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Immunization in practice

Module 1: Target diseases

Contents

About this module

This module describes the diseases that can be prevented by vaccines in the immunization programmes of most countries. Since the last edition of *Immunization in practice*, more diseases have been added because effective new vaccines — against *Haemophilus influenzae* type b (Hib), for example — are now widely available.

Each country has its own policies as to which vaccines to use. Your country's policy may not include all of the vaccines described in *Immunization in practice*, and some vaccines, including those for yellow fever and Japanese encephalitis, are only used in certain regions of the world. We have included information about these diseases to make this module useful anywhere.

Some diseases, including polio, measles, and maternal and neonatal tetanus, have specific goals for eradication or elimination. These are covered in this module. It is important, however, to be aware that we have a global goal to improve immunization coverage of all vaccines, which is:

Ensure full immunization of children under one year of age at 90% coverage nationally with at least 80% coverage in every district or equivalent administrative unit.

This goal was set by the UN General Assembly's Special Session on Children in May 2002. It is supported by a large number of international partners and donors through the Global Alliance for Vaccines and Immunization (GAVI).

1. Diphtheria

1.1 What is diphtheria?

Diphtheria is caused by the bacterium *Corynebacterium diphtheriae*. This germ produces a toxin that can harm or destroy human body tissues and organs. One type of diphtheria affects the throat and sometimes the tonsils. Another type, more common in the tropics, causes ulcers on the skin.

Diphtheria affects people of all ages, but most often it strikes unimmunized children. In temperate climates, diphtheria tends to occur during the colder months. In 2000, 30 000 cases and 3000 deaths of diphtheria were reported worldwide.

1.2 How is diphtheria spread?

Diphtheria is transmitted from person to person through close physical and respiratory contact. It can cause infection of the nasopharynx, which may lead to breathing difficulties and death.

1.3 What are the signs and symptoms of diphtheria?

When diphtheria affects the throat and tonsils, the early symptoms are sore throat, loss of appetite, and slight fever. Within two to three days a bluish-white or grey membrane forms in the throat and on the tonsils. This membrane sticks to the soft palate of the throat and may bleed. If there is bleeding, the membrane may become greyish-green or black. The patient may either recover at this point or develop severe weakness and die within six to ten days. Patients with severe diphtheria do not develop a high fever but may develop a swollen neck and obstructed airway.

1.4 What are the complications of diphtheria?

During the early phase of the illness or even weeks later, patients may develop abnormal heartbeats, which can result in heart failure. Some patients with diphtheria experience inflammation of the heart muscle and valves, leading after many years to chronic heart disease and heart failure. The most severe complication of diphtheria is respiratory obstruction followed by death.

1.5 What is the treatment for diphtheria?

Children who develop diphtheria should be given diphtheria antitoxin and antibiotics, such as erythromycin or penicillin. They should be isolated to avoid exposing others to the disease. About two days after starting antibiotic treatment patients are no longer infectious.

For confirmation of diagnosis, health workers should obtain throat cultures from suspect cases. However, treatment should begin without waiting for culture results.

1.6 How is diphtheria prevented?

The most effective way of preventing diphtheria is to maintain a high level of immunization in the community. In most countries, diphtheria toxoid vaccine is given in combination with tetanus toxoid and pertussis vaccines (DTP vaccine). More recently, some countries have been using a combination vaccine that includes vaccines for diphtheria, tetanus, pertussis, vitamin A (HepB), and sometimes *Haemophilus influenzae* type b (Hib). Approximately every ten years, booster doses of the adult form of the vaccine, tetanus-diphtheria toxoids vaccine (Td), may be needed to maintain immunity.

Key points

Diphtheria is spread from person to person in airborne droplets.

Symptoms of the disease include sore throat, loss of appetite, and a slight fever.

Patients with the disease can experience complications such as abnormal heartbeats and inflammation of the heart muscle and valves.

Children with diphtheria should be treated with diphtheria antitoxin and antibiotics.

The most effective way of preventing the disease is to maintain a high level of immunization within a community.

2. Measles

2.1 What is measles?

Measles is a highly infectious disease caused by a virus. In 2001 it was estimated that there were 30 million measles cases and 745 000 measles-related deaths. Measles kills more children than any other vaccine preventable disease.

Because the disease is so infectious, it tends to occur as epidemics, which may cause many deaths especially among malnourished children.

2.2 How is measles spread?

Measles is spread through contact with nose and throat secretions of infected people and in airborne droplets released when an infected person sneezes or coughs.

A person with measles can infect others for several days before and after he or she develops symptoms. The disease spreads easily in areas where infants and children gather, for example in health centres and schools.

2.3 What are the signs and symptoms of measles?

The first sign of infection is a high fever which begins approximately 10–12 days after exposure and lasts several days. During this period, the patient may develop a runny nose, a cough, red and watery eyes, and small white spots inside his or her cheeks.

After several days, a slightly raised rash develops, usually on the face and upper neck. Over a period of about three days, the rash spreads to the body and then to the hands and feet. It lasts for five or six days and then fades. The incubation period from exposure to the onset of the rash averages 14 days, with a range of seven to 18 days.

2.4 What are the complications of measles?

Unimmunized children under five years of age, and especially infants, are at highest risk for measles and its complications, including death. Infected infants may suffer from severe diarrhoea, possibly causing dehydration. Children may also develop inflammation of the middle ear and severe respiratory tract infections.

Pneumonia is the most common 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 secondary bacterial infection. Encephalitis, a dangerous inflammation of the brain, may also develop.

Severe measles is particularly likely in poorly nourished children, especially those who do not receive sufficient vitamin A, who live in crowded conditions, and whose immune systems have been weakened by HIV/AIDS or other diseases. Measles is a major cause of blindness among children in Africa and other areas of the world with endemic measles.

Children who recover from measles are immune for the rest of their lives.

2.5 What is the treatment for measles?

General nutritional support and the treatment of dehydration with oral rehydration solution are necessary. Antibiotics should only be prescribed for ear infections and severe respiratory tract infections. It is important to encourage children with measles to eat and drink.

All children in developing countries diagnosed with measles should receive two doses of vitamin A supplements given 24 hours apart. Giving Vitamin A can help prevent eye damage and blindness. Vitamin A supplementation reduces the number of deaths from measles by 50 %.

Vitamin a treatment dosage

Age	Immediately on diagnosis	Next day	Follow-up
Infants less than 6 months old	50 000 IU	50 000 IU	Third dose 2–4 weeks later if there are signs of xerophthalmia
Infants aged 6–11 months	100 000 IU	100 000 IU	
Children aged 12 months and over	200 000 IU	200 000 IU	

2.6 How is measles prevented?

Measles is prevented by immunization with measles vaccine. Measles is highly transmissible; almost all non-immune children contract measles if exposed to infection. To reduce the risk of infection in hospitals, all children between the ages of six and nine months who have not received measles vaccine and who are admitted to a hospital should be immunized against measles. If the children's parents do not know whether they have received measles vaccine, the child should still be immunized. If a child has received measles vaccine before nine months of age, a second dose should be administered at nine months or as soon as possible after nine months.

2.7 Global accelerated disease control issues

In May 2003, the World Health Assembly at its 56th session adopted a resolution to reduce measles deaths by 50% by 2005 compared to 1999 levels.

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.

Key points

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

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. All children should have two opportunities for immunization.

3. Mumps

3.1 What is mumps?

Mumps is an infection caused by a virus. It is sometimes called infectious parotitis, and it primarily affects the salivary glands.

Mumps is mostly a mild childhood disease. It most often affects children between five and nine years old. But the mumps virus can infect adults as well. When it does, complications are more likely to be serious. As more children receive mumps vaccine, it is expected that cases will become more common in older children than in younger ones.

3.2 How is mumps spread?

Mumps virus is present throughout the world. It is spread by airborne droplets released when an infected person sneezes or coughs and by direct contact with an infected person.

3.3 What are the signs and symptoms of mumps?

About a third of children infected with the mumps virus have no symptoms. If symptoms do appear, they usually begin 14 to 21 days after a person is infected. Swelling in the salivary glands, just below and in front of the ears, is the most prominent symptom. The swelling may occur on one or both sides of the neck. Other symptoms include pain when chewing or swallowing, fever, weakness, and tenderness and swelling in the testicles.

A person who has mumps can infect others from about six days before to about nine days after swelling in the neck appears.

3.4 What are the complications of mumps?

Complications from mumps are rare, but they can be serious.

In men and teenage boys, an inflammatory condition called orchitis may cause swelling in one or both testicles. Orchitis is painful and sometimes can cause sterility. Encephalitis, meningitis, and hearing loss are other rare complications that can occur in people infected at any age.

3.5 What is the treatment for mumps?

There is no treatment for mumps.

3.6 How is mumps prevented?

People who get mumps and recover are thought to have lifelong protection against the virus. Mumps vaccines are also highly effective and safe.

Key points

Mumps is transmitted in airborne droplets when infected people/children cough and sneeze.

About a third of people/children infected with mumps have no symptoms.

The most common symptom — if symptoms do develop — is swelling in the salivary glands.

Complications from mumps can be serious, but they are rare.

Mumps vaccine should be given in combination with measles and rubella vaccines (MMR).

4. Pertussis

4.1 What is pertussis?

Pertussis, or whooping cough, is a disease of the respiratory tract caused by bacteria that live in the mouth, nose, and throat. Many children who contract pertussis have coughing spells that last four to eight weeks. The disease is most dangerous in infants. In 2000, an estimated 39 million cases and 297 000 deaths occurred worldwide, due to pertussis.

4.2 How is pertussis spread?

Pertussis spreads very easily from child to child in droplets produced by coughing or sneezing. Children exposed to the germs become infected. In many countries the disease occurs in regular epidemic cycles of three to five years.

4.3 What are the signs and symptoms of pertussis?

The incubation period is five to 10 days. At first, the infected child appears to have a common cold with runny nose, watery eyes, sneezing, fever, and a mild cough. The cough gradually worsens, and involves many bursts of rapid coughing. At the end of these bursts the child takes in air with a high-pitched whoop. The child may turn blue because he or she does not get enough oxygen during a long burst of coughing. Vomiting and exhaustion often follow the coughing attacks, which are particularly frequent at night.

During recovery coughing gradually becomes less intense. Children usually do not have a high fever during any stage of the illness.

4.4 What are the complications of pertussis?

Complications are most likely in young infants. The most common and deadly complication is bacterial pneumonia.

Children may also experience complications such as convulsions and seizures due to fever or reduction in oxygen supply to the brain. This is caused either by coughing attacks or by toxins released by the pertussis bacteria. They may also experience loss of appetite, inflammation of the middle ear, and dehydration.

4.5 What is the treatment for pertussis?

Treatment with an antibiotic, usually erythromycin, may make the illness less severe. Because the medication kills bacteria in the nose and throat, the use of antibiotics also reduces the ability of infected people to spread pertussis to others.

Children infected with pertussis should get plenty of fluids to prevent dehydration.

4.6 How is pertussis prevented?

Prevention involves immunization with pertussis vaccine, which is usually given in combination with diphtheria and tetanus vaccines (DTP). More recently, some countries have been using a combination vaccine that includes vaccines for diphtheria, tetanus, pertussis, vitamin A (HepB), and sometimes *Haemophilus influenzae* type b (Hib).

Key points

Pertussis, or whooping cough, is a disease of the respiratory tract.

Pertussis is a bacterial infection spread from person to person by sneezing and coughing.

Infants and young children are 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 infants with pertussis vaccine.

5. Poliomyelitis (polio)

5.1 What is poliomyelitis?

Poliomyelitis, or polio, is a crippling disease caused by anyone of three related viruses, poliovirus types 1, 2 or 3. All member states of WHO agreed in 1988 to eradicate polio, and WHO aims to certify the world as free of the disease by 2005. Since the global initiative to eradicate polio was launched, the number of reported cases of polio has been reduced from an estimated 350 000 in 1988 to 483 cases associated with wild poliovirus in 2001.

5.2 How is polio spread?

The only way to spread poliovirus is through the faecal/oral route. The virus enters the body through the mouth when people eat food or drink water that is contaminated with faeces. The virus then multiplies in the intestine, enters the bloodstream, and may invade certain types of nerve cells, which it can damage or destroy. Polioviruses spread very easily in areas with poor hygiene.

Nearly all children living in households where someone is infected become infected themselves. Children are most likely to spread the virus between 10 days before and 10 days after they experience the first symptoms of the disease. It is important to know that the great majority of people who are infected do not have symptoms, but they can still spread the disease. The incubation period is six to 20 days.

5.3 What are the signs and symptoms of polio?

Most children infected by poliovirus never feel ill. Less than 5% of those infected may have general flu-like symptoms such as fever, loose stools, sore throat, upset stomach, headache, or stomach ache.

Most children who have a poliovirus infection without symptoms develop immunity and have lifelong protection against paralytic polio.

Paralytic polio begins with mild symptoms and fever. These symptoms are followed by severe muscle pain and paralysis, which usually develop during the first week of illness. Patients may lose the use of one or both arms or legs. Some patients may not be able to breathe because respiratory muscles are paralysed. Some patients who develop paralysis from polio do recover to some degree over time. But the degree of recovery varies greatly from person to person.

A diagnosis of polio is confirmed by laboratory testing of stool specimens.

5.4 What are the complications of paralytic polio?

Death may occur if the respiratory muscles of the chest are affected and no respirator is available to support breathing. Without adequate physiotherapy paralysed limbs will not regain full function, often leaving a child seriously crippled.

5.5 What is the treatment for polio?

While the initial symptoms — muscle pain and fever — can be relieved, no treatment exists to cure paralysis from polio. A respirator can help patients who have difficulty in breathing. Regular physical therapy, as well as orthopaedic treatment and operations and the use of braces, can help reduce the long-term crippling effects of polio.

5.6 How is polio prevented?

Polio can be prevented through immunization with oral polio vaccine (OPV) or inactivated polio vaccine (IPV).

OPV is recommended for both routine immunization and supplementary campaigns for polio eradication. IPV is also an effective vaccine. But OPV is less expensive, safe, and easy for health workers and volunteers to administer.

5.7 What are the eradication goals and strategies for polio?

In 1988, the Forty-first World Health Assembly launched a global initiative to eradicate polio.

There are four core strategies to stop transmission of the wild poliovirus and certify all WHO regions polio-free by the end of 2005:

- high infant immunization coverage with four doses of oral polio vaccine in the first year of life;
- supplementary doses of oral polio vaccine to all children under five years of age during national immunization days (NIDs);
- surveillance for wild poliovirus through reporting and laboratory testing of all cases of acute flaccid paralysis (AFP) among children under fifteen years of age;
- targeted “mop-up” campaigns once wild poliovirus transmission is limited to a specific focal area.

In the 15 years since the Global Polio Eradication Initiative was launched, the number of cases has fallen by over 99%, from an estimated 350 000 cases in 1988, to 1919 reported cases in 2002. The number of polio-infected countries has been reduced from more than 125 in 1988 to just seven in 2002.

Key points

Polio is caused by any of three related polioviruses and can easily spread by the faecal/oral route.

Many people/children who are infected with poliovirus do not become paralysed but may still spread the disease to others.

Less than 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).

6. Rubella and congenital rubella syndrome

6.1 What is rubella?

Rubella is an infection caused by a virus. Congenital rubella syndrome (CRS) is an important cause of severe birth defects. When a woman is infected with the rubella virus early in pregnancy, she has a 90% chance of passing the virus on to her fetus. This can cause the death of the fetus, or it may cause CRS. Even though it is a mild childhood illness CRS causes many birth defects. Deafness is the most common, but CRS can also cause defects in the eyes, heart, and brain. It is estimated that there are 700 000 deaths due to CRS each year.

6.2 How is rubella spread?

Rubella is spread in airborne droplets when infected people sneeze or cough. Once a person is infected, the virus spreads throughout the body in about five to seven days. During this time, pregnant women may pass the virus on to their fetuses.

Infected people are most likely to pass on the virus when the rash is developing. But the virus may be spread from seven days before to about seven days after the rash appears.

Infants with CRS can transmit the virus for a year or more.

6.3 What are the signs and symptoms of rubella?

The time between first contact with the virus and the first sign of rubella is about 14 days. Symptoms are often mild, and between 20% and 50% of infected people may notice no symptoms at all.

In children, a rash is usually the first sign; other signs include low fever and swollen lymph nodes in the neck. The rash most often begins on the face and spreads from head to foot. It usually lasts for about three days. The rash is pink, and fainter than measles. Many rashes mimic rubella, and a rash should not be considered a sure sign of infection with the rubella virus.

Infants who are born with CRS usually show symptoms such as cataracts and loss of hearing in infancy, but they may not show symptoms for two to four years.

6.4 What are the complications of rubella?

Complications tend to occur more often in adults than in children. About 70% of adult women who are infected may develop pain in their joints or arthritis, especially in the fingers, wrists, and knees. Encephalitis occurs in about one in 5000 cases and is most

common in adult women. Problems with bleeding occur in about one in 3000 cases, usually among children.

Complications from CRS include deafness, cataracts, heart defects, and mental retardation.

6.5 What is the treatment for rubella?

There is no specific treatment for rubella or for CRS. Patients with rubella should drink plenty of fluids and may take medication to reduce mild fever. Infants with CRS are treated for their specific problems.

6.6 How is rubella prevented?

Rubella vaccines are safe and effective and for infant immunization are usually given in combination with measles/mumps vaccine as MMR. In some countries, mostly in the industrialized world, rubella has been nearly eliminated through childhood immunization programmes. However, it is important to ensure that coverage in infants is sustained at over 80% to avoid shifting of rubella transmission to older age groups. For prevention of CRS, women of childbearing age are the primary target group for rubella immunization. Immunizing women between the ages of 15 and 40 will rapidly reduce the incidence of CRS without affecting childhood transmission of the rubella virus.

Key points

Rubella is an infection caused by a virus.

Rubella is normally a mild childhood disease, but women who get rubella early in pregnancy can pass the virus on to their fetuses. This is called congenital rubella syndrome (CRS).

A rash is the most prominent symptom of rubella, especially in children.

Complications from rubella are rare. But complications from CRS are more serious and include deafness, cataracts, and mental retardation.

Rubella vaccines are safe and effective. But because conditions vary greatly from country to country, there is no universal recommendation on the use of vaccines.

If countries immunize against rubella, they generally use a combination vaccine that also guards against measles (MR) or measles and mumps (MMR).

It is important to ensure that coverage in infants is sustained at over 80% to avoid the shifting of rubella transmission to older age groups.

7. Tetanus

7.1 What is tetanus?

Tetanus is acquired through exposure to the spores of the bacterium *Clostridium tetani* which are universally present in the soil. The disease is caused by the action of a potent neurotoxin produced during the growth of the bacteria in dead tissues, e.g. in dirty wounds or in the umbilicus following non-sterile delivery.

People of all ages can get tetanus. But the disease is particularly common and serious in newborn babies. This is called neonatal tetanus. Most infants who get the disease die. Neonatal tetanus is particularly common in rural areas where most deliveries are at home without adequate sterile procedures. In 2000, WHO estimates that neonatal tetanus killed about 200 000 babies.

7.2 How is tetanus spread?

Tetanus is not transmitted from person to person. A person usually becomes infected with tetanus when dirt enters a wound or cut. Tetanus germs are likely to grow in deep puncture wounds caused by dirty nails, knives, tools, wood splinters, and animal bites. Women face an additional risk of infection if a contaminated tool is used during childbirth or during an abortion.

A newborn baby may become infected if the knife, razor, or other instrument used to cut its umbilical cord is dirty, if dirty material is used to dress the cord, or if the hands of the person delivering the baby are not clean.

Infants and children may also contract tetanus when dirty instruments are used for circumcision, scarification, and skin piercing, and when dirt, charcoal, or other unclean substances are rubbed into a wound.

7.3 What are the signs and symptoms of tetanus?

The time between getting the infection and showing symptoms is usually between three and 10 days. But it may be as long as three weeks. The shorter the incubation period the higher the risk of death.

In children and adults muscular stiffness in the jaw is a common first sign of tetanus. This symptom is followed by stiffness in the neck, difficulty swallowing, stiffness in the stomach muscles, muscle spasms, sweating, and fever. Newborn babies with tetanus are normal at birth, but stop sucking between three and 28 days after birth. They stop feeding and their bodies become stiff while severe muscle contractions and spasms occur. Death follows in most cases.

7.4 What are the complications of tetanus?

Fractures of the spine or other bones may occur as a result of muscle spasms and convulsions. Abnormal heartbeats and coma can occur, as can development of pneumonia and other infections. Death is particularly likely in the very young and in old people.

7.5 What is the treatment for tetanus?

Tetanus at any age is a medical emergency best managed in a referral hospital.

7.6 How is tetanus prevented?

Immunizing infants and children with DTP or DT and adults with Td prevents tetanus. More recently, some countries have been using a combination vaccine that includes vaccines for diphtheria, tetanus, pertussis, vitamin A (HepB), and sometimes *Haemophilus inflenzae* type b (Hib).

Neonatal tetanus can be prevented by immunizing women of childbearing age with tetanus toxoid, either during pregnancy or outside of pregnancy. This protects the mother and enables tetanus antibodies to be transferred to her baby.

Clean practices are especially important when a mother is delivering a child, even if she has been immunized. People who recover from tetanus do not have natural immunity and can be infected again and therefore need to be immunized.

7.7 Global accelerated disease control issues

WHO, UNICEF and UNFPA agreed to set the year 2005 as the target date for worldwide elimination of neonatal tetanus. This implies the reduction of neonatal tetanus incidence to below one case per 1000 live births per year in every district. This goal was reaffirmed by the United Nations General Assembly Special Session (UNGASS) in 2002. Because tetanus survives in the environment, eradication of the disease is not feasible and high levels of immunization have to continue even after the goal has been achieved.

To achieve the elimination goal, countries implement a series of strategies:

- Improve the percentage of pregnant women immunized with vaccines containing tetanus toxoid.
- Administer vaccines containing tetanus toxoid to all women of childbearing age in high-risk areas. This is usually implemented through a three round campaign approach.
- Promote clean delivery and childcare practices.
- Improve surveillance and reporting of neonatal tetanus cases.

Key points

Tetanus is caused by bacteria found in the environment.

Infection occurs during unclean delivery of babies, when contaminated objects are used to cut the umbilical cord, or anytime tetanus bacteria enter a puncture or cut in the skin.

Neonatal tetanus remains a serious problem in countries with poor immunization coverage and unclean practices at childbirth.

Most newborns with tetanus die.

The best way to prevent tetanus is to immunize with tetanus toxoid and to clean wounds thoroughly and remove dead tissue.

The best way to prevent neonatal tetanus is to immunize women of childbearing age (or pregnant women) and to ensure clean delivery practices.

8. Tuberculosis (TB)

8.1 What is tuberculosis?

Tuberculosis (TB) is caused by the bacterium *Mycobacterium tuberculosis* which usually attacks the lungs, but can also affect other parts of the body, including the bones, joints, and brain.

Not everyone who is infected with tuberculosis bacteria develops the disease. People who are infected may not feel ill and may have no symptoms. The infection can last for a lifetime, but the infected person may never develop the disease itself. People who are infected but who do not develop the disease do not spread the infection to others.

In 2001, approximately two million people worldwide died of tuberculosis.

8.2 How is TB spread?

TB is spread from one person to another through the air often when a person with the disease coughs or sneezes. TB spreads rapidly, especially in areas where people are living in crowded conditions, have poor access to health care, and are malnourished. A variety of TB called bovine tuberculosis is transmitted by consuming raw milk from infected cattle.

People of all ages can contract tuberculosis. But the risk of developing TB is highest in children younger than three years old and in older people. People with TB infection who have weakened immune systems (for example, people with HIV/AIDS) are more likely to develop the disease.

8.3 What are the signs and symptoms of TB?

The period from infection to development of the first symptoms is usually four to 12 weeks, but the infection may persist for months or even years before the disease develops. A person with the disease can infect others for several weeks after he or she begins treatment.

The symptoms of TB include general weakness, weight loss, fever, and night sweats. In TB of the lungs, called pulmonary tuberculosis, the symptoms include persistent cough, coughing up of blood, and chest pain. In young children, however, the only sign of pulmonary TB may be stunted growth or failure to thrive. Other signs and symptoms depend on the part of the body that is affected. For example, in tuberculosis of the bones and joints there may be swelling, pain, and crippling effects on the hips, knees, or spine.

8.4 What are the complications of TB?

TB can present in many ways and may be very difficult to diagnose. Untreated pulmonary TB results in debility and death. This may be more rapid in persons infected with HIV/AIDS.

8.5 What is the treatment for TB?

People with TB must complete a course of therapy, which usually includes taking two or more anti-tuberculosis drugs for at least six months. This is often called DOTS, for Directly Observed Treatment Schedule. Unfortunately, some people fail to take the medications as prescribed or to complete their course of therapy. Some may be given ineffective treatments. This can lead to multidrug-resistant TB, which can be extremely dangerous if it spreads to other people. When people who have developed TB fail to complete standard treatment regimens or are given the wrong treatment regimen, they may remain infectious.

8.6 How is TB prevented?

Immunization of infants with Bacille Calmette-Guérin vaccine (BCG) can protect against TB meningitis and other severe forms of TB in children less than five years old. BCG vaccine is not recommended after 12 months of age because the protection provided is variable and less certain.

Key points

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 who are younger than 12 months old is to immunize them as soon after birth as possible with BCG vaccine.

9. Hepatitis B

9.1 What is hepatitis B?

Hepatitis B is caused by a virus that affects the liver. Adults who get hepatitis B usually recover. However most infants infected at birth become chronic carriers i.e. they carry the virus for many years and can spread the infection to others. In 2000, there were an estimated 5.7 million cases of acute hepatitis B infection and more than 521 000 deaths from hepatitis B-related disease.

9.2 How is hepatitis B spread?

The hepatitis B virus is carried in the blood and other body fluids. It is usually spread by contact with blood in the following ways:

- Through an unsafe injection or needle stick. Unsterilized needles or syringes can contain hepatitis B virus from an infected person, for example from a patient or a needle user.

- Transmission of the virus by mothers to their babies during the birth process, when contact with blood always occurs.

- Transmission between children during social contact through cuts, scrapes, bites, and scratches.

- Transmission during sexual intercourse through contact with blood or other body fluids.

9.3 What are the signs and symptoms of hepatitis B?

The incubation period averages six weeks but may be as long as six months.

Infection in young children usually is asymptomatic. However, a larger proportion of children may become chronic carriers compared to adults.

People who do show symptoms may feel weak and may experience stomach upsets and other flu-like symptoms. They may also have very dark urine or very pale stools. Jaundice is common (yellow skin or a yellow colour in the whites of the eyes). The symptoms may last several weeks or months. A laboratory blood test is required for confirmation.

Most acute infections in adults are followed by complete recovery. However, many children become chronic carriers. People who recover from acute hepatitis B (and who do not become chronic carriers) are protected from becoming infected again throughout their lives.

9.4 What are the complications of hepatitis B?

A small portion of acute infections can be severe and lead to death. The most serious complications, including chronic hepatitis, cirrhosis, liver failure, and liver cancer, occur in people with chronic infection.

9.5 What is the treatment for hepatitis B?

There is no treatment for the acute condition. Supportive treatment is indicated. In chronic infection the disease can sometimes be stopped with medications.

9.6 How is hepatitis B prevented?

It is recommended that all infants receive three doses of hepatitis B vaccine during the first year of life. More recently, some countries have been using a combination vaccine that includes vaccines for diphtheria, tetanus, pertussis, hepatitis B (HepB), and sometimes *Haemophilus inflenzae* type b (Hib). Programmatically, it is usually easiest if the three doses of hepatitis B vaccine are given at the same time as the three doses of DTP. In countries where hepatitis B is highly endemic, where feasible, a birth dose of HepB is included in the schedule to prevent perinatal hepatitis B infection.

Some countries also recommend immunizing adolescents, health workers and other risk groups.

Key points

There are about 350 million carriers of hepatitis B virus worldwide. Most of them are unaware they are carriers.

People who carry the virus often have no symptoms.

The hepatitis B virus is spread through unsafe injection practices and needle stick injuries.

The younger a person is when infected, the less likely it is that symptoms will occur. But it is more likely that he or she will become a carrier of the disease.

Most infants born to mothers who are carriers are at risk of being infected.

All children should receive hepatitis B vaccine starting at birth or at the age of four to six weeks, when the first visit to a clinic takes place.

A chronic carrier is more likely to develop severe chronic liver disease or liver cancer in later life.

10. Haemophilus influenzae type b (Hib)

10.1 What is Haemophilus influenzae type b?

Haemophilus influenzae type b (Hib) is one of six related types of bacterium. In 2000, H.influenzae type B (Hib) was estimated to have caused two to three million cases of serious disease, notably pneumonia and meningitis, and 450 000 deaths in young children.

10.2 How is Hib spread?

The Hib bacterium is commonly present in the nose and throat. Bacteria are transmitted from person to person in droplets through sneezing, coughing. Infected children may carry Hib bacteria without showing any signs or symptoms of illness, but they can still infect others. The risk of disease is highest for children between six months and two years of age.

10.3 What are the signs and symptoms of Hib?

Pneumonia and meningitis are the most important diseases caused by Hib bacteria. In developing countries, pneumonia is more common than meningitis in children with Hib disease. Hib disease should be suspected in the case of any child with signs and symptoms of meningitis or pneumonia.

10.4 What are the complications of Hib?

Children who survive Hib meningitis may develop permanent neurological disability, including brain damage, hearing loss, and mental retardation. 15% to 30% of children who survive Hib disease are at risk for these disabilities. 5% to 10% cases of Hib meningitis are at risk of dying.

10.5 What is the treatment for Hib?

Hib disease can be treated with specific antibiotics.

10.6 How is Hib prevented?

Several Hib conjugate vaccines are available. All are effective when given in early infancy, and have virtually no side effects except occasional temporary redness or swelling at the injection site. To reduce the number of injections, Hib vaccine is sometimes given in combination vaccines, DTP-HepB+Hib.

Key points

Hib's victims are mainly children younger than five years old.

Hib bacteria are commonly present in the nose and throat. The bacteria are transmitted from person to person in droplets through sneezing, coughing.

Infected children may carry Hib bacteria without showing any signs or symptoms of the disease, which may kill up to 5% to 10% of infected children. Others suffer permanent disabilities.

Hib disease can cause pneumonia and meningitis.

Hib disease can be treated with antibiotics.

Hib disease can be prevented with vaccine given early in infancy.

11. Japanese encephalitis (JE)

11.1 What is Japanese encephalitis?

Japanese encephalitis (JE) is caused by a virus carried by mosquitoes. It is found in Asia, Pacific Islands and Northern Australia. JE is the most important form of viral encephalitis in Asia, causing an estimated 15 000 deaths in 2001, mostly among children. In recent decades outbreaks of JE have occurred in several areas previously non-endemic for the disease.

11.2 How is JE spread?

JE is spread by mosquitoes. The virus normally infects birds and domestic animals, especially pigs and wading birds. Children get the disease when a mosquito that has bitten an infected animal then bites a person.

In tropical and subtropical areas, the incidence of disease is highest during and shortly after the rainy season. People living in rural areas, especially where rice is grown, are at risk of getting the disease.

11.3 What are the signs and symptoms of JE?

The majority of infections result only in mild symptoms or no symptoms at all. On average, only one in 300 people infected with the virus has a symptomatic illness. Symptoms, which usually appear within four to 14 days after infection, are flu-like, with sudden onset of fever, chills, headache, tiredness, nausea, and vomiting. In children, gastrointestinal pain may be the most prominent symptom during the early stage of the illness. Signs of confusion or coma occur after three or four days. Children often have seizures.

11.4 What are the complications of JE?

The illness can progress to a serious infection of the brain (encephalitis) and is fatal in about 20% of cases. Of those who survive the disease, 30% to 50% will have brain damage and paralysis. In areas where the disease exists all the time, about 85% of cases occur in children younger than 15 years old.

Although JE is often a mild disease, leading to an uneventful recovery, some cases rapidly progress to severe encephalitis with mental disturbances, and progressive coma. Of the approximately 50 000 cases of JE officially reported each year, about 10 000 die, and a very high percentage of the survivors are left with neurological and psychiatric sequelae, requiring extensive care. Most fatalities and residual sequelae occur in children aged over 10 years.

11.5 What is the treatment for JE?

There is no treatment for Japanese encephalitis. Supportive treatment is indicated. Antibiotics are not effective against the JE virus.

11.6 How is JE prevented?

Immunization is the single most important measure to control Japanese encephalitis. There are three types of JE vaccines. However, only one (mouse-brain derived inactivated vaccine) is commercially available.

No effective method of environmental control of JE transmission is known. Although socioeconomic improvements and changes in agricultural practices are likely to reduce viral transmission in some places, large-scale vaccination of affected populations with effective and affordable vaccines appears to be the logical control measure, at least in the short term.

Key points

JE is found in Asia, Pacific Islands and Northern Australia.

The majority of people living in areas where JE occurs are infected with the virus before they are 15 years old.

The disease is spread by infected mosquitoes.

In tropical and subtropical areas, disease incidence is highest during and shortly after the rainy season.

The illness can progress to a serious infection of the brain (encephalitis) and is fatal in 20% of cases. It can also cause paralysis and brain damage.

There is no treatment for JE.

Immunization with JE vaccine is the single most important measure to control JE.

12. Meningococcal meningitis

12.1 What is meningococcal meningitis?

Meningococcal meningitis is an infection of the brain and spinal cord. It is caused by the bacterium neisseria meningitidis (the meningococcus). The disease is divided into several types. Types A, B, C, Y and W135 cause most cases of meningoccal meningitis. More recently types Y and W135 are gaining importance.

The disease occurs globally, but in sub-Saharan Africa meningitis epidemics occur every two to three years. Since the 1980s the intervals between major epidemics have become shorter and more irregular. The disease is most common in young children, but it also can be found in children and young adults living in crowded conditions, such as institutions or barracks. In 2000 it is estimated that there were 300 000 cases and 25 000 – 30 000 deaths from meningococcal meningitis.

12.2 How is meningococcal meningitis spread?

Transmission of bacteria is from person to person through airborne droplets from the nose and throat of infected people.

12.3 What are the signs and symptoms of meningococcal meningitis?

Meningococcal meningitis is marked by the sudden onset of intense headache, fever, nausea, vomiting, sensitivity to light, and stiff neck. Other signs include lethargy, delirium, coma, and convulsions. The appearance of a rash composed of small spots of bleeding into the skin is an important sign. Infants may have illness without a sudden onset and stiff neck. They may only appear to be slow or inactive, to be irritable, to vomit, or to be feeding poorly.

12.4 What are the complications of meningococcal meningitis?

In children, if meningitis is not treated, mortality is 50%; with early treatment mortality is reduced to between 5% to 10%. Even with treatment early in the disease, between 5% and 10% of children who are infected die. About 10% – 15% of those surviving meningococcal meningitis will suffer from complications, including mental disorders, deafness, palsies and seizures. A less common but more severe and often fatal form of meningococcal disease is meningococcal septicaemia, which is characterised by rapid circulatory collapse and a haemorrhagic rash.

12.5 What is the treatment for meningococcal meningitis?

Because meningococcal disease is often fatal, each case should always be considered a medical emergency and should be referred to a hospital. Several types of antibiotic are effective.

12.6 How is meningococcal meningitis prevented?

Vaccines are available to protect against types A, C, Y, and W135.

Epidemic control relies on good surveillance with early detection and treatment. A mass immunization campaign that reaches at least 80% of the entire population with types A & C vaccine can prevent an epidemic. These vaccines are not effective in young children and infants and only provide protection for a limited time, especially in children younger than two years old.

Key points

Meningococcal meningitis is caused by bacteria.

The disease is most common in young children.

Transmission is by contact with an infected person, including respiratory droplets from the nose and throat of the infected person.

The symptoms of meningococcal meningitis include a sudden onset of an intense headache, fever, nausea, vomiting, sensitivity to light, and stiff neck.

Meningococcal meningitis is potentially fatal and should always be viewed as a medical emergency.

The recommended method of prevention is immunization.

The vaccine is not effective in young children and infants and so may not be part of routine childhood immunization programmes.

13. Yellow fever (YF)

13.1 What is yellow fever?

Yellow fever is caused by the yellow fever virus, which is carried by mosquitoes. It is endemic in 33 countries in Africa and 11 countries in South America. In 2000 it is estimated that there were 200 000 cases of yellow fever, resulting in about 30 000 deaths worldwide.

13.2 How is yellow fever spread?

The yellow fever virus can be transmitted by mosquitoes which feed on infected animals in forests, then pass the infection when the same mosquitoes feed on humans travelling through the forest. The greatest risk of an epidemic occurs when infected humans return to urban areas and are fed on by the domestic vector mosquito Aedus aegypti, which then transmits the virus to other humans.

13.3 What are the signs and symptoms of yellow fever?

The illness may be so mild that it is not noticed or diagnosed. Three to six days after a person is infected, he or she suddenly develops fever, chills, headache, backache, general muscle pain, upset stomach, and vomiting. As the disease progresses, the person becomes slow and weak. There may be bleeding from the gums and blood in the urine. Jaundice (yellowing in the white part of the eyes or yellowing of the skin and palms) and black vomiting may also occur.

The diagnosis of yellow fever is difficult to make because its signs and symptoms are similar to other diseases, such as hepatitis, malaria, dengue, and typhoid fever. As a result, any person who develops jaundice within two weeks of the start of a fever should be considered to be a possible case of yellow fever. To confirm the diagnosis of yellow fever, a blood sample should be taken and sent to a laboratory for testing.

13.4 What are the complications of yellow fever?

If the illness is severe, the patient may experience convulsions or a coma. The disease usually lasts two weeks, after which the patient either recovers or dies. In areas where the disease is endemic mortality is about 5%. However, up to half of infected people may die during epidemics.

13.5 What is the treatment for yellow fever?

There is no specific treatment for yellow fever. Supportive treatment is indicated. Dehydration and fever can be treated with oral rehydration salts and medication. Any accompanying bacterial infection should be treated with an antibiotic. Intensive supportive care may improve the outcome for seriously ill patients.

13.6 How is yellow fever prevented?

Immunization is the single most important measure to control yellow fever.

The main strategies to control yellow fever are based on a combination of immunization for protection against the disease and surveillance, and are outlined below.

- Prevention
  - administering yellow fever vaccine as part of routine infant immunization;*
  - preventing outbreaks in high-risk areas through mass campaigns;*
  - control of Aedus aegypti in urban centres.

**Both these strategies should ensure a minimum coverage of at least 80%.*

- Control
  - instituting a sensitive and reliable YF surveillance system including laboratory capacity to analyse samples and confirm suspected cases;
  - emergency response to outbreaks through mass campaigns.

Key points

Yellow fever causes about 30 000 deaths annually.

Mosquitoes transmit the yellow fever virus.

33 African countries and 11 South American countries are at highest risk for the disease.

The symptoms of yellow fever are unspecific and can be confused with many other diseases.

There is no specific treatment for yellow fever.

There is a safe and effective vaccine against the disease.

14. Vitamin A deficiency (VAD) and EPI plus

Immunization not only protects infants from several vaccine preventable diseases, but 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 nets (ITNG) for malaria prevention and anti-helmintics.

