Refresher Training for Frontline Health Workers in Expanded Program of Immunization (EPI)

Module 1

EPI Target Diseases, Vaccines and Their Administration

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A collaborative in-service training jointly developed by the SNNPR, Oromia and Amhara Regional Health Bureaus and the ESHE Project

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ESSENTIAL SERVICES FOR HEALTH IN ETHIOPIA

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The Refresher Training Modules Were Principally Adapted From the Following Sources:

- WHO Immunization in Practice
- WHO Mid-Level Managers Training
- WHO module on Increasing Immunization Coverage at Health Facility Level
- MOH and WHO/Ethiopia, "Improving routine immunization coverage in Ethiopia through Reaching Every District (RED) approach."

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Acronyms

AIDS	acquired immune deficiency syndrome
BCG	bacillus of Calmette and Guerin (tuberculosis vaccine)
DPT	diphtheria-pertussis-tetanus vaccine
DT	diphtheria tetanus vaccines
EPI	Expanded Program on Immunization
HIV	human immuno-deficiency virus
IU	International Unit
ml	milliliter
MNT	maternal and neonatal tetanus
NNT	neonatal tetanus
OPV	oral polio vaccine
PHC	primary health care
TB	tuberculosis
TT	tetanus toxoid
VAD	vitamin A deficiency
VVM	vaccine vial monitor
UNICEF	United Nations Children's Program
WHO	World Health Organization

About Module 1

This module describes six of the infectious diseases that kill or disable children and the vaccines that can prevent them. The diseases are: tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis, and measles. Vitamin A deficiency, and the use of vitamin A to prevent it, is also covered in this module.

For each disease the following information is provided:

- **What the disease is.**
- **How it is spread.**
- **The signs and symptoms.**
- **The complications.**
- **Treatment and prevention.**

For each vaccine the following information is provided:

- **What it is.**
- **How it is stored.**
- **When it is given.**
- **The number and amount of the dose(s).**
- **Where it is given (site of immunization).**
- **How it is given.**
- **Any side effects that may occur and how they will be treated.**

A brief review of true and false contraindications to immunization is also provided.

This module is intended for the use of the health worker at the immunization service delivery point.

This module should be used as training material for service providers and reference material for immunization service delivery.

1. Tuberculosis (TB)

1.1 What is tuberculosis?

- TB is one of the leading causes of morbidity and mortality and a leading cause of hospital admission.
- Tuberculosis is caused by a bacteria called *Mycobacterium tuberculosis*.
- It usually attacks the lungs, but it can attack any part of the body.
- People of all ages can contract tuberculosis.
- The risk of developing TB is highest in children under 3 years of age.

1.2 How is tuberculosis spread?

- Tuberculosis is spread through the air. When a person with the disease coughs or sneezes the germs enter the air.
- A person inhaling air that contains TB germs may become infected.
- TB can spread rapidly where people are living in crowded conditions.
- Children get the disease from adults with lung disease.
- In some areas it is possible to become infected by consuming unpasteurized milk (bovine TB).

1.3 What are the signs and symptoms?

The general symptoms of TB include:

- weakness
- weight loss
- fever
- night sweats

In TB of the lungs (pulmonary TB) the symptoms include:

- persistent cough
- chest pain
- coughing up of blood

However, in young children the only sign of pulmonary tuberculosis may be:

- failure to thrive
- stunted growth

Other signs and symptoms depend on the part of the body that is affected.
For instance, in TB of the bones and joints there may be

- swelling
- pain
- crippling effects in the hips, knees or spine

1.4 What are the complications of TB?

- Untreated TB results in debility and death. This may be more rapid in persons infected with HIV/AIDS.

1.5 How is tuberculosis treated?

- Patients with TB are treated with multiple drugs that should be taken regularly for at least six months.
- Unfortunately, some people fail to take the medications as prescribed or to complete their course of therapy, or they may be given ineffective treatments. This may lead to multi-drug-resistant TB, which is difficult to treat and can be spread to other people.
- A person with the disease can infect others for several weeks even after he or she begins treatment.

1.6 How is tuberculosis prevented?

The best protection available for children against tuberculosis infection is BCG immunization as soon as possible after birth. This protects against TB meningitis and other severe forms of TB in children less than 5 years old.

Remember:

TB usually affects the lungs but can also affect other parts of the body, including the bones, joints, and brain.

TB is spread through the air.

The symptoms of TB include general weakness, weight loss, fever, and night sweats.

People who develop TB must complete a course of drug therapy or they can spread the disease to others.

The recommended method of prevention for children is to immunize them as soon after birth as possible with BCG vaccine.

1.7 BCG Vaccine

1.7.1 What is BCG Vaccine?

- BCG vaccine protects against tuberculosis.
  - The letters, B, C and G stand for bacillus of Calmette and Guerin
  - Bacillus means bacterium/germ
  - Calmette and Guerin are the names of the people who developed the vaccine.

- BCG vaccine comes in powder form and before use must be reconstituted with the accompanying diluent from the same manufacturer.
- The reconstituted vaccine is even more sensitive to heat than the powder and must therefore be used within six hours or discarded.
- Wrap reconstituted BCG vaccine in foil or paper to protect it from sunlight.

1.7.2 How it is stored

- BCG vaccine should be stored at a temperature between $2^{o}C$ and $+8^{0}C$.
- Dry BCG vaccine (i.e. not reconstituted) can be stored at freezing temperatures and is not damaged by freezing.
- If there is sufficient storage space, keep the diluent side-by-side with the BCG in the refrigerator, cold box or vaccine carrier. The diluent is not affected by heat and can be stored at room temperature. However, the diluent must be cold at the time of reconstitution.

1.7.3 When it is given

- BCG vaccine is given at birth or as soon as possible after birth.
- It should not be given to children who have clinical HIV/AIDS.

1.7.4 The number and size of doses

- One dose of 0.05 ml for children less than 12 months old and 0.1 ml for children above 12 months.

1.7.5 Where it is given

- BCG vaccine is injected in the top layer of the skin (intradermal) of the upper right arm (see figure 1.1a and 1.1b).
- Health workers use the same anatomical site on every child for BCG injections so that everyone knows where to look for the scar.

