transmission. It may occur by direct (person-to-person) contact or indirectly by way of contaminated water, food or milk.
INFECTIVE MATERIAL: Mainly man’s faeces. Blood, serum and other fluids are infective during the brief stage of viraemia.

PERIOD OF INFECTIVITY:
The risk of transmitting HAV is greatest from 2 weeks before to 1 week after the onset of jaundice. Infectivity falls rapidly with the onset of jaundice. Infection with HAV is more frequent among children than in adults. However, people from all ages may be infected if susceptible.

3.12.2 Clinical Spectrum
The onset of jaundice is often preceded by gastrointestinal symptoms such as nausea, vomiting, anorexia, and mild fever. Jaundice may appear within a few days of the prodromal period, but anicteric hepatitis is more common. Hepatitis A resolves completely in 98 per cent of cases but relapse of symptoms are noted in 3–20 per cent cases.

3.12.3 Control of Transmission
The best means of reducing the spread of infection is by promoting simple measures of personal and community hygiene, e.g., hand washing before eating and after toilet.

Vaccines: Two types of hepatitis A vaccines are currently used worldwide:

a) Formaldehyde inactivated vaccines — produced in several countries and which are most commonly used worldwide.

b) Live attenuated vaccines — which are manufactured in China and are available in several countries.

Inactivated hepatitis A vaccines are licensed for use in persons 2 ½ months of age. The complete vaccination schedule consists of 2 dose administration into the deltoid muscle. The interval between the first (primary) dose and second (booster) dose is commonly 6–12 months; however, the interval between the doses is flexible and can be extended to 18–36 months. It can be administered simultaneously with other vaccines. Following 2 doses of vaccine the protective efficacy is about 94 per cent.

3.13 LET US SUM UP
In this unit we have discussed, the infectious diseases, their mode of spread, incubation period, symptoms and signs, prevention and control measures. After reading in detail about each of the infectious disease, you must have realised that these diseases are mostly preventable with vaccination available. We have also discussed the National Immunisation schedule for each vaccine, when and how to administered, where to store the vaccine, its preparation and route of injecting. You must read carefully the management of cases also as discussed with each of the infectious disease.

3.14 MODEL ANSWERS
Check Your Progress 1
1) i) mycobacterium tuberculosis
   ii) lungs
   iii) HIV+ve
   iv) Discarded
   v) Intra muscular
2) i) True
   ii) False
   iii) True
   iv) False
   v) True

Check Your Progress 2

1) Symptoms and Signs of Pertussis

There are usually three distinct phases of the disease: 1) catarrhal, 2) paroxysmal, and 3) convalescence.

1) **Catarrhal phase**
   - Common cold
   - Running nose
   - Watery eyes
   - Sneezing
   - Fever
   - Mild cough

   The catarrhal phase lasts for two weeks.

2) **Paroxysmal Phase (2–4 weeks)**

   The cough gradually worsens and involves numerous bouts of rapid coughing. At the end of these bouts, the child takes in air with a high-pitched whoop. During the bout of cough, child may get sub-conjunctival haemorrhage.

   The child may turn blue because of lack of oxygen during long bouts of coughing.

   Vomiting and exhaustion often follow the coughing attacks, which are particularly frequent at night. This stage usually lasts for one to six weeks but may continue upon ten weeks.

   The attacks become milder with the passage of time.

3) **Convalescence (2–4 weeks)**

   In this phase when recovery takes place, the number, severity and duration of attacks decrease to come to an end.

2) Newborn baby with tetanus (NNT) appears normal at birth but is unable to suck at the onset of disease after 3 days of birth. This is the presenting feature. Later, they develop typical face of tetanus (clenching of jaw, laterally drawn lips and raised eyebrows) with lockjaw; even contraction of muscles of the face is visible. The whole body becomes stiff, severe muscle contractions and convulsions occur, the body is bent backwards in a bow shape due to spasm of muscles of back and death follows in most cases.

3) **Poliomyelitis** is a communicable disease due to an acute viral infection caused by an RNA virus, known as Poliovirus. It has three sero-types – 1, 2 and 3. All of these sero-types can cause paralysis. However, most outbreaks of paralytic poliomyelitis are due to type-I virus. Paralytic poliomyelitis is the most common cause of acute flaccid paralysis in the country.

**Mode of Spread of Polio**

Main route of transmission of virus is faeco-oral route. It is excreted in stool of patients.
for 6–8 weeks after illness and enters the body through the mouth with contaminated food and drinks as a result of poor personal hygiene, flies or filth.

The disease may be waterborne due to sewage contamination of drinking water. Hot humid climate, in summer months, helps viral proliferation while rainy season helps in its spread.

The disease spreads very easily. Nearly all children-living in households of index case get infected. Affected person can spread the virus seven to ten days before and after onset of symptoms.

Check Your Progress 3

1) Symptoms and Signs of Measles

The first sign of infection is high fever lasting one to seven days. During this period there may be running nose, cough, red and watery eyes and also small white spots inside the cheeks (Koplik’s spots).

After a few days, usually 4th day, a slightly raised rash develops which spreads from the face and upper neck down to the body, then to the hands and feet over a period of about three days. It lasts for five to six days and fades successively from the same areas. There may also be loss of appetite and loose stools, especially in infants.

2) Management of a Case of Measles

- There is no specific anti-viral drug against measles virus.
- Patients are managed symptomatically with supportive measures only.
- Vitamin A, two lakh international units for >1 year and one lakh international units for <1 year, reduces severity of the disease and prevents further deficient of Vitamin A. This helps in prevention of blindness. All children with measles should receive vitamin A supplementation as soon as they are seen at a health facility.
- Feeding should be continued as there is a tendency to withheld food during and after the attack of Measles.
- The treatment of dehydration with oral rehydration solution for diarrhoea is necessary.
- For pneumonia, antibiotics may be necessary.

3) Hepatitis B Prevention: There is no treatment for Hepatitis B. By following the measures of Universal Precautions like hand washing, wearing gloves etc. For details please refer Practical Course 3, Block 2, Unit 1 about Universal Precautions.

Further, occurrence of Hepatitis B could be brought down by:

- Universal immunisation of infants with Hepatitis B vaccine: In India, 9th Five Year Plan approach paper recommended introduction of Hepatitis B immunisation in UIP.
- Universal screening of pregnant mothers for HbsAg and appropriate management of newborns.
- Use of safe blood and blood products.
- Use of sterile separate needle and syringe for each injection.
- Prevent drug addiction and sexual promiscuity.
• Use of condoms.
• Careful handling of blood and blood products by health care personnel.
• Careful handling of secretions of patients while nursing or examining a patient.

4) i) vitamin A  
   ii) 9 months  
   iii) sub-cutaneous  
   iv) parenteral route