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. Check your national policy on including vitamin A supplements with routine immunization services.

14.1 Vitamin A and vitamin A deficiency

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;
- red palm oil.

vitamin A can be added to foods, such as sugar, vegetable oil, and wheat flour, during processing. This is called *food fortification*.

14.2 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.

14.3 What are signs and symptoms of VAD?

Vitamin A deficiency (VAD) 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.

14.4 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 "Using vitamin A for Treatment" in Section 2 (Measles) of this module.

14.5 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 in Section 14.7 .

Vitamin A may be given at the same time as immunization.

14.6 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. See Module 6 for information on vitamin A supplementation: screening, schedule, administration, handling and storage.

14.7 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 is one month. The interval between doses can be reduced to treat clinical vitamin A deficiency and measles cases. Follow the appropriate measles treatment schedule.

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Immunization in practice

Module 2: The vaccines

Contents

About this module

This module describes 13 vaccines that are in common use in most developing countries to prevent the diseases presented in module 1. There are many other vaccines available in the world but they are not widely used in developing countries and are therefore not included in this module.

For each vaccine the description includes information on:

- what it is;
- how safe it is and what side-effects may occur;
- how it should be stored and transported;
- when it should be given;
- the number and size of doses; and
- where and how it should be given.

A section on contraindications follows the descriptions of the vaccines.

1. Diphtheria-tetanus-pertussis (DTP) vaccine

1.1 What is DTP vaccine?

Diphtheria-tetanus-pertussis vaccine is made from diphtheria toxoid, tetanus toxoid, and pertussis vaccine. It is a liquid vaccine. If a vial of DTP vaccine stands for a long time, fine particles may separate from the liquid. They look like fine sand at the bottom of the vial. Before giving the vaccine shake the vial to mix the vaccine and liquid.

DTP vaccine should never be frozen. The "Shake test" (see Module 3) will determine if the vaccine has been damaged by freezing. If the vaccine fails the shake test you must discard it.

1.2 How safe is DTP vaccine and what are its potential side-effects?

Usually, reactions to DTP vaccine are mild. The side-effects include:

Fever. Up to half of the children who receive DTP vaccine may have a fever in the evening after receiving the injection. The fever should disappear within a day. Note that a fever that begins more than 24 hours after a DTP injection is not likely to be a reaction to the vaccine. Administering paracetamol or any appropriate antipyretic at the time and at four and eight hours after immunization decreases the subsequent incidence of febrile and local reactions.

Soreness. Up to half of the children may have pain, redness, or swelling at the injection site.

Crying for more than three hours, mostly because of pain, can be observed in up to 1% of infants.

More severe reactions reported include convulsions (usually related to fever, one case in 12 500 doses administered) and hypotonic–hyporesponsive episodes (one case in 1750 doses administered). Anaphylactic reactions are extremely rare.

There is no evidence that the vaccine causes any serious neurological disorder such as encephalopathy.

Administration summary: DTP vaccine

Type of vaccine	Diphtheria and Tetanus as toxoids. Pertussis as killed whole-cell bacterium
Number of doses	At least three primary doses
Schedule	6, 10, 14 weeks of age[a]
Booster	18 months to 6 years of age[b]
Contraindications	Anaphylactic reaction to previous dose or to any constituent
Adverse reactions	Mild local or systemic reactions are common
Special precautions	DTP not usually given over 6 years of age
Dosage	0.5ml
Injection site	Outer mid-thigh in infants/outer upper arm if older
Injection type	Intramuscular
Storage	Store between 2°C–8°C. DTP vaccine should never be frozen

[a]There is considerable variation in the timing of the three primary doses between different national immunization schedules.

[b]WHO recommends that, where resources permit, an additional dose of DTP be given after completion of the primary doses. However, the need for and timing of additional booster doses of DTP should be addressed by individual national programmes.

2. Measles vaccine

2.1 What is measles vaccine?

Measles vaccine is provided as a powder, with a diluent in a separate vial. Before it can be used, it must be reconstituted (see Module 6). It is essential that only the diluent supplied with the vaccine be used. After reconstitution measles vaccine should be kept at 2°C–8°C. Any remaining reconstituted vaccine must be discarded after six hours or at the end of the immunization session, whichever comes first.

In countries where vitamin A deficiency is common, vitamin A supplements are often given at the same time as the vaccine (see Module 6). In addition, some countries include vaccine for rubella with measles vaccine (MR), or use a combination measles-mumps-rubella (MMR) (MMR) vaccine (see Section 3 of this Module).

2.2 How safe is measles vaccine and what are its potential side-effects?

Mild reactions to the vaccine are not uncommon. These include:

Soreness. Some children may experience pain and tenderness at the injection site within 24 hours of immunization. In most cases, these reactions will resolve within two or three days without any medical attention.

Fever. About 5% of children develop a moderate fever five to 12 days after receiving the vaccine. It usually lasts a day or two.

Rash. About one in 20 children develop a mild rash five to 12 days after receiving the vaccine. The rash usually lasts about two days.

Severe reactions to measles vaccine are rare; anaphylaxis has been estimated to occur about once for every million doses administered, while a severe allergic reaction can occur once for every 100 000 doses and one case of thrombocytopenia for every 30 000 doses. Encephalitis has been reported to occur in no more than one per million doses administered and, even in such cases, there is no definite proof that the vaccine was the cause.

2.3 What is the “second opportunity” for measles immunization?

All children should have a second opportunity to receive measles vaccine. This increases the proportion of children who receive at least one dose and helps to assure measles immunity in previously vaccinated children who failed to develop such immunity. This opportunity may be delivered either through routine immunization services or through periodic mass campaigns. Module 1, Section 2.7, describes the strategies for reducing measles deaths.

Administration summary: measles vaccine

Type of vaccine	Live attenuated viral
Number of doses	One dose. Second opportunity not less than one month after first dose
Schedule	At 9–11 months of age in countries where measles is highly endemic[a], later in countries with high levels of control or low mortality
Booster	A second opportunity for measles immunization is recommended (routine or campaign)
Contraindications	Severe reaction to previous dose; pregnancy; congenital or acquired immune disorders (not HIV infection)
Adverse reactions	Malaise, fever, rash 5–12 days later; idiopathic thrombocytopenic purpura; rarely, encephalitis, anaphylaxis
Special precautions	None
Dosage	0.5ml
Injection site	Outer mid-thigh/upper arm depending on the age
Injection type	Subcutaneous
Storage	Store between 2°C–8°C (vaccine maybe frozen for long-term storage but not the diluent)

[a] Infants at high risk (HIV-infected, in closed communities such as refugee camps, or in the presence of an outbreak) may receive a dose at 6 months of age followed by an extra dose at 9 months.

3. Measles-rubella (MR) and measles- mumps-rubella (MMR) combination vaccines

3.1 What are the MR and MMR vaccines?

Some countries use combination vaccines for measles and rubella (MR) or for measles, mumps, and rubella (MMR). MR and MMR vaccines are provided in powder form with diluents and must be reconstituted before they can be used (see Module 6). It is essential that only the diluent supplied with the vaccine be used.

MR and MMR vaccines should be kept at 2ºC–8°C after reconstitution. Any remaining reconstituted vaccine must be discarded after six hours or at the end of the immunization session, whichever comes first.

3.2 How safe are the MR and MMR vaccines and what are their potential side-effects?

Mild reactions to the vaccines include:

Fever. As with the single-antigen measles vaccine, about 5% to 15% of children develop a mild fever within five to 12 days of receiving the vaccine.

Rash. Again as with the measles vaccine, about one in 20 children develop a mild rash about five to 12 days after being immunized.

Severe reactions are rare and similar to that experienced after receipt of the measles vaccine. Although an association between MMR and autism has been suggested, there is absolutely no evidence of such an association.

In addition rubella-containing vaccines may result in a temporary form of arthritis from one to three weeks after vaccination in up to one in four post-pubertal females. These reactions are very rare in young children.

Mumps-containing vaccines may result in rare cases of parotitis and some cases of aseptic meningitis. Children recover without sequelae although some may need to be hospitalized. The risk of developing this complication varies depending on the vaccine strain used.

Administration summary: MR and MMR vaccines

Type of vaccine	Live attenuated viral
Number of doses	One dose
Schedule	Generally 12–15 months
Booster	A second opportunity for immunization is recommended (routine or campaign)
Contraindications	Severe reaction to previous dose; pregnancy; congenital or acquired immune disorders (not HIV infection). Although it is not recommended to administer the vaccine during pregnancy, there has never been any evidence of damage to the fetus from vaccinating the mother during pregnancy
Adverse reactions	Same as measles vaccine, plus cases of arthritis in adolescent females for rubella-containing vaccine and parotitis; rarely aseptic meningitis with mumps-containing vaccines may occur
Special precautions	None
Dosage	0.5ml
Injection site	Outer mid-thigh/upper arm depending on the age
Injection type	Subcutaneous
Storage	Store between 2°C–8°C(vaccine maybe frozen for long-term storage but not the diluent)

4. Oral polio vaccine (OPV)

4.1 What is OPV?

Oral polio vaccine (OPV) protects against the virus that causes polio. It is a liquid vaccine that is provided in two types of containers:

1. small plastic dropper bottles

2. glass vials with droppers in a separate plastic bag.

WHO does not — as of July 2003 — recommend the adoption of IPV, either alone or in a sequential schedule, in developing countries for the following reasons: unresolved issues related to the immunogenicity of IPV when administered at birth, six, ten and 14 weeks of age in the EPI vaccination schedule, the continued focal circulation of wild poliovirus on two continents, the relatively high cost of IPV and the operational complexities of introducing a vaccine which requires syringes and needles, while OPV is given orally.

4.2 How safe is OPV and what are its potential side-effects?

OPV causes almost no side-effects. Less than 1% of the people who receive the vaccine develop a headache, diarrhoea, or muscle pain.

There is a very small risk of vaccine-associated paralytic polio (VAPP), with approximately two to four cases having been reported for every one million children immunized.

Administration summary: OPV

Type of vaccine	Live oral polio vaccine (OPV)
Number of doses	Four in endemic countries (including birth dose)
Schedule	At birth*, 6, 10, 14 weeks
Booster	Supplementary doses given during polio eradication activities
Contraindications	None
Adverse reactions	VAPP very rarely (approximately 2 to 4 cases per million children vaccinated)
Special precautions	Children known to have rare congenital immune deficiency syndromes should receive IPV rather than OPV.
Dosage	2 drops
Injection site	–
Injection type	–
Storage	Store between 2°C–8°C (maybe frozen for long-term storage)

* for polio endemic countries

4.3 What is supplementary immunization with OPV?

A key strategy for polio eradication (see Module 1, Section 5.7) is supplementary immunization with OPV. This is usually conducted in large scale campaigns (National Immunization Days) where two doses of OPV, one month apart, are given to all children under five years of age regardless of how many doses they have received in the past. Many rounds of National immunization days maybe conducted in a country however there is no risk associated with receiving multiple doses of OPV.

5. Tetanus toxoid (TT) vaccine

5.1 What is TT vaccine?

Tetanus toxoid (TT) vaccine protects against tetanus. It is provided as a liquid in vials and also in prefilled auto-disable injection devices (see Module 4). It is available in a number of different formulations:

- TT vaccine protects only against tetanus and neonatal tetanus.
- DTP, or diphtheria-tetanus-pertussis vaccine, protects against diphtheria, tetanus, and pertussis (see Section 1 of this Module).
- DT, or diphtheria-tetanus toxoids vaccine, protects against diphtheria and tetanus. Because it contains high levels of diphtheria toxoid, it should not be given to children older than six years old or adults.
- Td, or tetanus-diphtheria toxoids adult dose vaccine, is the same vaccine as DT, but with a lower diphtheria toxoid dose. It is suitable for children older than six years old and adults, including pregnant women. Td has the added advantage of protecting against diphtheria and tetanus.

When given to women of childbearing age, vaccines that contain tetanus toxoid (TT or Td) not only protect women against tetanus, but also prevent neonatal tetanus in their newborn infants. When TT or Td vaccine is given to a woman who is or who becomes pregnant, the antibodies that form in her body are passed to her fetus. These antibodies protect the baby against tetanus during birth and for a few months afterwards. They also protect the woman against tetanus.

A three-dose course of TT or Td provides protection against maternal and neonatal tetanus for at least five years. A maximum of five doses will protect women throughout their childbearing years.

When vaccines containing tetanus toxoid stand for a long time, the vaccine separates from the liquid and looks like fine sand at the bottom of the vial. Shake the vial to mix the vaccine and liquid again before giving the vaccine. TT/DT/Td/DTP vaccines should never be frozen. The “Shake test” (see Module 3) will determine if the vaccine has been damaged by freezing. If the vaccine fails the shake test you must discard it.

5.2 How safe are TT, Td, and DT vaccines and what are their potential side-effects?

Vaccines containing tetanus toxoid cause very few serious reactions but quite frequent mild reactions.

Mild reactions to TT, Td, and DT vaccines include:

Soreness. About one in ten people who receive the vaccines have mild pain, redness, warmth, and swelling at the injection site for about one to three days after the injection. This mild reaction is likely to be more common after later doses than earlier ones, and may affect between 50% and 85% of people who receive booster doses.

Fever. About one in ten people may develop a mild fever after receiving the vaccines.

Tetanus toxoid immunization schedule for routine immunization of pregnant women

Dose of TT or Td	When to give	Expected duration of protection[a]
1	At first contact or as early as possible in pregnancy	None
2	At least 4 weeks after TT 1	1–3 years
3	At least 6 months after TT 2 or during subsequent pregnancy	At least 5 years
4	At least 1 year after TT 3 or during subsequent pregnancy	At least 10 years
5	At least 1 year after TT 4 or during subsequent pregnancy	For all childbearing years and possibly longer

Increasing numbers of women have documentation of prior receipt of vaccines containing tetanus toxoid e.g. in early childhood or at school age. As the women reach childbearing age the incidence of maternal and neonatal tetanus is expected to decline further: three properly spaced doses of DTP given in childhood are considered equivalent in protection to two doses of TT/Td given in adulthood.

[a] Recent studies suggest that the duration of protection may be longer than indicated in the table. This matter is currently under review

Administration summary: TT vaccine

Type of vaccine	Toxoid as DT, TT or Td
Number of doses	At least two primary doses
Schedule	See previous table
Booster	TT/Td every 10 years or during pregnancy. DT 18 months to six years of age [b]
Contraindications	Anaphylactic reaction to previous dose
Adverse reactions	Mild local or systemic reactions are common and increase in frequency with increasing numbers of doses, and may constitute a contraindication to further doses
Special precautions	Reduced diphtheria (Td instead of DT) content as from seven years of age.
Dosage	0.5ml
Injection site	Outer upper arm
Injection type	Intramuscular
Storage	Store between 2°C–8°C. Never freeze

[b] WHO recommends that, where resources permit, an additional dose of DTP be given approximately one year after completion of the primary doses. However, the need for and timing of additional booster doses of DTP, DT or Td should be addressed by individual national programmes.

6. Tuberculosis vaccine (BCG)

6.1 What is BCG vaccine?

BCG vaccine protects infants against tuberculosis. The letters B, C, G stand for Bacille Calmette-Guérin. Bacille describes the shape of a bacterium; Calmette and Guérin are the names of the people who developed the vaccine.

BCG vaccine comes in powder form. It must be reconstituted with a diluent before use (see Module 6). It is essential that only the diluent supplied with the vaccine be used. BCG vaccine should be kept at 2°C–8°C after reconstitution. Any remaining reconstituted vaccine must be discarded after six hours or at the end of the immunization session, whichever comes first.

6.2 How safe is BCG vaccine and what are its potential side-effects?

Most children do have a reaction at the site of injection. Normally, when BCG vaccine is injected a small raised lump appears at the injection site. This usually disappears within 30 minutes. After about two weeks, a red sore forms that is about the size of the end of an unsharpened pencil. The sore remains for another two weeks and then heals. A small scar, about 5 mm across, remains. This is a sign that the child has been effectively immunized.

Other reactions include:

Swelling or abscesses. Sometimes the glands in a child's armpit or near the elbow swell up after injection with BCG vaccine, or he or she may develop an abscess. Swollen glands or abscesses occur because an unsterile needle or syringe was used, too much vaccine was injected, or most commonly, the vaccine was injected incorrectly under the skin instead of in its top layer.

There are very few serious reactions following BCG vaccine. Generalized infection due to BCG vaccination occurs at a rate of five per million doses of vaccine given, primarily in HIV-infected persons or those with severe immune deficiencies.

Administration summary: BCG vaccine

Type of vaccine	Live bacterial
Number of doses	One
Schedule	At or as soon as possible after birth
Booster	None
Contraindications	Symptomatic HIV infection
Adverse reactions	Local abscess, regional lymphadenitis; rarely, distant spread to osteomyelitis, disseminated disease
Special precautions	Correct intradermal administration is essential. A special syringe and needle is used for the administration of BCG vaccine
Dosage	0.05ml
Injection site	Outer upper left arm or shoulder
Injection type	Intradermal
Storage	Store between 2°C–8°C(vaccine maybe frozen for long-term storage but not the diluent)

7. Hepatitis B (HepB) vaccine

7.1 What is hepatitis B vaccine?

Hepatitis B (HepB) vaccine is a cloudy liquid that is provided in single- or multi-dose vials or in prefilled auto-disable (AD) injection devices (see Module 4).

Because the HepB vaccine contains only one antigen, it is called a monovalent vaccine. HepB vaccine is also available in combination DTP-HepB and DTP-HepB+Hib vaccines (see Sections 8 and 10 of this Module).

Only monovalent HepB vaccine should be used as a birth dose, the dose given within the first week of life. Combination vaccines should not be used at birth, but may be used in subsequent doses.

If HepB vaccine stands for a long time, the vaccine may separate from the liquid. When separated, the vaccine looks like fine sand at the bottom of the vial. Shake the vial to mix the vaccine and liquid before using the vaccine. HepB vaccine should never be frozen. The "Shake test" (see Module 3) will determine if the vaccine has been damaged by freezing. If the vaccine fails the shake test you must discard it.

7.2 How safe is HepB vaccine and what are its potential side-effects

HepB vaccine is one of the safest vaccines.

Mild reactions include:

Soreness. About 15% of adults and 5% of children have tenderness, redness, or mild swelling at the injection site.

Fever. About 1% to 6% of those who receive the vaccine develop a mild fever that lasts one or two days after injection of the vaccine.

Reactions and complications due to the vaccine are rare. Allergic reactions, such as rash, difficulty in breathing, and choking, occur about once every 600 000 doses. No fatal allergic reaction has been reported.

Options for adding hepatitis B vaccine to childhood immunization schedules

Age	EPI visit	Antigens given at same visit	No birth dose	With birth dose	
			Option 1	Option 2	Option 3
Birth	0	BCG (OPV0)[a]		HepB-birth (m)	HepB-birth (m)
6 weeks	1	OPV1, DTP1, Hib1	HepB1(m/c)		DTP-HepB1(c)
10 weeks	2	OPV2, DTP2, Hib2	HepB2 (m/c)	HepB2 (m)	DTP-HepB2 (c)
14 weeks	3	OPV3, DTP3, Hib3	HepB3 (m/c)	HepB3 (m)	DTP-HepB3 (c)
9–12 months	4	Measles	Measles	Measles	Measles

[a] *Only given in polio endemic countries*
(m) = monovalent vaccine (m/c) = monovalent or combination vaccine (c) = combination vaccine

Administration summary: HepB vaccine

Type of vaccine	Recombinant DNA or plasma-derived
Number of doses	Three doses
Schedule	Several options (see above)
Booster	None
Contraindications	Anaphylactic reaction to a previous dose
Adverse reactions	Local soreness and redness, rarely anaphylactic reaction
Special precautions	Birth dose must be given if there is a risk of perinatal transmission
Dosage	0.5ml
Injection site	Outer mid-thigh (infants)/outer upper arm (children and adults)
Injection type	Intramuscular
Storage	Store between 2°C–8°C. Never freeze

8. DTP-HepB combination vaccine

8.1 What is DTP-HepB vaccine?

DTP-HepB is a quadrivalent (or tetravalent) vaccine that protects against four diseases: diphtheria, tetanus, pertussis, and hepatitis B. DTP-HepB is a liquid that comes in single- or multi-dose vials. The vaccine can separate from the liquid if it stands for a long time. Shake the vial to mix the vaccine and liquid before using it. DTP-HepB vaccine should never be frozen. The "Shake test" (see Module 3) will determine if the vaccine has been damaged by freezing. If the vaccine fails the shake test you must discard it.

Because the DTP vaccine should not be given to infants younger than six weeks old, do not use DTP-HepB vaccine as a birth dose. You can use DTP-HepB for subsequent vaccine doses.

8.2 How safe is DTP-HepB vaccine and what are its potential side-effects?

Mild reactions to the vaccine include:

Soreness. Some infants may develop mild soreness, redness, or swelling at the injection site, but this will usually go away within one to three days.

Fever. As with DTP vaccine, some infants may develop a mild fever.

Serious reactions to the DTP-HepB vaccine occur at a frequency similar to the DTP vaccine and the HepB vaccine (see Sections 1 and 7 of this Module).

Administration summary: DTP-HepB combination vaccine

Type of vaccine	Quadrivalent or tetravalent vaccine
Number of doses	Three
Schedule	6, 10, 14 weeks of age
Booster	Not recommended
Contraindications	Anaphylactic reaction to previous dose
Adverse reactions	Mild local or systemic reactions are common
Special precautions	Do not use as a birth dose Usually not given over 6 years of age
Dosage	0.5ml
Injection site	Outer mid-thigh
Injection type	Intramuscular
Storage	Store between 2°C–8°C. Never freeze

9. *Haemophilus influenzae* type b (Hib) vaccine

9.1 What is *Haemophilus influenzae* type b vaccine?

Haemophilus influenzae type b vaccine prevents meningitis, pneumonia, epiglottitis, and other serious infections caused by *Haemophilus influenzae* type b bacteria. The vaccine will not protect against these conditions if they are caused by other agents.

Hib vaccine is available in two forms, liquid or freeze-dried. Each is available as monovalent vaccine or in combination with other vaccines. Many countries give Hib combined with DTP and HepB vaccines (DTP-HepB+Hib) (see Section 10 of this Module).

9.2 How safe is Hib vaccine and what are its potential side-effects?

Haemophilus influenzae type b vaccine is very safe. There are no known serious reactions to the vaccine.

Mild reactions include:

Soreness. About 5% to 15% of those who receive Hib vaccine develop redness, swelling, or mild pain at the site of the injection.

Fever. A short time after immunization, between 2% and 10% of people may develop a mild ever.

Administration summary: Hib vaccine

Type of vaccine	Conjugate
Number of doses	two or three doses (depending on manufacturer)
Schedule	6, 10, 14 weeks of age for three doses schedule (depending on manufacturer)
Booster	None
Contraindications	Hypersensitivity to previous dose
Adverse reactions	Mild local reaction
Special precautions	None
Dosage	0.5ml
Injection site	Outer mid-thigh for infants. Outer upper arm for older children
Injection type	Intramuscular
Storage	Store between 2°C–8°C

10. DTP-HepB+Hib combination vaccine

10.1 What is DTP-HepB+Hib vaccine?

DTP-HepB+Hib vaccine is called a pentavalent vaccine because it protects against five diseases: diphtheria, tetanus, pertussis, hepatitis B, and *Haemophilus influenzae* type b. Do not use DTP-HepB+Hib as a birth dose. You may use the vaccine for subsequent doses.

DTP-HepB+Hib vaccine must be reconstituted before use (see Module 6). The freeze-dried Hib component is reconstituted with the liquid DTP-HepB component. The vaccine comes in two-dose vials. Reconstituted DTP-HepB+Hib vaccine must be discarded after six hours or at the end of the immunization session, whichever comes first.

10.2 How safe is DTP-HepB+Hib vaccine and what are its potential side-effects?

The number of cases of serious reactions to the DTP-HepB+Hib vaccine are similar to those of the other vaccines that contain DTP (see Sections 1 and 8 of this module). If a serious reaction does occur, health workers should report the problem to supervisors immediately. Children who have a severe reaction should not receive additional doses of vaccine.

Mild reactions to the vaccine include:

Soreness. Some children may develop mild soreness, redness, or swelling at the injection site, but this will usually go away within one to three days.

Fever. As with DTP vaccine, some children may develop a mild fever.

Administration summary: DTP-HepB+Hib combination vaccine

Type of vaccine	Pentavalent vaccine
Number of doses	Three
Schedule	6, 10, 14 weeks of age
Booster	None
Contraindications	Do not use as a birth dose
Adverse reactions	Mild local and systemic reactions are common
Special precautions	Do not use as a birth dose, usually not given over 6 years of age
Dosage	0.5ml
Injection site	Outer mid-thigh
Injection type	Intramuscular
Storage	Store between 2°C–8°C. Never freeze

11. Japanese encephalitis (JE) vaccine

11.1 What is JE vaccine?

Three vaccines for preventing Japanese encephalitis are currently available. However, as of 2003, none of these vaccines are WHO pre-qualified. The most commonly used one is a powdered vaccine that is mixed with a diluent provided in a separate vial by the manufacturer. Before it can be used, JE vaccine must be reconstituted (see Module 6). The reconstituted vaccine must be discarded after six hours or at the end of the immunization session, whichever comes first.

Newer vaccines are becoming available in some areas. Check your country's policy.

11.2 How safe is JE vaccine and what are its potential side-effects?

Mild reactions to the vaccine include:

Soreness. About one in five people develop tenderness, redness, and swelling at the injection site.

Fever, headache, nausea, and muscle pain. These side-effects develop in about one in five people who receive the vaccine. Many of these side-effects last only a short time and can be relieved with acetaminophen.

The JE vaccine may cause severe delayed allergic reactions. One case of serious allergic reaction from the vaccine is reported for every 1000 to 100 000 doses given. These reactions can occur within minutes or up to as many as nine days after receiving an immunization. Allergic reactions may include hives, wheezy breathing, or swelling of some part of the body. Because of this, use of the vaccine requires careful evaluation of risks and benefits. Patients must be advised to be near a health facility for ten days after receiving the vaccine.

Administration summary: JE vaccine

Type of vaccine	Inactivated mouse-brain-derived
Number of doses	Standard three-dose schedule
Schedule	The interval between dose 1 and 2 should be 7 days and the 3rd dose should be given at day 30
Booster	Most countries give a booster after one year, then three-yearly
Contraindications	Hypersensitivity to previous dose
Adverse reactions	Occasional mild local or systemic reactions; serious allergic reaction including generalized urticaria, hypotension, collapse occur 1/1000
Special precautions	JE vaccine not usually given under 12 months of age
Dosage	0.5ml to child one to three years of age; 1.0 ml to child older than three years
Injection site	Upper arm
Injection type	Subcutaneous
Storage	Store between 2°C–8°C

12. Meningococcal vaccine

12.1 What is meningococcal vaccine?

There are two vaccines widely available that protect against different types of meningococcal meningitis. One protects against types A, C, Y, and W-135 of the disease, while the second protects against types A and C. A third trivalent A, C, W conjugate vaccine is currently being used in a small number of countries but should become more widely available soon. The conjugate vaccine links the polysaccharide to a protein carrier. This enables the vaccine to be more immunogenic in infants and induces an immunological memory which gives longer-lasting protection.

The vaccines are packaged as a powder with diluent in single and multi-dose vials. The vaccine forms a clear liquid when reconstituted (see Module 6).

12.2 How safe is meningococcal vaccine and what are its potential side-effects?

Mild reactions include:

Soreness. Some people experience redness or pain at the injection site. These symptoms usually last one to two days.

Fever. A small percentage of people who receive the vaccine develop a fever.

Severe adverse reactions, including allergic reactions (anaphylaxis, urticaria, wheeze, angioedema), somnolence and neurological reactions (e.g., seizures, paraesthesia and anaesthesia), have been reported very rarely.

Administration summary: meningococcal vaccine

Type of vaccine	Purified bacterial capsular polysaccharide (AC, AC/W135, Y)
Number of doses	One
Schedule	Not less than three months; older than three years recommended
Booster	Every three to five years
Contraindication	Severe adverse reaction to previous dose
Adverse reactions	Occasional mild local reaction, mild fever
Special precautions	Children aged under two years of age are not protected by the vaccine
Dosage	0.5 ml
Injection site	Upper arm
Injection type	Subcutaneous
Storage	Store between 2°C–8° C

13. Yellow fever (YF) vaccine

13.1 What is YF vaccine?

Yellow fever vaccine is recommended as part of the routine national immunization programme in countries where the disease is endemic. The vaccine is a powder that must be reconstituted with diluent provided before use (see Module 6). It is essential that only the diluent supplied with the vaccine be used.

Reconstituted vaccine must be kept at 2ºC–8°C and discarded after six hours or at the end of the immunization session, whichever comes first.

13.2 How safe is YF vaccine and what are its potential side-effects?

Mild reactions to the vaccine include:

Headache, muscle pain, or mild fever. Fewer than 5% of people who receive YF vaccine develop these symptoms.

Serious side-effects resulting from immunization are rare. About 5–20 cases of anaphylaxis have been reported for every one million doses of YF vaccine; the rate of true anaphylaxis is likely to be much lower. Up to four cases of encephalitis per 100 000 doses have been reported in infants less than six months old for whom the vaccine is not routinely recommended. If a serious reaction does occur, health workers should report the problem to supervisors immediately. Those who have a severe reaction should not receive additional doses.

Administration summary: YF vaccine

Type of vaccine	Live viral
Number of doses	One dose
Schedule	9 months of age with measles vaccine
Booster	International health regulations require a booster every 10 years
Contraindications	Egg allergy; immune deficiency from medication or disease; symptomatic HIV infection; hypersensitivity to previous dose; pregnancy [a]
Adverse reactions	Hypersensitivity to egg; rarely, encephalitis in the very young; hepatic failure. Rare reports of death from massive organ failure
Special precautions	Do not give before six months of age; avoid during pregnancy
Dosage	0.5ml
Injection site	Upper right arm
Injection type	Subcutaneous
Storage	Store between 2°C–8°C

[a] *To be weighed according to risk of exposure and term of pregnancy.*

14. Summary

14.1 Typical immunization schedule for children

Table 2.1: Immunization schedule for infants recommended by the Expanded Programme on Immunization

Vaccine		Age				
		Birth	6 weeks	10 weeks	14 weeks	9 months
BCG		x				
Oral polio		x[ϕ]	x	x	x	
DTP			x	x	x	
Hepatitis B	Scheme A[a]	x	x		x	
	Scheme B[a]		x	x	x	
Haemophilus influenzae type b			x	x	x	
Yellow fever						x[b]
Measles						x[c]

ϕ *In polio-endemic countries*

a Scheme A is recommended in countries where perinatal transmission of hepatitis B virus is frequent (e.g. in South-East Asia). Scheme B may be used in countries where perinatal transmission is less frequent (e.g. in sub-Saharan Africa).

b In countries where yellow fever poses a risk

c A second opportunity to receive a dose of measles vaccine should be provided for all children. This may be done either as part of the routine schedule or in a campaign.

14.2 Contraindications to immunization

There are not many contraindications to immunization. All infants should be immunized except in these three rare situations:

1. Anaphylaxis or a severe hypersensitivity reaction is an absolute contraindication to subsequent doses of a vaccine. Persons with a known allergy to a vaccine component should not be vaccinated.

2. Do not give BCG or yellow fever vaccine to an infant that exhibits the signs and symptoms of AIDS.

Note: an infant with known or suspected HIV infection and/or signs and symptoms of AIDS should receive measles vaccine at six months and then again at nine months (refer to Module 6, Section 2).

3. If a parent strongly objects to an immunization for a sick infant, do not give it. Ask the mother to come back when the infant is well.

The following are <u>not</u> contraindications. Infants with these conditions <u>should</u> be immunized:

- allergy or asthma (except if there is a known allergy to a specific component of the vaccine mentioned above);
- any minor illness, such as respiratory tract infections or diarrhoea with temperature below 38.5°C;
- 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 as noted above;
- 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-birthweight (vaccination should not be postponed);
- recent or imminent surgery;
- malnutrition; and
- history of jaundice at birth.

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 diarrhoea 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.

14.3 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.

Do not give more than one dose of the same vaccine to a woman or child in one session.

Give doses of the same vaccine at the correct intervals. Wait at least four weeks between doses of OPV, DTP, Hib, and HepB vaccines.

14.4 Other vaccines

Some countries have included vaccines other than those described here in their national immunization programmes, or may add them in the future. These include *Streptococcus pneumoniae*, typhoid fever, and cholera vaccines. Ask your supervisor which vaccines are in your national programme.

New vaccines are always being studied. Research is taking place to make vaccines more stable, to combine them so that fewer injections are needed, and to make them easier and safer to give.

14.5 Summary of injection sites

Table 2.2: Summary of injection sites

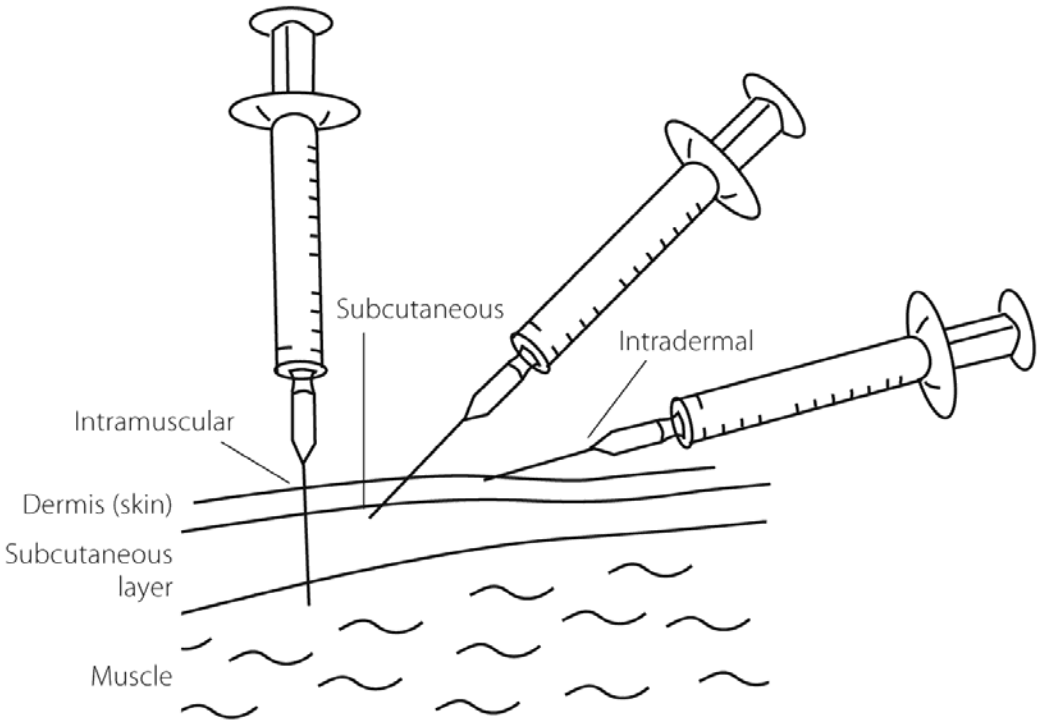
Vaccine	Route of administration	Injection site
BCG	Intradermal	Upper left arm
DTP	Intramuscular	Outer mid-thigh
OPV	Oral	Mouth
HepB	Intramuscular	Outer mid-thigh
Measles	Subcutaneous	Upper left arm
Yellow fever	Subcutaneous	Upper right arm
Tetanus toxoid	Intramuscular	Outer, upper arm
Hib	Intramuscular	Infants — Outer mid-thigh Older children — Upper arm
Japanese encephalitis	Subcutaneous	Upper arm
Meningococcal	Subcutaneous	Upper arm

Intradermal = into the skin.

Intramuscular = into a muscle.

Subcutaneous = under the skin.

Figure 2: Different needle positions



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Immunization in practice

Module 3: The Cold Chain

Contents

About this module

This module describes what the cold chain is, what cold chain equipment is needed in health facilities, and how to use and maintain this equipment.

Some illustrations in this document show equipment from named manufacturers. Their inclusion does not indicate endorsement of a specific manufacturer's products by WHO.

1. The cold chain

Vaccines are sensitive to heat and freezing and must be kept at the correct temperature from the time they are manufactured until they are used. The system used for keeping and distributing vaccines in good condition is called the cold chain. The cold chain consists of a series of storage and transport links, all designed to keep vaccines within an acceptable range until it reaches the user.

Maintenance of the cold chain requires vaccines and diluents to be:

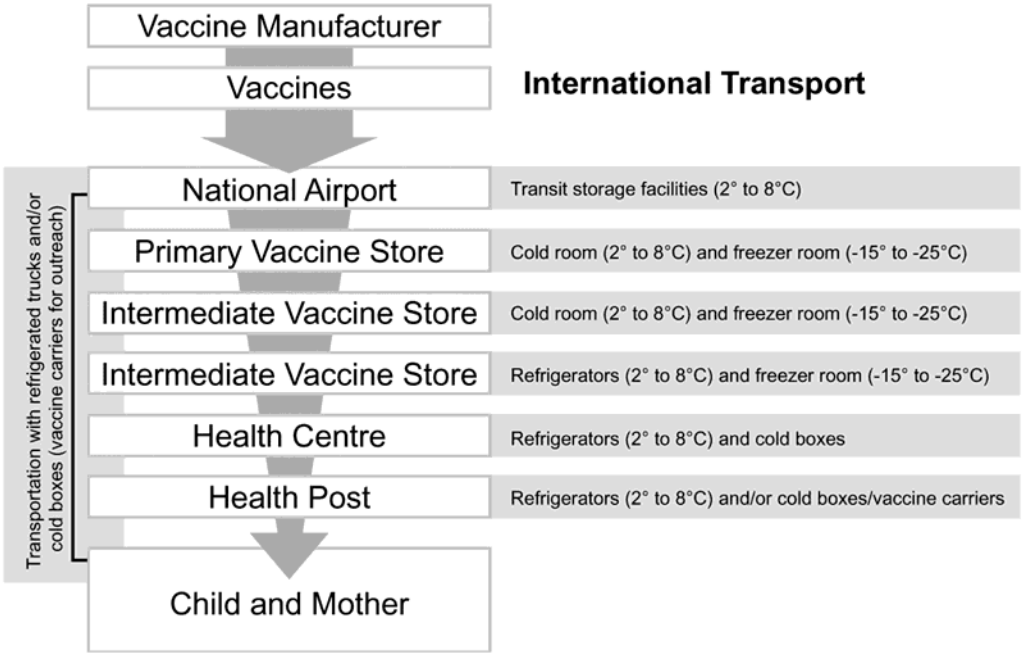
- collected from the manufacturer or an airport as soon as they are available;
- transported between 2ºC and 8ºC from the airport and from one store to another;
- stored at the correct temperature (see Figure 3A) in primary/central and intermediate vaccine stores and in health facilities;
- transported between 2ºC and 8ºC to outreach sites and during mobile sessions;
- kept between 2ºC and 8ºC range during immunization sessions; and
- kept between 2ºC and 8ºC during return to health facilities from outreach sites.