Figure 1.1a: Position of syringe and needle for BCG vaccine (intradermal)

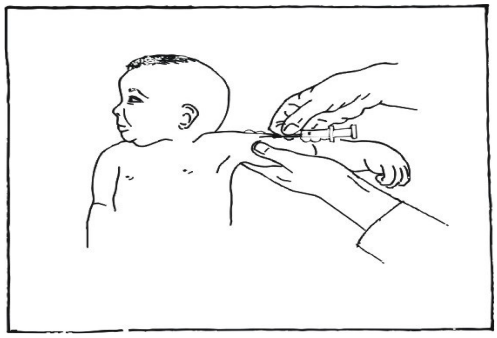
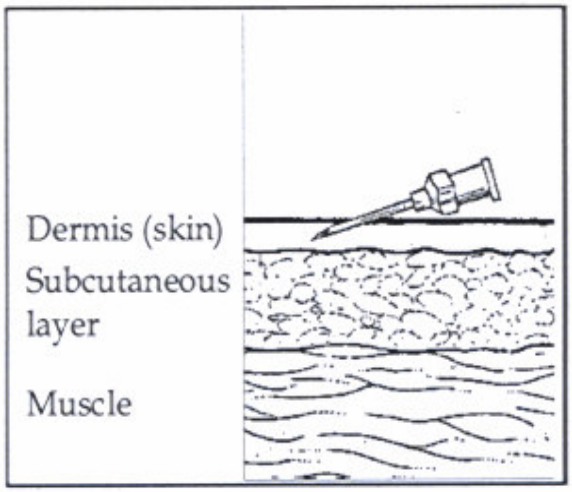


Figure 1.1b: Needle position for injection of BCG vaccine (intradermal)



1.7.6 How it is given

Table 1.1 BCG administration guidelines

	Recommendation	Comment
Age	Birth	If not given at birth, as soon as possible after birth
Dose size	0.05ml	See the manufacturer's instructions. If the child is over 1 year old give 0.1ml
Number of doses	One	If the child is over 1 year old give 0.1ml
Injection site	Upper right arm in top layer of skin	Do not rub or apply anything to injection site

1.7.7 Side effects

Normal reaction

- When BCG vaccine is injected, a small raised lump appears at the injection site. This usually disappears within 30 minutes.

- After approximately two weeks, a red sore develops which is 10mm in diameter (the size of the end of an unsharpened pencil).

- The sore remains for another two weeks and then heals. A small scar about 5mm across, resulting from the sore, remains for life. This is a sign that the child has been effectively immunized.

Swelling of glands or formation of abscess

Sometimes the glands in a child's armpit or near the elbow swell up after injection with BCG vaccine, or he / she may develop an abscess. Swollen glands or abscesses occur because:

- A non-sterile needle or syringe was used
- Too much vaccine was injected
- The vaccine was injected under the skin instead of in its top layer

1.6.8 How to treat side effects

Table 1.2 Treatment of side-effects (BCG)

Vaccine	Side effects	Treatment	Remarks
BCG	• Small sore will develop at site after a week and may last for about 2 weeks • Swollen glands • Abscess	• Keep dry and clean (do not put any ointment or medicine on it) • Refer to a doctor • Refer to a doctor or try antibiotic if bacterial infection is suspected	Will leave a small scar Abscess can be due to bacterial causes other than TB.

2. Diphtheria

2.1 What is diphtheria?

- Diphtheria is caused by a bacteria called *Corynebacterium diphtheriae*.
- The germ produces a toxin that can harm or destroy human body tissues and organs.
- One type of the disease affects the pharynx and other parts of the throat.
- Another type, commoner in the tropics, causes ulcers on the skin.
- Diphtheria affects people of all ages, but mostly non-immunized children under 15 years of age.

2.2 How is diphtheria spread?

- The type of diphtheria that affects the throat is spread in droplets and secretions from the nose, throat and eyes when there is close contact between infected and uninfected people.
- The other type is spread through contact with skin ulcers. This form of the disease is often disseminated on clothing and other articles that have been contaminated with fluid from skin ulcers.
- The spread of the disease is favored by overcrowding and poor living conditions.

- People infected with diphtheria usually become ill within two to four days, although the symptoms may not appear until six days have elapsed.
- Infected individuals can usually spread the disease to others for up to four weeks, or longer.
- During outbreaks and epidemics some infected persons may carry the germ without showing any signs or symptoms (healthy carriers) but can still spread the disease to other people.
- Any chronic skin lesions may become infected with diphtheria.

2.3 What are the signs and symptoms?

When diphtheria affects the throat and tonsils, the early symptoms and signs are:

- Sore throat
- Loss of appetite
- Slight fever
- Within two to three days a bluish-white or grey membrane forms in the throat and tonsils. If there is bleeding the membrane may become greyish-green or black. It sticks to the soft palate of the throat, and bleeding may occur if attempts are made to remove it.

The patient may recover at this point or may develop severe forms of the disease.

Patients with severe disease:

- Do not show high fever
- May develop severe weakness
- May develop swelling of the neck and obstruction of the airway
- Abnormal heart beat and heart failure may occur
- Patients with severe disease or complications may die

2.4 How is diphtheria treated?

- Persons in whom diphtheria is suspected should be given diphtheria anti-toxin and erythromycin or penicillin.
- They should be isolated to avoid exposing others to the germs.
- Patients become non-infectious about two days after the commencement of antibiotic treatment.

2.5 How is diphtheria prevented?

- The most effective way of preventing diphtheria is to maintain a high level of immunization in the community.
- A mother can pass protective antibodies to her baby, but this protection lasts for only about six months after birth.
- Diphtheria toxoid vaccine is given together with pertussis vaccine and tetanus toxoid as DPT vaccine.

Remember:

- **Diphtheria is spread from person to person in airborne droplets and through close contact.**
- **The disease can spread rapidly and result in large epidemics where immunization coverage is low.**
- **It most often affects children under 15 years of age.**
- **The most effective way to prevent diphtheria is to maintain a high level of immunization coverage in the community.**

3. Pertussis

3.1 What is pertussis?

- Pertussis, or whooping cough, is a disease of the respiratory tract caused by a bacteria called *Bordetella pertussis*.
- The germ lives in the mouth, nose and throat.
- The disease is common in non-immunized children all over the world.
- Severe epidemics can occur where immunization coverage is low.
- The disease is most dangerous in children less than 12 months old.

3.2 How is Pertussis spread?

- Pertussis spreads very easily from person to person through droplets produced by coughing or sneezing.
- Most unprotected persons exposed to the germs become infected.
- In many countries the disease occurs in regular epidemic cycles of three to five years.
- The most susceptible people are the youngest non-immunized children.
- The disease is most readily transmitted as from seven days after a person has been exposed to the germs until three weeks after the start of coughing.