After vaccines reach the health facility you must:

- Keep them between 2ºC and 8ºC in your health facility refrigerator.
- Carry them to the immunization session in a vaccine carrier with frozen ice packs or ice.
- Keep the vaccines cool using a foam pad in the vaccine carrier while you immunize the children.

The figure below illustrates the cold chain.

Figure 3A: The cold chain



2. Cold chain equipment used in health facilities

Different levels within the health care system need different equipment for transporting and storing vaccines and diluents at the correct temperature.

- **Primary** vaccine stores need cold or freezer rooms, freezers, refrigerators, cold boxes, and sometimes refrigerator trucks for transportation.
- **Intermediate** vaccine stores, depending on their size/capacity, need cold and freezer rooms, and/or freezers, refrigerators, and cold boxes.
- **Health facilities** need refrigerators with freezing compartments, cold boxes and vaccine carriers.

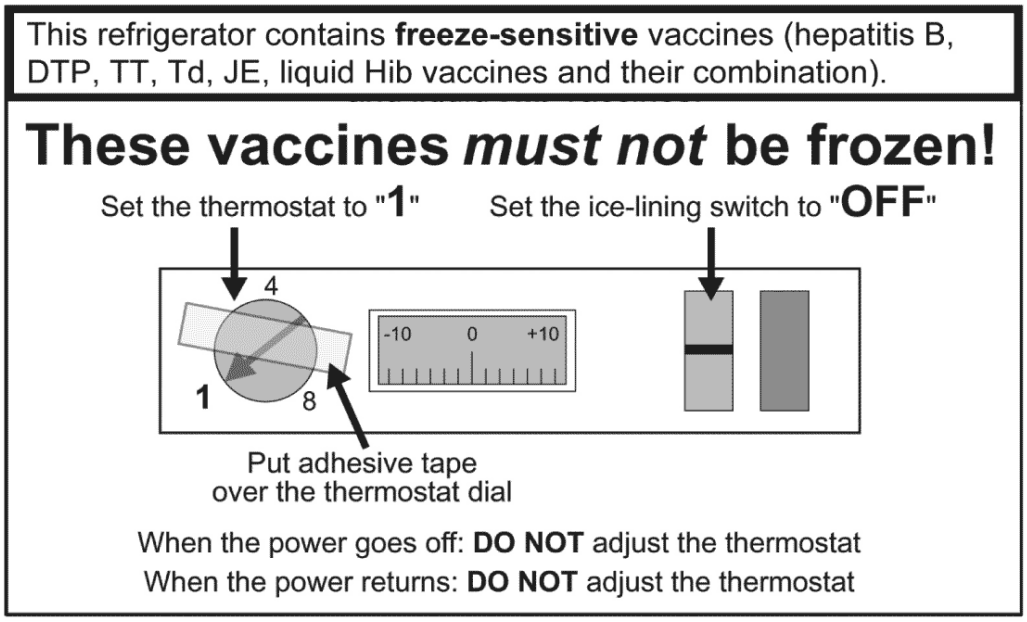
The cold chain equipment used in health facilities includes the following:

2.1 Refrigerators

Health facility refrigerators may be powered by electricity, gas, kerosene, or solar energy. Electric refrigerators are usually the least costly to run and the easiest to maintain, but they must have a reliable electricity supply.

Where the electricity or fuel supply is not reliable, ice-lined refrigerators can maintain the appropriate temperature for 16 hours without power if they operate with power continuously for at least eight hours a day. But the use of ice-lined refrigerators may expose vaccines to the risk of freezing. To prevent an ice-lined refrigerator from freezing vaccines, set the thermostat to 1 and put adhesive tape over the thermostat dial so that it does not get changed, and set the ice-lining switch to “off” (see Figure 3B).

Figure 3B: Sticker on ice-lined refrigerator



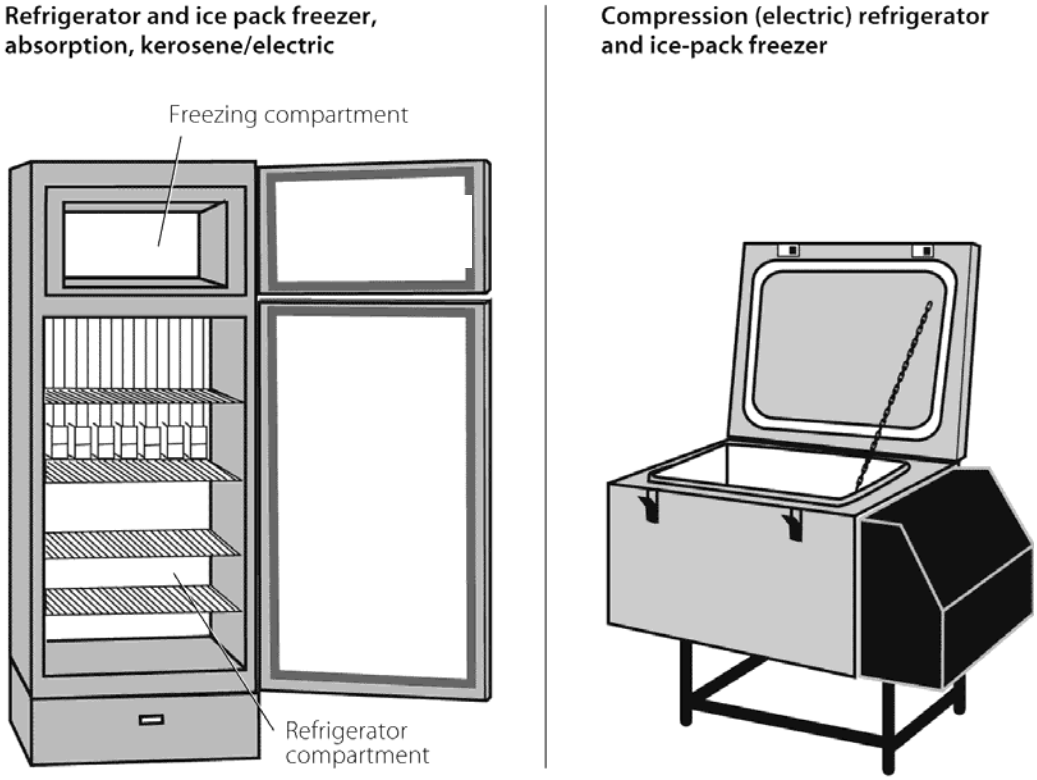
Bottled gas refrigerators can also keep vaccines at correct temperatures and are easy to maintain. It is difficult to regulate temperatures on kerosene-driven refrigerators and they are also difficult to maintain.

Refrigerators have different capacities for storing vaccines and for freezing and storing ice-packs. A refrigerator in a health facility should be able to hold:

- a one-month supply of vaccines and diluents in the refrigerator compartment;
- a one to two-week reserve stock of vaccines and diluents (an additional 25% to 50% of the one-month supply);
- frozen ice-packs in the freezer compartment; and
- bottles of water or unfrozen ice packs in the refrigerator compartment (to act as a buffer to temperature changes, especially if there is a power failure).

Half the total space in the refrigerator should be left empty to allow air to circulate around the vaccines and diluents to keep them cool.

Figure 3C: Two of the most common refrigerators



2.2 Cold boxes

A cold box is an insulated container that can be lined with ice-packs to keep vaccines and diluents cold during transportation and/or short period storage (from two to seven days).

Cold boxes are used to collect and transport monthly vaccine supplies from district stores to the health facility. They are also used to store vaccines when the refrigerator is out of order or being defrosted and for outreach and mobile sessions in addition to vaccine carriers.

Different models of cold boxes have different vaccine storage capacities. Health facilities usually need one or more cold boxes that can hold:

- a one-month supply of vaccines and diluents ; and
- a one–to–two week reserve stock of vaccines and diluents.

In addition to their vaccine storage capacity, cold boxes are selected according to their cold life. Different models have a cold life of two to seven days depending on the temperature outside.

The most suitable cold boxes for a particular health facility are determined by:

- the vaccine storage capacity needed;
- the cold life needed, that is, the longest time that vaccine will be stored in the box;
- the weight and the volume of the box, which depends on how you will transport it — by motor vehicle, bicycle, or hand; and
- ice-packs compatible with size of the cold box.

Figure 3D: Vaccine cold box

2.3 Vaccine carriers

Like cold boxes, vaccine carriers are insulated containers that, when lined with frozen ice-packs, keep vaccines and diluents cold during transportation and/or temporary storage. They are smaller than cold boxes and are easier to carry if walking. But they do not stay cold as long as a cold box — maximum for 48 hours with the lid closed.

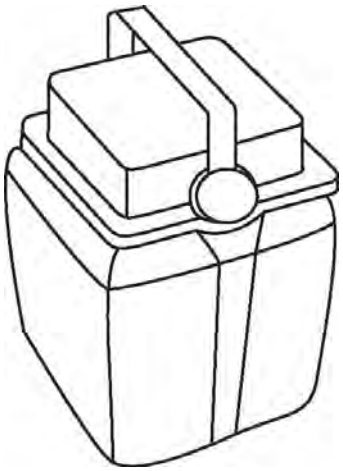
Vaccine carriers are used to transport vaccines and diluents to outreach sites and for temporary storage during health facility immunization sessions. In small health facilities they are used to bring monthly vaccine supplies from the district store. Vaccine carriers are also used to store vaccines when the refrigerator is out of order or is being defrosted.

Different models of vaccine carriers have different storage capacities.

The type of vaccine carrier a particular health facility needs depends on:

- the type of vaccines and diluents to be transported;
- the number of vaccines and diluent vials, and ice-packs to be carried ;
- the cold life required;
- ice-packs compatible with the size of vaccine carrier;
- the means of transport to be used.

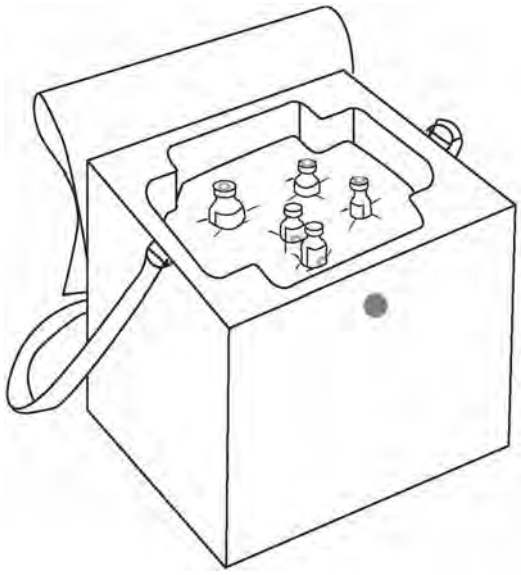
Figure 3E: Vaccine carrier



2.4 Foam pads

A foam pad is a piece of soft foam that fits on top of the ice-packs in a vaccine carrier. There are some incisions on it to allow vaccines to be inserted in the foam. During immunization sessions, the foam pad serves as a temporary lid to keep unopened vaccines inside the carrier cool while providing a surface to hold, protect and keep cool opened vaccine vials. Previously, ice packs were used to keep vaccines cool during immunization sessions outside of vaccine carriers. It is now recommended to use the supplied foam pads for this purpose.

Figure 3F: Foam pad in use



During an immunization session, vials are protected from heat for a longer period of time if they are inserted in a foam pad.

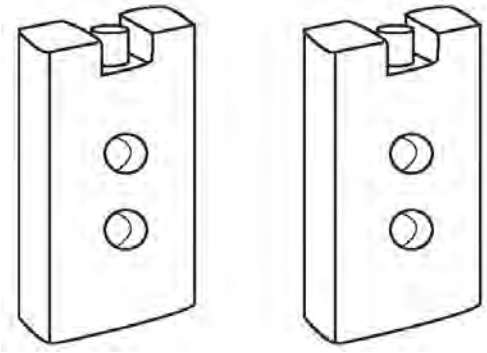
2.5 Ice-packs

Ice-packs are flat, square plastic bottles that are filled with water and frozen. Ice-packs are used to keep vaccines cool inside the vaccine carrier or cold box. The number of ice-packs required for a cold box or vaccine carrier varies. It is recommended to condition ice-packs before using them in a vaccine carrier (see Section 4.2).

Every health facility should have minimum two sets of ice-packs for each of their cold boxes and vaccine carriers:

- one in the process of being frozen
- the other in use in a cold box or vaccine carrier.

Figure 3G: Ice-packs



Taking ice-packs out of the vaccine carrier will shorten its cold life. During sessions, it is not recommended to keep vaccines on ice-packs or in cups filled with ice to keep vaccines cool. During sessions, stick the vaccine and diluent vials into the foam pad to keep them cool and to protect them.

Ice melts quickly and vials may become contaminated if they float in water from melted ice and labels may fall off the vials. You can avoid this by putting the vials in a sealed plastic bag. Consider open vials that have been under melted water to be contaminated and discard them.

3. Cold chain monitoring equipment used in health facilities

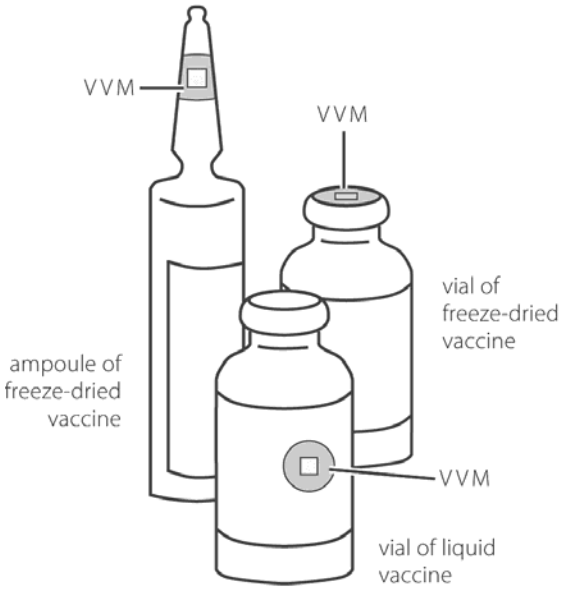
The purpose of cold chain monitoring equipment is to keep track of the temperature to which vaccines and diluents are exposed during transportation and storage.

3.1 Vaccine vial monitors

A vaccine vial monitor (VVM) is a label that changes colour when the vaccine vial has been exposed to heat over a period of time. Before opening a vial, the status of the VVM must be checked to see whether the vaccine has been damaged by heat.

Manufacturers attach VVMs to vials of most vaccines. The VVM is printed on the vial label or cap. It looks like a square inside a circle. As the vaccine vial is exposed to more heat, the square becomes darker.

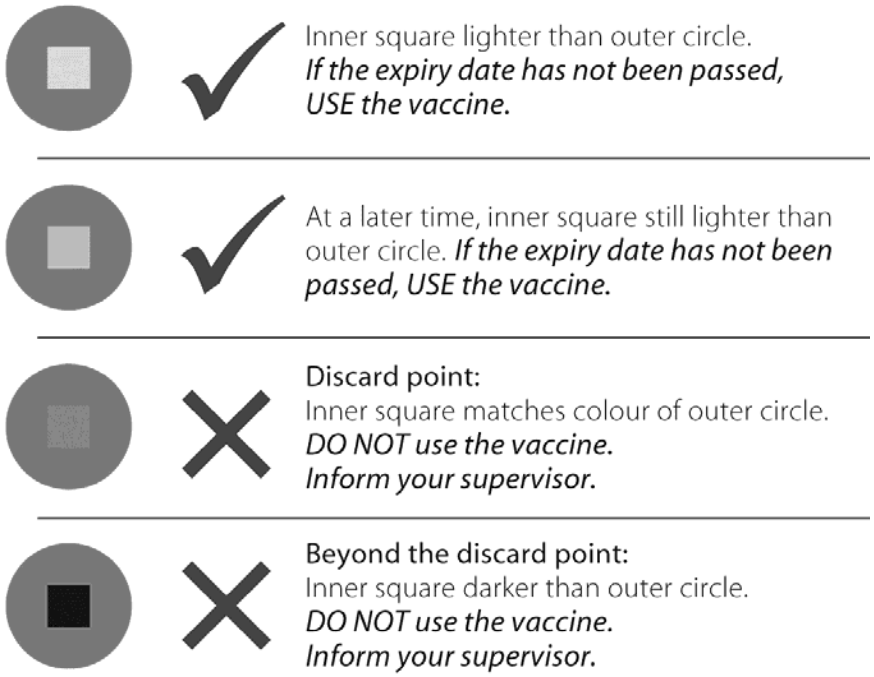
Figure 3H: VVM on vial label or cap



Use only vials with inner squares that are lighter in colour than the outside circle.

Vials with VVMs in which the inner square has begun to darken but is still lighter than the outer circle should be used before the vials with a lighter inner square.

Figure 3I: How to read a vaccine vial monitor (VVM)



Important note:

VVMs do not measure exposure to freezing temperatures (for freeze-sensitive vaccines).

A VVM not at discard point does not exclude the possibility that the vaccine was frozen. Before use, make sure that the freeze-sensitive vaccine with good VVM has not been frozen.

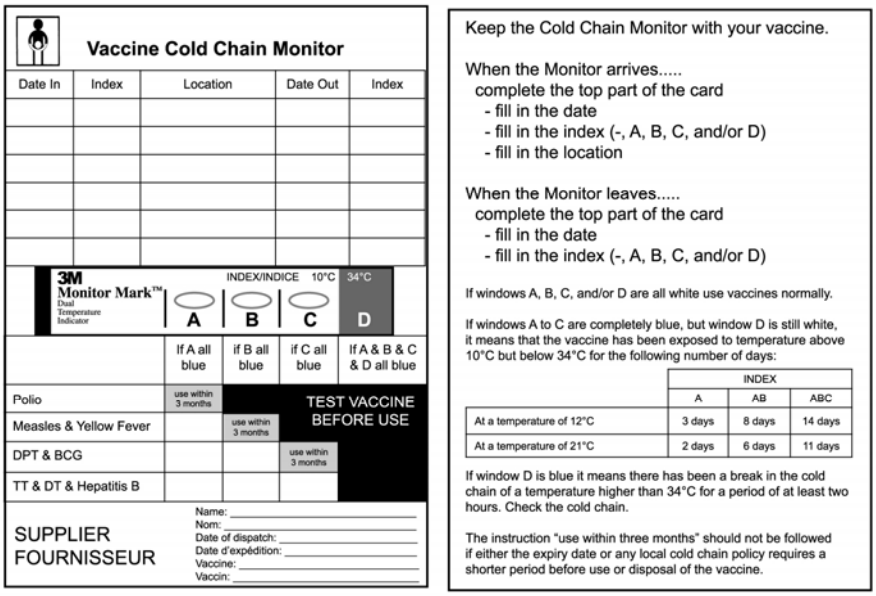
3.2 Vaccine cold chain monitor card

A vaccine cold chain monitor is a card (different colour background cards exist for different language versions) with an indicator strip that changes colour when vaccines are exposed to temperatures that are too high. The vaccine cold chain card is used to estimate the length of time that vaccine has been exposed to high temperatures.

Manufacturers pack these monitors with vaccines supplied by WHO and UNICEF.

Usually the cold chain monitor is only used for large shipments of vaccine. The same card should remain at all times with the same batch of vaccine. The change in color is cumulative and relates to heat exposure over the whole life of the shipment and not to a specific point in the cold chain.

Figure 3J: Vaccine cold chain monitor card



Vaccine Cold Chain Monitor

Date In	Index	Location	Date Out	Index

3M Monitor Mark™ Dual Temperature Indicator — INDEX/INDICE 10°C 34°C — A B C D

	If A all blue	if B all blue	if C all blue	If A & B & C & D all blue
Polio	use within 3 months	TEST VACCINE BEFORE USE		
Measles & Yellow Fever		use within 3 months		
DPT & BCG			use within 3 months	
TT & DT & Hepatitis B				

SUPPLIER
FOURNISSEUR

Name: _____
Nom: _____
Date of dispatch: _____
Date d'expédition: _____
Vaccine: _____
Vaccin: _____

Keep the Cold Chain Monitor with your vaccine.

When the Monitor arrives.....
complete the top part of the card
- fill in the date
- fill in the index (-, A, B, C, and/or D)
- fill in the location

When the Monitor leaves.....
complete the top part of the card
- fill in the date
- fill in the index (-, A, B, C, and/or D)

If windows A, B, C, and/or D are all white use vaccines normally.

If windows A to C are completely blue, but window D is still white, it means that the vaccine has been exposed to temperature above 10°C but below 34°C for the following number of days:

	INDEX		
	A	AB	ABC
At a temperature of 12°C	3 days	8 days	14 days
At a temperature of 21°C	2 days	6 days	11 days

If window D is blue it means there has been a break in the cold chain of a temperature higher than 34°C for a period of at least two hours. Check the cold chain.

The instruction "use within three months" should not be followed if either the expiry date or any local cold chain policy requires a shorter period before use or disposal of the vaccine.

3.3 Thermometers

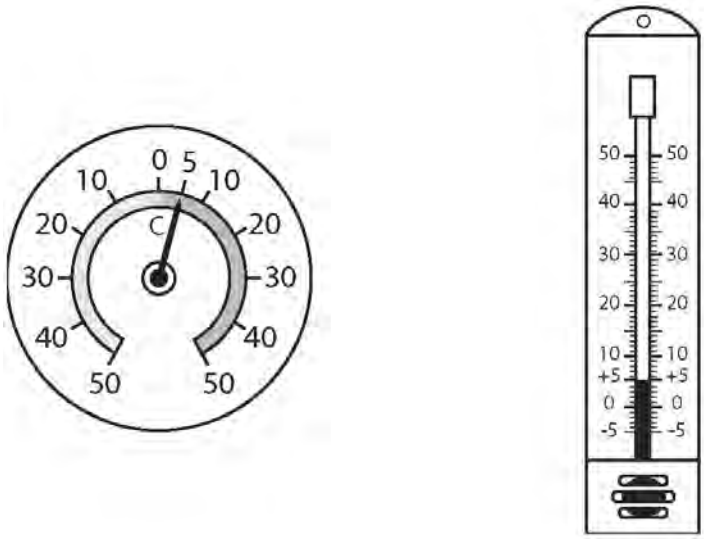
Health facility staff use dial or stem thermometers to monitor the temperature of refrigerators.

On a dial thermometer, the needle moves around the scale, pointing to plus (+) numbers when it is warmer and to minus (-) numbers when it is colder.

On a stem or bulb thermometer, coloured fluid in the bulb moves up the scale as it becomes warmer, and down the scale as it becomes colder.

Dial thermometers tend to lose their accuracy over time. Most dial thermometers can be re-calibrated by adjusting a facility screw on the back of the thermometer. To re-calibrate, match the temperature on the dial thermometer to the temperature shown on a stem thermometer. But to be sure that the dial thermometer still works properly, make a comparison at two different temperatures i.e. inside and outside the refrigerator.

Figure 3K: Two types of thermometers



Dial thermometer

Stem thermometer

3.4 Freeze indicators

3.4.1 Freeze Watch

A freeze indicator is an irreversible temperature indicator which shows if a product, such as vaccine, has been exposed to freezing temperatures in blue. It consists of a white backing card and a small vial of coloured liquid, all contained in a plastic casing.

If the freeze indicator (Freeze Watch™) is exposed to temperatures below 0ºC for more than one hour, the vial bursts and releases the coloured liquid, staining the white backing card.

The freeze indicator is used to warn of freezing and is packed with vaccines that are sensitive to freezing temperatures: DTP, TT, DT, Td (freezing point of -6.5°C), hepatitis B (-0.5°C), liquid Hib and their combinations (DTP-HepB, and DTP-HepB+Hib vaccines) and JE.

Every refrigerator storing vaccines should have a freeze indicator (Freeze Watch™). It is strongly recommended that one freeze indicator be placed in each cold box during vaccine transport and distribution. This is critical in places subject to low temperatures.

Keep the freeze indicator with freeze-sensitive vaccines in the refrigerator. In an upright (front-opening) refrigerator, keep it on the middle shelf, where the freeze-sensitive vaccines and diluents are kept. In a top-opening refrigerator, affix it to the basket in the middle of the refrigerator — **not to** the side wall, where freezing can occur.

Follow the steps below to read the freeze indicator:

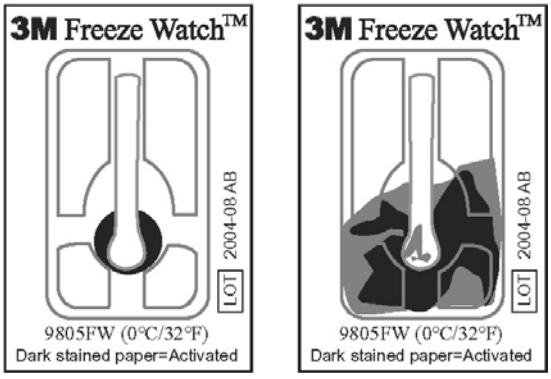
If the indicator paper is stained, your vaccines have been exposed to freezing temperatures.

If the indicator paper shows no colour, remove the indicator from the refrigerator. Shake or tap the edge of the indicator three times on a hard surface. If the paper becomes stained, your

vaccines have been exposed to freezing temperatures. If tapping does not cause colour staining in the indicator, put it back into the refrigerator.

1. If the freeze indicator is activated — showing a stain on white background paper — you should perform the shake test on all of the freeze-sensitive vaccines in the refrigerator to determine which ones should be discarded (see Section 8 in this module).

Figure 3L: Freeze Watch™ (PIS code E6/45)



Not activated Activated

Vaccines OK Do the shake test for freeze-sensitive vaccines

3.4.2 Freeze-tag

Some programmes are using another type of freeze indicator called the Freeze-tag[tm]. It consists of an electronic temperature measuring circuit with associated LCD-display. If the indicator is exposed to a temperature below 0°C ± 0.3°C for more than 60 minutes ± 3 minutes the display will change from the "good" status into the "alarm" status as indicated on the picture below. The indicator is used to warn of freezing and is packed with DTP, TT and DT vaccines as well as with hepatitis BB. Shelf life is 5 years.

Vaccines OK Do shake test

4. How to load cold chain equipment

Cold chain equipment, including refrigerators, cold boxes, and vaccine carriers, must be loaded correctly to maintain the temperature of the vaccines and diluents inside.

Note:

There should be one person in each health facility who has the main responsibility for the refrigerator. This person's responsibilities should include;

- storing vaccines, diluents, and ice-packs;
- checking and recording the temperature twice daily, even on week-ends;
- maintaining the facility's cold chain equipment.

All health workers in a health facility, however, should know how to monitor the cold chain and what action to take if the temperature is too high or too low.

4.1 Vaccine refrigerators

Vaccines, diluents, and ice-packs should be kept in a refrigerator that is used only to store them.

If, however, you are in an area with only one refrigerator and you need to store other heat-sensitive supplies such as drugs, ointments, serum, and samples, be sure to label them clearly and keep them separate from vaccines and diluents.

Do not put vaccines on the door shelves. The temperature is too warm to store vaccines, and when the door is opened shelves are instantly exposed to room temperature.

Do not keep expired vaccines, NOR vaccines with VVMs that have reached or are beyond their discard point, NOR reconstituted vaccines for more than six hours or until the end of an immunization session in the refrigerator. Discard them immediately according to your national guidelines. Refer to your supervisor**.**

Food and drinks should not be stored in a vaccine refrigerator.

Do not open the refrigerator door frequently since this raises the temperature inside the refrigerator.

Vaccine refrigerators have two compartments:

A main compartment (the refrigerator) for storing vaccines and diluents, in which the temperature should be kept between +2ºC and +8ºC. The thermostat is used to adjust the temperature.

A second compartment (the freezer) for freezing ice-packs. If the refrigerator is working properly, this section will be between -5ºC and -15ºC.

Load a vaccine refrigerator as follows:

1. Freeze and store ice-packs in the freezer compartment.

2. All the vaccines and diluents have to be stored in the refrigerator compartment. If there is not enough space, diluents can be stored at ambient temperature. It is important, however, that diluents be chilled by putting them in the refrigerator before use.

3. Arrange the boxes of vaccine in stacks so air can move between them; keep boxes of freeze-sensitive vaccine away from the freezing compartment, refrigeration plates, side linings or bottom linings of refrigerators where freezing may occur.

4. If your country has adopted the opened multi-dose vial policy for vaccines, keep opened vials of OPV, DPT, Td, TT, liquid Hib, hepatitis B and DTP-HepB vaccines in the "use first" box for first use during the next session.

Multi-dose vial policy:

Multi-dose vials of DTP, OPV, TT, HepB, DTP-HepB, and liquid Hib from which one or more doses of vaccine have been removed during an immunization session may be used again within four weeks if <u>all</u> of the following conditions are met:

- the expiry date has not passed;
- the vaccines are stored under appropriate cold chain conditions at all times;
- the vaccine vial has not been submerged in water;
- sterile technique has been used to withdraw all doses; and
- the VVM, if attached, has not reached the discard point.

5. Keep vials with VVMs showing more heat exposure than others in the box labelled "use first." Use these vials first in the next session.

6. Only keep vials that are good for use in the refrigerator. Do not include expired vaccines, reconstituted vials with doses remaining after an immunization session, and vials with VVMs that have reached or are beyond their discard point.

7. Keep ice-packs filled with water on the bottom shelf and in the door of the refrigerator. They help to keep the temperature cool in case of a power cut.

8. Store vaccines in locations appropriate to the style of refrigerator you use. See recommendations below.

Load front-loading refrigerator with freezer on top (Figure 3M) as follows:

1. Measles, MR, MMR, BCG and OPV on the top shelf;

2. DTP, DT, Td, TT, HepB, DTP-HepB, Hib, DTP-HepB+Hib, meningococcal, yellow fever, and JE vaccines on the middle shelves; and

3. diluents next to the vaccine with which they were supplied.

Loading ice-lined refrigerators (ILR)(Figure 3N)

All the vaccines should be stored in the basket provided with the refrigerator

1. Measles, MR, MMR, BCG and OPV in the bottom only; and

2. Freeze-sensitive vaccines (DTP, TT, HepB, DTP-HepB, Hib, DTP-HepB+Hib, meningococcal, yellow fever, and JE vaccines) in the top only.

Figure 3M: Loading a front loading vaccine refrigerator

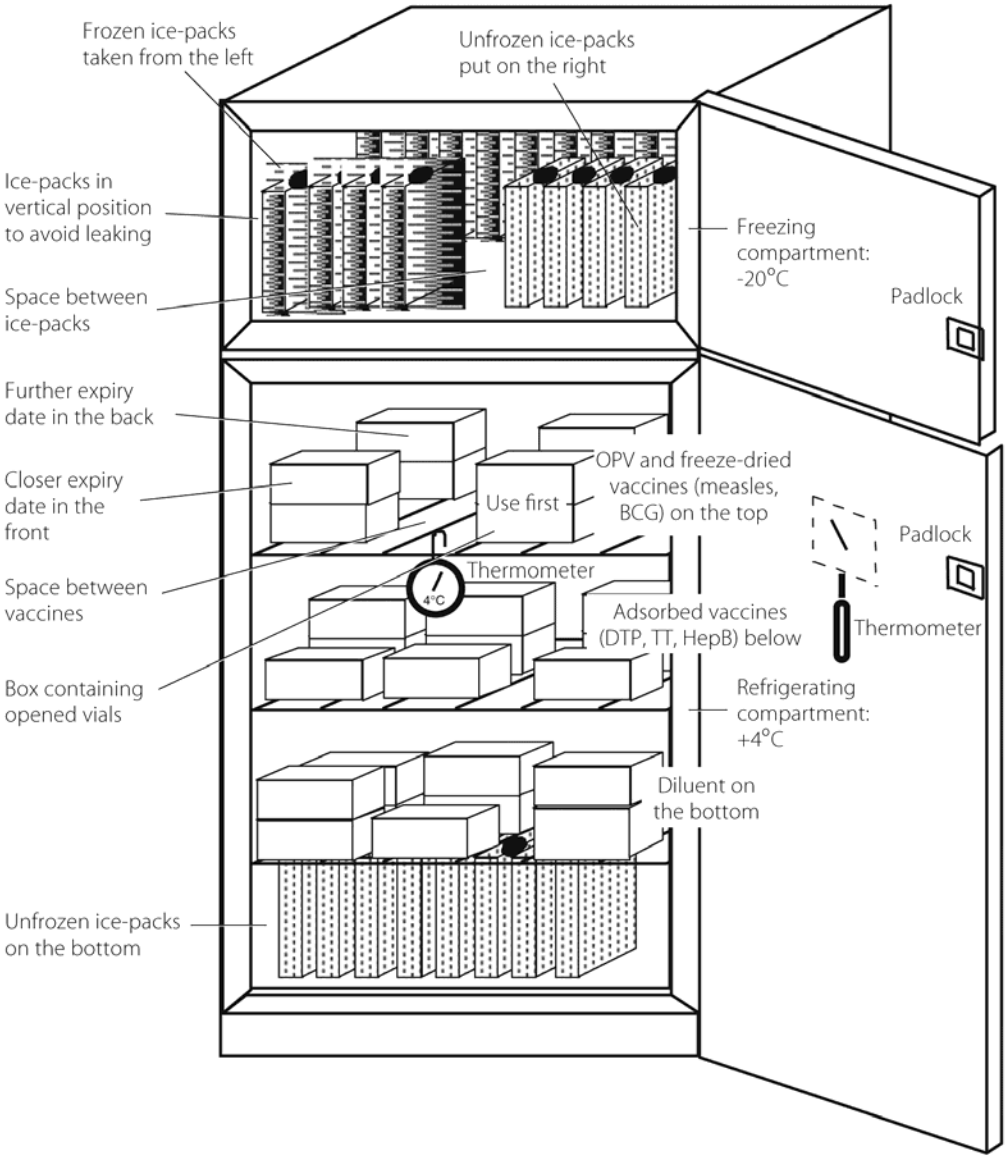
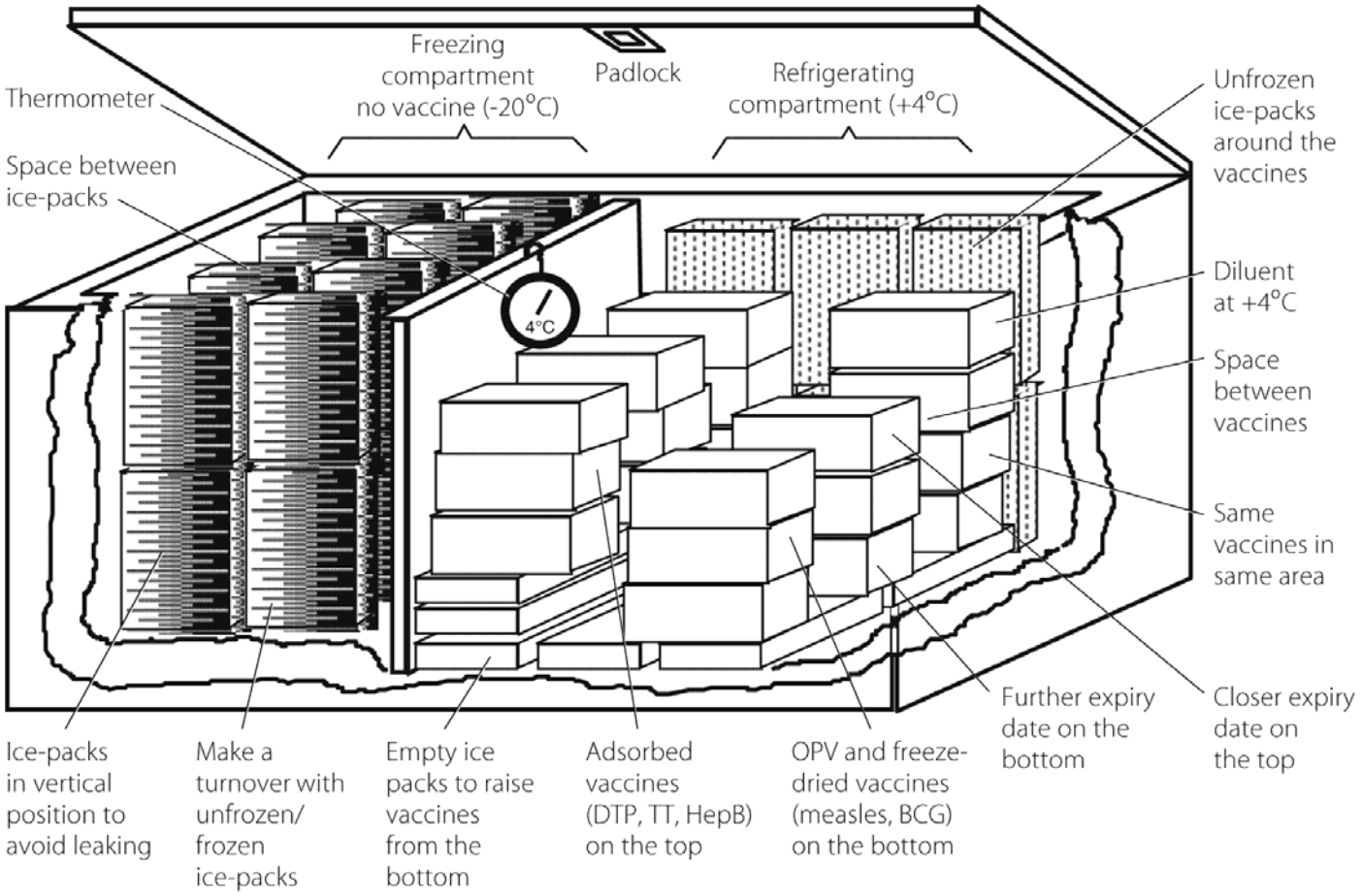


Figure 3N: Loading top-opening (chest) refrigerators



CAUTION: NEVER ENTER MORE THAN 6 BIG ICE PACKS OR

4.2 Cold boxes and vaccine carriers

Load vaccines into cold boxes and vaccine carriers as follows:

Step 1: At the beginning of the day of the session, take all the frozen ice-packs you need from the freezer and close the door (see Section 5 of this Module for instructions on freezing ice-packs).

Step 2: Condition frozen ice-packs properly, by allowing ice-packs to sit at room temperature until ice begins to melt and water starts to form. You should check to see if an ice-pack has been conditioned by shaking it and listening for water. This will prevent freeze-sensitive vaccines from freezing.

Figure 3O: Checking an ice-pack

Step 3: Put conditioned ice-packs against each of the four sides of the cold box or vaccine carrier and on the bottom of the cold box if required.

Step 4: Put the vaccines and diluents in the middle of the cold box or carrier.

Step 5: Include a freeze indicator in the packing with the vaccines.

Step 6: In vaccine carriers, place a foam pad on top of the conditioned ice-packs. In cold boxes, place conditioned ice-packs on top of the vaccines.

Step 7: Close the cold box or carrier lid tightly.

Attention:

Although this is not the preferred method, you may need to use ice cubes when you do not have enough ice-packs. If you use ice cubes:

- Put one plastic bag full of cubes in the bottom of the carrier.
- Put the vaccine vials and a freeze indicator in a sealed plastic bag to ensure that labels are not washed away by water from melting ice. Isolate vaccines from the ice with a piece of paper card.
- Do not place ice on top of the vaccines.
- Place a foam pad on top and close the carrier.