3.3 Signs and symptoms of Pertussis

There are usually three stages in the illness.

Stage 1

- Initially a child appears to have a common cold-like illness.

Stage 2

- The cough worsens.
- The child has numerous bouts of rapid coughing.

- At the end of these bouts the child takes in air with a high-pitched whoop.
- The child may turn blue because of a lack of oxygen during a long bout of coughing.
- Vomiting and exhaustion often follow the coughing attacks, which are particularly frequent at night.

This stage usually lasts one to six weeks but may go on for up to ten weeks. The attacks become milder with the passage of time.

Stage 3

- Recovery takes place.
- The coughing gradually becomes less intense and stops in two to three weeks.

Note: Usually there is no high fever during the illness.

3.4 Complications of Pertussis

Complications are most probable in young infants.

- Convulsions
- Other bacterial pneumonia
- Middle ear infection
- Dehydration
- Malnutrition

3.5 What is the treatment for pertussis?

- Erythromycin helps the patient only if it is given early in the first stage of the illness. But treatment with antibiotics, usually erythromycin, helps to reduce the ability of the patient to infect others.
- Plenty of fluids should be given to prevent dehydration.

3.6 How is pertussis prevented?

- Prevention involves immunization with pertussis vaccine, which is usually given in combination with diphtheria and tetanus as DPT.
- Newborns and infants are **not** protected against pertussis by maternal antibodies.
- A person infected with pertussis usually acquires lifelong immunity.

Remember:

- **Pertussis is a bacterial infection spread from person to person by sneezing and coughing.**
- **The disease is highly infectious, especially under crowded living conditions.**
- **Newborns and infants are not protected against pertussis by maternal antibodies.**
- **Infants and very young children are the people most likely to be infected, to have serious complications, and to die from the disease.**
- **The most effective way to prevent pertussis is to immunize all children aged under 1 year.**

4. Tetanus including maternal and neonatal tetanus (MNT)

4.1 What is tetanus?

- Tetanus or lockjaw, is caused by a bacteria *Clostridium tetani*, which grows in damaged tissue, for instance in a wound or in a baby's umbilical cord.
- The germ is common in the environment, often occurring in soil containing manure.
- The bacteria form spores that can survive in the environment for years.
- The toxin they produce poisons the nerves that control the muscles, and this causes stiffness.
- In tetanus the affected person's muscles all contract, making the body stiff. The disease is particularly common and serious in newborn babies, when it is called neonatal tetanus (NNT).
- People of all ages can contract tetanus.
- Almost all babies who contract the disease die.
- Maternal tetanus can occur following unhygienic abortion or delivery.

4.2 How is tetanus spread?

- Tetanus is **not** transmitted from person to person.
- A person may become infected if soil or animal dung enters a wound or cut. This may happen, for example, if a wound is made with a dirty tool.
- A newborn baby may become infected if the knife, razor or other instrument used to cut the umbilical cord is dirty or if the hands of the person delivering are not clean.
- Infection may also occur if animal dung or ash is used to dress the cord, or if soil enters the baby's navel.
- Infants and children may contract tetanus when dirty instruments are used for circumcision, scarification and skin piercing or when unclean substances are rubbed into a wound.

4.3 What are the signs and symptoms?

In all cases of tetanus, the incubation period is usually between 3 and 10 days but may be as long as three weeks. In newborn babies, the symptoms usually appear 4 to 14 days after birth. The shorter the incubation period, the higher is the risk of death.

- Inability to open the mouth is a common first sign, followed by:
  - Stiffness of the body
  - Muscle spasms
  - Sweating
  - Fever

Newborn babies with tetanus appear normal at birth but stop sucking, usually 3 to 10 days later. The whole body becomes stiff, severe muscle contractions and convulsions occur, and death follows in most cases.

4.4 What are the complications?

- Pneumonia and other infections may occur.
- Death is particularly likely in the very young.

4.5 What is the treatment for tetanus?

- Wounds should be thoroughly cleaned and dead tissue should be removed.
- For persons with wounds that are neither clean nor minor and who are not already protected, tetanus antitoxin (TAT) should be given as soon as possible.
- The patient should be referred for expert medical and nursing care.

Note: Persons who recover from tetanus do not have natural immunity. They need to be vaccinated.

4.6 How is tetanus prevented?

Immunizing infants and children with tetanus toxoid prevents tetanus. Neonatal tetanus can be prevented by immunizing women of childbearing age with tetanus toxoid, either during pregnancy or outside of pregnancy. This also protects the mother against tetanus and transfers tetanus antibodies to her fetus. Hygienic birth practices are especially important, even if the woman has been immunized.

Remember:

- **Tetanus is caused by bacteria found in the soil.**
- **Infection occurs when unclean objects puncture or cut the skin and umbilical cord and also during unclean delivery practices.**
- **Nearly all newborns with tetanus die, even if treatment is provided.**
- **All children should be immunized against tetanus because antibodies transferred from the mother before birth last for only a few months.**
- **The most immediate way to prevent maternal and neonatal tetanus is to immunize women during pregnancy or outside of pregnancy with tetanus toxoid and to ensure clean delivery practices.**

Exercise

Buzz group discussion

Case study

The two months pregnant woman

Mrs. Rahel, two months pregnant with her first baby, is at the clinic and hears a health worker talking to a group of women. He is telling them about neonatal tetanus, a disease that causes death in newborn babies and about the injection that women can get to protect themselves and their babies.

Nurse Kinfe is giving tetanus toxoid immunization. Mrs. Rahel asks him for one. "I am going to my mother's village soon and will stay several months", she says. "There may not be time for two injections when I come back."

"I am sorry," says Nurse Kinfe, "I can't give you tetanus toxoid now. It's too early in your pregnancy and it might harm the baby."

"My friend told me that the health workers in Haik give these injections to every woman the first time she goes to the antenatal care clinic - even if she is only one month pregnant. They say it is not dangerous."

"I am sorry," says Nurse Kinfe. "My supervisor has told me not to give tetanus toxoid before a woman is at least four months pregnant."