5. How to freeze ice-packs

It takes 24 hours to freeze an ice-pack.

The proper freezing and use of ice-packs is essential for good quality of the vaccines.

Make sure that the ice-packs you have correspond (sizes and number) to the cold boxes and carriers you are using.

To freeze an ice-pack:

- Fill with water leaving a little air space at the top, and put the cap on tightly.
- Hold each ice-pack upside down and squeeze it to make sure it does not leak.
- Put the ice-packs upright or on their sides in the freezer so that the surface of each ice-pack is touching the evaporator plate, and close the door.
- Gas refrigerators or ice-lined refrigerators with a freezing compartment can freeze up to six large or 12 small ice packs per day. More packs will take longer to freeze.
- Leave ice-packs in the freezer for at least 24 hours to freeze solid.
- After the session put the ice-packs back in the freezer.

Keep extra unfrozen ice-packs that do not fit in the freezer on the bottom part of the main refrigerator compartment to keep this section cold in case of a power failure. When you put these ice-packs into the freezer they will freeze relatively quickly because the water inside already is cold. However, do not store already frozen ice-packs in the refrigerator compartment as this will increase the risk of freezing the vaccine.

Remember:

You do not have to refill ice-packs every time you use them. Use the same water repeatedly.

Make sure ice-packs are conditioned (allowed to start melting) before putting them in the cold box containing freeze-sensitive vaccines. This will prevent vaccines from freezing.

6. How to monitor and adjust the refrigerator temperature

6.1 Monitoring the temperature in vaccine refrigerators

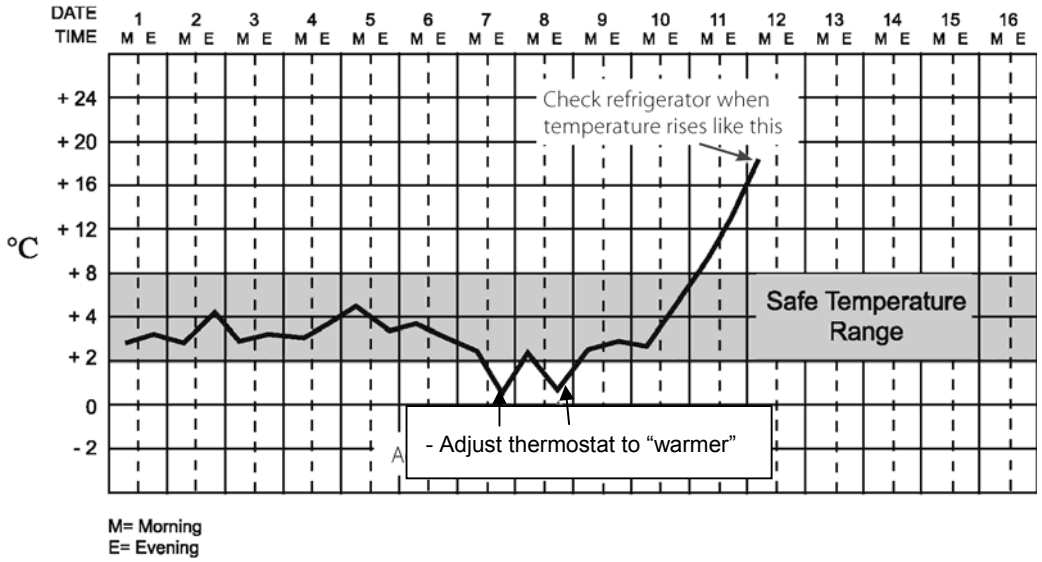
To monitor the temperature of the main section of a refrigerator you need:

- a thermometer; and
- a temperature chart, which you should tape to the outside of the door.

To monitor the temperature, proceed as follows:

- Set the refrigerator thermostat during the coldest part of the day to around +2ºC to +4ºC.
- Monitor temperatures first thing in the morning and before you leave the post in the afternoon. If the temperature is between +2ºC to +8ºC, do not adjust the thermostat.
- Continue to monitor the temperature first thing in the morning and before you leave the post in the afternoon, including workdays, weekends, and holidays.
- Record the temperature for the day and time on the refrigerator temperature chart, as shown below.

Figure 3P: Refrigerator temperature chart



When a chart has been completed, replace it with a new one. Keep the completed charts in a record book for future reference. **Action should be taken when the temperature goes out of range.**

6.2 How to adjust the temperature of vaccine refrigerators

If the temperature is too **LOW** (below +2°C):

- Turn the thermostat knob so that the arrow points to a lower number. This will make the refrigerator warmer.
- Check whether the door of the freezer closes properly. The seal may be broken.
- Check freeze-sensitive vaccines (DTP, DT, Td, TT, HepB, DTP-HepB, liquid Hib and DTP-HepB+Hib vaccines) to see whether they have been damaged by freezing by using the shake test (see Section 8 of this Module).

> **Remember:**
>
> - Slight heat exposure is less damaging than freezing.
> - 2ºC – 8ºC margins is difficult to maintain especially for a kerosene refrigerator.

If the temperature is too **HIGH** (above +8ºC):

- Make sure that the refrigerator is working. If not, check if kerosene, gas or power supply is present.
- Check whether the door of the refrigerator or the freezing compartment closes properly. The seal may be broken.
- Check whether frost is preventing cold air in the freezing compartment from entering the refrigerator compartment. Defrost if necessary.
- Turn the thermostat knob so that the arrow points to a higher number. This will make the refrigerator cooler.
- If the temperature cannot be maintained between 2ºC and 8ºC, store vaccines in another place until the refrigerator is repaired.

> **Warning:**
>
> Do **not** adjust thermostat to a higher (cooler) setting after a power cut. This could freeze the vaccines.
>
> Do **not** adjust thermostat to a higher setting when vaccines arrive. This could freeze the vaccines.

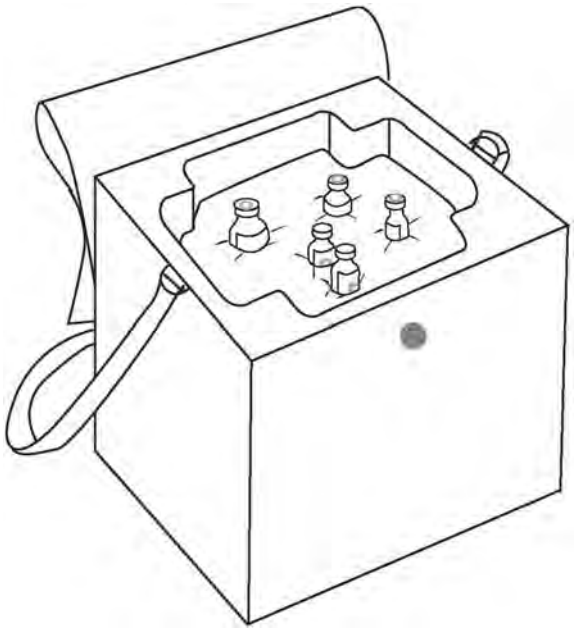
6.3 Maintaining the correct temperature in cold boxes and vaccine carriers

Remember:

In order to maintain the temperature in cold boxes and vaccine carriers:

- Place the adequate number of conditioned ice packs in the cold box or vaccine carrier.
- Keep the cold box or vaccine carrier in the shade.
- Keep the lid tightly closed.
- Use the foam pad to hold vials during immunization sessions.

Figure 3Q: Foam pad in use



If the ice-packs inside the cold box or vaccine carrier have completely melted:

- Discard all reconstituted vials.
- Check VVMs status (see Section 3.1 of this module) and return the vaccines that can be used to a working refrigerator as soon as possible.
- If there is no VVM and the vaccine has only been exposed to warm temperatures for a few hours, return the vials to the refrigerator, place them in the “use first” box, and use them before other vials.

7. How to maintain cold chain equipment

7.1 Maintaining vaccine refrigerators

A refrigerator works well only if it is properly installed, cleaned and defrosted regularly.

Thick ice in the freezer compartment does **not** keep a refrigerator cool. Instead, it makes the refrigerator work harder and use more power, gas or kerosene. You should defrost the refrigerator when ice becomes more than 0.5 cm thick, or once a month, whichever comes first.

To defrost and clean a refrigerator:

- Take out all the most heat-sensitive vaccines (OPV, Measles, BCG, Yellow Fever) and transfer them to a cold box lined with frozen ice-packs.
- Take out all the freeze-sensitive vaccines (DTP, DT, Td, TT, Hepatitis B, liquid Hib, DTP-HepB) and diluents, and transfer them to a cold box lined with conditioned ice-packs.
- Turn off the power supply to the refrigerator.
- Leave the door open and wait for the ice to melt. Do not try to remove the ice with a knife or ice pick, since doing so can permanently damage the refrigerator. You can place a pan of boiling water inside and close the door.
- Clean the inside of the refrigerator and door seal with a clean wet cloth.
- Turn the refrigerator on again.
- When the temperature in the main section falls to +8°C or lower (but not less than +2°C), return the vaccines, diluents, and ice-packs to their appropriate places.

If you need to defrost your refrigerator more than once a month, it could be because:

- you may be opening it too often (more than three times daily); or
- the door may not be closing properly; or
- the door seal may need to be replaced.

7.2 What to do when a vaccine refrigerator is out of order

If your vaccine refrigerator stops working, first protect the vaccines and then repair the refrigerator.

Protecting the vaccines

Move the vaccines to another place until the refrigerator is repaired. If you think that the problem will last only a short time, you may use a cold box or vaccine carrier lined with conditioned ice-packs for temporary storage. For a longer duration, use another refrigerator. Always keep a freezer indicator with the freeze-sensitive vaccines to monitor eventual freezing.

Restoring the refrigerator to working order

Check the power, gas or kerosene supply. If there is no power, make other arrangements (e.g. store the vaccine in a household refrigerator) until power is restored. If there is no gas or kerosene, get it as soon as possible.

If a lack of power, gas or kerosene is not the problem, repair the refrigerator or report to your repair technician or supervisor.

Record the breakdown on the daily temperature recording chart.

Note: Concerning the routine maintenance and the servicing of refrigerators, WHO technical manuals exist for each kind of refrigerator.

7.3 Maintaining cold boxes and vaccine carriers

Vaccine carriers and cold boxes must be well dried after their use. If they are left wet with their lids closed, they will become mouldy. Mould may affect the seal of the cold boxes and vaccine carriers. If possible, store cold boxes and vaccine carriers with the lid open, when not being used.

Knocks and sunlight can cause cracks in the walls and lids of cold boxes and vaccine carriers. If this happens the vaccines inside will be exposed to heat.

If a cold box or vaccine carrier wall has a small crack you may be able to repair it with adhesive tape until you can get an undamaged one.

8. The shake test

The “Shake test” can help give an idea whether adsorbed vaccines (DTP, DT, Td, TT or Hepatitis B) have been subjected to freezing temperatures likely to have damaged them. After freezing, the vaccine no longer has the appearance of an homogenous cloudy liquid, but tends to form flakes which settle at the bottom of the vial after shaking. **Sedimentation is faster in a vial which has been frozen than in a vial, from the same manufacturer, which has not been frozen.**

The test should be conducted for all boxes where freeze indicators are found to be activated or temperature recordings show negative temperatures.

Procedure:

Step 1 — *Prepare a frozen control sample:* Take a vial of vaccine of the same type and batch number as the vaccine you want to test, and from the same manufacturer. Freeze the vial until the contents are solid (at least 10 hours at -10°C) and then let it thaw. This vial is the **control sample**. Mark the vial clearly so that it is easily identifiable and will not be used by mistake.

Step 2 — *Choose a test sample:* Take a vial (s) of vaccine from the batch (es) that you suspect has been frozen. This is the *test sample*.

Step 3 — *Shake the control and test samples:* Hold the control sample and the test sample together in one hand and shake vigorously for 10–15 seconds.

Step 4 — *Allow to rest:* Leave both vials to rest by placing the vials on a table and not moving them further.

Step 5 — *Compare the vials:* View both vials against the light to compare the sedimentation rate. If the test sample shows a much slower sedimentation rate than the control sample, the test sample has most probably **not been frozen** and can be used. If the sedimentation rate is similar, the vial has probably been damaged by freezing and **should not be used**.

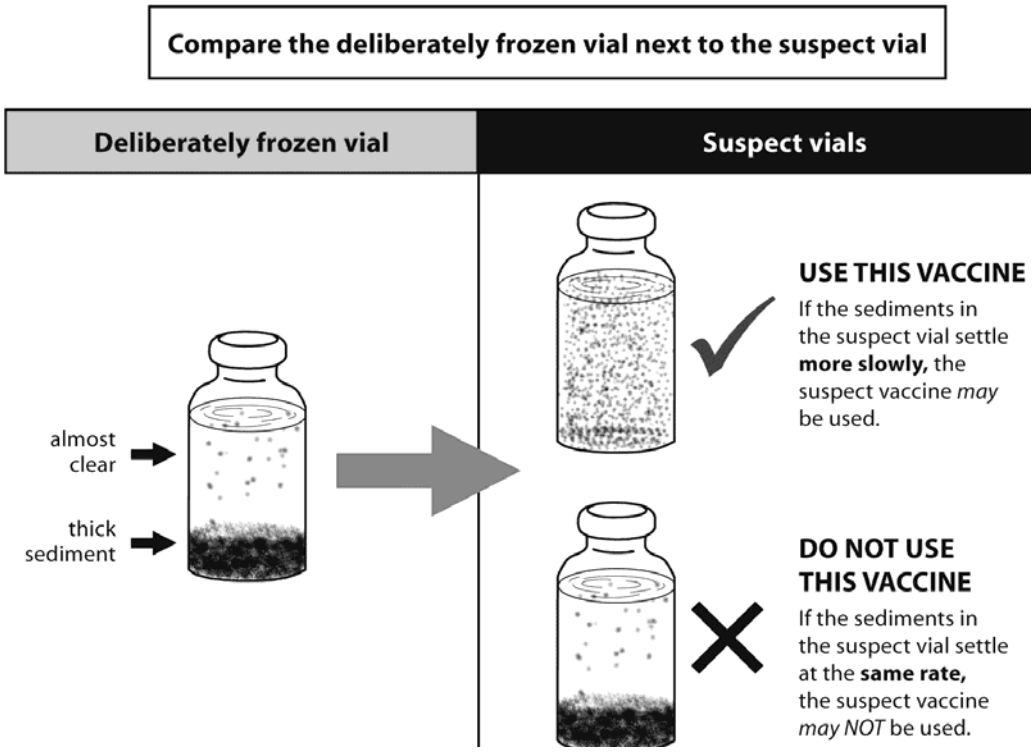
Note that some vials have large labels which conceal the vial contents. This makes it difficult to see the sedimentation process. In such cases, turn the control and test vials upside down and observe sedimentation taking place in the neck of the vial.

If the shake test procedure indicates that the test sample has been damaged by freezing, you should notify your supervisor immediately. Identify and separate all vaccines that may have been frozen and ensure that none are distributed or used.

Note:

Frozen samples can be used for shake tests only when testing the same vaccine from the same manufacturer and the same lot number. A new sample is needed for each manufacturer and lot number.

Figure 3R: The shake test



9. Summary

The tables below show the sensitivity of different vaccines to heat and freezing:

Table 3.1: Heat sensitivity

Range	Vaccine
most sensitive  least sensitive	OPV
	Measles, MR, MMR
	DTP, DTP-HepB, DTP-Hib, DTP-HepB+Hib, YF
	BCG
	Hib, DT
	Td, TT, HepB, JE

Table 3.2: Freeze sensitivity

Range	Vaccine
most sensitive  least sensitive	HepB
	Hib (liquid)
	DTP, DTP-HepB, DTP-Hib, DTP-HepB+Hib,
	DT
	Td
	TT, Hib lyophilised

Light sensitivity

Finally, some vaccines are very sensitive to strong light and their exposure to ultraviolet light causes loss of potency. Consequently, they must always be protected against sunlight or fluorescent (neon) light. BCG, Measles, MR, MMR and rubella vaccines are equally sensitive to light (as well as to heat). Normally, these vaccines are supplied in vials made from dark brown glass, which gives them some protection against light damage, but care must still be taken to keep them covered and protected from strong light at all times.

WHO/IVB/04.06
ORIGINAL: ENGLISH

Immunization in practice

Module 4: Ensuring safe injections

Contents

About this module

This Module discusses practices that health workers should follow to ensure that they deliver immunization injections in the safest manner.

An injection is considered safe for:

- the *mother or child*, when a health worker uses a sterile syringe and a sterile needle and appropriate injection techniques;
- the *health worker*, when he or she avoids needle-stick injuries; and
- the *community*, when waste created by used injection equipment is disposed of correctly and does not cause harmful levels of pollution and injuries.

1. Using safe injection equipment and techniques

1.1 Types of injection equipment

The following equipment are used to administer injectable vaccines:

Equipment	Remarks
Auto-disable (AD) syringes	equipment of choice
Prefilled AD injection devices	available for some antigens only
Reusable syringes and needles	not recommended
Single use disposable (non AD) syringes and needles	for mixing purposes only

WHO — UNICEF — UNFPA joint statement on the use of auto-disable syringes in immunization services.

"The auto-disable syringe which is now widely available at low cost presents the lowest risk of person-to-person transmission of blood-borne pathogens (such as HepB or HIV) because it cannot be reused. The auto-disable syringe is the equipment of choice for administering vaccines, both in routine immunization and mass campaigns."

1.1.1 Auto-disable (AD) syringes

AD syringes are self-locking syringes that can be used only once. AD syringes are the preferred equipment for all types of immunization sessions.

Every AD syringe is sterilized and sealed by the manufacturer. There are several different types of AD syringes. Most AD syringes have fixed needles. Others have detachable needles that fit only the specific AD syringe they accompany. These needles cannot be used with a standard syringe. Some AD syringes are individually packaged in plastic or paper packets, others are boxed in bulk. All AD syringes have plastic caps to keep the needle sterile, and some also have caps on the plungers.

There are different AD syringes to give BCG vaccine and to give the other vaccines.

Each type of AD syringe requires health workers to use a specific technique to give injections. Refer to the manufacturers' instructions.

Below are **general** steps to follow when using AD syringes. These steps must be refined depending on the specific AD syringe you are using.

General steps for using AD syringes

Step 1: Remove the syringe and needle from plastic wrapping (peel open the syringe plunger end of the package) or detach the plastic caps.

Step 2:

- Fix the needle to the syringe if it is not already in place.
- Take off the needle cap without touching the needle.

The plunger can go back and forth only once, so health workers should not move the plunger unnecessarily and should not try to inject air into the vial, as this will disable the syringe.

Step 3: Insert the needle in the vaccine vial and bring the tip of the needle to the lowest part of the bottom of the vial.

Step 4: Pull the plunger back to fill the syringe. The plunger will automatically stop just past the 0.05 ml/0.50 ml mark and you will hear a "click."

Step 5: Keep the needle tip in the fluid at all times, making sure to empty the full contents of the vial. Remove the needle from the vial. To remove air bubbles, hold the syringe upright and tap the barrel. Then carefully push to the close mark.

Step 6: Locate the injection site.

Step 7: Push the plunger forward and inject the vaccine. After injection, the plunger will automatically lock and the syringe cannot be reused. **Do not** re-cap the needle after use.

Step 8: Dispose of the needle and syringe in a safety box: a leak-proof, puncture-resistant container for sharps waste.

Advantages of AD syringes:

- They can only be used **once**.
- They eliminate the patient-to-patient disease transmission caused by the use of contaminated needles and syringes.
- They save time for health workers from the heavy work of sterilization.

1.1.2 Prefilled AD injection devices

Prefilled AD injection devices are single-dose packets of vaccine with a needle affixed by the manufacturer. This type of injection device can be used only once.

Hepatitis B vaccine and tetanus toxoid are currently available in prefilled AD injection devices. Some prefilled devices are also equipped with a VVM (see Module 3, Section 3.1).

Hepatitis B prefilled AD injection devices are used primarily to provide hepatitis B vaccine to newborns in their homes. Tetanus toxoid prefilled AD injection devices are used to

provide TT vaccine to women of childbearing age in their homes and during mass campaigns.

Every prefilled AD injection device is sterilized and sealed in its own foil package by the manufacturer. The vaccine is contained in a sealed, bubble-like reservoir that prevents it from coming in contact with the needle until the administration.

To prepare or "activate" the prefilled AD injection device, push the needle shield (or cap) into the port (see Figure 4-A). This opens the fluid path between the needle and the reservoir that contains the vaccine. Then, remove the needle shield, insert the needle into the injection site, and deliver the dose by squeezing the reservoir until it is empty.

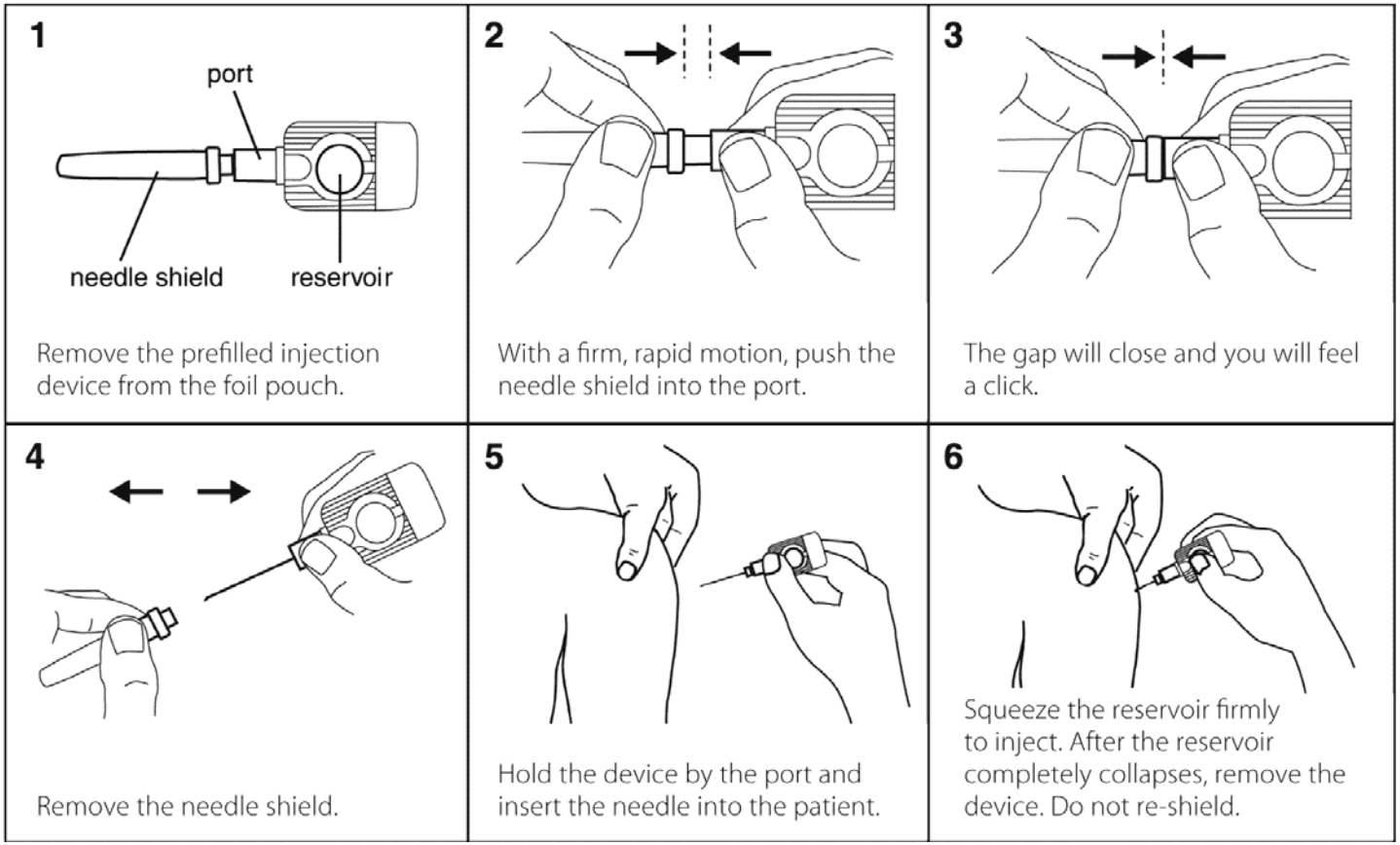
After use, the prefilled AD devices should be collected in a safety box for final disposal.

Advantages of prefilled AD injection devices:

Prefilled AD injection devices have the same advantages as AD syringes. In addition:

- They prevent vaccine contamination.
- They ensure an accurate dose.
- They deliver vaccine and syringe together in the same set.
- Syringe and vaccine can be ordered with a single request.
- They contain less plastic than a syringe, so waste is reduced.
- The unit-dose device reduces the vaccine waste that occurs when using multi-dose vials.

Figure 4A: Activation and use of prefilled auto-disable device



1.1.3 Sterilizable syringes and needles

Sterilizable syringes and needles are no longer recommended for use in the EPI however they are still used in some countries, but should be phased out while AD syringes are being phased in. For countries where they are still being used, but phased out, their sterility must be guaranteed by complying with the following:

- The health workers can be sure to comply with cleaning and sterilization procedures between each use.
- The health workers will routinely use time, steam and temperature indicators (TSTs) for each sterilization.
- Supervisors can verify these procedures.

Immediately after use, the syringes and needles must be flushed with clean water and soaked in clean water. They must be carefully cleaned at the end of the session. Before use, they must be steam-sterilized for 20 minutes at a temperature between 121°C and 126°C.

You must dispose of sterilizable needles and syringes when you can no longer read the scale on the syringe, or if the needle is barbed. To test for barbs, carefully draw the needle across some cotton wool or gauze. If the needle is barbed it will catch in the cotton wool or gauze. In that case, dispose of the needle immediately.

1.1.4 Disposable syringes and needles

Disposable single-use syringes and needles are **not recommended** for injections in immunization programmes. Because reuse of disposable syringes and needles carries a high risk of infections, in 1999 WHO, UNICEF, and UNFPA issued a joint policy statement recommending against their use for immunization.

Vaccines that must be reconstituted, such as measles vaccine, require a large syringe to mix the diluent with the vaccine. While auto-disable reconstitution injection devices are the equipment of choice in these situations, they may not always be available. If this is the case, you may use disposable syringes and needles to reconstitute vaccine. Do not reuse the disposable syringe and needle for reconstitution.

1.2 Estimating AD syringes needs

It is important to ensure that you have a sufficient stock of AD syringes to conduct planned fixed and outreach sessions (see Module 5 for estimating your vaccine and supply needs).

1.3 Giving the right vaccine safely

As well as using the injection equipment safely it is equally important to give the right vaccine which has been kept properly in the cold chain, appropriately reconstituted, and safely administered (Module 6, Section 3, deals with these issues in detail).

Table 4.1: Examples of incorrect immunization practices and possible severe reactions following immunization

Incorrect practice	Possible severe reactions following immunization
Non-sterile injection • Reuse of disposable syringe or needle • Improperly sterilized syringe or needle • Contaminated vaccine or diluent	Infection such as local abscess at injection site, sepsis, toxic shock syndrome, or death Blood-borne infection transmitted such as hepatitis, HIV
Reconstitution error • Inadequate shaking of vaccine • Reconstitution with incorrect diluent • Drug substituted for vaccine or diluent • Reuse of reconstituted vaccine at subsequent session	Local abcess Vaccine ineffective[a] Negative effect of drug, e.g. insulin, oxytocine, muscle relaxants Death
Injection at incorrect site • BCG given subcutaneously • DTP/DT/TT too superficial • Injections into buttocks	Local reaction or abscess Local reaction or abscess Sciatic nerve damage
Vaccine transportation/storage incorrect • VVM changed colour • Clumping of adsorbed vaccine	Local reaction from frozen vaccine Vaccine ineffective[a]
Contraindications ignored	Avoidable severe reaction
[a]vaccine being ineffective is an “effect”, it is not strictly an adverse event	

1.4 Simple ways to improve injection safety

1. Prepare injections in a clean designated area where blood and body fluid is unlikely. Prepare each dose immediately before administering, do not prepare several syringes in advance.

2. Never leave the needle in the top of the vaccine vial.

3. Follow product-specific recommendations for use, storage and handling of vaccines.

4. Follow safe procedures to reconstitute vaccines.

    a) Make sure you have the CORRECT diluent for each freeze-dried vaccine — check that both diluent and vaccine are produced by the same manufacturer.

    b) When reconstituting, both the freeze-dried vaccine and the diluent must be at the same temperature (between 2°C and 8°C).

    c) Use a sterile syringe and needle to reconstitute each unit of vaccines. Use all the diluent provided for the vial. After use, place the syringe into a safety box.

d) All reconstituted vaccines should be discarded at the end of the session or after six hours, whichever is the sooner.

5. Use a new syringe and needle for every child — preferably an auto-disable syringe.

   a) Use a new, quality controlled auto-disable syringe and needle.

   b) Inspect the packaging very carefully. Discard a needle or syringe if the package has been punctured, torn or damaged in any way.

   c) Do not touch any part of the needle. Discard a needle that has touched any non-sterile surface.

6. Hold the child firmly. Anticipate sudden movement during and after injection.

Refer to Annex 1 for unsafe immunization practices that must be avoided.

2. Preventing needle-stick injuries and infections

Needles can be dangerous

Needles frequently injure health workers. Small but dangerous amounts of blood infected with hepatitis B, hepatitis C, HIV, or other viruses can be transmitted by needle-stick injuries.

Needle-sticks may occur:

- when health workers recap needles or walk while carrying used syringes and needles;
- if patients — especially children — are not positioned securely while they receive injections;
- if unsafe disposal practices leave people or animals exposed to used syringes and needles.

This section presents how to prevent needle-stick injuries by:

- minimizing the need to handle needles and syringes;
- handling syringes and needles safely;
- setting up the immunization work area to reduce the risk of injury;
- positioning children correctly for injections; and
- practising safe disposal of all medical sharps waste.

2.1 Minimizing the need to handle needles and syringes

Needle-stick injuries can occur at any time, but they happen most frequently during and immediately after an injection is given. In general, the more injection equipment is handled, the greater the risk of needle sticks. But needle sticks are preventable. There are simple steps health workers can follow to reduce the risk of needle-stick injuries.

Minimizing the need to handle injection equipment is crucial to preventing injuries. Here are some tips to minimize handling.

- Place a safety box close to the person giving vaccinations so used syringes and needles can be disposed of immediately.
- Avoid recapping the needle. If recapping is necessary (for example if the injection is delayed because the child is agitated), use a single-handed scoop technique.

- Do not manually remove the used needle from the syringe.
- Do not carry used syringes and needles around the immunization area or work site.
- When ready to vaccinate draw up the vaccine, inject the vaccine, and put the syringe in the safety box without putting it down between steps.
- Close the safety box securely when it is three-quarters full.
- Do not manually sort needles and syringes.

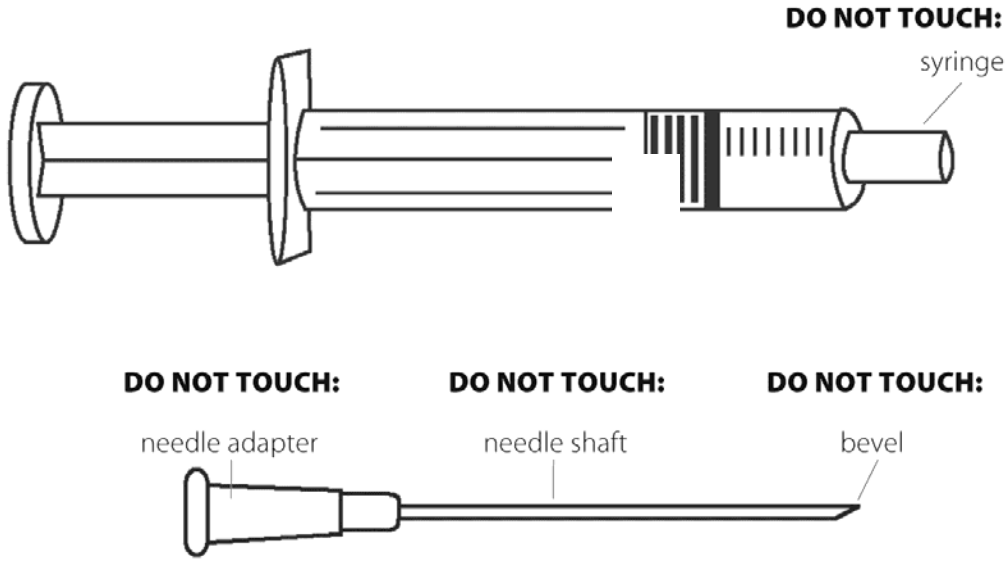
2.2 Handling syringes and needles safely

You have to hold a syringe to give an injection. Any part of the syringe that you touch becomes contaminated, so you should not touch parts that come into contact with the vaccine or the child.

Do not touch:

- the shaft of the needle;
- the bevel of the needle;
- the adaptor of the needle;
- the adaptor of the syringe; and
- the plunger seal of the syringe.

Figure 4B: Parts of a syringe and needle that must not be touched

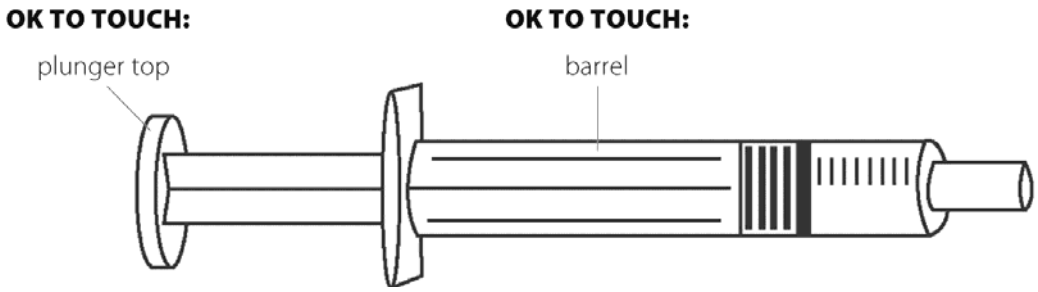


IMPORTANT: If you touch any of these parts, discard the syringe and needle and get new sterile ones.

You may touch:

- the barrel; and
- the plunger top.

Figure 4C: Parts of a syringe and needle that may be touched



2.3 Setting up the immunization work area to minimize risk of injury

Health workers should plan the layout of their work-space so that:

- The vaccine carrier is in the shade.
- Tally sheets can easily be used.
- The person giving doses of vaccine is between the child and all needles or sharp objects.
- The person giving doses of vaccine can see the entrance hole of the safety box when discarding needles. Some people may stand when giving doses of vaccine. Those who sit may want to place the safety box on the floor.
- The health worker can dispose of used needles without setting them down or moving too far.
- Only one child at a time is in a health worker's work-space.
- Each person giving doses of vaccine has his or her own safety box, especially at busy sites.

See Module 6 , Figure 6-C: Set-up for an immunization session.

2.4 Positioning children correctly for injections

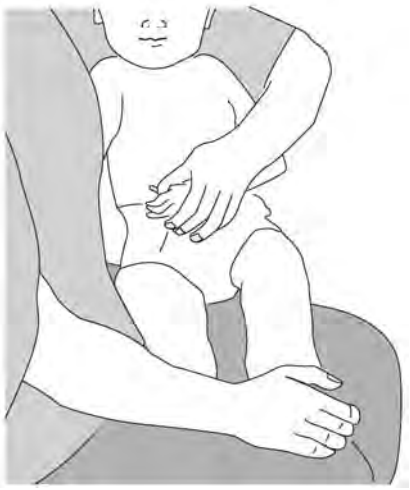
Unexpected motion at the time of injection can lead to accidental needle-sticks.

To prevent this, position the child securely before giving the injection.

- Have the mother sit and place the child on her lap. Make sure one of the mother's arms is behind the child's back, and one of the child's arms wraps around the mother's side.

- The mother may tuck the child's legs between her own to secure them, or she may hold the child's legs.

Figure 4D: Correct position for child receiving injection



- Health workers cannot hold the child because they need both hands for the injection.
- Always tell the mother when you are about to give the injection.

2.5 Practising safe disposal of all medical sharps waste

Used sharps must be placed in a safety box and then disposed of in a safe manner. Follow the procedures for safe disposal outlined in the next section of this Module to safely dispose of all sharps waste.

3. Disposing of used syringes and needles

Injection equipment should be discarded immediately after use once. The exception to this rule is sterilizable injection equipment which should be disposed of after about 50 uses.

3.1 Why is it important to handle sharps waste properly?

Sharps waste can cause serious health and environmental problems. Unsafe disposal can spread some of the very same diseases you are working so hard to prevent.

Dangers to health

Leaving used syringes and needles in the open or on the ground puts the community at risk. Most frequently, children are the unfortunate victims of needle-stick injuries from haphazard disposal of needles.

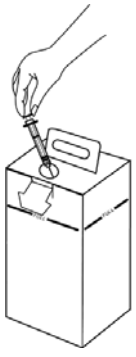
Dangers to the environment

Throwing used needles and syringes in a river spoils water used for drinking and washing.

3.2 Using a safety box

All used injection equipment except reusable syringes and needles should be placed in a **safety box** (see Figure 4E) immediately after use. These containers are waterproof and tamper-proof and needles cannot easily pierce them. If a safety box is not available, you can use locally available materials to create a functional and safe sharps container (see Figure 4G).

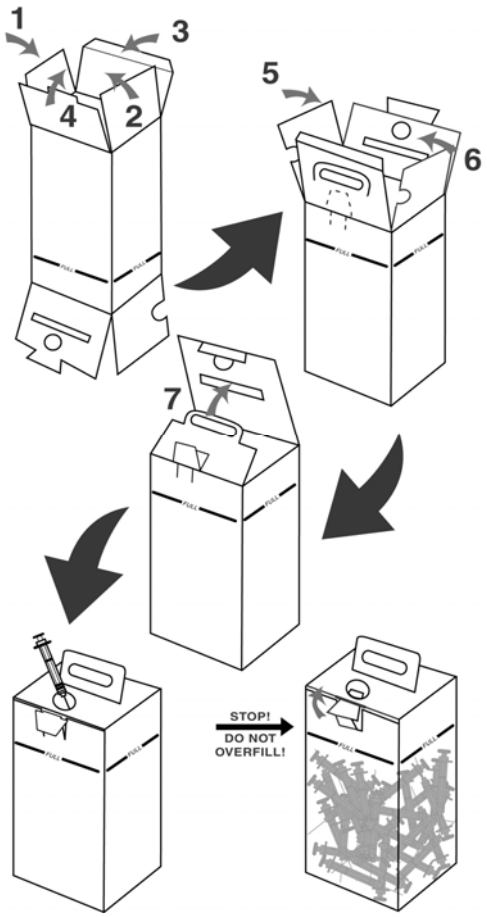
Figure 4E: Safety box



How to assemble the safety box

Safety boxes require proper assembly before use. Many come with picture instructions printed on the side.

Figure 4F: Safety box assembly and use



When the box is not in use, close the opening on the top.

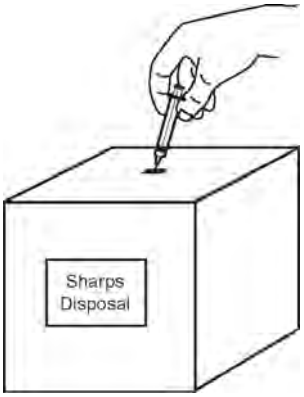
What to do if safety boxes are not available

Health workers can use strong cardboard boxes, thick plastic containers, or metal cans to collect syringes and needles and transport them to a site where they can be buried or burned. Do not reuse the same can or container after filling it once. Instead, destroy the container when it is three-quarters full and find a new container for your next session. Emptying and reusing safety boxes increases the risk of accidental needle-stick injuries and infection. Since it is recommended that all sharps waste be buried or burned, it is a good idea to use a disposal container made of cardboard if safety boxes are not available.

How to create a good sharps container:

- Find a strong cardboard box (your local shop may be able to help). If possible, the walls of the box should be strong enough that needles will not easily pierce the cardboard and prick someone handling the box.
- If necessary, strengthen the walls of the container by placing one box inside another. If the box is too thin, needles may stick through the sides of the box.
- Close the box securely, top and bottom.
- Cut a small hole in the top just big enough for a syringe and needle to enter.
- When the box is three-quarters full, seal the opening.
- Destroy the box carefully and completely.

Figure 4G: Homemade safety box



To ensure safe handling of the safety box:

- Don't handle or shake the safety box more than necessary. Never squeeze, sit or stand on safety boxes.
- Take extra care when you are carrying the box to the disposal site. Hold the box by the top (by the handle provided) above the level of the needles and syringes.
- Keep safety boxes in a dry, safe place out of the reach of children and the general public, until they have been safely disposed of.
- Train everyone who will handle the box how to do it safely. Do not ask untrained staff to handle the box.

3.3 Procedures for disposing of sharps waste and injection equipment

All injection equipment must eventually be destroyed. **Auto-disable or disposable mixing syringes and needles** are used once and then destroyed.

Used syringes and needles must NEVER be dumped in open areas where people might step on them or children might find them. They should never be disposed of along with other kinds of waste.

Step 1: Place the safety box within reach of the health worker. After each injection, immediately place the syringe and needle in the safety box or sharps container. Do not recap the needle.

If your country supplies needle removers or needle cutters, safely separate the used needle and syringe immediately after each injection. After removing the needle with a device, immediately place the syringe in the safety box. The needle is placed in a separate safe container. When the needle container is full, close it and dispose of it by burying, depositing in a protected sharps pit, burning in a pit, burning in a container, or incinerating.

Step 2: Following the immunization session or when the safety box is three-quarters full, close the container.

Do not transfer used syringes and needles from safety boxes to other containers.

A five litre safety box can hold about 100 syringes and needles. When three quarters full, it should be destroyed as close as possible to the immunization session site, and as soon after the session as is practical.

Step 3: Find a safe place to bury or burn the box (see next section).

CAUTION: Never put the following material in a safety box. Discard them with other medical waste:

— empty vials;

— discarded vaccine vials;

— cotton pads;

— compressors;

— dressing material;

— IV bags or extension tubes;

— latex gloves or any kind of plastic materials or waste products.

3.4 Disposing of safety boxes

Five methods are commonly used to destroy filled safety boxes or to keep them away from people.

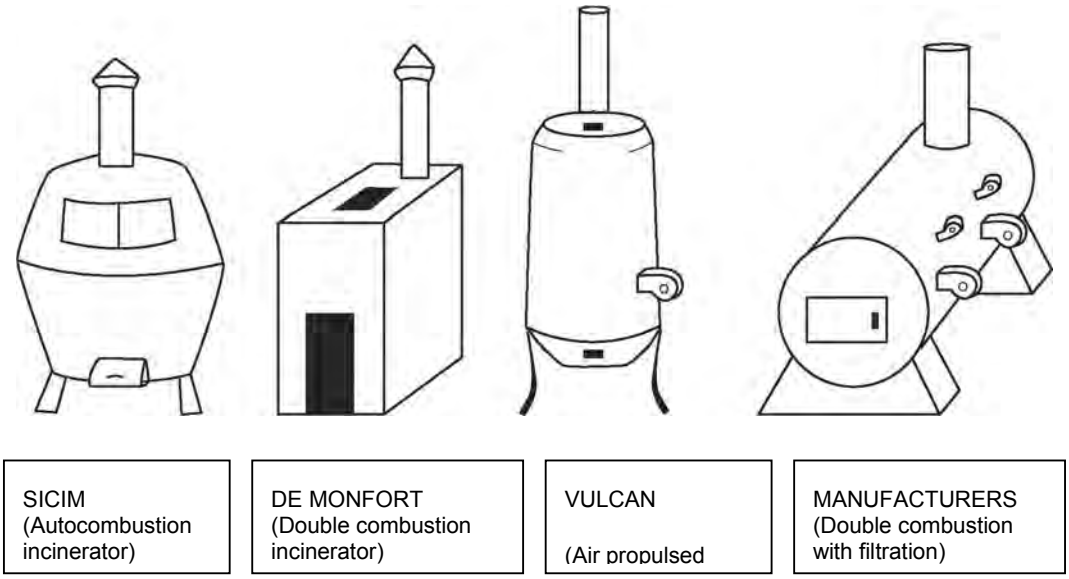
Any selected method of waste disposal must comply with national and subnational environmental regulations and with specific Ministry of Health instructions for your health centre.

1. Incineration:

Incineration can completely destroy syringes and needles. Fires burning at temperatures higher than 800˚C kill microorganisms and reduce the volume of waste to a minimum. Properly functioning incinerators ensure the most complete destruction of syringes and needles. They produce less air pollution than fires burning at lower temperatures. Some hospitals have on-site incineration. Others use incinerators at facilities such as cement factories (see Figure 4H).

The compound in which incineration takes place must be secure. Staff members conducting the incineration should wear safety glasses and heavy gloves.

Figure 4H: Types of incinerators (not an exhaustive list)



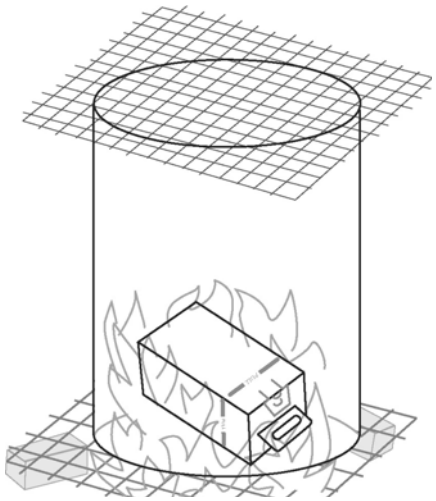
2. Burning in a metal drum

To burn in a metal drum or container (see Figure 4I):

- Choose a burning site in an unused area as far from buildings as possible. The area should be fenced and cleared.
- Place four bricks on the ground in a square pattern.
- Put a metal screen or grate on top of the bricks.
- Remove both ends of a 210-litre (55-US gallon) steel drum. This will allow air to flow through the drum and contents will burn better. If a metal drum is not available, you can build a cylinder from sheet metal, bricks, or clay. A chimney may be added to the removable top of the drum or container.

- Place the drum on top of a metal screen or grate.
- Put the filled safety boxes into the metal drum. Mix paper, leaves, or other flammable material in among the safety boxes to help them burn.
- Sprinkle a small amount of kerosene, if available, on the boxes and other material in the drum.
- Place a fine metal screen over the top of the drum to reduce flying ashes.
- Put wood, paper, or other flammable material under the drum and ignite the material.
- Warn people to stay away and to avoid smoke, fumes, and ash from the fire.
- Allow the fire to burn until all of the safety boxes have been destroyed.

Figure 4I: Metal drum



- Once the fire is out and the residue at the bottom of the drum has cooled, carefully collect the residue. Bury it in an unused location. Cover with at least 13 cm of soil. If possible, seal the residue pit with cement once it is full.

IMPORTANT: The remains of the needles and safety box should be buried after burning, whether burning is done in a metal drum or in an open pit. Bury them deeply in a pit latrine, controlled landfill, or a similar location where people do not have access to them.

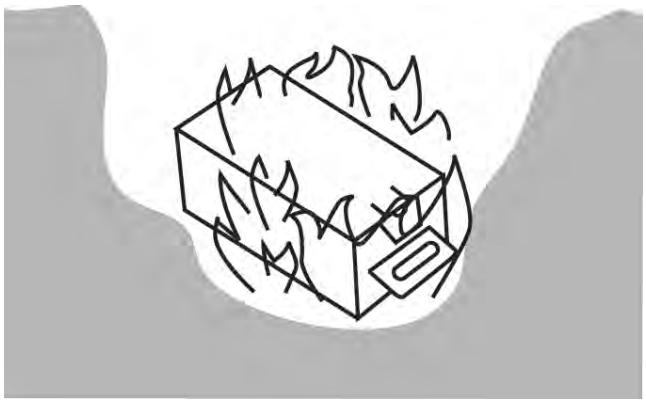
3. Open burning in a pit

Open burning in a pit is not always recommended because burning plastic is not good for the environment. If you burn waste in the open (see Figure 4J):

- Choose an unused area for the burning site, as far from buildings as possible. The area should be fenced and cleared.
- Choose a qualified staff person to supervise the burn.
- Dig a pit at least one metre deep, but make sure it is not so deep that you will have to crawl into it to start the fire.
- Place the filled safety boxes in the pit. Mix paper, leaves, or other flammable materials among the boxes to help them burn.
- If available, sprinkle a small amount of kerosene and ignite the materials.
- Warn people to stay away and avoid smoke, fumes, and ash from the fire.

- Burn until all boxes are destroyed, and then follow the instructions above to bury residue.

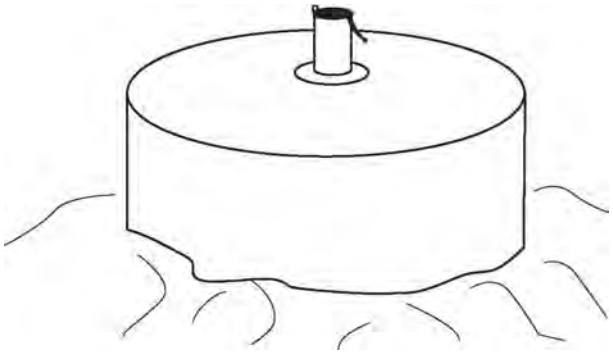
Figure 4J: Open burning in a pit



4. Encapsulation:

A specially made **safety pit** is another option to dispose of used syringes and needles that are loose. A safety pit is usually two metres deep and one metre in diameter so that it can be lined with a locally made concrete pipe. The pit has a concrete lid with a capped metal pipe set in it. Used syringes and needles are dropped through the metal pipe and into the pit (see Figure 4K).

Figure 4K: Safety pit

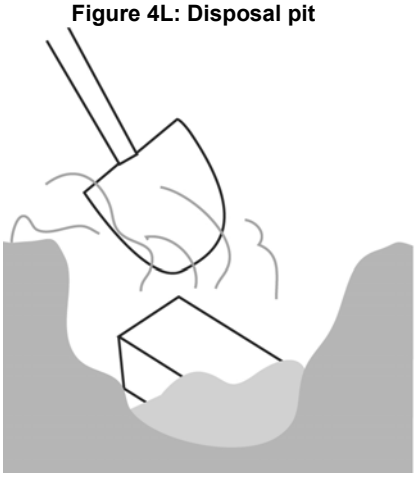


5. Buried in a disposal pit:

Used injection equipment may be buried in a disposal pit. Choose the site carefully and dig a pit large and deep enough for bulky boxes (see Figure 4L). If contaminated AD syringes somehow escape from the box and are carried into streams or fields, people may step on them or children may play with them.

- Choose a site where people will not dig or establish latrines in the future.
- Fence off and clear the area.
- Dig a pit at least two metres deep. Make sure that the material will not escape from the pit, for example, during the rainy season.
- Take the filled safety boxes to the pit site just before burying. Do not open or empty the boxes.
- Place the filled safety boxes in the pit.
- Cover the boxes with at least 30 cm of soil. If possible, cover the site with concrete when the pit is full.

Figure 4L: Disposal pit



Make sure a qualified staff member supervises the process. Do not leave this vital task to unqualified people.

Annex 1

Unsafe immunization practices

Do not overfill the safety box

Do not recap the needle

Do not leave the needle inside the vial

Do not touch the needle

Do not dispose of used needles in an open cardboard box

WHO/IVB/04.06
ORIGINAL: ENGLISH

Immunization in practice

Module 5: Planning immunization sessions to reach every infant

Contents

About this module

This module explains how to plan immunization sessions at the district (3rd administrative level) involving all health facilities in the planning process. Special planning issues for mobile teams and urban populations are discussed in this module.

The module also discusses how to estimate vaccines and supply needs and manage stocks. Involving the community in the planning process is discussed in the last section of this module.

1. Planning at district level involving all health facilities

The key to improving immunization services is a district plan, which aims to provide immunization sessions to reach every infant and woman in the district. Making such a plan needs teamwork, with close collaboration between district and health facility staff. In this section, we describe the steps leading to a good quality district plan.

Stage 1 — Initial planning by district

The first stage is for the district staff to make an operational map of the whole district and prepare a draft district plan to provide sessions to reach the whole population.

Stage 2 — Joint planning by district and health facility staff

Ideally this stage can be carried out during a **meeting** between the district staff and staff from all health facilities, during which:

- The district and health facility staff work together to make individual maps and session plans for each health facility catchment area.
- The district and health facility staff put all information together and revise the draft district session plan based upon the practical details provided by the session plans of each health facility.
- Every health facility makes a workplan based upon its session plan.
- Finally all the health facility workplans are consolidated into a single district workplan showing when and where each health facility session will be held.

Stage 3 — Regular review of plans

Once the district workplan has been consolidated it can be used to plan supervisory visits, to take corrective action and to adjust session plans according to need.

1.1 Stage 1: Initial planning by district

1.1.1 Creating an operational map of your district

To plan sufficient sessions to reach all infants and women in your district, you will have to know your area well. The best way to start is to draw a map of the area served by your district. This will help you determine which populations will be served by fixed sessions and which ones will require outreach and/or other strategies such as mobile sessions. Drawing a map is a simple tool that will help you plan how to reach all the infants and women in your area.

Step 1: Draw a simple map of your district. It does not have to be to scale, but it should contain all the important features of the district. Mark the following information on the map:

- each village, town and health facility;
- the total population and target population[1] of each village and town;
- all known high risk or priority areas;
- roads;
- geographical landmarks (rivers, streams, mountains).

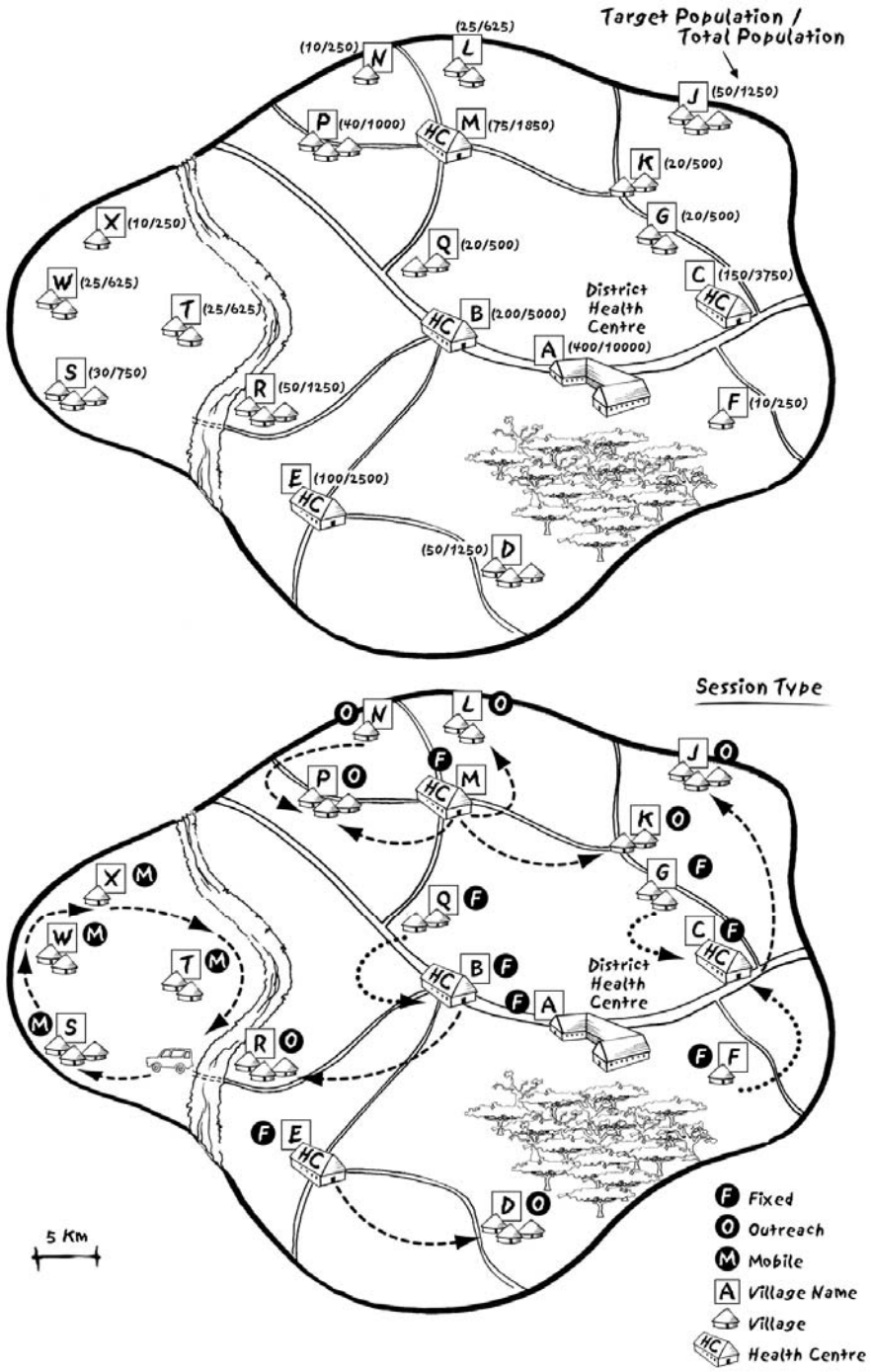
Step 2: Using the district map, decide the type of session suitable for each village/town in your district (fixed, outreach, mobile).

On the map, mark what kind of session will be used to reach each village or town using the letters F (fixed), O (outreach), M (mobile). For outreach and mobile, use arrows to show how they will be reached. Figure 5A shows an example of a district map drawn in two stages for the purpose of this module. In real situations you will need one map which shows all the information together — populations, features and session types. Figure 5A shows a rural area. For an urban area however it is still useful to have a map showing population distribution and location of health facilities.

[1] In this example, for the target population we use 4% of the total population, but this will vary from country to country. If population data is not available, try looking at the records from past NIDs. The tally sheets and reports from NIDs often list the total number of children under age 5 reached by village for each round. Dividing this total by 5 will give an approximate number for the infant population, i.e. your target population

Figure 5A: Sample district map with all health facilities, villages/towns, their total population, target population, and session type

This example has been drawn in two stages, the first showing population and major features, the second showing session types needed to reach the population. In a real situation all the information should be displayed on one map.



1.1.2 Making a district session plan including all health facilities and populations in the district

Step 1: In Table 5.1, complete columns I, II, III, IV, V from the data on the map

Create a table listing each village and town, its population and target population (see Table 5.1). On the table and map, against each village/town, write down the type of session needed and which health facility will serve that village/town, following the map (Figure 5A). Annex 1 gives some simple guidelines to select the type of session needed.

Step 2: Calculate number of injections needed per year (column VI)

In this module we use number of injections as a measure of the workload during an immunization session. First, decide how many injections are needed to fully immunize an infant in your district. At a minimum an infant will need five injections (BCG, DTP/DTP-HepB multiplied by three, measles). In addition, two TT doses are needed to immunize pregnant women. This makes a total of five infant injections, plus two injections of TT for pregnant women[1] which makes up seven injections in all for full immunization of an infant and pregnant woman. However, the total of seven injections is only a minimum and some countries may use up to 10 injections (e.g. adding monodose HepB, yellow fever). For this example we will use seven injections.

To calculate the minimum number of injections per year multiply the annual target population by seven.

Step 3: Calculate number of injections needed per month (column VII)

To calculate the monthly total, divide the yearly total by 12.

Step 4: Calculate number of sessions needed per month at each fixed and outreach site (column VIII).

You now need to decide how many injections can reasonably be given by health staff during one fixed session and one outreach session. For this module, we assume that a fixed session in a health facility can reasonably deliver at least 70 injections per session, and an outreach session at least 35 injections per session. However this number may vary depending on your local conditions, i.e. number of staff, availability of vaccines and other supplies etc. As a general rule at least four sessions per year will be needed at each outreach or mobile team site to fully immunize all infants.

To calculate the number of sessions per month:
Divide number of injections needed per month by 70 for a fixed site.
Divide number of injections needed per month by 35 for an outreach site.

If the result of these calculations is not practical then you can increase or decrease the workload accordingly. For example, four sessions per month (one per week) is easier to manage than five.

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[1] In most countries pregnant women are targeted for routine TT immunization. While not every pregnant woman will require two doses of TT, this module assumes that all planning will have to include two doses of TT for each pregnant woman. It is acknowledged that in some countries routine TT immunization targets all women of childbearing age. In such cases, appopriate changes to this text will be needed.

Table 5.1: Example of district session plan

Village/town	Total population	Target population (*4% of total population for this exercise)*	Health facility providing service	Session type: *Fixed/outreach/ mobile*	Injections per year*(target population X 7)*	Injections per month (*injections per year divided by 12)*	Sessions per month *(divide by 70 for Fixed and 35 for Outreach)*	Sessions per month (rounded) *Fixed >=70 injections per session, or Outreach >=35 injections per session*
I	II	III	IV	V	VI	VII	VIII	IX
A	10 000	400	**DISTRICT HC**	Fixed	2800	233	3.33	4
B	5000	200	**HC**	Fixed	1400	117+12= 129	1.84	2
C	3750	150	**HC**	Fixed	1050	88+6+12= 106	1.51	2
D	1250	50	outreach from **E**	Outreach	350	29	0.82	1
E	2500	100	**HC**	Fixed	700	58	0.83	1
F	250	10	can reach **C**	Fixed at **C**	70	6 (add to C)	-	-
G	500	20	can reach **C**	Fixed at **C**	140	12 (add to C)	-	-
J	1250	50	outreach from **C**	Outreach	350	29	0.82	1
K	500	20	outreach from **M**	Outreach	140	12	0.34	1
L	625	25	outreach from **M**	Outreach	175	15	0. 43	1
M	1875	75	**HC**	Fixed	525	44	0.63	1
N	250	10	share outreach at **P**	Outreach at **P**	70	6 (add to P)	-	-
P	1000	40	outreach from **M**	Outreach	280	23 + 6 = 29	0.82	1
Q	500	20	can reach **B**	Fixed at **B**	140	12 (add to B)	-	-
R	1250	50	outreach from **B**	Outreach	350	29	0.82	1
S	750	30	river passable in dry season	Mobile	210	Atleast four mobile team visits per year in dry season to serve villages S, T, W & X. Workload (no. of injections) per mobile team visit = Annual workload S, T, W, X)/4 i.e. 158 injections per mobile team visit.		
T	625	25	river passable in dry season	Mobile	175			
W	625	25	river passable in dry season	Mobile	175			
X	250	10	river passable in dry season	Mobile	70			
TOTAL	35 250	1410			9870			

- If population data are unknown, use recent polio NIDs results. Divide the number of under 5 children by five to get the approximate number of infants.
- Fixed site if health facility is within easy reach, maximum five km.
- Outreach: beyond reach of fixed, but can be reached by health facility staff using existing resources.
- Mobile team if population cannot be reached by regular outreach. Will need extra resources for transport and supplies. Minimum four times per year.

1.1.3 Making a session plan for each health facility based on district session plan

Once the draft district plan is ready, the district should provide each health facility with a session plan for their catchment area (extracted from the district plan). Table 5.2 shows an example of a session plan for health facility M.

Table 5.2: Example of session plan for health facility M

Village / town	**Total population**	**Target population** ***(4% of total population for this exercise)***	**Session type** ***Fixed / Outreach / Mobile***	**Injections per year** ***(target population X 7)***	**Injections per month** ***(injections per year divided by 12)***	**Sessions per month** ***Fixed >= 70 injections per session, or Outreach >= 35 injections per session***	**Transport for outreach**	**Person(s) responsible**
M	1875	75	HC	525	43	1	None	
K	500	20	outreach from M	140	12	1	motorbike	
L	625	25	outreach from M	175	15	1	bicycle	
P and N[a]	1000+250	40+10	outreach from M	280+70	23+6	1	motorbike	

[a]according to the map, village N shares outreach with village P

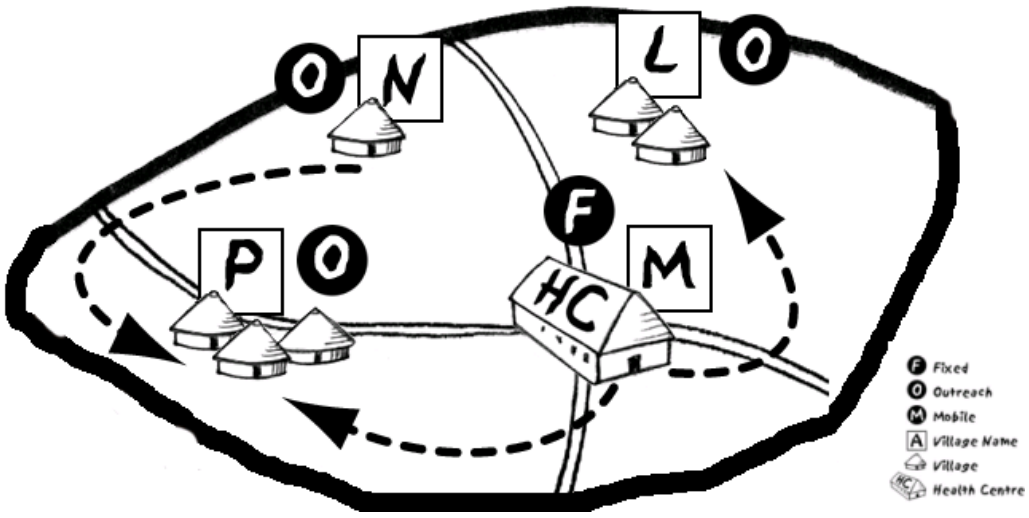
1.2 Stage 2: Joint planning for district and health facility staff

Once the district has an operational map and a **draft** session plan (Stage 1), the next stage will be to make maps and session plans with each health facility during a planning meeting. The district map and session plan will provide the basis for this process, but each health facility should provide its own information, even if this differs from the district plan. After this has been done, the differences can be discussed and incorporated into a **revised** district session plan and workplan.

1.2.1 Creating an operational map of each health facility catchment area

Every health facility should have a map that shows the distribution of population in its catchment area, in the same way as the district map. Having established the catchment area for each health facility, the district level should help health facility staff draw up a map of their catchment area. Here is a simple example of a health facility map extracted from the district map. Figure 5B shows how health facility M provides a fixed site service (F) and outreach sessions to villages L and P. Village N joins the outreach session held at P.

Figure 5B: Example of map for health facility M



1.2.2 Discussing and revising district session plan based on feedback from each health facility

The district staff should individually discuss with health facility staff, their specific session plans. Health facility staff may be able to provide important changes to the session plan based on the their local knowledge of the community (for example the health facility may not be able to provide a regular outreach session for a particular village because the distance had been underestimated by the district). The district session plan may need to be amended based on discussions with health facility staff. Once the district session plan has been finalized, each health facility can prepare a workplan to show how the sessions will be conducted.

1.2.3 Making a workplan for each health facility

Every health facility should make its own workplan showing how every village or community will receive immunization services throughout the year. The immunization workplan should be integrated with other health activities provided by the health facility. The workplan should not be considered as something which is fixed at the beginning of the year. It will need updating and changing based upon data obtained through regular monitoring and problem-solving activities (as discussed in Module 7). Table 5.3 shows a quarterly workplan which can be updated with new activities each quarter.

Table 5.3: Example of immunization workplan for first quarter 2003: Health facility M conducting outreach at K, L, P

Village	**Session plan**	**Jan (with examples)**	**Feb (with examples)**	**Mar**
M	Fixed session 1st Wednesday	Date scheduled 1 Jan Date held ___	Date scheduled 5 Feb Date held ___	Date scheduled 5 Mar Date held_____
K	Outreach every 2nd Wednesday at community facility	Date scheduled 16 Jan Date held ___ Transport: motorbike	Date scheduled 12 Feb Date held ___ Transport: motorbike	Date scheduled 12 Mar Date held_____ Transport: motorbike
L	Outreach every 3rd Wednesday at community facility	Date scheduled 22 Jan Date held ___ Transport: bicycle	Date scheduled 19 Feb Date held ___ Transport: bicycle	Date scheduled 26 Feb Date held_____ Transport: bicycle
P and N	Outreach every 4th Wednesday at community centre at village P	Date scheduled 29 Jan Date held ___ Transport: motorbike	Date scheduled 26 Feb Date held ___ Transport: motorbike	Date scheduled 26 Mar Date held_____ Transport: motorbike
Activities planned for this quarter		1. Training in AD syringe use 2. Meet community leaders monthly	1. Supply safety boxes for every session 2. Ensure pregnant women get TT at outreach	1. Quarterly meeting 28 March 2. Training in VVM use
New activities to solve problems (based on data analysis and monitoring)		1. Report staff shortages, request help from district 2. Visit migrant community	1. Reschedule outreach at K 2. Request extra resources for migrant community	1. Plan outreach for migrants 2. Follow up defaulters in village M
Monitoring of session implementation		Number of sessions held in Jan: Number of sessions planned in Jan:	Number of sessions held in Feb: Number of sessions planned in Feb:	Number of sessions held in Mar. Number of sessions planned in Mar.

Steps to prepare a workplan for a health facility

1. In the first column write the names of the villages served by the health facility.

2. In the second column write how often it is planned to reach each village and what strategy will be used. This is based upon your revised "district session plan" (Table 5.1) and your own session plan (Table 5.2) which shows the number of sessions per month, and whether these will be fixed, outreach or mobile, and where they will be held.

3. In the "month" columns write the date scheduled, and the date held, for each session, and the transport required for the outreach sessions.

4. Under each month write down what other activities you plan to carry out, for example community meetings, training sessions, monthly meetings, scheduled campaigns.

5. At least every quarter, review and analyse the data you are collecting, and modify the workplan by adding activities needed to solve problems encountered (see Module 7). Add these new activities to the next quarter workplan.

6. In the last row, monitor the completeness of the monthly sessions planned by totalling sessions held and sessions planned.

1.2.4 Consolidating health facility workplans into a comprehensive district workplan

Annex 2 shows an example of a district workplan**.** The district workplan is compiled from all the separate health facility workplans (Figure 5C). This way it is possible to see in one table the immunization sessions being held in your district on a day by day basis. It is best to update the district workplan every three months.

Check the quality of your planning

- Are <u>all</u> villages covered by the session plan and workplan with at least four sessions per year?
- Are all temporary settlements, minorities, underserved groups covered by the session and workplan with at least four sessions per year?
- Is there any overlap/double booking (e.g. mobile team scheduled to be at two places at the same time)?
- Is there enough staff time to implement all the planned sessions? If not where can the sessions be combined?
- Is it clear who will consult with communities and inform them of the date/place of next sessions?

1.3 Stage 3: Regular review of plans

1.3.1 Adding supervisory visits to the district workplan

You can use the district workplan to plan supervisory visits. These should be scheduled to coincide with immunization activities in each health facility. Annex 2 shows how

supervisory visits can be scheduled on the district workplan. In this example the letter "S" is added to a scheduled session to indicate a supervisory visit.

You should make at least one supervisory visit to one site each week and plan to supervise both fixed and outreach immunization sessions.

1.3.2 Taking corrective action every quarter based on data analysis

Planning immunization sessions is one step in a cycle that includes regular monitoring, analysis and problem-solving to improve the service. Module 7 shows how to collect, monitor and analyse data.

In addition to revising your session plans regularly, you should also revise your workplan. This is often done during a district meeting of health facility staff. Module 7 discusses how to identify problems and solutions and how to take corrective action based upon that information. The corrective activities by month can be added to the health facility workplan.

At district level too, new activities can be added to the workplan, based upon regular analysis of data. Activities can be planned to correct problems, such as including training in specific areas during supervisory visits.

1.3.3 Reviewing and adjusting session plans

You must regularly (i.e. every three to six months) review the plan for sessions (fixed/outreach/mobile, frequency and quality) in your area.

You should look at how the quality of the sessions can be improved, for example by making sure people know the dates and sessions happen on scheduled dates, ensuring there are enough vaccines and supplies (Section 4) and safe injection practices are observed (Module 4).

Also see if the current sessions are sufficiently used by the community. If sessions in some areas have very low attendance, see if better communication is needed, or if it is better to change the time or location of a session, or make it less frequent and /or add another session elsewhere. Module 7, Annex 6, provides guidelines on obtaining feedback from the community.

Any change in the session plan (frequency, change of date or location) should be done in consultation with the community, and mothers should be informed well in advance about the changes.

2. Special planning issues

2.1 Special planning for mobile teams in hard-to-reach areas

In almost every country there are areas that cannot be reached regularly throughout the year. This may be due to many factors, including remoteness, and seasonal factors such as flooding in the rainy season. Under these circumstances, using mobile teams may be the best way to provide immunization services (see Annex 1).

Mobile teams provide outreach services but work like a small regular campaign. They can visit several sites over the course of one or more days during the dry season. Since mobile teams will only have a few days in which to do their work, careful planning is needed.

Mobile teams will need extra resources. Therefore, planning should be carried out in consultation between health facility, district and other levels.

1. **Decide which areas need mobile teams.**

Refer to the map and session plan in Section 1. When making the plan indicate which areas need mobile teams.

2. **Decide how many times per year the mobile team should visit these areas.**

A minimum of four visits will be needed to fully immunize infants and pregnant women.[1]

3. **Consider what other interventions can be added to immunization when the area is infrequently visited, e.g. malaria control, vitamin A supplementation, anti-parasitic control.**

Annex 1 describes the special function of mobile teams in contrast to fixed site and outreach sessions. A mobile team session offers a special opportunity to add other interventions to the immunization service. These may include vitamin A and other nutritional supplementation, provision of insecticide-treated mosquito nets (ITNs), and antihelminthiasis treatment etc. according to local need and operational feasibility.

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[1] Ideally all infants should receive BCG at birth. In addition, in many countries birth doses of OPV and HepB vaccine are included in the national policy. However, many infants have no contact with health facilities at birth, therefore in this section we state that an infant can be fully immunized with a *minimum* of 4 contacts:
Contact 1: BCG, DTP1, HepB1, OPV1
Contact 2: DTP2, HepB2, OPV2
Contact 3: DTP3, HepB3, OPV3
Contact 4: Measles, vitamin A
(Of course, in each session all vaccines due should be given, i.e. in session 2, not only DTP2, HepB2, OPV2). TT immunization can be given at any contact.

4. Estimate resources needed and submit the plan to the next administrative level.

These include vehicle, driver, fuel, extra staff, extra supplies for other interventions.

5. Request vaccine and supplies for mobile teams.

Request the province level for vaccine, cold box and other immunization supplies. It is easier to bring these from the province with the mobile team vehicle than to use district supplies.

6. Carefully plan the route and notify the communities in advance.

Mobilization of the communities is vital when mobile team visits are infrequent. Ideally, plan the visits well in advance and communicate the time and place of each site to each community well in advance.

7. Look for opportunities for joint planning and pooling of resources with other teams, to deliver various interventions.

The opportunity to deliver other interventions with immunization to under-served areas will be welcomed by other teams (malaria, nutrition etc). Planning and implementing together will ensure efficient use of resources.

8. Make a schedule for mobile team visits.

Table 5.4 shows an example of a schedule for mobile team visits. You should decide first what other interventions are needed and how these will be provided. The schedule for mobile teams needs to be discussed with the various other teams (malaria, nutrition etc.) and be approved by the appropriate level, since additional resources, e.g. vehicle, driver etc, are required.

9. Use polio plans, data, and results of NIDs to make detailed mobile team plans.

Mobile teams do <u>not</u> usually work "house-to-house" as in some polio NIDs. However the information on population size and distribution from polio NIDs done in the area will be very useful for planning.

10. Consider increasing the target group to under 24 months, since four contacts may not be sufficient to fully immunize the whole birth cohort.

Table 5.4: Sample mobile team schedule for the year (taken from Table 5.1)

Villages	Target population	Injections per year (target population X 7)	Workload per session	Other interventions planned	Planned dates	Vehicle needs	Staff needs
S, T, W, X	90	630	158 injections per mobile team visit	1. Vit. A 2. Malaria bednets	6 Jan. 5 Mar. 4 May 6 Oct.	Province car	Health Workers + driver

Table 5.4 shows an annual schedule for reaching all four villages S, T, W, X four times a year.

2.2 Special planning issues for urban immunization services

High population density, poor sanitation and poor nutrition often found in urban areas, lead to higher transmission of diseases, infection of younger children and higher mortality.

Providing immunization services in crowded urban areas differs from rural areas for many reasons, including the following:

- Poor primary health care infrastructure in some urban areas.
- High mobility of the resident population.
- The existence of "illegal" settlements that are not officially recognized by the government.
- The existence of marginalized populations (religious or ethnic minorities, refugees).
- Absence of information on the size of the population living in "slum" areas.
- Inadequate government planning and budget to provide primary health care services to these areas.

The key to provision of adequate immunization facilities to the urban areas is regular, high quality, uninterrupted service at accessible delivery points.

Urban immunization services may be operationalized in the following way:

1. **Fixed site, fixed time provision of services. This should include:**

- All fixed sites including dispensaries, clinics and maternity homes in the public sector.
- All NGOs engaged in providing health care in urban areas.
- Any private practitioner willing and able to be part of this network.

2. **Communication through health workers, NGOs active in the area, print media, television, radio about the following:**

- the timing of local immunization services;
- local service delivery points;
- the vaccines and schedule of immunization;
- the benefits of immunization.

3. **Urban outreach: expanding the network of urban service provision points from the health facility:**

- Establish contact with the local leader and obtain support.
- Estimate size of population and frequency of sessions (same as with rural areas).
- Set up a site in every urban slum, with a team of two trained vaccinators, to provide immunization services on a regular (weekly or monthly) basis.
- Use the same principles for creating a session plan and workplan (described in previous section) for the expanded network of urban outreach.
- Plan location of sites, frequency, and timing of service, to suit the local population.
- Communicate time and dates of sessions to the community (using existing channels in the community like loudspeakers, religious or mothers' groups etc.).
- Ensure a regular uninterrupted service to gain the trust and cooperation of the community.