Discussion

1. Who is following the correct procedure Nurse Kinfe or the health workers in Haik?

2. What should Nurse Kinfe do?

5. Diphtheria-Pertussis-Tetanus (DPT) vaccine

5.1 What it is

Diphtheria-pertussis-tetanus (DPT) vaccine is made from:

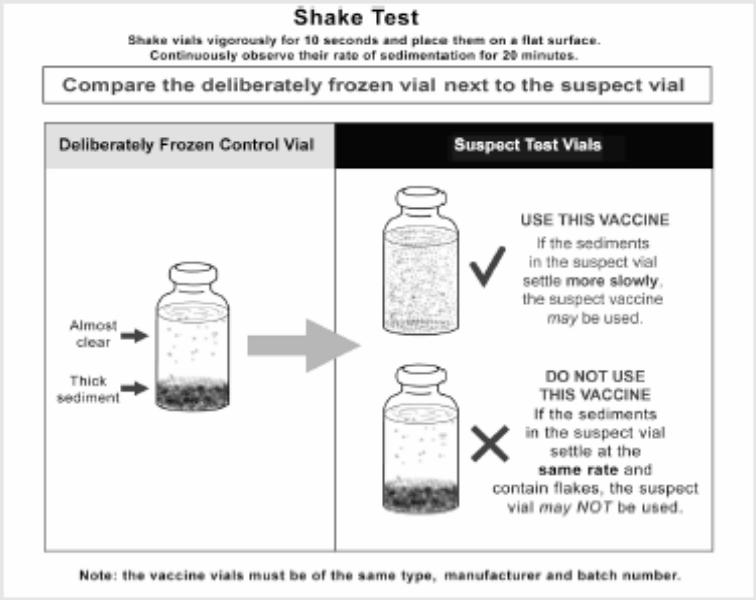
- **D**iphtheria toxoid
- **P**ertussis vaccine
- **T**etanus toxoid

5.2 How it is stored

- DPT vaccine should be stored at a temperature between $2^{o}C$ and $+8^{o}C$.

- The diphtheria and tetanus toxoid parts of DPT vaccine are damaged by freezing. **DO NOT FREEZE DPT VACCINE.**

After freezing the vaccine is no longer a uniform cloudy liquid, but tends to form flakes that gradually settle to the bottom after the vial has been shaken. Sedimentation occurs faster in a vaccine vial that has been frozen than in a vaccine vial from the same manufacturer that has never been frozen. If you suspect the vaccine may have frozen in the past, perform the "shake test" as follows:



To perform the shake test, take a vaccine vial of the same type, manufacturer and batch number as the vaccine vial you want to test. Freeze the vial for at least 10 hours at -10°C until the contents are solid, and then let it thaw. This vial is the "control" sample and should be labeled as "frozen" to avoid its use for vaccination.

Then take a vaccine vial from the batch that you suspect has been frozen. This is the "test" sample. Vigorously shake the control and test samples for 10 seconds, place both vials on a flat surface to rest, and continuously observe them over the following 20 minutes.

View both vials against the light to compare the rate of sedimentation. If the test sample shows a much slower sedimentation rate than the control sample, the test sample has probably not been frozen and may be used.

However, if the sedimentation rate is similar and the test sample contains flakes, the test sample has probably been damaged by freezing and should be withdrawn from use. The health worker must notify the supervisor immediately to ensure that any other damaged vials are also identified and withdrawn from use.

5.3 When it is given

DPT vaccine should be given at the ages of:

- 6 weeks
- 10 weeks
- 14 weeks

The interval between doses must be at least 4 weeks.

DPT vaccine should **NOT** be given to children over 5 years of age or to children who have suffered a severe reaction to a previous dose of this vaccine. Instead, a combination of tetanus and diphtheria toxoids (Td) should be given if available.

5.4 The number and size of doses

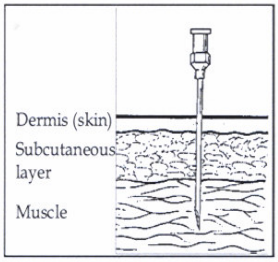
- Three doses are given each of 0.5 ml.

5.5 Where it is given

- DPT is injected into the muscle in the outer part of the thigh (see figure 1.2a and 1.2b).

Figure 1.2a: Site of injection of DPT vaccine (outer part of the thigh)

Figure 1.2b Needle position for injection of DPT vaccine (intramuscular)



5.6 How it is given

Table 1.3 DPT administration guidelines

	Recommendation	Comment
Age	DPT 1------ 6 weeks DPT 2------ 10 weeks DPT 3------ 14 weeks	If a child is not given DPT vaccine at 6 weeks, give it as soon as possible thereafter. Wait 4 weeks between doses. Complete all 3 doses before 6 months of age for timely protection.
Dose size	0.5ml for each dose	See the manufacturer's instructions
Number of doses	Three	
Injection site	Muscle of outer upper thigh	Never immunize in the buttocks

5.7 Side-effects

Reactions to DPT vaccine are usually mild. Normal reactions include fever and soreness at the site of the injection.

- **Fever:** A child may have fever the evening after receiving DPT vaccine. The fever should disappear within a day.

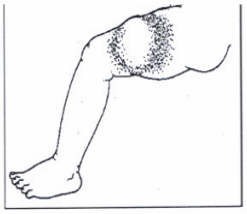
Note: Fever that begins more than 24 hours after DPT injection is unlikely to be a reaction to the vaccine.

- **Soreness:** Some children have pain, redness or swelling at the injection site.

An abnormal reaction includes an abscess at the site of the injection.

- **Abscess:** An abscess may develop a week or more after a DPT injection. This can happen because:
  - A non-sterile needle or syringe was used
  - The vaccine was not injected into the muscle.
  - The vaccine had frozen at some time in the past.

Figure 1.3 Abscess caused by non-sterile syringe, incorrectly administered injection, or administration of previously frozen DPT vaccine



5.8 How to treat side-effects

Table 1.4 Treatment of side-effects (DPT)

Vaccine	Side-effect	Treatment	Remarks
DPT	• Fever • Pain and soreness • Abscess	• Paracetamol and tepid bath • Paracetamol • Antibiotics	Will disappear within 1 day May require incision and drainage

6. Tetanus toxoid (TT)

6.1 What it is

- Tetanus toxoid (TT) is given to women of childbearing age and pregnant women to prevent maternal and neonatal tetanus.
- It is the same tetanus toxoid as that given to children in DPT vaccine.

When given to a woman, who is or becomes pregnant, the antibodies that form in her body cross the placenta into the fetus. These antibodies protect the baby against tetanus during birth and for a few months thereafter. They also protect the woman against tetanus.