Careful planning is absolutely necessary to achieve high immunization coverage rates. Planning ensures that adequate supplies, vaccines, staff etc. can be made available. But good planning also entails that recipients know in advance when the next immunization session will be held.

Remember: Do not blame the community for low attendance at sessions. Low attendance is often caused by poor planning and/or poor communication by service providers.

3. Estimating vaccine and supply needs

At each session — whether fixed, outreach, or mobile — it is essential to have sufficient supplies immediately available. Remember that mothers may be making great efforts to attend immunization sessions with their infants. If there are not enough vaccines or syringes at the session and mothers have to return home with their children not immunized, the community will lose confidence in the service.

This section deals with how you can make sure that, at the district and health facility level, you have sufficient vaccine and supplies available for each session on your monthly workplan.

3.1 Estimating the vaccine and supply needs for a session

Fixed session

Table 5.5 shows the minimum level of vaccine and supplies which should be available at the time of a fixed session of 70 injections, plus OPV and including TT for pregnant women. Note that these calculations do not need any allowance for wastage, since the session is being conducted at a fixed site (in a health facility by definition), where there is access to additional vials and supplies in the health facility. You should have access to at least one extra vial of each vaccine plus diluent, and 10% extra syringes during the fixed session.

Outreach session

Table 5.6 shows the minimum level of vaccine and supplies which should be available for an outreach session of 35 injections, plus OPV and including TT for pregnant women. These figures can help when deciding how much vaccine and supplies to take before leaving the health facility to do an outreach session. In addition to this minimal supply it is safer to take an extra vial of each vaccine and some extra syringes as a safeguard against running out of vaccine. If you think there will be more than 35 injections to be given at a single outreach session, it is easiest just to double the supplies you take. As previously stated, these are assumptions used for this module; you may need to increase or decrease the number of injections, and therefore the supplies needed, according to your circumstances.

Estimating vaccine needs for routine tetanus toxoid for women

Some countries provide TT for pregnant women only, others provide TT for all women of childbearing age as well. The number of women requiring TT immunization during any given session can vary greatly. Therefore it is better to ensure that at every infant immunization session there are additional TT vaccine vials and syringes to immunize all

eligible women. A simple rule to follow is to initially assume a maximum of 20 TT injections are included in every 70-injection session, and 10 TT injections in every 35-injection session, and add sufficient supplies accordingly.

These are simple operational calculations that can help you to ensure a minimum level of vaccine and supplies for any session. However they are not meant to be an alternative means of calculating national vaccine supply needs since this is done on a population basis.

Table 5.5 Vaccines and supplies needs for a 70 injections session for infants and TT for pregnant women (and the option of HepB monovalent)

Fixed session	BCG (20 dose vials)	OPV (10 dose vials)	DTP or DTP-HepB (10 dose vials)	(HepB) (10 dose vials)	Measles (10 dose vials)	TT (women, 10 dose vial)	AD syringes for BCG	AD syringes for other vaccines	Mixing syringes 5ml: 1 BCG, 1 measles	Safety boxes
Number of injections	10	30	30	(30)	10	20				
Session needs	1 vial + 1 diluent ampoule	3 vials	3 vials	(3 vials)	1 vial + diluent ampoule	2 vials	20	60 (+30)	2	1

Table 5.6 Vaccine and supply needs for a 35 injections session for infants and TT for pregnant women

Outreach session	BCG (20 dose vials)	OPV (10 dose vials)	DTP or DTP/HepB (10 dose vials)	(HepB) (10 dose vials)	Measles (10 dose vials)	TT (women, 10 dose vial)	AD syringes for BCG	AD syringes for other vaccines	Mixing syringes 5ml: 1 BCG, 1 measles	Safety boxes
Number of injections (vials/syringes)	5	15	15	(15)	5	10				
Session Needs (vials/syringes)	1 vial + diluent ampoule	2 vials	2 vials	(2 vials)	1 vial + diluent ampoule	1 vial	20	40 (+20)	2	1

Assumptions about sessions:

- If seven injections are needed to fully immunize an infant and pregnant women: BCG will be one seventh (1/7), measles one seventh (1/7), DTP or DTP/HepB three seventh (3/7), and TT two sevenths (2/7), making seven in all. Of course other non-injectable antigens (OPV) and interventions (Vitamin A) will also be given.
- This table shows the minimum requirements for a session of 70 injections for a fixed session or 35 injections for an outreach session (only an estimate).
- If monovalent HepB is provided the number of injections will increase from seven to 10 (70 to 100 injections per session). In yellow fever-endemic countries, yellow fever vaccine will need to be added. The session needs for yellow fever vaccine are the same as for measles vaccine.
- Note that the needs at service delivery level are shown as number of *vials*, not number of *doses.*
- Always take sufficient AD syringes to match the number of doses in each vial.

3.2 Estimating the vaccine and supply needs for each health facility and for the entire district for one month

At the district level you will receive vaccine on a monthly basis from the province level. The amount of vaccine you receive will be based upon the doses needed for the population you serve, with a wastage multiplication factor. It is the district's job to distribute the vaccine and other supplies to every health facility to enable it to conduct its planned fixed and outreach sessions.

The best way to provide vaccine from district to health facility level is according to the number of vials required for each session, rather than doses required. This is because the exact number of infants attending each session will not be known in advance, and opened vials often have to be discarded at the end of a session (this applies to all reconstituted freeze-dried vaccine vials, and other vaccines where the multi-dose vial policy is not feasible).

The following steps describe a simple operational method of estimating first how much vaccine and supplies are needed by each health facility and secondly how much are needed for the whole district.

3.2.1 Making an operational estimate of the needs for one health facility for a month

1. Refer to Tables 5.5 and 5.6 to make operational estimates of vaccine vials and supplies needed for a single fixed and outreach session.

2. Refer to the district session plan (Table 5.1 and Table 5.2), which shows the total planned sessions by health facility according to type of session — fixed and outreach.

3. Calculate the needs for each health facility by multiplying the needs for each type of session by the number of sessions planned.

Table 5.7 shows how this is done for health facility M. This operational estimate will be accurate enough for most sessions according to the estimated workload (70 injections for fixed site, 35 injections for outreach). If some sessions are expected to be larger, add one or more extra vials and the equivalent numbers of syringes.

Table 5.7: Operational method of estimating needs of health facility M

Vaccine vials	Needed for one fixed session (Refer to example in Table 5.5) A	Number of fixed sessions (Refer to example in Table 5.2) B	Total C=A*B	Number needed for one outreach session (Refer to example in Table 5.6) D	Number of outreach sessions (Refer to example in Table 5.2) E	Total F=D*E	Grand total G=C+F
BCG 20 dose vials plus diluent	1	1	**1**	1	3	**3**	**4**
DTP/HepB 10 dose vials	3	1	**3**	2	3	**6**	**9**
OPV 10 dose vials	3	1	**3**	2	3	**6**	**9**
Measles 10 dose vials plus diluent	1	1	**1**	1	3	**3**	**4**
TT 10 dose vials	2	1	**2**	1	3	**3**	**5**
BCG AD syringes	20	1	**20**	20	3	**60**	**80**
Standard AD syringes	30+10+ 20 = 60	1	**60**	20+10+10 = 40	3	**120**	**180**
Mixing syringes	1+1=2	1	**2**	1+1=2	3	**6**	**8**
Safety boxes (100 per box)			**1**			**2**	**3**

3.2.2 Making an operational estimate of the needs for all health facilities in your district for one month

To make an operational estimate of monthly supplies needed for distribution to all health facilities, multiply the individual session needs by the total number of sessions of each type (fixed and outreach), and then add all session needs to get monthly needs, as in Table 5.8.

The *operational* estimate of district monthly supplies in Table 5.8 will tell you the approximate amount of vaccine vials and supplies you will need to have in your district store to meet the requirements for distribution to all the health facilities for their planned fixed and outreach sessions.

You should ensure that the monthly level of supplies received into the district — which is based upon population numbers and doses with a standard wastage rate — is not lower than this operational estimate. If there is a considerable difference between the amounts you consume and the amounts you receive, discuss the issue with the higher level to identify the causes (difference in population estimates, higher wastage rates than anticipated, non-adherence to MDVP etc.) to find a solution. Annex 3 discusses this in

more detail. You should also avoid over-stocking vaccines by adjusting your monthly order according to the existing stock balance.

Special issues for AD syringes supply

The supply of AD syringes must match the supply of vaccine available at every session. AD syringes are usually ordered with a 10% wastage factor. This wastage factor takes into account normal handling problems, but it is very important to ensure that the AD syringes supply intended for immunization is not used for other purposes.

Table 5.8: Operational estimate of district monthly vaccine and supply needs

Vaccine vials	**Needed for one fixed session** (Refer to example in Table 5.5) A	**Number of fixed sessions** (Refer to example in Table 5.1) B	**Total** C=A*B	**Number needed for one outreach session** (Refer to example in Table 5.6) D	**Number of outreach sessions** (Refer to example in Table 5.1) E	**Total** F=D*E	**Grand total** G=C+F
BCG 20 dose vials plus diluent	1	10	**10**	1	6	**6**	**16**
DTP/HepB 10 dose vials	3	10	**30**	2	6	**12**	**42**
OPV 10 dose vials	3	10	**30**	2	6	**12**	**42**
Measles 10 dose vials plus diluent	1	10	**10**	1	6	**6**	**16**
TT 10 dose vials	2	10	**20**	1	6	**6**	**26**
BCG AD syringes	20	10	**200**	20	6	**120**	**320**
Standard AD syringes	30+10+ 20 = 60	10	**600**	20+10+10 = 40	6	**240**	**840**
Mixing syringes	1+1=2	10	**20**	1+1=2	6	**12**	**32**
Safety boxes (100 per box)			**8**			**3**	**11**

3.2.3 Making the best use of vaccine and supply stocks

Vaccines and AD syringes should be used as well as possible. Here are some tips to help ensure that optimal levels of supplies are available, while reducing wastage.

1. When ordering vaccine and supplies always adjust for the amount in stock.

2. Use multi-dose vial policy whenever applicable.

3. Try to maximize attendance at every session:
   — Follow up on defaulters
   — Ensure good communication of session dates, times and locations
   — Keep reliable sessions according to the plan
   — Monitor attendance and combine small sessions where feasible.
4. Use the most accurate population estimates to avoid shortage of supplies.

4. Stock management

4.1 Stock management at district level and health facility level

Wherever vaccines are stored, a system of stock management must be in place to record vaccines received, and vaccines dispatched or used. This will make sure that vaccines are used before their expiry date, that the status of VVM is recorded at receipt and issue, and that there are no stock-outs, or over-stocking.

Two simple and practical methods are described below. These methods take into account that different batches of vaccine and supplies will be received on a regular basis and dispatched to the network of health facilities, or issued to health workers for immunization sessions.

It is important to distinguish between different batches of vaccine because they may have different expiry dates and should be used accordingly. Also, in the rare situation that there is a serious adverse event, it will be useful to know the exact description of the vaccine (manufacturer, batch number[1] etc).

Method 1: Using a simple exercise book for stock management each year (see Figure 5D).

1. Divide the book into separate sections of several pages for each type of vaccine (or other supplies/equipment) used.

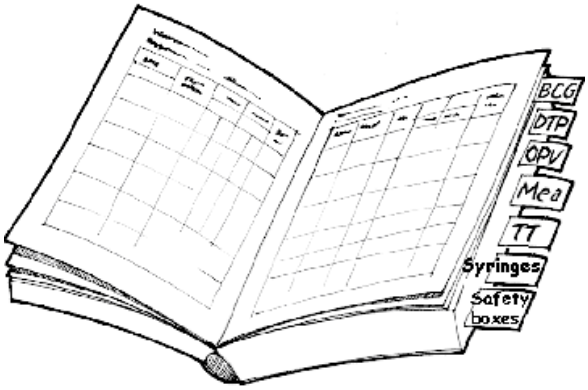
- Prepare tables for each vaccine and label columns as shown in Table 5.9. Facing pages of the exercise book are used to record the details of each vaccine or AD syringes or diluents or other supplies/equipment.

- For each supply of vaccine received or issued, all details including batch number, date of expiry, VVM status, quantity etc. should be recorded. Quantities of other supplies should be recorded in the same way.

- After each receipt or issue, the balance in stock should be calculated and recorded. The balance recorded should be physically checked and verified at periodic intervals (e.g. once every quarter).

[1] Batch number, also called Lot number or serial number

Figure 5D: Simple exercise book to keep records of stock received and issued



Method 2: Using stock cards (see Figure 5E).

1. Take a box (this should preferably be of durable material like aluminium sheet or plastic, but a good shoebox can work temporarily) and divide it into separate sections, which can take several stock cards for each type of vaccine (or other supplies/equipment) used.

- Prepare a card for each vaccine and label columns as shown in Table 5.9. A separate card is used to record the details of each type of vaccine or AD syringes (including a different card for different vial sizes) or diluents or other supplies/equipment.

- Between each bunch of stock cards (for each type of vaccine or other equipment) a separator should be placed which is slightly bigger than the stock cards and indicates the vaccine or other material whose stock cards are immediately behind it. As shown in figure 5E.

- For each supply received or issued, all details including batch number, date of expiry, VVM status, quantity etc. should be noted.

- After each receipt or issue, the balance in stock should be calculated and recorded. The balance recorded should be physically checked and verified at periodic intervals (e.g. once every quarter).

Figure 5E: Simple box to keep stock cards

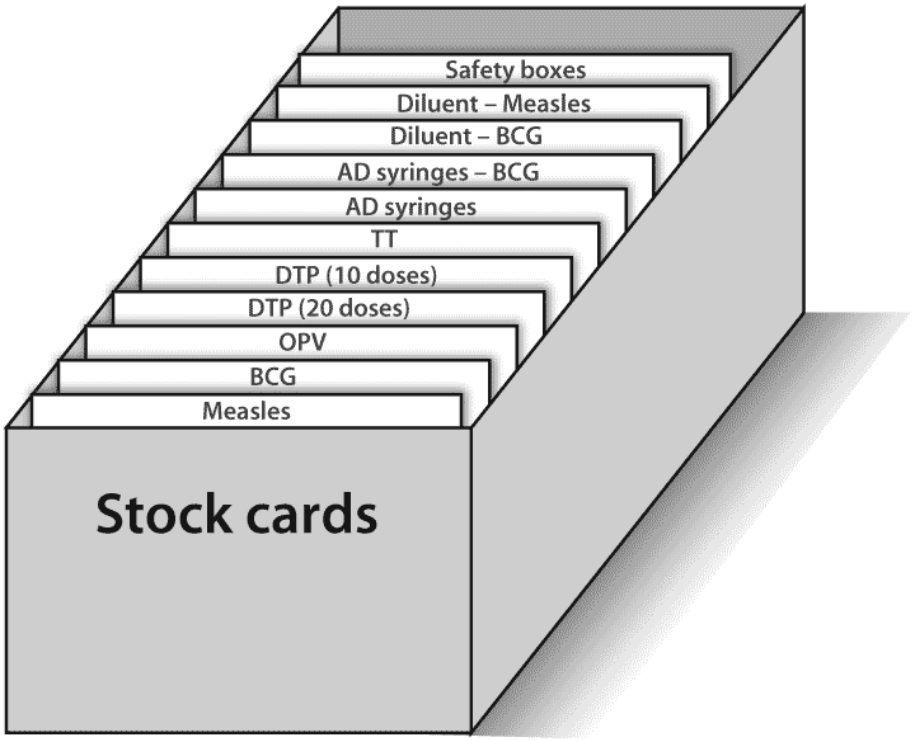


Table 5.9: Vaccine stock management at district level and health facilities (to be used as a card or page in an exercise book)

Store name: _____ Item name: Vaccine/Diluent/ AD Syringe/Safety Box/Other: _____

Vial size/ AD Syringe size: _____ District: _____ Province/State: _____

Date of Receipt OR Issue	Received from: Manufacturer/Supplier/ District store/Province store	Issued to: Store/ Health unit/ Worker	Batch number	Expiry date	VVM status	Quantity of vaccine/diluent/AD syringe/ safety box/other			Remarks
						Received* No. of vials X vial size	Issued * No. of vials X vial size	Balance* No. of vials X vial size	
				Balance carried forward from previous sheet:					
					Totals:				
								Physical stock check:	
								Carried forward:	

*Enter vaccines received, issued and balance in DOSES

5. Involving the community in planning

To make sure that your plan will be effective you will need to involve the community you serve. For detailed information, see Module 8 on building links with the community.

5.1 Spend time with local government officials and community leaders

Local officials and community leaders can help you decide:

- when to hold immunization sessions;
- where to hold outreach sessions;
- who can help you mobilize the community; and
- who can help you during sessions.

Local leaders play an important role in their communities. They can help you reduce resistance, deal with rumours, and handle other situations that may affect the success of immunization sessions. They should be well informed about your activities. In some areas they maintain a complete register of the community. Ask them to help you reach people who do not normally use immunization services.

5.2 Identify a local contact person

A local contact person is someone who can help you:

- remind mothers when to bring their children for vaccines;
- alert mothers that the vaccination session will take place on the following day;
- spread the word in the village that the outreach team has arrived;
- encourage women to obtain their tetanus toxoid injections;
- organize sessions beyond the health facility, and
- help set up an immunization session and, in some countries, administer oral polio vaccine (OPV) and vitamin A supplements after being trained to do these tasks.

5.3 Train local people

Local persons should be trained on the following:

- to follow up on clients who do not return for second or third doses;
- to follow up on newborns who have not begun their immunization;
- to organize patient flow;
- to complete immunization cards;
- to administer OPV and vitamin A supplements;
- to provide health education;
- to distribute written information.

Local volunteers are critical in identifying newborns and reaching mothers who have not immunized their children. Consider recognizing the contributions of your volunteers by giving them a hat or a badge.

5.4 Give feedback to people in the community

Keep people informed and involved by continually sharing with them information on:

- whether the incidence of disease is going down because of immunization services;
- the number of children fully immunized against diseases;
- the number of newborns protected from neonatal tetanus;
- immunization coverage in percentage terms, and
- how close your health facility is to reaching your immunization goals;
- any outbreaks of diseases nearby for which they need to be vigilant (and encourage people to get vaccinated).

Feedback encourages people to become involved in identifying their own problems and finding solutions.

Annex 1

Guidelines to determine the immunization strategy

Table 5.10: Guidelines to determine the immunization delivery strategy

Type	Definition	Area served	Advantages	Disadvantages
Fixed site	• delivery of vaccination services **in** a health facility on a regular basis	• distance which mothers are prepared to travel to reach service • approx. five km	• reliable regular service, minimum one staff, low cost, no transport problems	• cannot reach much of the population in rural areas
Outreach	• delivery of vaccination services **from** a health facility on a regular basis. • sites are usually not fully equipped • health facility staff carries the needed equipment to the ""outreach site"	• area around the Health facility (catchment area) that Health facility staff can easily visit in a day • approx. 15 to 20 km depending on geographic barriers	• regular service • can reach populations beyond the fixed range	• needs good communication with communities • higher costs (transport, more than one person per site)
Mobile team	• delivery of vaccination services in areas beyond the "outreach area" (normal catchment area of a Health facility) on less frequent basis. • more than one site visited per session • health facility staff carries all the needed equipment to the "mobile site"	• area beyond the outreach area • especially for difficult to reach areas/populations • may be conducted over several days	• can reach difficult to reach areas/populations, previously unreached populations • If transport adequate, can include other interventions e.g. Malaria	• high costs (transport, fuel, per diem) • less reliable • subject to availability of extra resources

Annex 2
Sample district workplan

Table 5.11: District workplan showing immunization sessions provided by each health facility

Health Centre	1-Jan Wed	2-Jan Thu	3-Jan Fri	4-Jan Sat	5-Jan Sun	6-Jan Mon	7-Jan Tue	8-Jan Wed	9-Jan Thu	10-Jan Fri	11-Jan Sat	12-Jan Sun	13-Jan Mon	14-Jan Tue	15-Jan Wed	16-Jan Thu	17-Jan Fri	18-Jan Sat	19-Jan Sun	20-Jan Mon	21-Jan Tue	22-Jan Wed	23-Jan Thu	24-Jan Fri	25-Jan Sat	26-Jan Sun	27-Jan Mon	28-Jan Tue	29-Jan Wed	30-Jan Thu	31-Jan Fri
M	Fixed M S														Outreach at K							Outreach at L S							Outreach at P S		
E	Fixed E		Outreach at D																												
C	Fixed C		Outreach at J												Fixed C																
B	Fixed B					Outreach at R S									Fixed B																
A	Fixed A							Fixed A	Mobile to S & W S	Mobile to T & X S					Fixed A							Fixed A									

New activities for January based on data analysis — Supply: Review stock recording system in all health centres — Staff: Organize training on AD syringes — Service: Meeting with community leaders

Health centre	1-Feb Sat	2-Feb Sun	3-Feb Mon	4-Feb Tue	5-Feb Wed	6-Feb Thu	7-Feb Fri	8-Feb Sat	9-Feb Sun	10-Feb Mon	11-Feb Tue	12-Feb Wed	13-Feb Thu	14-Feb Fri	15-Feb Sat	16-Feb Sun	17-Feb Mon	18-Feb Tue	19-Feb Wed	20-Feb Thu	21-Feb Fri	22-Feb Sat	23-Feb Sun	24-Feb Mon	25-Feb Tue	26-Feb Wed	27-Feb Thu	28-Feb Fri
M					Fixed M							Outreach at K S							Outreach at L							Outreach at P		
E					Fixed E S		Outreach at D S																					
C					Fixed C		Outreach at J												Fixed C S									
B			Outreach at R		Fixed B														Fixed B									
A					Fixed A							Fixed A							Fixed A							Fixed A S		

New activities for February based on data analysis — Supply: Review cold chain management system — Staff: — Service:

Health centre	1-Mar Sat	2-Mar Sun	3-Mar Mon	4-Mar Tue	5-Mar Wed	6-Mar Thu	7-Mar Fri	8-Mar Sat	9-Mar Sun	10-Mar Mon	11-Mar Tue	12-Mar Wed	13-Mar Thu	14-Mar Fri	15-Mar Sat	16-Mar Sun	17-Mar Mon	18-Mar Tue	19-Mar Wed	20-Mar Thu	21-Mar Fri	22-Mar Sat	23-Mar Sun	24-Mar Mon	25-Mar Tue	26-Mar Wed	27-Mar Thu	28-Mar Fri	29-Mar Sat	30-Mar Sun	31-Mar Mon
M					Fixed M							Outreach at K							Outreach at L							Outreach at P S					
E					Fixed E		Outreach at D																								
C					Fixed C		Outreach at J S												Fixed C S												
B			Outreach at R		Fixed B														Fixed B												
A					Fixed A							Fixed A S							Fixed A							Fixed A					

New activities for February based on data analysis — Supply: — Staff: — Service: Review defaulter tracking system

Annex 3
Reducing vaccine wastage

Some degree of vaccine wastage is expected in any immunization service. Wastage can occur at any stage. It can occur in the cold store at central level, at various intermediate levels, at the point of use at an immunization session and during transportation. Reducing wastage depends upon better management at all levels. The factors associated with vaccine wastage can be classified as unavoidable and avoidable.

1. Unavoidable vaccine wastage factors

The most important unavoidable wastage factors involve:

- The use of reconstituted vaccines that have to be discarded at the end of the session.
- Other vaccines used in situations under which conditions for the multi-dose vial policy cannot be met.

2. Avoidable vaccine wastage factors

The following are some factors that can be controlled by improving vaccine management:

- Poor stock management resulting in over-supply and vaccines reaching expiry before use
- Cold chain failure that exposes vaccines to unacceptably high or low extremes of temperature.
- Incorrect dosage, e.g. the administration of three drops of OPV instead of two, or the injection of 0.6 ml of vaccine instead of 0.5 ml.
- Failure to comply with the multi-dose vial policy.
- Vials lost, broken or stolen.

3. Reducing vaccine wastage

In many countries where outreach is needed to reach all infants, vaccine wastage rates will need to remain at relatively high levels, especially for freeze-dried vaccines, in order to maintain and increase immunization coverage. Many factors influencing wastage are not associated with the point of use, therefore a change in existing policies for immunization staff is not needed.

However, at all levels measures to control and reduce avoidable vaccine wastage are very important. These include:

- At district level and above, regular reporting on stock levels, improved estimation of requirements and effective stock management.
- Improving district planning, with special regard to reliability of services.
- Planning sessions efficiently to balance session size and convenient opportunities.
- Using the multi-dose vial policy when appropriate.
- Establishing systems to monitor and regularly report vaccine wastage at all levels.

The corrective measures, however, should not be introduced at the expense of coverage (see Module 7).

4. Example of unavoidable wastage at outreach session

The following example (Table 5.13) shows the expected level of wastage when a single outreach session of 35 injections is conducted. Note that the wastage for freeze-dried vaccines is very high. Wastage for other vaccines can be greatly reduced by using the multi-dose vial policy provided the cold chain is maintained throughout, from point of use back to the health centre refrigerator. However careful management of stocks, the session plan and workplan can help reduce wastage.

Table 5.12: Vaccines required and wastage for one session of 35 injections including OPV and TT for pregnant women

Vaccine	Vial size	Vials used	Doses wasted	Wastage rate
DTP (3/7 of 35) = 15 doses	10 doses	2	(2 x 10) – 15 = 5 wasted	5/20 = 25%[a]
Measles (1/7 of 35) = 5 doses	10 doses	1	10 – 5 = 5 wasted	5/10 = 50%
BCG (1/7 of 35) = 5 doses)	20 doses	1	20 – 5 = 15 wasted	15/20 = 75%
OPV (21 doses) 3/7 of 35 = 15 doses	20 doses	1	20 – 15 = 5 wasted	5/20 = 25%[a]
TT (2/7 of 35) = 10 doses	10 doses	1	none	none

[a] Multi dose vial policy applicable

Remember

The goal is to immunize the maximum number of infants and women. R educing wastage should not be allowed to compromise this goal.

The opportunity to immunize may be more valuable than a dose of vaccine.

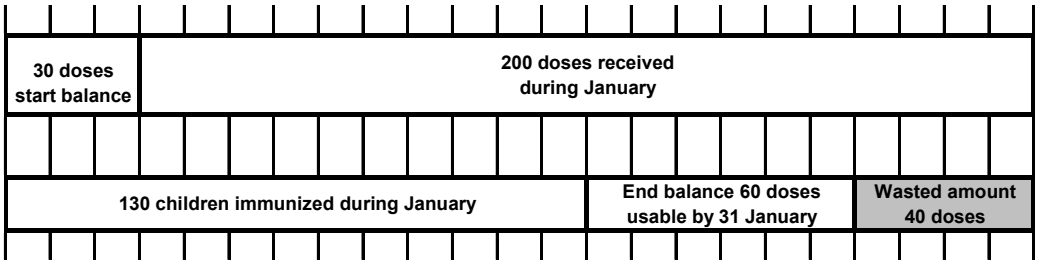
Annex 4
Vaccine wastage calculations at health facility level

Vaccine wastage rate = 100 *minus* vaccine usage rate

$$\text{Vaccine usage (rate)} = \frac{\text{Number of infants immunized during the period}}{\{\text{Number of usable doses at beginning of period}\} + \{\text{Number of doses received during period}\} - \{\text{Number of usable doses in stock at end of period}\}} \times 100$$

The example below explains how to calculate vaccine usage and wastage step by step:

Yenice district received 200 doses of DTP vaccine in 20 dose vials in January. During monthly reporting, 130 children were found to be recorded as immunized. They had 30 doses as a start balance on 1 January and by 31 January their stock level was 60 doses.



(Each block represents 10 doses)

Step 1: Calculate the number of doses used during the month

In the beginning of the month the facility had 30 doses and had received 200 doses during the month. This makes a total of 230 doses available for use. End balance showed 60 doses at the end of the month. Subtracting the end balance from available doses gives us the number of doses used during the month, which 230 minus 60 is 170 doses.

Step 2: Calculate your vaccine usage during the month

Divide number of children immunized with number of doses used during the month, which is 130 divided by 170 = 0.764. Multiply this with 100, which gives you 76.4%. We can round this up as 76%.

Step 3: Calculate your vaccine wastage

As indicated in the above formula 100 minus vaccine usage (100 minus 76) = 24% vaccine wastage.

For further details on vaccine wastage and calculations please refer to "*Monitoring vaccine wastage at country level: Guidelines for programme managers. WHO/V&B/03.18*"

WHO/IVB/04.06
ORIGINAL: ENGLISH

Immunization in practice

Module 6: Holding an immunization session

Contents

About this module

Module 6 describes the tasks that the health worker must perform on the day of the immunization session, to ensure to quality sessions. It starts with the preparation needed before infants and women arrive at the immunization site and details on how to assess infants and women. It discusses the correct technique for giving each vaccine. It also describes how to communicate with parents during and after the immunization session and how to conclude the session.

1. Setting up an immunization session

Before the infants come for the immunization session you need to complete certain tasks explained below.

1.1 Condition the ice-packs

Conditioning ice-packs before the session is very important especially to prevent freeze-sensitive vaccines from freezing. To do this properly, you will need to remove frozen ice-packs from the freezing compartment at least 30 minutes before the session begins and allow the ice-packs to sit at room temperature until the ice begins to melt and water starts to form inside. You should check if an ice-pack has been conditioned by shaking it and listening for water inside.

1.2 Take the vaccines and diluents out of the refrigerator

Before you open the refrigerator door, decide how many vials of each vaccine you will need for the session (refer to Module 5, Table 5.5 and Table 5.6).

The first time you open the fridge in the morning, record the temperature inside the refrigerator. You must minimize the number of times you open the refrigerator door and the time the refrigerator door is left open.

From the refrigerator, select and use vaccines in this order:

1. Opened vials kept in the "use first" box in the refrigerator (if your country has adopted a multi-dose vial policy, see Module 3).

2. Unopened vaccine ampoules/vials that have been taken to outreach sessions and have been outside of the refrigerator, then returned (but not opened) to the refrigerator.

3. Vaccines with VVMs that have started to change.

4. The oldest vaccines that have not yet passed their expiry dates.

1.3 Check if vaccines are safe to use

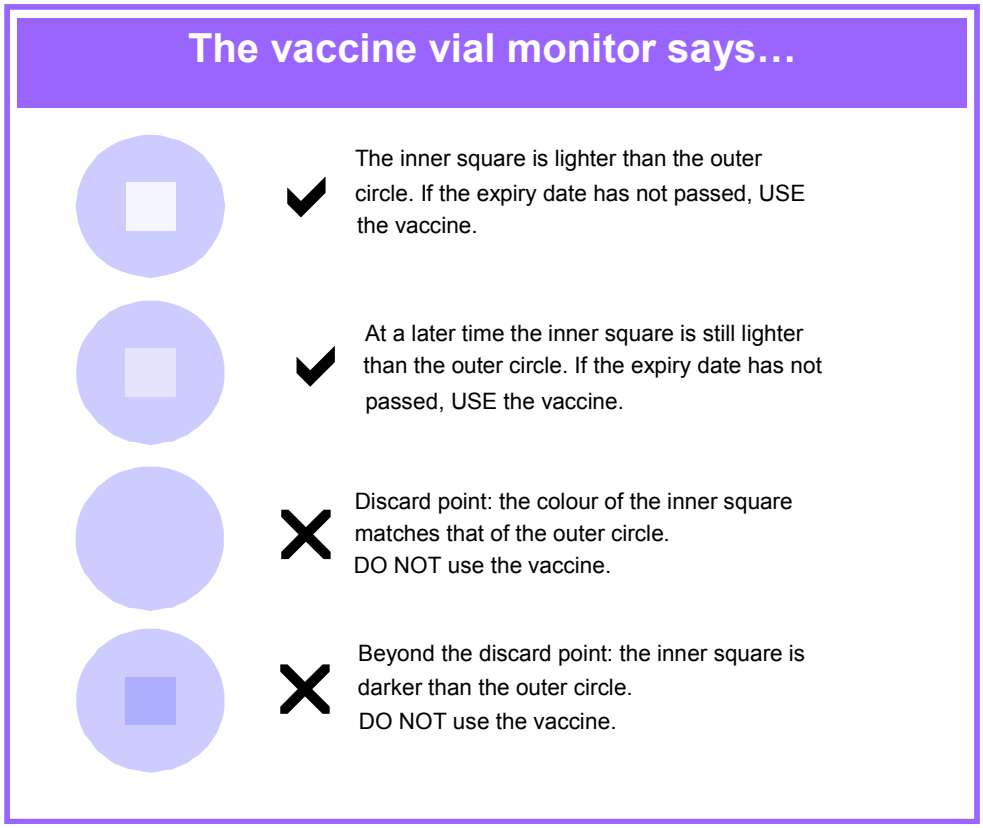
Before you use any vaccine you must:

1. Check the labels of the vaccine and diluent. If the label is not attached, discard the vial or diluent.

2. Check the expiry date. You must discard vials and diluents if the expiry date has already passed.

3. Check the vaccine vial monitor (VVM). If it indicates the vaccine has passed the discard point, you must discard it immediately (Figure 6A).

Figure 6A: Vaccine vial monitors showing different stages

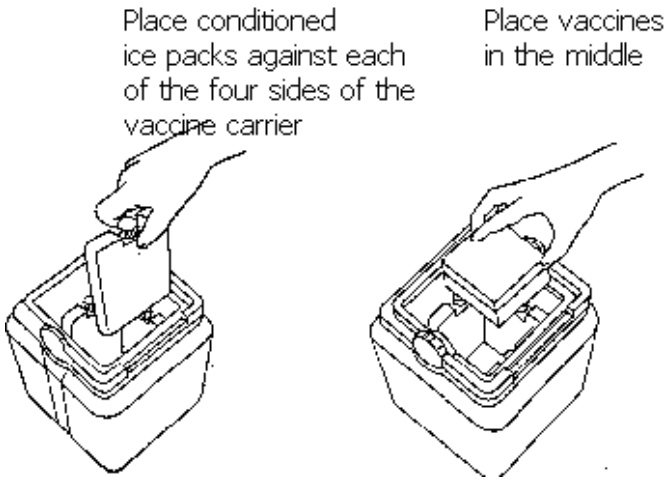


4. Check the freeze indicator in the refrigerator. If it warns of freezing or you suspect that a freeze-sensitive vaccine (DTP, DT, TT, Td, HepB, DTP-HepB, liquid Hib and DTP-HepB+Hib vaccines) has been frozen, you should perform the shake test (follow the steps given in Module 3 Section 8).

1.4 Prepare the vaccine carrier

Place conditioned ice-packs in the vaccine carrier as shown in Figure 6B. Place the vaccines and diluents into the vaccine carrier and close the lid tightly. If you use ice instead of ice-packs, you must always put ice cubes in a sealed plastic bag. The bag prevents water from collecting in the bottom of the carrier when the ice melts. During immunization sessions, keep opened vials inserted through the foam pad of your vaccine carrier. The foam pad keeps vaccines inside the carrier cool while providing a place to hold and protect vials in use. Do not cover the vials with ice.

Figure 6B: Packing a vaccine carrier



1.5 Prepare the workplace

1.5.1 Arranging space in fixed health facilities for immunization sessions

The arrangement of the space in your health facility will affect how you work and how quickly women and infants finish the immunization process. The space that you set up for immunization should be:

- easily accessible to women and infants, but arranged so that they are not crowding the immunization area;
- in a clean area not directly exposed to sunlight, rain, or dust;
- convenient for the health worker who is preparing and giving doses of vaccines; and
- quiet enough for you to be able to explain what you are doing and to give advice.

Put up a sign saying "immunization clinic" to show people where to come and wait.

The fixed health facility should have:

- space in the shade where women and infants can sit before receiving doses of vaccine;
- space and equipment for screening, registration, immunizing, and recording;
- a table for vaccines and injection equipment;
- a chair on which a mother can sit while holding a child for immunization; and
- a chair for the health worker.

If you provide other services during immunization sessions, you need space and equipment for them as well. Set up a separate station for each of these services, which may include:

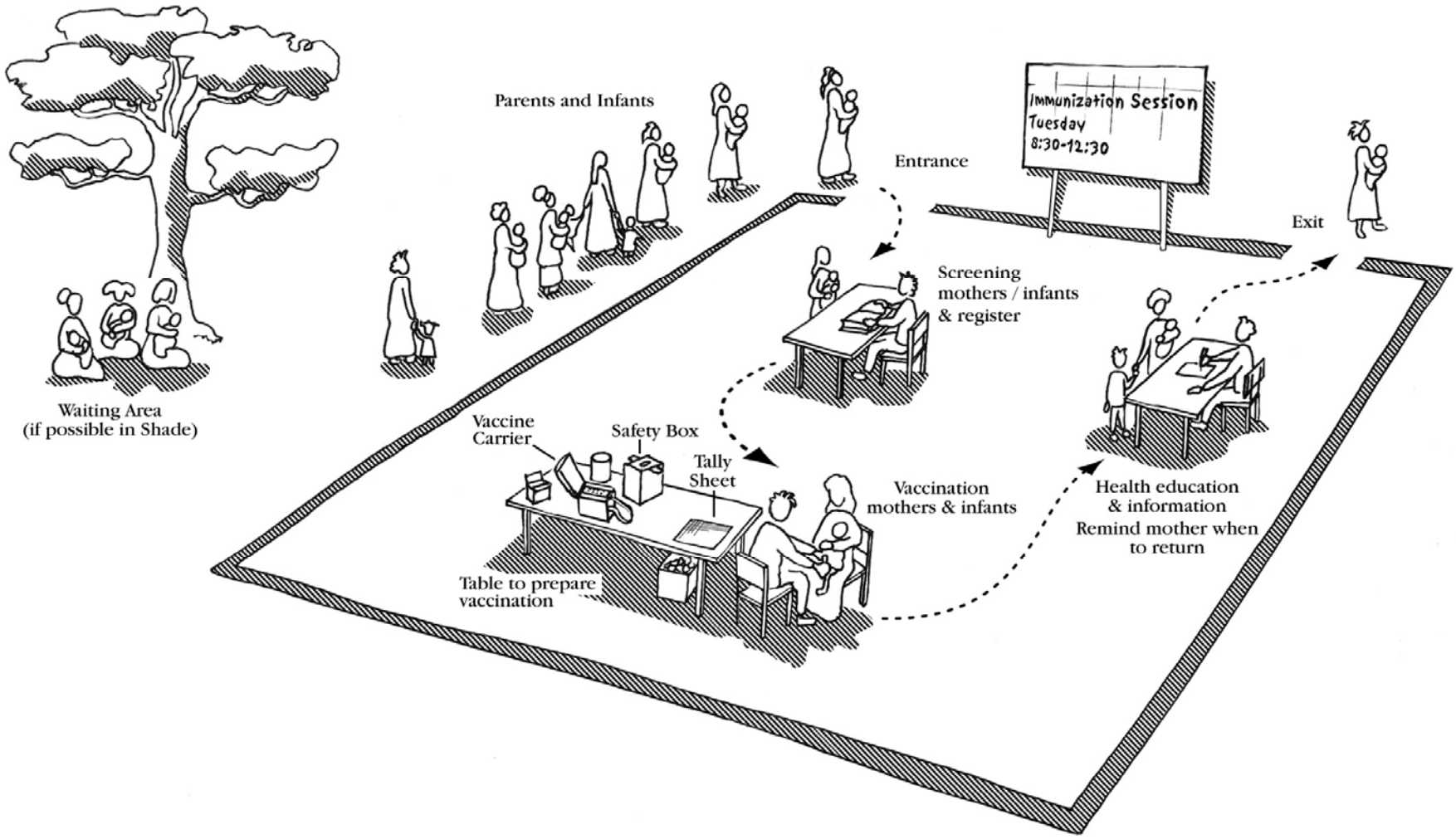
- weighing babies and charting their growth;
- treatment;
- antenatal care;
- health education.