6.2 How it is stored

- Tetanus toxoid should be stored at a temperature between 2°C and +8°C.
- It should **never** be frozen.

6.3 When it is given

Five doses are given to women of childbearing age:

- TT 1: at first contact with woman of childbearing age, or as early as possible in pregnancy.
- TT 2: At least 4 weeks after TT 1.

- TT 3: At least 6 months after TT 2
- TT 4: At least 1 year after TT 3
- TT 5: At least 1 year after TT 4

6.4 The number and size of doses

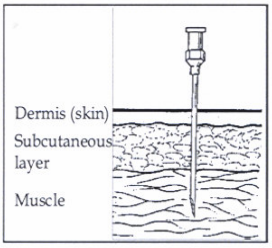
- Five doses are given each of 0.5ml.

6.5 Where it is given

- Tetanus toxoid is injected into the muscle of the upper arm of the woman.

Figure 1.4a Position and site for injection of TT vaccine (intramuscular)

Figure 1.4b Needle position for injection of TT vaccine (intramuscular)



6.6 How it is given

Table 1.5 Tetanus toxoid administration guidelines

	Recommendation	Comment
Age	TT 1: at first contact with woman of childbearing age, or as early as possible in pregnancy. TT 2: At least 4 weeks after TT 1. TT 3: At least 6 months after TT 2 TT 4: At least 1 year after TT 3 TT 5: At least 1 year after TT 4	**Period of protection** No protection 3 years 5 years 10 years All childbearing years
Dose size	0.5ml	See manufacturer's instructions
Number of doses	5	Provide protection during child bearing years
Injection site	Muscle of upper arm	Never immunize in the buttocks

6.7 Side-effects

After injection a woman may have:

- Mild pain
- Redness
- Warmth
- Swelling for one to three days at the injection site.

This reaction may be more common after later doses than earlier ones.

6.8 How to treat side-effects

Table 1.6 Treatment of side-effects (TT)

Vaccine	Side-effects	Treatment	Remarks
TT	Mild pain Redness and warmth Swelling	Paracetamol No treatment necessary No treatment necessary	Will disappear within 1 to 3 days

7. Poliomyelitis (Polio)

7.1 What is polio?

- Polio is caused by the poliomyelitis virus.
- It is a paralyzing disease that mostly occurs in early childhood but may occur at any age.

7.2 How is polio spread?

- The virus enters the body through the mouth when people eat food or drink water contaminated by faeces.
- The disease is most likely to spread in areas of poor sanitation.
- The virus enters the bloodstream and may invade certain types of nerve cells, which it can damage or destroy.
- The virus also occurs in throat secretions, and is sometimes spread through close contact with infected persons who are sneezing or coughing.
- The disease is very easily spread. Nearly all children living in households where someone is infected become infected.
- The great majority of infected persons do not have symptoms, but they can still spread the disease.

7.3 What are the signs and symptoms?

- Most children infected with the poliovirus do not feel ill.
- Some may have influenza-like or cold symptoms.
- Sometimes there may be pain or stiffness in the neck, back and legs.
- The most serious form of the disease is paralytic polio.
  - It begins with the milder forms but usually causes severe muscle pain.
  - Paralysis usually develops during the first week of illness. The use of one or both legs or arms may be lost, and breathing may become impossible without the help of a respirator.
- In childhood polio there is initially a slight fever.
  - Within 3 to 5 days the child develops a headache, stiff neck, and muscle pain, and the fever then increases.
  - After a further period of 1 to 3 days, the child becomes paralyzed in the legs, arms, face or chest.

7.4 What are the complications?

- About 1 in 200 infected children become paralyzed, and most of these children have some permanent paralysis.
- Death may occur if the muscles used for breathing are paralyzed and no respirator is available.

7.5 How is polio treated?

- There is no treatment but the symptoms can be relieved.
- Sometimes the patient has to use a respirator in order for breathing to continue.

- Referral is needed for regular physical therapy, as well as orthopaedic treatment and operations and the use of braces.

7.6 How is polio prevented?

- Polio is prevented through immunization with oral polio vaccine (OPV) during routine immunization services and campaigns.

Remember:

- **Polio is caused by a poliovirus and is easily spread through food or drink contaminated with infected faeces.**
- **Many people/children who are infected with poliovirus do not become paralysed but may still spread the disease to others.**
- **About one in 100 non-immunized children infected by poliovirus develop paralysis.**
- **The recommended method of prevention in children is immunization with oral polio vaccine (OPV).**

7.7 Oral polio vaccine (OPV)

7.7.1 What it is

- Oral polio vaccine (OPV) gives protection against the three types of viruses that cause polio.
- It is a liquid that comes in two types of containers:
  - Small plastic bottles that work like droppers
  - Glass vials with droppers supplied in a separate plastic bag.
- All OPV vials supplied by WHO/UNICEF have had a vaccine vial monitor (VVM) attached.
  - The VVM shows the health worker whether the OPV in the vial to which the monitor is attached has been damaged by heat.

7.7.2 How it is stored

- OPV should be stored at a temperature between 2°C and +8°C at health facility level. At higher levels of the cold chain, it is stored in the freezer.
- It is easily damaged by heat
- OPV is not harmed by freezing or by freezing and thawing multiple times.

7.7.3 When it is given

- OPV should be given at:
  - OPV0 at birth
  - OPV1 at 6 weeks of age

- OPV2 at 10 weeks of age
- OPV3 at 14 weeks of age

- The interval between doses must be at least four weeks.

7.7.4 The number and size of doses

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

7.7.5 Where it is given

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

7.7.6 Side-effects

- OPV has no side-effects.

8. Measles

8.1 What is measles?

- Measles is caused by the measles virus and is highly infectious, i.e. very easily spread.
- It kills more children than any other of the EPI target diseases. In the absence of immunization, all children eventually develop measles and about 3 of every 100 will die.
- Unimmunized children under 5 years of age, and especially infants, are at highest risk for measles and its complications, including death.

8.2 How is measles spread?

- Measles is spread by contact with nose and throat secretions of infected people and in airborne droplets released when an infected person sneezes or coughs.
- Transmission by airborne droplets can occur even hours after an infected person has left a room or other closed area.
- An infected person can infect others a few days before and for several days after he or she develops symptoms.
- The disease spreads easily wherever infants and children gather together.

8.3 What are the signs and symptoms?

- The incubation period ranges from 7 to 18 days.
- The first sign of infection is a high fever lasting 1 to 7 days.
- In order to diagnose measles, in addition to fever, there must be a generalized rash and at least one of the following: cough, runny nose, and red eyes.

8.4 What are the complications?

Because measles is so infectious, it tends to occur in epidemics, which may cause many deaths especially among malnourished children. Complications include:

- Severe diarrhea and dehydration, especially in infants.
- Infection of the middle ear.
- Pneumonia, which is the commonest cause of death, associated with measles.
  - This occurs usually because the measles virus weakens the immune system.
  - The pneumonia may be caused by the measles virus itself or by other germs.
- Encephalitis, a dangerous swelling of the brain.
- Blindness
- Severe measles is particularly likely in:
  - Poorly nourished children, especially those not receiving sufficient vitamin A.
  - Children living in crowded conditions, and
  - Those with immune systems that have been weakened by AIDS or other diseases.

Note: Infants born to mothers who have had measles are usually immune for six to eight months.

8.5 What is the treatment for measles?

Treatment of uncomplicated measles is symptomatic and supportive with antipyretics, fluids, calamine lotion and Vitamin A.

Treatment of complications of measles includes:

- Vitamin A administration, which helps to prevent eye damage, blindness, and death.
  - All children with severe measles, and all children in developing countries with measles, should receive vitamin A supplementation as soon as they are seen at a health facility, and a second dose should be given the next day.
- Antibiotics for secondary ear infections and severe respiratory tract infections.
- General nutritional support and the treatment of dehydration with oral rehydration solution (ORS) may be necessary.
- Encouraging children with measles to eat and drink.

Table 1.7 Treatment with Vitamin A

AGE	IMMEDIATELY ON DIAGNOSIS	NEXT DAY
Infants less than 6 months	50,000 IU	50,000 IU
Infants 6 – 11 months	100,000 IU	100,000 IU
Children 12 months or more	200,000 IU	200,000 IU

A third dose of vitamin A should be given 2-4 weeks later. Treat malnourished children with clinical eye signs of vitamin A deficiency in the same way.

8.6 How is measles prevented?

Measles is prevented by measles vaccination. Children should:

- Receive one dose at nine months of age.
- Be immunized against measles on admission to hospital because of the danger of infection.
- Be isolated for at least four days after the skin rash appears if admitted to hospital with measles.
- Be isolated for the duration of the illness if they are also malnourished.

Note: *If they are aged between 6 and 9 months, the initial measles vaccination should be followed by a second one as soon as possible after the age of 9 months.*

The strategies recommended for reducing measles deaths include the following:

- A dose of measles vaccine should be provided to all infants at nine months of age or shortly thereafter through routine immunization services. This is the foundation of the sustainable measles mortality reduction strategy.

- All children should be provided with a second opportunity for measles immunization. This will assure measles immunity in children who failed to receive a previous dose of measles vaccine, as well as in those who were vaccinated but failed to develop such immunity following vaccination. The second opportunity may be delivered either through routine immunization services or through periodic mass campaigns.

- Measles surveillance should be strengthened through the integration of epidemiological and laboratory information.

- The clinical management of measles should be improved.

Remember:

Measles is a highly infectious viral disease that kills more children than any other vaccine-preventable disease

In the absence of immunization, all children would eventually develop measles and about 3 of every 100 children would die from it.

The disease is spread from person to person through sneezing, coughing, and close personal contact.

The first sign of infection is a high fever lasting one to seven days and a generalized rash develops after onset/ exposure to the virus.

Pneumonia is the most common cause of death associated with measles.

Severe complications can be avoided through proper case management, including vitamin A supplementation.

Measles can be prevented by immunization of all infants at nine months of age, or shortly thereafter, through routine immunization services

All children should have two opportunities for measles immunization.

8.7 Measles vaccine

8.7.1 What it is

Measles vaccine is for preventing measles.

- Measles vaccine comes in powder form and before use must be reconstituted with the accompanying diluent from the same manufacturer.
  - Reconstituted measles vaccine must be used within six hours and then discarded.

Note: ***Where there is vitamin A deficiency, such as in Ethiopia, vitamin A is often given at the same time with measles vaccine.***

8.7.2 How it is stored

- Measles vaccine and diluent should be stored at a temperature between 2^{o}C and $+8^{o}$C.
- Freezing **does not** damage dry measles vaccine.

8.7.3 When it is given

- Measles vaccine is given at 9 months or as soon as possible after 9 months regardless of whether the parent says the child has had measles disease in the past.

- Maternal antibodies against measles last longer than other antibodies, so immunization with measles vaccine is often not effective before 9 months of age.

- During epidemics, children from 6 to 9 months of age may receive a dose but they must be given a second dose at 9 months of age. The doses must be at least 4 weeks apart.

Note: ***All children between 6 and 9 months of age who are admitted to hospital should be given a dose of measles vaccine. This should <u>not</u> be marked on their immunization cards. Another dose should be given at 9 months of age.***

8.7.4 The number and size of doses

- One dose of 0.5 ml is given.

8.7.5 Where it is given

- Measles vaccine is injected into the subcutaneous layer of the upper **left** arm.

Figure 1.5a Position of Measles vaccine injection

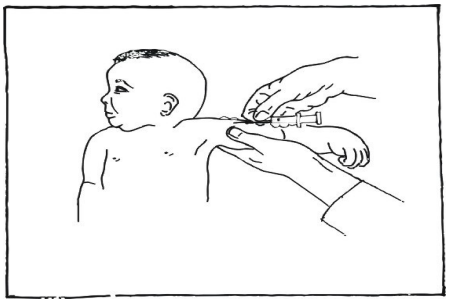
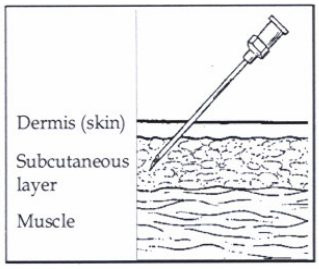


Figure 1.5b Needle position for measles injection (subcutaneous)



8.7.6 How it is given

Table 1.8 Measles vaccine administration guidelines

	Recommendation	Comment
Age	9 months	If a child is not immunized at 9 months, immunize as soon as possible thereafter. All children 9 months of age should receive measles vaccine regardless of whether or not they have had measles before. All children between 6 and 9 months of age who are admitted to hospital should be given a dose of measles vaccine. This should not be marked on their immunization cards. Another dose should be given at 9 months of age. The doses must be at least 4 weeks apart.
Dose size	0.5 ml	See the manufacturer's instructions.
Number of doses	One	A second dose through routine or campaign approaches is safe and effective for measles control.
Injection site	Subcutaneous injection in upper left arm	Press the site gently with cotton wool after injection.