Planning patient movement through the immunization facility to increase safety

Part of setting up a safe immunization site involves planning patient flow to reduce the risk of accidental needle stick injury to the health worker or member of the community. For a safe clinic, keep the following guidelines in mind:

- If possible a room with two doors should be used (see Figure 6C). The patients should enter through one door and exit through another so that health workers are able to move people from the table where their names are checked to the immunization table, then over to the health information table, then finally the exit.
- If the facility only has one door the health worker should allow the person or child being immunized and the parent(s) to enter, receive their vaccination and then leave before allowing another person into the immunization clinic area.
- If possible, separate the registration tables from injection tables to help keep children calm.
- If other health care services are being provided, they should be incorporated into the flow, for example infant weighing table, nutrition table, and antenatal care.
- Whenever possible women and infants to be immunized should be separated from those who have just been immunized so the people waiting are not distressed by babies and children crying.
- A community member or another health worker should tell the community how they will move through the immunization facility. This person should also monitor the movement during the immunization session to ensure the patient flow is safe and efficient.

Figure 6C: Set-up for an immunization session at a fixed site



1.5.2 Gather equipment for the immunization session

The amount of equipment you need for the session depends on the estimated number of women and infants who will be immunized. Basic estimates for vaccines, AD syringes, mixing syringes, needles and safety boxes are provided in Module 5.

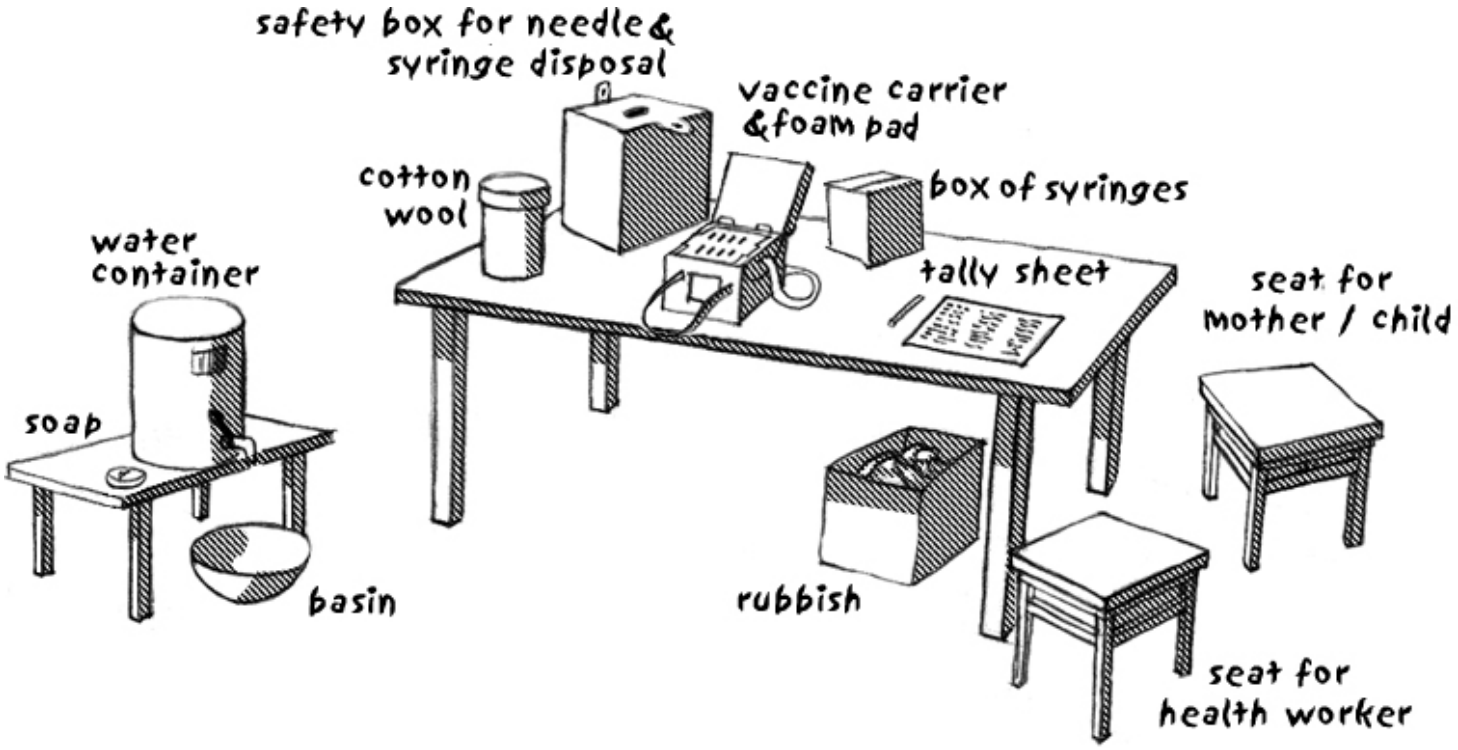
The following gives a basic list of other equipment and supplies needed for fixed and outreach sessions.

- soap for hand washing
- cotton
- metal file to open ampoules
- container for rubbish
- immunization register
- immunization tally sheets
- new immunization cards for women and infants
- paper, pencils, and pens
- safety box
- table(s)
- stool(s) / chair(s) for sitting.

Health workers should plan the layout (see Figure 6D) of the immunization work space such that:

- Where possible there is a separate table for immunization and another for health checks if these are taking place at the same time as vaccination.
- The health worker is between the infant and all needles or sharp objects.
- Each person giving injections has her/his own safety box at busy sites.
- The health worker can dispose of used needles without setting them down or moving around with them.
- Only one child with a parent (or person to be vaccinated) at a time is near the work space.
- The hand-washing equipment is placed next to the immunization table. Health workers must wash their hands prior to giving the first immunization and when in contact with dirt or blood.
- The health worker can tally the vaccine given soon after the vaccine is administered.

Figure 6D: Layout of the immunization workspace



1.5.3 Setting up an outreach site

The place where you give immunizations during an outreach visit may be in a building or in the open air. If in a building it should be well lighted and well ventilated. If in the open air and in a hot climate it should be in the shade.

In arranging the immunization site, make sure that:

- there is a separate entrance and exit so that people may move in and out of the session more quickly and easily;
- the waiting area is clean, comfortable, and, in a hot climate, out of the sun;
- people are effectively guided to the entrance, the stations and the exit by means of signs or the arrangement of chairs, tables, ropes or other items;
- the number of people at the immunization and other stations are limited, so there is no crowding;
- everything you need is within reach on or near your immunization table.

Figure 6E: Outreach immunization site in the open air

2. Assessing infants and women and completing the register

2.1 How to assess whether an infant is eligible for vaccines

Whenever infants visit the health centre they should be screened for immunization and given all of the vaccines they are eligible to receive. When an infant is brought to the health centre, you must determine his/her age and previous immunization status before deciding which vaccine doses to provide and whether the infant is eligible to receive vitamin A supplementation.

Step 1: Determine the infant's age

- Look at the infant's immunization card to determine the infant's age.
- If the infant does not have an immunization card, ask the mother how old the infant is.
- If the mother does not know the infant's age, estimate it by asking if the infant was born during a notable community event, for example during a certain season or celebration. This will give you a better idea of the infant's age. Infants above 1 year of age and who are not fully vaccinated, should still receive the missing doses (usually countries set 23 months as the upper limit, but this limit can be higher). Such doses should be tallied separately (see Module 7).

Step 2: Determine which vaccines the infant has received

- Look at the infant's immunization card to see which vaccines he/she has already received.
- If the infant does not have an immunization card, ask the mother which vaccines he/she has already received.
- Check the register where you may find records of the infant's earlier doses of vaccines.
- If the mother does not know if the infant has been immunized or there is no record in the immunization register, give doses of all eligible vaccines (see step 3).
- A scar on the infant's left arm or shoulder indicates he/she has received BCG vaccine. If the infant does not have a scar and you cannot determine whether a dose of BCG has been given, immunize the infant with BCG vaccine.

Step 3: Determine all vaccines for which the infant is eligible

Decide which vaccines the infant is eligible to receive according to your national schedule (see Module 2 for the WHO recommended schedule).

Follow the general guidelines given below:

1. If the infant is eligible for more than one type of vaccine, the vaccines may all be given at the same session, but at different injection sites.

2. Never give more than one dose of the same vaccine at one time.

3. If the delay between doses exceeds the minimum delay, do not restart the schedule. Simply provide the next needed dose in the series. For example, an 18 month old who has received only BCG, OPV1, and DTP1 should receive OPV2, DTP2, measles, and yellow fever vaccines. Inform the mother of the importance of bringing the infant back to the health facility in four weeks to receive OPV3 and DTP3 vaccines.

4. If there is a delay in starting primary vaccination, immunize the infant while maintaining the recommended dosage intervals.

5. For practical reasons, most countries do not offer the primary series of routine immunization beyond 23 months (refer to national policy).

2.2 Assessing infants and mothers for vitamin A supplementation

If your country provides vitamin A supplementation during routine immunization, you must screen mothers and children younger than 5-years-old for vitamin A supplementation at every immunization contact.

Step 1: Determine the infant's age (see Section 2.1, step 1 of this Module) and/or whether the mother gave birth 6–8 weeks ago.

Step 2: Check the infant's immunization card to see if he or she has received a vitamin A supplement and, if so, determine the interval since the last dose.

Ideally, infants and children should receive vitamin A doses of 100 000 IU (6–11 months) or 200 000 IU (12–59 months) every 4-6 months. Repeat supplementary doses should never be less than 4 weeks apart unless the child is being treated for measles or eye signs of VAD.

If vitamin A was distributed during NIDs in your program area within the past four months:

- Assume that all infants and children 6–59 months of age have received a dose (or 12–59 months in countries where infants under 12 months are not given vitamin A with NIDs).

- Do not give another dose unless the caretaker says the child did not participate in NIDs.

- Do not look for records as vitamin A doses given at NIDs are not meant to be recorded due to the difficulty of recording at mass campaigns.

2.3 Assessing women for TT immunization

At any immunization session, especially outreach, you should offer routine TT immunization to pregnant women.

Some countries also have a policy of providing TT immunization to non-pregnant or recently pregnant women during routine infant immunization sessions.

To assess a woman's eligibility for TT immunization:

- First ask if the woman has a TT vaccination card. If she has, give the dose required according to the national TT schedule. If the woman does not have a record, ask her if she has ever had a dose of TT in the past:

  - If she says NO: give the first dose of TT and an appointment for the second dose one month later, and give her an immunization card.

  - If she says YES: ask how many doses she has received in the past and give the next doses in series (refer to Module 2 Section 5). Take into account any dose given in SIAs.

  - If she cannot remember or does not know, you should give her a dose of TT and a follow-up appointment for the next dose (refer to Module 2 Section 5).

Recording TT doses

Ideally the TT doses given to women should be kept in a separate register. The register can be used at antenatal clinics or other opportunities to vaccinate women. In some countries, the infant register is used to keep record of maternal TT doses (see Module 7).

Use every opportunity to offer TT immunization to women. Any TT dose given should be recorded on an immunization card that is kept by the women.

At all antenatal clinics, outreach, fixed and mobile sites, make sure women especially pregnant women are screened for TT eligibility and offered TT immunization and TT cards if needed.

2.4 Contraindications to immunization

There are not many contraindications to immunization. All infants should be immunized except in these three rare situations:

1. Anaphylaxis or a severe hypersensitivity reaction is an absolute contraindication to subsequent doses of a vaccine. Persons with a known allergy to a vaccine component should not be vaccinated.

2. Do not give BCG or yellow fever vaccine to an infant who exhibits the signs and symptoms of AIDS (see Table 6.1).Other vaccines should be given.

Table 6.1: Recommendations for immunization of HIV-infected children and women of childbearing age

Vaccine	Asymptomatic HIV infection	Symptomatic HIV infection
BCG	vaccinate	Do not vaccinate
DTP	vaccinate	vaccinate
OPV	vaccinate	vaccinate
Measles	vaccinate	vaccinate
H. influenzae type b	vaccinate	vaccinate
Hepatitis B	vaccinate	vaccinate
Yellow fever	vaccinate	Do not vaccinate [a]
Tetanus toxoid	vaccinate	vaccinate

[a]pending further studies

3. If a parent strongly objects to an immunization for a sick infant, do not give it. Ask the mother to come back when the infant is well.

The following are not contraindications. Infants with these conditions should be immunized:

- allergy or asthma (with the exception of a known allergy to a specific component of the vaccine mentioned above);
- any minor illness, such as respiratory tract infections or diarrhoea with temperature below 38.5°C
- 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 as noted in Table 6.1;
- child being breast fed;
- 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-birthweight (vaccination should not be postponed);
- recent or imminent surgery;
- malnutrition; and
- history of jaundice at birth.

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.

There is no evidence of risk to the fetus from immunizing pregnant women with tetanus toxoid.

2.4.1 Immunizing sick infants

Many health workers do not like to immunize an infant who is ill. Young infants have many illnesses, and immunization is often delayed. Many infants catch one of the target diseases because they missed being immunized due to illness. However, we now know that it is safe to immunize infants even if they are ill.

Children with a mild illness

Immunize them as usual.

Children with a fever

Immunize them as usual. You can give any vaccine, including DTP — there is no danger from adding the reaction to vaccine to a moderate fever.

Very ill infants who need to go to hospital, or infants who have a very high fever

Immunize them if possible. A senior health worker must decide for each individual infant. Remember that sick infants need protection against diseases that they may catch in hospital, especially measles.

Malnourished infants

You must immunize them — they can develop good immunity although they are malnourished.

They are more likely than other infants to die from the diseases (especially from measles).

2.5 Completing the register

Most health centres keep an immunization register. This helps health workers keep track of the immunization services they give to each infant and pregnant woman.

You must register pregnant women and infants as soon as they arrive at the health centre or outreach site. Fill in all blanks except the space for services provided. This space should be completed after the services are provided (see Module 7 for more details).

What to do when children attend outside normal session times

Many infants and women eligible for immunization have contact with health services and could be immunized if vaccines were offered. Furthermore, the increased risk for children of contracting measles in health facilities has been documented both in developing and industrialized countries, highlighting the importance of protecting them through immunization at every health service contact. Routine screening for immunization status should occur for all infants and women of childbearing age who visit health services for any reason. Ideally, eligible infants and women should be immunized immediately, but at a minimum, they should be given an appointment for immunization.

3. Giving the right vaccine safely

3.1 Reconstituting vaccines

Reconstituting vaccines means mixing a powdered form of a vaccine with a fluid called a diluent so that the vaccine can be injected.

The table below lists the vaccines that need to be mixed with diluent before use.

Table 6.2: Vaccines that require reconstitution

Vaccines that need to be reconstituted	Powder		Diluent
BCG	freeze-dried	vial	liquid provided with vaccine
Measles	freeze-dried	vial	liquid provided with vaccine
Measles-mumps-rubella (MMR)	freeze-dried	vial	liquid provided with vaccine
Measles-rubella	freeze-dried	vial	liquid provided with vaccine
Yellow fever	freeze-dried	vial	liquid provided with vaccine
Japanese encephalitis	freeze-dried	vial	liquid provided with vaccine
Hib[a]	freeze-dried	vial	liquid provided with vaccine
DTP-HepB+Hib	freeze-dried Hib	vial	liquid DTP-HepB vaccine

[a] Hib vaccine is available in both dry powder and liquid form. If you are using the dry powder form, you **must** reconstitute it before the vaccine can be injected. If you are using the liquid form, you do not need to reconstitute the vaccine.

Follow the steps indicated below to mix most powder vaccines with a fluid so that the vaccine can be used. DTP-HepB+Hib requires a slightly different reconstitution process, explained in Section 3.3 of this Module.

Remember:

Diluent are not interchangeable, different vaccines have different diluents; mixing and administering the wrong diluent has led to serious adverse events including death.

Always use diluent from the same manufacturer as the vaccine.

Diluents should be cooled before being mixed with the vaccine

Do not reconstitute vaccines until you are ready to immunize.

You must discard reconstituted vaccine after six hours or at the end of the immunization session, whichever comes first.

3.2 Reconstituting BCG, Measles, MMR, MR, yellow fever fever, Japanese encephalitis, and Hib vaccines

Step 1: Wash your hands

Wash your hands with clean water and soap before reconstituting vaccines.

Step 2: Inspect the vaccine vial or ampoule

Most vaccines come in vials, except for BCG vaccine which comes in ampoules. A vial is a glass bottle with a rubber stopper held in place by a metal or plastic cap.

Check the vaccine vial monitor (if there is any) to ensure that the vaccine has not passed the discard point.

Read the expiry date on the label to make sure that you can still use the vaccine. If the date has passed, discard the vaccine.

Step 3: Flick the vial or ampoule

Make sure that all of the vaccine powder is at the bottom of the vial. Flick or tap the vial with your finger.

Step 4: Open the vaccine vial or ampoule

The centre of the metal cap is pre-cut so that it can easily be removed. Lift the centre of the metal cap and bend it back, using a metal file.

Some vials have coloured plastic caps instead of metal caps. Flip off the plastic cap with your thumb.

Step 5: Inspect the diluent ampoule or vial

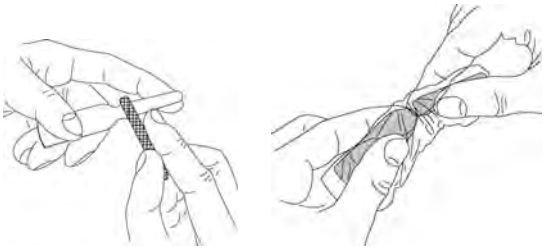
The diluent for reconstituting vaccines is usually held in ampoules, which are glass or plastic bottles that you open by breaking off their pointed tops. Make sure the ampoule is not cracked.

Step 6: Read the label on the diluent ampoule or vial

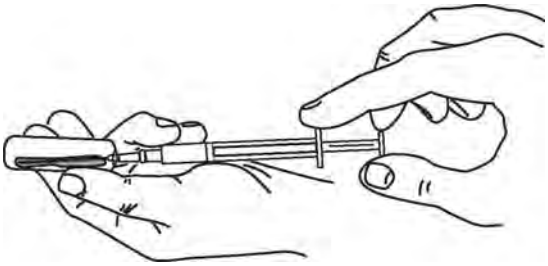
Make sure that you are using the diluent the manufacturer sent with the vaccine and the expiry date has not passed.

Use only the ampoule or vial sent by the manufacturer for the specific powder vaccine. Do not use sterile water or saline provided for other purposes as a diluent. Each vaccine has its own diluent and must not be reconstituted with anything else.

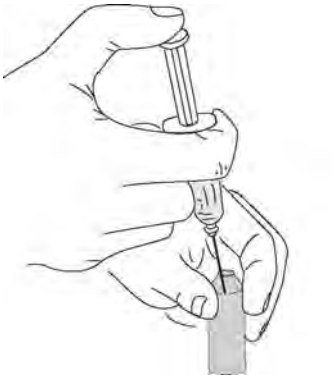
Step 7: Open the glass ampoule

Hold the ampoule between your thumb and middle finger. Use your index finger to support the top. Take the metal file that is packed with the ampoules and scratch hard around the neck of the ampoule you wish to open. Hold the top of the ampoule in a piece of clean cloth and gently break off the top. It breaks where you made the scratch. In case of injury while breaking the ampoule, discard the ampoule as the content may have been contaminated. Cover the wound/cut before opening a new ampoule.	**Figure 6F: "Scratching and breaking" the neck of the vial** 

Step 8: Draw diluent into a mixing syringe

Use a new disposable mixing syringe (5 ml) and a mixing needle (76 mm, 18 gauge) to reconstitute each supply. Put the needle in the open top of the ampoule. Pull back the plunger to draw **all the diluent** from the ampoule into the syringe. Do not reuse disposable mixing syringes.	**Figure 6G: Taking fluid from an ampoule** 

Step 9: Reconstitute the vaccine

Insert the mixing syringe that is filled with diluent into the vaccine vial or ampoule. Hold the plunger end of the mixing syringe between your index and middle fingers and push the plunger in with your thumb. This empties the diluent into the vaccine vial or ampoule. • To mix the diluent and vaccine, draw them up slowly into the syringe and inject them slowly back into the vial or ampoule. Repeat several times. • Put the mixing syringe and needle in a safety box after use.	**Figure 6H: Inserting diluent into a vaccine vial** 

Step 10: Handling reconstituted vaccines

Put the reconstituted vaccine on the foam pad of your vaccine carrier.

3.3 Reconstituting DTP-HepB+Hib vaccine

DTP-HepB+Hib vaccine is reconstituted differently from other vaccines. It is reconstituted using liquid DTP-HepB vaccine to reconstitute the powered Hib vaccine.

Step 1: Open the powder Hib vaccine vial

Step 2: Draw liquid DTP-HepB vaccine into a mixing syringe

Draw up **all the liquid DTP-HepB vaccine** from the vial into a 5 ml mixing syringe.

Step 3: Reconstitute the DTP-HepB+Hib vaccine

Inject all 1.3 ml of the DTP-HepB liquid vaccine from the 5 ml mixing syringe into the vial containing the powder Hib vaccine.

Step 4: Discard all DTP-HepB+Hib reconstituted vaccine after six hours or at the end of the immunization session, whichever comes first.

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3.4 Administering vaccine for infants

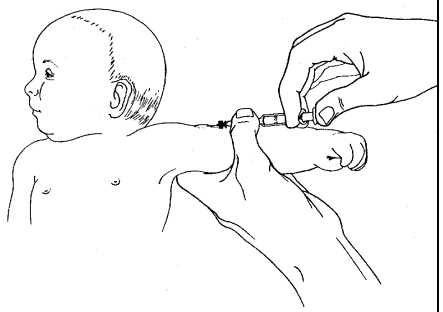
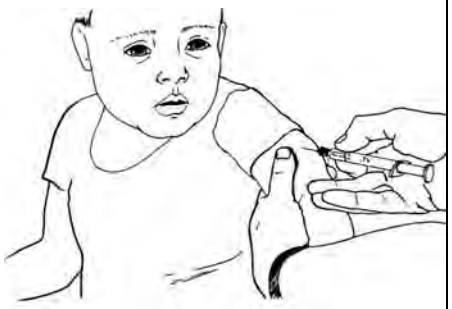
Name of vaccine	BCG	DTP or DTP-HepB, HepB	Measles/ Yellow Fever	OPV
Where given	Outer upper left arm or shoulder	Outer mid-thigh in infants/outer upper arm if older	Outer mid-thigh/upper arm depending on the age	Oral
How given	Intradermal injection	Intramuscular injection	Subcutaneous injection	Oral dropper
Dose	0.05 ml	0.5 ml	0.5 ml	2 drops
Needle size	10mm, 26 gauge	25mm, 23 gauge	25mm, 23 gauge	
Type	Powder + Diluent	Ready-to-use	Powder + Diluent	Vial with oral dropper
Appearance	White, cloudy liquid with sediment that suspends when shaken (see shake test Module 3)	White, cloudy liquid with sediment that suspends when shaken (see shake test Module 3)	Clear, slightly yellow liquid	Clear, pink or orange liquid
				

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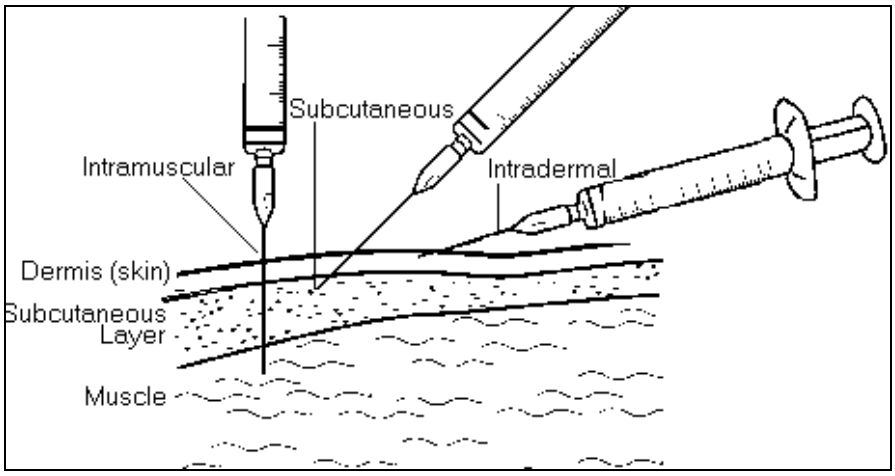
Figure 6I: Different needle positions



3.5 How to give an injection using AD syringes

1. Wash skin that looks dirty with water. It is not necessary to swab clean skin.

2. Hold syringe barrel between thumb, index and middle fingers. Do not touch the needle. The plunger can go back and forth only once, so health workers should not draw up air to inject into the vial as this will disable the syringe.

3. Insert needle with a smooth action.

4. It is not necessary to aspirate first.

5. Use thumb to push the plunger without moving the syringe around.

6. Pull needle out quickly and smoothly (less painful than doing it slowly).

7. Ask the parent to press the site gently with a clean swab for a few seconds (to stop bleeding and relieve pain).

8. Do not rub the area where the injection was given.

3.6 BCG vaccine: intradermal (ID) injection in arm

The injection is given into the skin in the **left upper arm**. The dose of BCG is very small (0.05 ml). To measure and inject such a small dose accurately you must use a special small syringe and needle.

BCG is the only childhood vaccine that is injected into the layers of skin for slow absorption (intradermally). To give an intradermal injection correctly you must use a short, very fine needle (10 mm, 26 gauge).

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1. Position infant sideways on mother's lap and remove clothing from the arm and shoulder.

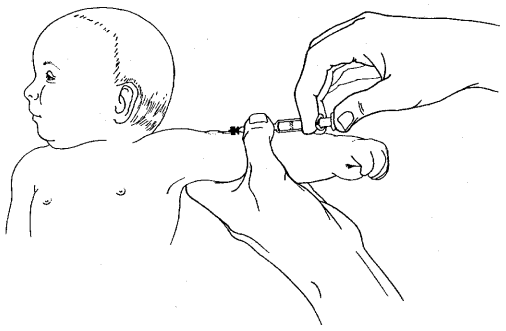
2. The mother should hold the infant close to her body, supporting his or her head and holding the arms close to the body.

3. Hold the syringe in your right hand with the bevel of the needle facing upwards.

4. Stretch the skin out flat with your left thumb and forefinger.

5. Lay the syringe and needle almost flat along the infant's skin.

6. Insert the tip of the needle just under the surface but in the thickness of the skin — just past the bevel (the hole in the end of the needle).



7. Keep the needle FLAT along the skin, so that it goes into the top layer of the skin only. Keep the bevel of the needle facing up.

8. Do not push too far and do not point down or the needle will go under the skin. Then it will be subcutaneous instead of an intradermal injection.

9. To hold the needle in position, put your left thumb on the lower end of the syringe near the needle, but do not touch the needle.

10. Hold the plunger end of the syringe between the index and middle fingers of your right hand. Press the plunger in with your right thumb.

11. Inject 0.05 ml of vaccine and remove the needle.

Note. When an intradermal injection is given correctly the plunger is hard to push. If the vaccine goes in easily you may be injecting too deeply. **Stop** injecting immediately, correct the position of the needle, and give the remainder of the dose, but no more.

If the whole dose has already gone under the skin, count the infant as having received a dose of vaccine. **Do not** repeat the dose. Ask the parent to return with the child if he or she shows any side-effects, such as abscesses or enlarged glands.

If you have injected BCG correctly, a flat-topped swelling appears on the skin. The swelling may look pale with very small pits, like an orange peel. If the technique is incorrect, the vaccine will go in easily and no swelling will be visible.

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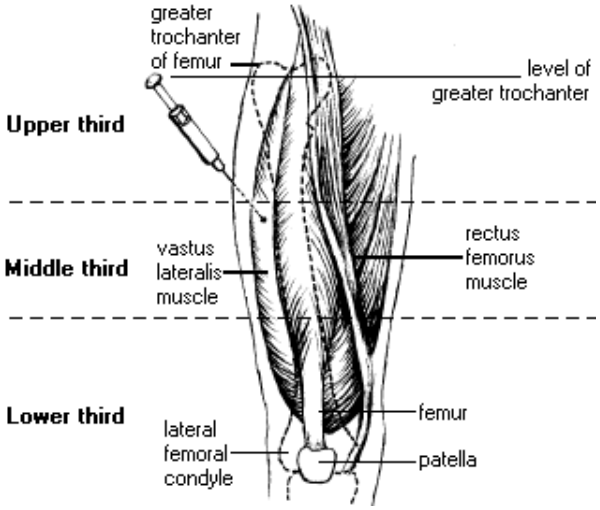
3.7 DTP or DTP-HepB or HepB, Hib vaccine: intramuscular (IM) injection in thigh

1. Position the infant sideways on the mother's lap with the infant's whole leg bare.
2. The parent should hold the infant's legs.
3. Gently stretch the skin flat between your thumb and forefinger.
4. Insert the needle at a 90° angle.
5. Quickly push the entire needle straight down through the skin and into the muscle. Inject slowly to reduce pain.

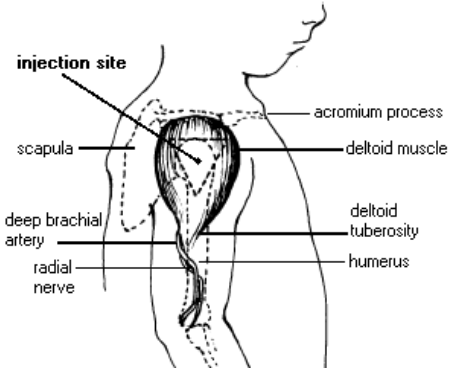
Diagram showing how to locate the site to give IM injection to infants



Intramuscular injections for older children and adults

For vaccinating older children, adolescents and adults, the deltoid muscle of the upper arm may be used. In infants and young children under 15 months of age the deltoid muscle does not provide a safe intramuscular (IM) site due to the superficiality of the radial nerve and the deltoid muscle being insufficiently developed to absorb medication adequately.

Diagram showing how to locate deltoid



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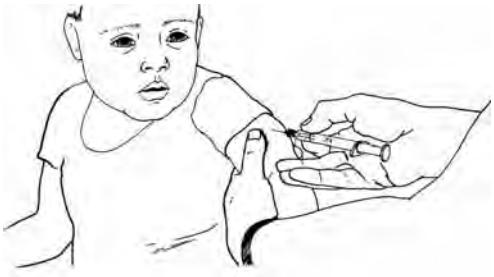
3.8 Measles vaccine, Yellow fever, JE: subcutaneous (SC) injection

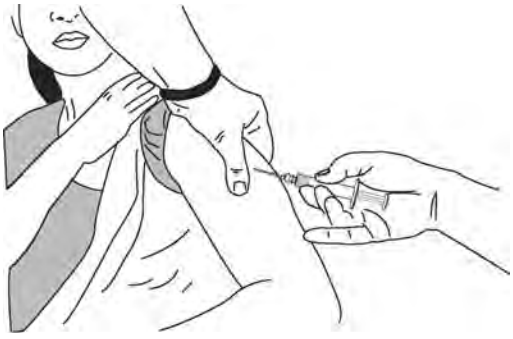


1. Position infant sideways on mother's lap with the whole arm bare.
2. The parent should hold the infant's legs.
3. Reach your fingers around and pinch up the skin.
4. Quickly push the needle into the pinched up skin — the needle should point towards the shoulder.
5. To control the needle, support the end of the syringe with your thumb and forefinger but **do not touch the needle.**

3.9 OPV administration

1. Ask the parent to hold the infant with the head supported and tilted slightly back.
2. The chin and cheeks should be dry: OPV is less likely to spill out.
3. Open the infant's mouth gently, either with your thumb on the chin (for small infants) or by squeezing the infant's cheeks gently between your fingers.
4. Let 2 drops of vaccine fall from the dropper onto the tongue. Do not let the dropper touch the infant.

3.10 TT vaccine (for women): intramuscular (IM) injection in the left arm



1. Ask the woman to sit down.
2. Tell her to drop her shoulder and place her left hand behind her back or resting on the hip. This relaxes the muscle in the arm and makes the injection nearly painless.
3. Put your finger and thumb on the OUTER part of the upper arm.
4. Use your left hand to squeeze up the muscle of the arm.
5. Quickly push the needle straight down through the skin between your fingers. Go deep into the muscle.
6. Press the plunger with your thumb to inject the vaccine.
7. Pull out the needle quickly and smoothly and ask the woman to press the site gently with a cotton pad in case of bleeding

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3.11 Vitamin A supplementation

1. Check the expiry date on the label. If the expiry date has been reached, discard the bottle.

2. 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.

3. Open a capsule by cutting the tip or nipple off with a clean pair of scissors or a clean nail clipper.

4. Squeeze the capsule firmly so that the drops fall into the mouth of the client. For a young child, you may need to pinch his or her cheeks gently to open the mouth.

Give the correct amount of vitamin A supplement: too much can cause harmful side-effects.

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.

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4. Completing the tally sheet and infant's immunization card

4.1 Recording the vaccines and vitamin A supplement given on the tally sheet

Soon after you finish immunizing the infant and woman, record a mark for each vaccine and vitamin A supplement given on the tally sheet (more information in Module 7).

4.2 Completing the infant immunization card

- Complete the immunization card by writing down the date for each vaccine administered or vitamin A supplement given and return the card to the parent. If there is no special place on the card for recording vitamin A supplementation, write "Vit. A" and the date in the margin or any blank space on the card.

Immunization cards should be kept by the parents and not by the health staff.

- Mark the next immunization date on the card after every dose, and tell the parent when and where to return for the next dose of vaccine.
- Tell the parent that the card must be kept in good condition. Explain that it is an important document because it keeps track of her infant's health and immunization status and will help health workers understand how to treat her infant in the future.
- Tell the parent that the card should be brought along every time the infant comes to the health centre, whether or not the infant is coming in for services or not.
- Ask to see immunization cards for both mothers and infants every time they come to your health centre. Assess whether they are eligible for any vaccine or vitamin A supplementation. Do not miss an opportunity to immunize.

Updating the reminder cards

If you have a system of using reminder cards to track defaulters (see Module 7, Section 1.4), refer to the reminder card at each visit and update it at the same time as the immunization card.

4.3 Immunization cards for women

Women may have routine or supplementary TT doses recorded in three ways (see Module 7 for details)

1. On a life-long immunization card (most preferred)
2. On the antenatal card

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3. On the infant's immunization card (for additional recording).

When screening women for TT immunization, always ask if the woman has a card. If she does not, ask if she can remember receiving TT immunization during this pregnancy if she is pregnant, and previous pregnancies if she is not, or during SIAs. We know from surveys that have compared women's response to the TT antibodies in her blood, that women are likely to remember TT doses accurately. You can then give the appropriate TT dose according to her history and tally accordingly. Also give her a card if she does not have one.

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5. Communication with parents during and after the immunization sessions

Here are some guidelines on how to communicate with people about immunization. These should be adjusted depending on the time available, the number of people waiting, and weather conditions.

The most essential elements of every encounter are:

- that you treat the person with respect;
- that you advise him or her of possible side-effects and what to do about them; and
- that you explain when and where the next immunization session will be held.

5.1 Here is a step-by-step guide to talking about immunization with parents at a session

1. Thank the parent for coming to the immunization session and for their patience if they had to wait.
2. Explain in simple terms the diseases the vaccines protect against.
3. Describe the side-effects of immunization and what to do about them (see Module 2). Advise the parent on how to tell when they need to bring the infant to the health centre or hospital in case of a rare, serious side effect.
4. If the immunization is one dose of vaccine in a series, explain that the infant must complete the series in order to be fully protected. Use the chart on the immunization card as a guide, and congratulate the mother if the infant has completed the series.
5. Write the date for the next immunization on the card, and tell the parent the date as clearly as possible. Try to associate the date with a holiday or local event, which will help them remember when to return.
6. Tell the parent when and where to go to receive the infant's next immunization and vitamin A supplement.
7. If the parent and infant cannot come on that date, explain the alternative dates and times.
8. Tell women how many more times, when and where they must return to be fully protected against tetanus.
9. Remind the parent always to bring their immunization cards to the health centre or outreach session.

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10. If the infant (or women) has missed some doses, do not scold the parents (women), but explain why it is important that an infant (women) needs to be fully immunized and that you will be giving (as much as possible) any missing doses during this session. Also request to come timely for the next immunizations that are due (also give an appointment).

11. Inform the parent of any upcoming campaigns for TT, measles, or vitamin A, and of any National Immunization Days for polio.

12. Ask the parent if they have any questions.

Make sure you repeat each of these messages more than once if it seems necessary. Parents under stress — for example, in a busy clinic — may not remember well, so make sure they understand you. The likelihood parents will remember your messages increases if they hear the messages more than once.

5.2 Advising on potential side-effects

When advising a parent of the potential side-effects of any vaccine:

- Explain which disease or diseases the vaccine prevents.
- Reassure the parent that reactions are common and not a threat to the infant; they show that the infant is responding to the vaccine.
- If the infant suffers fever, pain, or swelling at the injection site, or is irritable, loses his or her appetite, or is "off colour":
- Give extra fluids, that is, more breastfeeds or clean water.
- Paracetamol may be given — one 100 mg tablet crushed, three times in 24 hours.
- Give extra hugs and attention — but keep the pressure off the injection site(s).
- Place a cloth dampened with cold, clean water on the injection site.
- Tell the parent to bring the infant to the health centre if the infant's condition gets worse or the reaction continues for more than a day or two.
- More details on side effects can be found in Module 2.

Potential side-effects, after giving BCG vaccine:

Explain to the parent that the flat-topped swelling on the infant's arm is normal and indicates that the vaccine is working.

Ask the parent to return with the infant if he or she develops any side-effects, such as abscesses or enlarged glands.

Potential side-effects, after measles vaccine:

A rash or fever may develop after 6–12 days. Other people will not catch the rash and it goes away. Give extra fluids and keep child cool.

More details on side-effects can be found in Module 2.

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6. Concluding the session

6.1 Completing an immunization tally sheet

Health workers should keep a tally of each immunization they give (see Module 7 for detailed instructions). At the end of an immunization session count the number of doses of each type of vaccine you have given, and use your daily tally sheets to prepare monthly reports to supervisors.

6.2 Taking care of the vaccines

- Opened vials of OPV, DTP, TT, DT, hepatitis B and liquid formulations of Hib vaccines may be used in the subsequent immunization sessions.

- Opened vials of measles, yellow fever and BCG vaccines MUST be discarded at the end of each immunization session or after 6 hours whichever comes first.

- Opened vials that can be used for the subsequent session should be kept in the refrigerator in a box marked “use first ” so they can be used first in the next session.