8.7.7 Side-effects

- A mild fever and rash lasting one to three days may occur approximately a week after immunization. It is not infectious.

8.7.8 How to treat Side-effects

Table 1.9 Treatment of side-effects (Measles vaccine)

Vaccine	Side-effects	Treatment	Remarks
Measles	• Mild temperature • Slight rash may appear	Give paracetamol No treatment	Will go away in 1-3 days

Exercise

Small group discussion

Case study

The Medical Officer of Zinab Woreda PHC

In Zinab Woreda, the Medical Officer, Dr. Ali is managing the immunization program.

One day, he visits a district hospital and is shocked to find 19 children with measles, some of them severely ill. He asks the hospital staff for information on the immunization histories of the children.

- 15 had not received measles vaccine.
- 5 of these 15 had never been to a health centre or other health facility before being hospitalized.
- 10 of the 15 had gone to a health centre for a measles immunization but had not received it because the health workers would not immunize children with colds or diarrhea.
- The remaining 4 out of the 19 children had received measles immunization in the same health centre and had been at the right age for this.

Discussion

1. Which of these cases of measles could have been prevented? How?

2. What should the medical officer do to reduce the number of measles cases in the district?

Exercise

Buzz group discussion

1. Which vaccines are damaged most by heat?

2. Why must you discard reconstituted vaccines?

3. When must you discard reconstituted vaccines?

4. What is the immunization schedule for children? Indicate the vaccines, the doses and the recommended ages for immunization.

5. What is the immunization schedule for women of childbearing age? Indicate the doses and recommended intervals after each immunization.

6. What are the side effects of each of the vaccines in the immunization schedules? What advice do you give parents/clients if they occur?

Exercise

Buzz group discussion

Case study

The window-ledge

On Friday, Tesfaye decides to defrost and clean his refrigerator because a lot of ice has collected around the freezer.

He puts ice packs in a vaccine carrier and then places the vaccines from the refrigerator in the middle. There is not enough room in the carrier for everything, so he puts the diluent on the window-ledge out of the way.

" The diluent will be safe here until I can put it back in the refrigerator. Diluent doesn't lose its potency as vaccine does"

On the following Monday, immunization day at the Clinic, many children come in for measles immunization. Tesfaye takes the measles vaccine out of the refrigerator but at first cannot find the diluent. Eventually he sees it on the window-ledge.

Discussion

1. Can the diluent from the window-ledge be used to reconstitute the measles vaccine?

2. What should Tesfaye do before he immunizes the children?

9. Vitamin A deficiency (VAD) and "EPI plus"

Immunization not only protects infants from several vaccine preventable diseases, but the immunization service also provides a platform for delivering other health interventions, a strategy commonly known as "EPI plus." Other interventions that can be integrated with the immunization services include vitamin A supplementation, insecticide treated bed nets for malaria prevention and de-worming.

The most success has been achieved with integrating vitamin A supplementation with routine immunization services. Any immunization contact is an opportunity to screen mothers and infants for eligibility to receive vitamin A, particularly if immunizations have been delayed and the child is six months or older.

9.1 What is vitamin A?

Vitamin A is a substance that is required by the human body. Vitamin A:

- strengthens resistance to infection;
- increases a child's chances of surviving an infection;
- promotes growth; and
- protects the transparent part of the eye, called the cornea. If a person does not have enough vitamin A in his or her body, the person may have difficulty seeing in dim light.

The body cannot make vitamin A, so all of the vitamin A we need must come from the food we eat. Vitamin A is present in the following foods:

- breast milk
- liver, eggs, meat, fish with liver;
- milk, cheese, and other dairy products;
- yellow and orange fruits, e.g. mangoes and papayas;
- yellow and orange vegetables, e.g. pumpkins and carrots;
- dark green, leafy vegetables and pepper;

9.2 What is vitamin A deficiency (VAD)?

Vitamin A deficiency occurs when a person does not eat enough food containing vitamin A or when it is used up too fast by the body. This often happens during an illness, during pregnancy and lactation, and when children's growth is most rapid, i.e. from age six months to five years.

9.3 What are signs and symptoms of VAD?

Vitamin A deficiency reduces resistance to infections, leading to more severe and prolonged illnesses and therefore increasing the risk of death. It can cause eye damage, such as corneal lesions, and when severe, can cause blindness. Generally, the first clinical sign of vitamin A deficiency is night blindness (impaired vision in dim light). However, because vitamin A deficiency reduces the body's resistance to infection, it is a threat even before any direct signs become apparent. Vitamin A deficiency can also cause anaemia. Vitamin A deficiency has been shown to increase a woman's risk of dying during pregnancy and the first three months after delivery.

Children suffering from vitamin A deficiency are more likely to get infections, such as measles, diarrhoea, and fevers; and their infections are more likely to be severe, sometimes resulting in death.

9.4 What is vitamin A supplementation?

When diets do not contain food with enough vitamin A, it is possible to increase vitamin A levels in the body by periodically taking a concentrated dose or supplement in the form of a capsule. This is called supplementation. When given to children, vitamin A capsules are cut open and the drops of liquid inside are squeezed into the mouth.

Vitamin A supplementation can be combined with immunization services for children and women when health officials know or suspect that vitamin A deficiency is present in an area or among a certain population.

In addition, vitamin A supplements are also given for treatment of measles and eye damage (xerophthalmia). See the measles section in this module for use of vitamin A in the treatment of measles.

9.5 Are there any contraindications to vitamin A supplements?

There are no contraindications to vitamin A supplements for children and post-partum women if they are given according to the schedules provided below. Vitamin A may be given at the same time as immunization.

9.6 Are there any side effects to vitamin supplements?

Usually, there are no side effects. However, on rare occasions a child may experience headache, loss of appetite, or vomiting. These symptoms will pass by themselves, and no treatment is necessary. Parents should be advised that this is normal.

9.7 What are the opportunities to link vitamin A and routine immunization?

Target for vitamin A	Immunization contact	Vitamin A dose
Mothers within 6–8 weeks of delivery, if they have not received vitamin A at delivery *Infants benefit via breast milk*	1st contact BCG, OPV-O, DTP-1 contact up to 6–8 weeks after delivery	200 000 IU
Infants 6–11 months*	Measles/Yellow fever Polio NIDs	100 000 IU
Children 12 months and older	Other EPI campaigns Boosters	200 000 IU
Children 12–59 months	Booster doses Delayed primary immunization	200 000 IU

Note: The optimal interval between doses is 4–6 months. The minimum recommended safe interval between doses of vitamin A is 1 month. The interval between doses can be reduced to treat clinical vitamin A deficiency and measles cases. Follow the appropriate measles treatment schedule.

*In Ethiopia, the routine EPI currently gives vitamin A along with measles vaccination at 9 months of age. National and sub-national immunization days give vitamin A starting at 6 months of age.

9.8 Administering vitamin A

- Check the capsules carefully to know what dose of vitamin A (how many drops) to give to what age group.
- Check the expiry date on the label. If the expiry date has been reached, discard the bottle.
- Open the bottle and write the current date on the label so that you will know when to stop using it. Opened bottles of vitamin A capsules are good for one year.
- Open a capsule by cutting the tip or nipple off with a clean pair of scissors or a clean nail clipper.
- Squeeze out the drops directly into the child's mouth. For a young child, you may need to pinch his or her cheeks gently to open the mouth. If only half dose is to be given to a child, squeeze out the required number of drops directly in the child's mouth and discard the rest.

If you are giving vitamin A to children ages 6 through 11 months and you have only 200 000 IU dose capsules, you need to know the number of drops in this size of capsule in order to be able to give a half dose (100 000 IU). To do that:

Step 1: Open one 200 000 IU capsule, and squeeze out the contents while counting the number of drops that are contained in it.

Step 2: Divide the total number of drops by two – this is the number of drops equal to a half dose or 100 000 IU. It is safe to assume that all capsules in a batch contain the same number of drops.

Remember:

- Vitamin A is important to strengthen the immune system to protect children from infection.
- Vitamin A is safe for children and high dose supplements protects them for 6 months.
- All children aged 6 – 59 months (through age 5) need a vitamin A supplement.
- Children sick with measles, or who have certain eye problems, severe diarrhea or severe malnutrition may need additional vitamin A and other treatment.

10. Contraindications to immunization

There are only *three* situations at present which are contraindications to immunization:

- Do not give BCG to a child known to have AIDS.
- Do not give DPT 2 or DPT 3 to a child who has had convulsions or shock within 3 days of the most recent dose.
- Do not give DPT to a child with recurrent convulsions or another active neurological disease of the central nervous system.

In all other situations, here is a good rule to follow:

There are no contraindications to immunization of a sick child if the child is well enough to go home

The following FALSE contraindications are common causes of missed opportunities. Infants with these conditions should be immunized.

- allergy or asthma (except if there is a known allergy to a specific component of the vaccine mentioned above);
- a child with fever but not classified as having severe disease;
- family history of adverse events following immunization;
- family history of convulsions, seizures, or fits;
- treatment with antibiotics;
- known or suspected HIV infection with no signs and symptoms of AIDS;
- signs and symptoms of AIDS, except for BCG which must not be given;
- child being breastfed;
- chronic illnesses such as chronic diseases of the heart, lung, kidney, or liver
- stable neurological conditions, such as cerebral palsy or Down's Syndrome;
- premature or low-birth weight (vaccination should not be postponed);
- recent or imminent surgery;
- malnutrition; and
- history of jaundice at birth.

- If a parent objects to an immunization try to convince him/her by explaining that the child is at risk of vaccine preventable disease and immunization will not harm but protects from these diseases.
- If a child needs referral for a severe disease, don't immunize that child but describe the need for immunization in the referral paper.

If a reaction does occur, health workers should report the problem to supervisors immediately. Children who have a severe reaction to a vaccine should not receive additional doses of that vaccine.

If a child has diarrhea when you give OPV, administer an extra dose — that is, a fifth dose — at least four weeks after he or she has received the last dose in the schedule.

Giving vaccines at the same time

If you are giving more than one vaccine, do not use the same syringe and do not use the same arm or leg for more than one injection.

Give doses of the same vaccine at the correct intervals. Wait at least four weeks between doses of OPV and DTP and subsequent doses of these vaccines.

Exercise

Small group competition

Answer the following by saying TRUE or FALSE. *Your facilitator will read the questions for you.*

1. Give DPT-2 and OPV-2 to a child who had convulsions immediately after DPT-1 a month before
2. Immunize a child with local skin infection
3. Immunize a child with chronic heart problem
4. Immunize a child who needs urgent referral, before he leaves the health facility
5. Immunize a child who has a brother with recurrent convulsions
6. Immunize a child who has a history of jaundice at birth
7. Immunize a child who is underweight
8. Do NOT immunize a child known to have AIDS and has not received any immunization at all
9. Do NOT immunize a child with pneumonia
10. Do NOT immunize a child with fever following DPT-1 and OPV-1, 4 weeks ago

Appendix

Administration guidelines for immunization of children < 1 Year

Vaccine	Number of Doses	Age	Minimum Interval between doses	Route of administration	Dose	Vaccination site
BCG	1	At birth	-----	Intradermal	0.05 ml for under 1 year and 0.1ml for above 1 year	Upper right arm
OPV	4	At birth and at 6, 10 and 14 weeks of age	4 weeks	Oral	2 drops	Mouth
DPT	3	6, 10 and 14 weeks of age	4 weeks	Intramuscular	0.5 ml	Outer part of thigh
Measles	1	9 months	------	Subcutaneous	0.5 ml	Upper left arm
Vitamin A	2	At 6 months At12 months*	6 months	oral	100,000 IU 200 000 IU	Mouth

*give only 100,000 IU if the child weighs less than 8 kg.

Intradermal	=	into the skin
Intramuscularly	=	into a muscle
Subcutaneous	=	under the skin.

Administration guidelines of tetanus toxoid (TT) for women of childbearing age.

	Recommendation	Comment
Age	TT 1: at first contact with woman of childbearing age, or as early as possible in pregnancy. TT 2: At least 4 weeks after TT 1 TT 3: At least 6 months after TT 2 TT 4: At least 1 year after TT 3 TT 5: At least 1 year after TT 4	**<u>Period of protection</u>** No protection 3 years 5 years 10 years All childbearing years
Dose size	0.5ml	See manufacturer's instructions
Number of doses	Five	Provides protection during child bearing years
Injection site	Muscle of upper arm	Never immunize into the buttock