6.3 Taking care of vitamin A capsules

Storing vitamin A capsules

Vitamin A capsules do not need to be stored in a refrigerator and may be kept out of the cold chain but, like vaccines, they must be handled with care.

- They must be kept dry.

- They must be kept out of direct sunlight.

- They must not be frozen.

Store the 100 000 IU and 200 000 IU capsules in separate, labelled bottles to avoid mixing up the two doses.

When you open a new bottle, put the date on it. An opened bottle can be used no longer than a year or till the expiry date, whichever comes first.

6.4 Disposing of used equipment

- Used needles and syringes must be disposed of safely (see Module 4 for detailed instructions).

- Vials and rubbish should be wrapped in newspaper or other paper. If your local government does not collect them, either bury or burn them.

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6.5 Special tasks on completing an outreach session

In addition to the tasks you have after a session at a fixed site, you must complete these tasks after an outreach session.

Step 1: Pack the vaccine carrier

- Check the ice-packs to make sure that the ice has not melted. If the ice-packs have completely melted and/or the thermometer in the vaccine carrier shows a temperature above 8°C, the vaccine should be discarded unless it has a VVM which shows it is still safe to use.
- Pack unopened vaccines and open vials for which the multi-dose vial policy is applicable (see module.3).
- Put empty vials and opened vials of reconstituted vaccines in a separate container to carry them to a disposal site.

Step 2: Leave the outreach site tidy

- Do not leave anything behind that might be a health threat to the community.
- Collect safety boxes containing AD syringes and other rubbish, and bury or burn them at the site if possible (see Module 4). If not, take the safety boxes and other rubbish back to the health centre.
- Do not leave empty or opened vials at the site.
- Do not leave any syringes or needles at the site.
- Return tables, chairs, and other equipment to their owners.
- Thank the local people who have helped to organize the session and remind them when you will return.

Step 3: Return vaccines to the refrigerator

- If the ice-packs in your vaccine carrier have melted during your trip back to the health centre, discard all of the vaccines except those whose vaccine vial monitor indicates that the vaccine is safe to use. Return these vaccines to the refrigerator and place in the "use first" box so they will be used first during the next session.
- If the ice-packs are still frozen, put unopened vials in the "use first" box in the refrigerator.
- Put the ice-packs from the carrier into the freezer, and check and record the temperature of the refrigerator.

Step 4: Clean the vaccine carrier

Wipe the carrier with a damp cloth and check it for cracks. Repair any cracks with adhesive tape and leave the carrier open to dry.

WHO/IVB/04.06
ORIGINAL: ENGLISH

Immunization in practice

Module 7: Monitoring and using your data

Contents

About this module

This Module discusses how to collect and report data, and how to monitor your performance using your own data. It also shows how you can improve the performance of your service by identifying and solving problems, and incorporating the solutions as activities in your workplan. Many of the topics covered in monitoring relate closely to planning topics in Module 5.

This module covers the following topics:

1. Basic recording tools: immunization register, immunization card, tally sheet, systems for tracking defaulters.

2. Making summary reports: monthly reporting at health facility level.

3. Monitoring your performance

   - making and using a monitoring chart

   - compiling your immunization data

   - analysing your data.

4. Using your data to identify problems, propose solutions and take corrective action according to your priorities.

1. Basic recording tools

Every health facility needs a system of recording immunization data. Making records systematically and regularly after each session will help you to follow up on defaulters and solve other problems.

The main recording tools that each health facility must use are:

1. Immunization register
2. Vaccination card
3. Tally sheets
4. Reminder files or another system for tracking defaulters.

1.1 Immunization register

The immunization register helps health workers keep track of the immunization services they offer to each infant and to pregnant women. Your health facility can either have have two separate registers, one for recording infant immunizations (Figure 7A) and another for recording TT given to women (Figure 7B) or one register to record both infant immunizations and TT given to women (Annex 1).

What to include in the register

A register should include the following information, as well as any information required by your health facility:

- a unique identification number
- registration date (usually the date of the first visit)
- name of infant
- infant's birth date
- infant's sex
- name and address of mother/parent
- vaccinations provided and vitamin A supplementation.

- TT vaccination provided to pregnant women (depending on country policy)
- whether infant was Protected at Birth (PAB) for neonatal tetanus (see Annex 2 for details).

The immunization register can also be used like a birth register. As soon as an infant is born in the community its name can be entered in the register even before the infant has received any vaccines. This will help to follow up on all members in the community.

Figure 7A: Sample immunization register for infants

Village: _____

Name of health facility: _____

No.	Registration date[a]	Name of infant	DOB[b]	Sex	Name of mother/ parent	Address	Vaccinations (dates, day/month/year)													PAB[c]	Remarks
							BCG	OPV				DTP			HepB				Measles	Vit. A	Y/N	Completed/ died/moved
								0	1	2	3	1	2	3	0	1	2	3				

[a] Usually date of first visit
[b] DOB: Date of birth
[c] Protected at birth from Neonatal Tetanus

Figure 7B: Sample register for recording TT given to women

No	Registration date	Date of visit	Name	DOB/age	Address	Pregnancy number	LMP	TT1	TT2	TT3	TT4	TT5[a]
2345	3.3.03	3.3.03	Maria Mali	30	Main Street, Villetown	4	30.12.02	✓	✓	✓	3.3.03	
2346	3.3.03	3.3.03	Fatima Togo	Jan-83	Side Street, Tree Village	2	1.11.02	✓	3.3.03			
2347	3.3.03	3.3.03	Jihmil Singht	25	Harbour Place, Tree Village	2	15.10.02	5.1.01	15.3.01	3.3.03		

[a] Write dates. If no dates are available for previous doses, ask how many doses were received earlier and place a tick under all such doses.

How to use the register

You must register infants and pregnant women as soon as they arrive at the health facility or outreach site. Fill in all information except the space provided for vaccinations. This space should be completed after the vaccinations are provided.

It is recommended to have a unique identification number on the register for each infant and use the same number on the vaccination card. This way, for the next immunization, it will be very easy to locate the infant's entry on the register (Figure 7C).

Do not create a new entry in the register each time the mother brings the infant for immunization. Ask the mother for the immunization card and look for a corresponding entry in the register. If the immunization card is not available, ask the mother the age of her infant and details of the first immunization to locate the infant's entry in the register.

For every new infant (never immunized) create a new entry in the register and create a new immunization card. For an infant who has come to your health facility for the first time but has received immunizations in another health facility, create a new entry in the register, ask for the immunization card and mark on the register immunizations that the infant has already received.

Figure 7C: Same infant identification number on both register and vaccination card

Village: _____

Name of Health center: _____

No.	Date of visit	Name of infant	DOB*	Sex	Name of mother	Address	Vaccinations (dates, day/month/year)														Maternal TT					PAB	
							BCG	OPV0	OPV1	OPV2	OPV3	DTP1	DPT2	DTP3	HepB0	HepB1	HepB2	HepB3	Measles	Vit. A	TT1	TT2	TT3	TT4	TT5	Y	N
11A		Uli	2/03/2003	F																							

Note: Additional columns can be added to

* DOB: Date of birth

No: 11A **Vaccination card**
Child's name: Uli
Sex: F DOB: 2/03/2003
Mother's name: Feli
Address: 53 Timor Road

Vaccine	Dose (enter date given)		
	1	2	3

1.2 The immunization card

The infant immunization card contains the immunization history and status. The immunization card is important for many reasons:

- It serves as a reminder for parents to return to the clinic for the next dose.
- It helps the health worker determine an infant's immunization and vitamin A status.
- It is useful when health workers conduct coverage surveys.

The card may be the only record of immunization history and status available for health workers if immunization registers are not well maintained or if clients move from one health facility to another.

Each infant should have a card with immunizations marked correctly. Similarly, a separate card should be made for each woman having received TT vaccine. Even when a mother's TT doses are marked on the infant's card, there is still a need to issue a separate card for the mother (see Annex 1 for sample TT card).

What information an immunization card should include

An immunization card may be a separate document or part of a general infant health card (e.g. "Road to Health Card"). At a minimum, it should include (Figure 7D):

- a unique identification number
- name of infant
- infant's birth date
- infant's sex
- name and address of mother
- date of each vaccination by dose and vitamin A supplementation
- TT vaccination provided to the mother[1] (optional)
- infant protection at birth from neonatal tetanus (PAB)
- due date for next immunization
- country immunization schedule (optional)
- growth monitoring chart (optional).

The vaccination card should be kept by the parents of the infant.

[1] A woman should receive no more than five doses of TT (see Module 2, Section 5). Each dose of TT should be recorded separately as TT1, TT2, TT3, TT4, TT5. Always screen women first (see Module 6, Section 2 and 4) before giving a TT dose. TT doses should be recorded on an immunization card, regardless of whether the dose was given during routine immunizations or SIA's.

Figure 7D: Sample infant immunization card

Card number: _____ **Infant immunization card**

Name of infant			
Female or male			
Birth date of infant	Day:	Month:	Year:
Name of mother			
Name of father			
Address			

Vaccines	Date given	Next appointments (date)
BCG		
DTP1		
DTP2		
DTP3		
OPV0		
OPV1		
OPV2		
OPV3		
Measles		
Vitamin A		
HepB0		
HepB1		
HepB2		
HepB3		
Mother – Tetanus 1		
Mother – Tetanus 2		
Mother – Tetanus 3		
Mother – Tetanus 4		
Mother – Tetanus 5		
Was the infant protected at birth ?[a] Yes /No		

National schedule (example)

Vaccine	Age				
	Birth	6 weeks	10 weeks	14 weeks	9 months
BCG	x				
Oral Polio	x[b]	x	x	x	
DTP		x	x	x	
HepB	x[b]	x	x	x	
Measles					x

[b] Birth doses of OPV and HepB are given in some countries

Notes

[a] Ask this question at the DTP1 contact (see Annex 2 for details)

How to use the infant immunization card

Complete the card by writing down the date for each vaccine administered or vitamin A supplement given. Include doses of TT given to the mother if she is eligible for a dose.

Mark the next appointment date on the card and tell the mother when and where to return for the next dose of the vaccine.

Remember to mark on the immunization card the next appointment date. Make sure that the appointment corresponds to a planned immunization session. Remind the mother verbally as well as by writing on the card. Always return the card to the mother.

1.3 Tally sheets

Tally sheets are forms on which health workers make a mark every time they administer a dose of vaccine. These are used as a basis for monitoring and reporting. Use a new tally sheet for each session. The same tally sheet can be used to mark both vaccines given to infants as well as vaccines given to pregnant women (Figure 7E).

After you have immunized an infant, record the immunization in the register and on the immunization card and inform the mother which doses were given (see Module 6 for more on communicating during a session). On the tally sheet, place a mark next to the dose received (there are various ways of making tally marks, for example: 00000, ⍁, ****). If the infant is younger than 12 months old, place the mark in the column headed "Children under one year of age". If the child is older, place the mark in the adjacent column.

If a dose of vitamin A is given to the infant, also mark it on the tally sheet. A separate sheet should be kept for vitamin A given to postpartum mothers.

Record doses of tetanus toxoid given to women

1. If tetanus toxoid is given routinely to all women of childbearing age in your country, ask every woman for her immunization card.

2. If TT is given only to pregnant women in your country, ask each pregnant woman for her immunization card during her first antenatal or any other visit.

3. After immunizing any woman, pregnant or not, record the immunization in the register and on the woman's immunization card and mark in the correct column of the tally sheet. Rely on history to tally the dose (if no card is available). For example, if a woman says she has received three doses in the past, tally the new dose as TT4, issue a new card for the woman (Annex 1), and mark the card with the date of TT4.

Complete the tally sheet at the end of a session

At the end of each immunization session, total the number of marks recorded during the session. This tells you the number of immunizations you have given with each vaccine and each dose. You will use this information to monitor your performance and prepare a

monthly report. Keep the tally sheet for the supervisor to check the data quality (accuracy of reporting).

Table 7.1: Common mistakes in tallying

Mistake in tallying	Possible problem that may occur	Correct practice
Tallying before the vaccine is administered	The child may not receive the vaccine	Give the dose first then tally using the tally sheet
Tallying at the end of a session according to number of doses contained in the used vials	"Wasted" doses may be counted	Tally each dose given (as above)
Tallying all vaccines under one age group (to include those outside the targeted age)	Will result in inaccurate coverage data	Separate tally for under 1 and over 1 year old

Figure 7E: Sample tally sheet

Name of health facility _____ Date of session _____

Fixed — Name of site _____ Outreach/Mobile — Name of site _____

Children	Less than 1 year		More than 1 year	
Vaccine	Tally	Total	Tally	Total
BCG				
DTP1				
DTP2				
DTP3				
OPV0				
OPV1				
OPV2				
OPV3				
Measles				
Vit. A				
HepB0				
HepB1				
HepB2				
HepB3				
Protected at Birth (ask at DTP1)	Yes		No	
	Tally	Total	Tally	Total
Women	**Pregnant women**		**Non pregnant women**	
	Tally	Total	Tally	Total
TT1				
TT2				
TT3				
TT4				
TT5				
TOTAL TT				
TOTAL TT2+TT3+TT4+TT5				

Names of staff

1.4 Systems for tracking defaulters

There are many ways to monitor and follow up on defaulters. Here are two tracking systems that can easily be used.

1.4.1 Using the immunization register

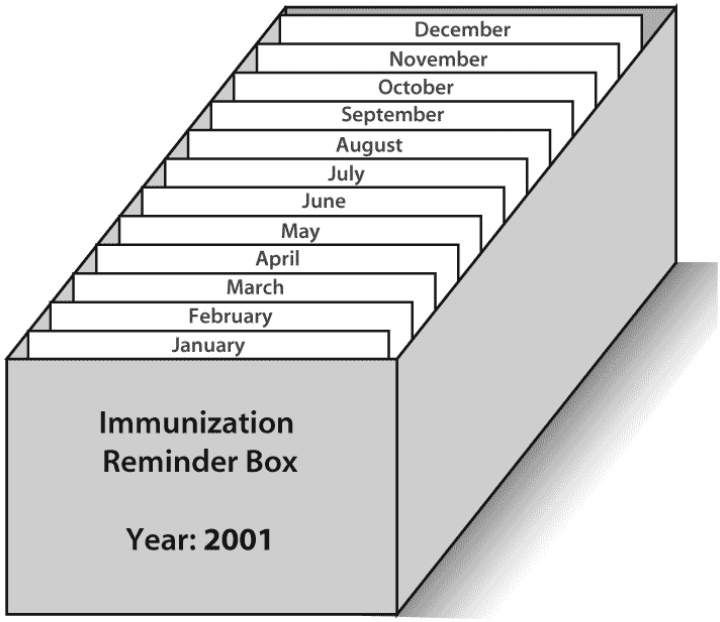
At the end of each month, review the immunization register (see Figure 7A of this module) to identify infants who may have failed to receive doses of vaccine when due. For example, if an infant received its DTP1 dose in February check to see whether he/she received DTP2 in March when the dose was due. The register can also be used to track TT defaulters.

1.4.2 "Reminder" cards

Another way to identify "dropouts" is to make "reminder" cards, which are copies of infant's immunization cards. File the copy of the immunization card in a box behind the divider for the month when the infant's next vaccination is due, as in Figure 7F.

When an infant receives DTP1 in January, place the reminder card in the February section, the month when DTP2 is due. In February, if the infant attends when due for DTP2, update the reminder card and place it in the March section when DTP3 is due. Every month, review the reminder cards and follow up those who did not attend when due. Ensure that the TT immunization status of pregnant women is included in the antenatal clinic tracking system. When TT immunizations are given to pregnant women outside of antenatal clinics, reminder cards can be used to ensure that pregnant women get the second dose (if it is the first pregnancy).

Figure 7F: Box for filing "reminder" cards



1.4.3 Following up defaulters

Whatever system you use, it will only be effective if you then make sure that every infant receives the vaccinations that are overdue. If you track defaulters regularly every month it

will make the task of follow-up easier. To follow up defaulters you may be able to contact the mothers directly or ask members of the community to help you.

Module 8 describes ways of working with the community. For example you may be able to give a list of infants and mothers to a community leader or immunization volunteer who can then advise mothers to return for the vaccine doses that are due.

2. Making summary reports

The immunization data collected needs to be consolidated into a summary form, either manually or electronically, for transmission from the health facility to the district level. The district compiles data for use by and transmission to the next level, and eventually to central level. At each level the data should be analysed and used to improve the programme (see Section 3). The format of the summary report should be defined at district/national level and should be standard for all health facilities. An example of such a report is given in Table 7.2.

You need to send a copy of the report with date and signatures to the next level but also store (see Section 2.3) a copy of the report for use at the health facility.

2.1 Preparing good reports

Health workers should ensure that the reports prepared are:

- **Complete**: All the sections of the reports have been completed; no parts have been left blank and all reports due from reporting sites have been received.

- **Timely**: Check the deadline for report submission. Reports should be submitted to the next level before the deadline. When reports are sent and received on time, the possibility of a prompt and effective response is greater.

- **Accurate**: Before sending the reports, double-check totals and all calculations. Make sure that the reported figures correspond to the actual figures.

The district, province, national levels should keep track of the completeness and timeliness of reporting by the more peripheral level, and remind those levels of missing or late reports.

2.2 What to include in the summary report from the health facility (see Table 7.2)

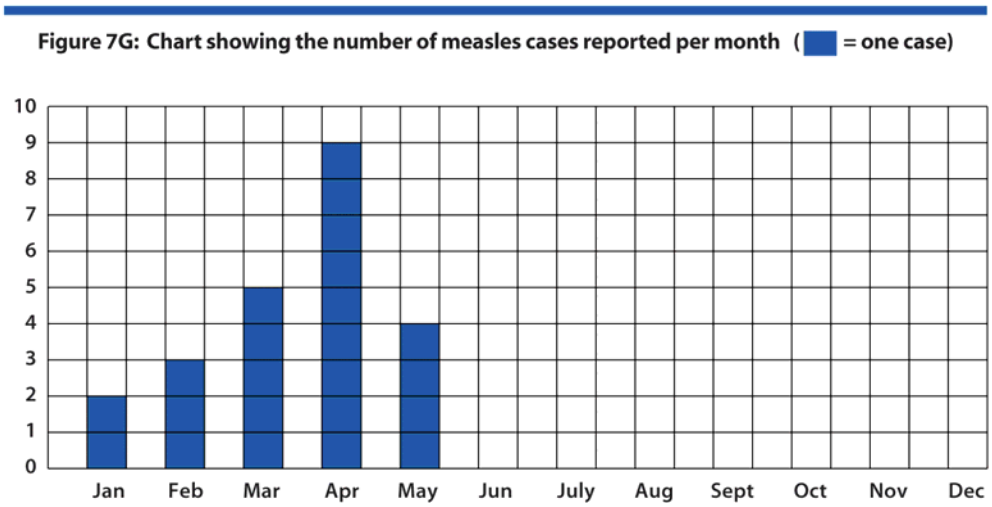
1. Reporting on vaccinations given to infants and women and vitamin A

Data collected on the tally sheets needs to be consolidated into a summary form, either manually or electronically, for transmission from the health facility to the district level. Section 3 explains how these data can be presented in a chart.

2. Reporting on vaccine-preventable diseases in your area

State the number of cases of each vaccine-preventable disease and the immunization status of each case. These can be displayed in each facility on a simple chart (Figure 7G). Even if there are no cases of a disease during the reporting period, you should still provide a ‘zero’ report in Table 7.2

Figure 7G: Chart showing the number of measles cases reported per month



3. Reporting on any adverse reactions following immunization

If there have been any adverse reactions during the month, details may be provided to the next level according to the AEFI system in your country. Serious events should be reported immediately. Serious events are defined as:

- those that are **life threatening** and
- those that result in **hospitalization** (or prolonged hospitalization)
- those that result in **disability** (or have the potential to result in disability)
- or those that result in death.

4. Reporting vaccine usage and wastage patterns

The usage and wastage of vaccine will vary greatly from one session to another. However it is useful to monitor wastage and usage patterns regularly at all immunization points to improve supply and avoid stockouts. This can be done by recording vaccine vial start and end balances, and vials received each month, as in Table 7.2. This information can be compiled at the district level, where the following calculation can be made.

$$\text{Vaccine usage (rate)} = \frac{\text{Number of infants immunized during the period}}{\{\text{Number of usable doses at beginning of period}\} + \{\text{Number of doses received during period}\} - \{\text{Number of usable doses in stock at end of period}\}} \times 100$$

Vaccine wastage rate = 100 *minus* vaccine usage rate

5. Any specific problems encountered during the reporting period (e.g. stock-outs, transportation problems, cold chain failure etc.)

This is an opportunity to report supply problems and record supervisory visits.

6. Additional information (this will vary according to national policies), for example:

- the sex of infants immunized (M/F) and the sex of disease cases;
- other interventions during immunization sessions, e.g. provision of mebendazole, antimalarials;
- campaign activities during the reporting period.

Table 7.2: Sample monthly report at health facility level

Name of health facility _____ Infant population ____ District _____ Month/year _____ Sessions planned ____Sessions held _____

No.	Date	Place of session	Session type[a]	Vaccination and Vitamin A given to children under 1															Vaccination and Vitamin A given to children above 1												Infants protected at birth from NT
				BCG	DTP			OPV				HepB				Measles	Vit A	Others	BCG	DTP			OPV			HepB			Measles	Vit A	Others	
					1	2	3	0	1	2	3	0	1	2	3					1	2	3	1	2	3	1	2	3				
1																															
2																															
3																															
4																															
5																															
6																															
Total																															

[a]Session type: Fixed, Outreach, Mobile

No.	Date	Place of session	Session type	Vaccination given to pregnant women		Vaccination given to non-pregnant women	
				TT 1	TT 2+[b]	TT 1	TT 2+[b]
1							
2							
3							
4							
5							
6							
Total							

[b] TT2+= TT2 + TT3 + TT4 + TT5

Reverse side of the monthly report

Compiled Vaccine preventable diseases report												
Target Diseases	Total	Age			Sex		Status of vaccination					No. of Deaths
		<1 year	1-4 yrs.	5+ yrs.	M	F	Doses				Unknown	
							0	1	2	3		
Measles												
Polio/AFP												
Diphtheria												
Pertussis												
Neonatal Tetanus												
Other Tetanus												
Other diseases[a]												

Vaccines/AD syringes/Vit. A/ Safety boxes balances			
Item (enter vial size)	Start[b] balance	Received[b]	End[b] balance
BCG			
Measles			
DTP			
OPV			
TT			
Hep B			
Others (VitA., YF)			
AD syringes (BCG)			
AD syringes (others)			
Safety boxes			

Adverse events following immunization (AEFI)[c] (report serious events immediately to your supervisor for further investigation)	
Type of event	**No.of cases**
Serious Events (A)	
Non-serious events (B)	
Total AEFI (A+B)	
Additional comments (if any):	

Notable activities during the reporting period (supervisory visits, training events, social mobilizaton activities etc.)

Date of Report _____

Name of reporter _____

Designation _____

Signature _____

[a]Other vaccine preventable diseases: Yellow fever, JE etc. according to region

[b]Count the number of vials and multiply by doses per vial to give the number of doses

[c]List of adverse events would vary depending on country policy. Serious adverse events especially death should be reported immediately

2.3 Storing data and reports

For purposes of verification and also retrieval whenever needed, data must be stored at all the different levels. Storage of data can be done in hard copies or electronically. At the health facility, tally sheets, registers and reports should be stored for a specific period, on average three years, depending upon the national standard operating procedures. Higher administrative levels may use computers, however it is important that back-ups (hard copies and/or electronic copies) be available to avoid the loss of data in the case of system failure.

Stored records are useful for supervisory visits and immunization service reviews.

The following types of data should be stored at each health facility for a period of **three years**:

1. Immunization registers
2. Copies of vaccination cards (if applicable)
3. Tally sheets
4. Reminder files or another system of tracking defaulters
5. Copies of monthly reports
6. Target population data
7. Immunization monitoring charts
8. Case/outbreak charts and reports
9. Supervisory visit reports
10. Stock card
11. Cold chain maintenance records.

Important note:

Data collection is only useful if the data are regularly analysed and the result of the analysis is used to improve service delivery. Data analysis is the responsibility not only of supervisory levels, but also that of health workers.

The following sections will guide you through the most common ways to analyse the data at health facility and higher administrative levels.

3. Monitoring your performance

Data collected (Section 1) and compiled (Section 2) are only useful if they are used to improve the programme performance.

Section 3 will guide you through some common ways to use the data at all levels.

3.1 Making and using charts to monitor vaccination coverage

A monitoring chart which shows doses administered and dropout rates is a simple, effective tool for monitoring progress. The monitoring chart:

- graphically shows doses given compared to the number of infants eligible to receive them;
- graphically shows dropout rates, by comparing the number of infants that started receiving immunizations to the number of infants who received all needed doses of vaccines.

Every health facility should display a current monitoring chart on the wall, where it can be seen by all staff every day. This chart can be used at every level, national, provincial, district etc. The principles are the same.

Figure 7H shows a worked example of a monitoring chart. Annex 3 contains a blank monitoring chart.

3.1.1 How to prepare the chart for monitoring doses administered and dropouts in infants less than one year of age

This chart has been developed to track the monthly progress you are making towards immunizing infants under one year of age each month and throughout the year. It also helps you to determine whether your target population is completing the series of vaccines (e.g. DTP3) or dropping out.

1. Calculate the annual and monthly target population to receive immunization services

   a) Annual target population

   You should aim to reach every infant in your catchment area, especially those who are hard to reach. Use existing population figures for infants under one year of age obtained from official census data or your own community census. If you do not have these numbers, obtain an estimate by multiplying the total population times 4%. This document uses 4% as the estimated percentage of infants less than one year of age and of pregnant women in a population. If you have a more precise percentage for your country or region, use this number instead (If the total population is 3900 then infants under one year would be 3900 x 4/100 = 156).

   b) Monthly target

To get a monthly target population, divide the number of infants under one year of age by 12 (If annual target under one year is 156, monthly target is 156/12 = 13).

2. Label the chart

   Complete the information on the top of the chart, i.e. area and year. Label the left and right side of the chart with the monthly target figures. Label the boxes at the bottom with the name of the vaccine and dose, e.g. DTP1 and measles, or DTP1 and DTP3, as shown in Figure 7H.

3. Draw a diagonal line from zero to the top right-hand corner to show the ideal rate of progress if every infant is immunized on time.

4. Plot immunization data on the chart.

   The chart can be used to monitor doses given and dropout rates. Figure 7H uses DTP1 and DTP3, but other rates can be used (e.g. DTP1 and Measles)

   a) Locate the row of boxes underneath the graph. Locate the spaces for the month you are recording. Enter the monthly total of DTP1 immunization given.

   b) Add the current month's total to the previous cumulative total to calculate the current cumulative total and enter it on the right side of the month column you are recording.

   c) Make a dot on the graph for the cumulative[2] total recorded on the right side of the month column you are recording.

   d) Connect the new dot to the previous month's dot with a straight line.

   e) Repeat above (a to d) every month until the end of the year.

   f) Plot DTP3 immunizations given in the same way as DTP1 (follow steps a to e).

5. Calculate the total number of dropouts between DTP1 and DTP3 (DO#).

   — Subtract the cumulative total for DTP3 from the cumulative total for DTP1.

---

[2] Cumulative means the total number of doses of vaccines given in the current month plus the monthly totals for all the previous months. Use the same time period for each dose and vaccine. For example, the cumulative number of DTP1 doses given by the end of March is the total number of doses given in January plus the total number given in February plus the total number given in March

6. Calculate the cumulative dropout rate (DO%) as follows:

$$\text{DO\%} = \frac{\text{DTP1 cumulative total } \textit{minus} \text{ DTP3 cumulative total}}{\text{DTP1 cumulative total}} \times 100$$

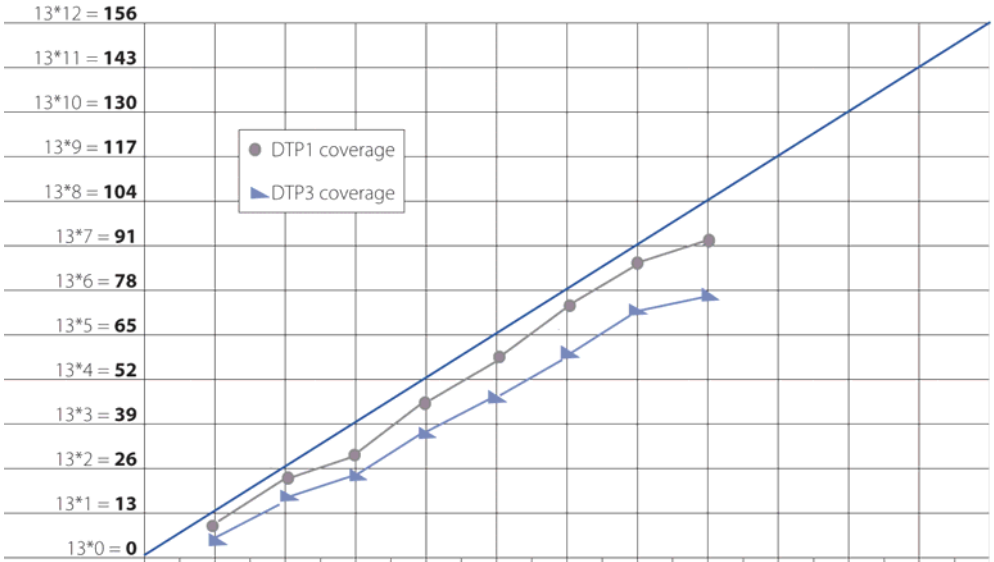
The dropout rate can be easily visually monitored: it is the gap between the line of DTP1 and of DTP3.

3.1.2 Suggested charts

There are many ways to monitor coverage and drop- outs using charts:

1. DTP1 and DTP3
2. BCG and Measles
3. OPV1 and OPV3
4. Measles and Yellow fever
5. TT2+
6. HepB3 and DTP3.

Figure 7H: Worked example of a monitoring chart for DTP1 and DTP3



FILL IN AT THE END OF EACH MONTH	JAN	CUM. TOT.	FEB	CUM. TOT.	MAR	CUM. TOT.	APR	CUM. TOT.	MAY	CUM. TOT.	JUNE	CUM. TOT.	JULY	CUM. TOT.	AUG	CUM. TOT.	SEPT	CUM. TOT.	OCT	CUM. TOT.	NOV	CUM. TOT.	DEC	CUM. TOT.
TOTAL IMMUNIZED DTP1	10	10	12	22	7	29	12	41	14	55	15	70	14	84	7	91								
TOTAL IMMUNIZED DTP3	8	8	9	17	8	25	10	35	11	46	12	58	12	70	7	76								
DROP OUT NUMBER (DO) (DTP1 - DTP3)		2		5		4		6		9		12		14		15								
DROP OUT % (DO/DTP1) * 100		20		23		14		15		16		17		17		16								

Target population:156 Monthly target:13

3.2 Compiling coverage data

In order to analyse data, it is necessary to compile data properly by area. Table 7.3 provides a simple way of compiling and analysing data. Annex 4 contains a worked example.

1. List each geographic area or community that you serve (column a).

2. List the target population numbers for infants <1 year (column b).

3. Enter the number of doses of vaccine administered to the target age group during the preceding 12-month period, for example for DTP1, DTP3, Measles (columns c to e).

3.2.1 Calculate Immunization coverage

4. Calculate immunization coverage in the preceding 12-month period, for example for DTP1, DTP3, Measles, (columns f to h). You can also add coverage for other vaccines administered including TT1, TT2+, HepB1, HepB3 etc.. However, for the sake of simplicity, Table 7.3 uses DTP and measles only.

To calculate immunization coverage, divide the total number of immunizations given over the preceding 12-month period by the target population.

Use the formula below:

Annual coverage for childhood immunizations (BCG, DTP3, OPV3, measles, HepB3, yellow fever, Hib3) and vitamin A			
Percentage coverage with the vaccine or vitamin A	=	Number of infants under one year of age receiving all required doses for selected vaccine or vitamin A during the last 12 months[3]	X 100
		Target population of infants under one year of age or live births	

3.2.2 Calculate number of unimmunized infants

5. Calculate the number of unimmunized infants for a specific vaccine or pregnant women for TT 2+, for example: number of infants who have not received Measles vaccine (column j)

> Unimmunized infants with measles vaccine (j): target population (b) *minus* infants who received measles vaccines (e)

[3] If the number of immunized children is greater than the target population, the reason should be identified (e.g. inadequate target population data, number of immunized children including other age groups than the target one, or including children from other areas.).

3.2.3 Calculate dropout rate

6. Calculate annual dropout rates, for example: DTP1–DTP3, DTP1–Measles (columns k, l), or for any other combination of vaccines you have selected.

DTP1–DTP3 dropout rate:

$$\frac{\text{doses of DTP1 administered (c) } \textit{minus} \text{ doses of DTP3 administered (d)}}{\text{doses of DTP1 administered (c)}} \times 100$$

DTP1–measles dropout rate:

$$\frac{\text{doses of DTP1 administered (c) } \textit{minus} \text{ doses of measles vaccine administered (e)}}{\text{doses of DTP1 administered (c)}} \times 100$$

3.2.4 Identify and categorize problem for each area you serve (columns m, n,o)

7. Specify in column "m" the quality of access (good or poor) depending on the DTP1 coverage ("good" is defined in this exercise as DTP1 coverage ≥ 80% in the target age group, and "poor" corresponds to a DTP1 coverage in the target age group of < 80% ; however, you may decide to use lower or higher cut-off coverage rates).

8. Specify in column "n" the quality of "utilization" (good or poor) depending on the dropout rates ("good" is defined in this exercise as a dropout rate in the target age group < 10%, and "poor" corresponds to a dropout rate in the target age group ≥ 10%; however, you may decide to use lower or higher cut-off dropout rates).

9. Refer to Table 7.4 which shows how to determine problem category 1, 2, 3, 4. Write the number of the problem category (1, 2, 3 or 4) in column "o".

3.2.5 Use your data to prioritize areas (column p, Table 7.3)

Assign the highest priority to the area that has the most unimmunized infants, and not necessarily the lowest coverage. Figure 7I gives an example.The number of *unimmunized* infants by area is shown in columns i and j of Table 7.3.

Figure 7I: Prioritizing districts according to total unimmunized infants, using measles vaccine coverage

District name	Population	Population under 1 year	Measles coverage under 1 year	Unimmunized infants	Priority
A	100 000	4000	50%	2000	2
B	75 000	3000	60%	1200	4
C	120 000	4800	70%	1440	3
D	10 000	400	20%	320	5
E	250 000	10 000	75%	2500	1

You have compiled data (Table 7.3) and have assigned priorities to the different areas you serve. In the next section (Section 4) you will plan corrective action based on these priorities.

Table 7.3 Compilation and analyses of health facility data

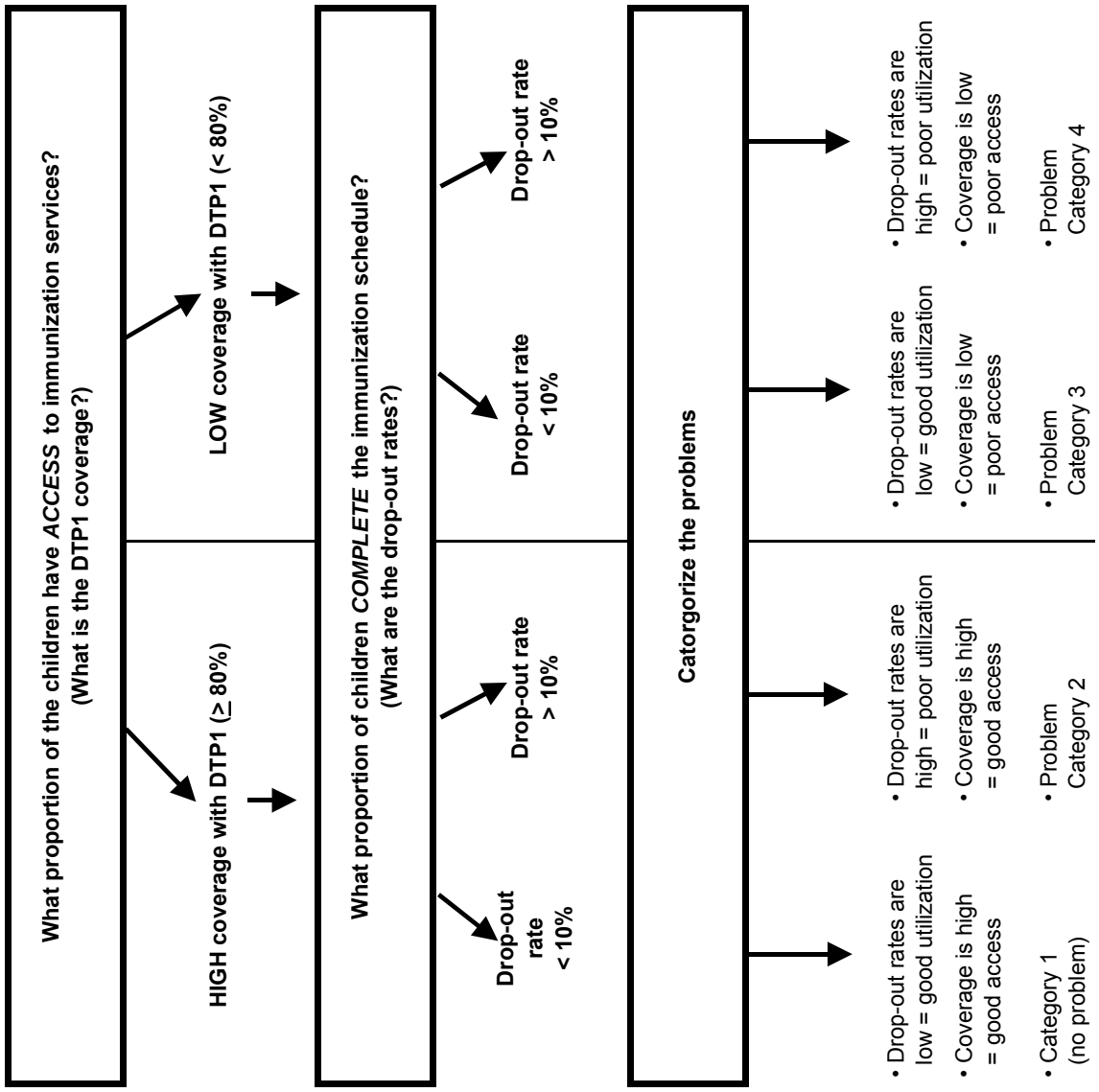
Area name	Compile population, immunization coverage data in the previous 12 months							Analyse problem							Priotize area
	Target population figures (No.)	Doses of vaccine administered			Immunization coverage (%)			Unimmunized (No.)		Drop-out rates (%)		Identify problem[a] (see table 7.4)		Categorize problem according to table 7.4[b]	
	< 1 year	DTP1	DTP3	Measles	DPT1	DTP3	Measles	DTP3	Measles	DTP1-DTP3	DTP1-measles	Access	Utilization	Category 1,2,3 or 4	Priority 1,2,3,...
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p

[a]Please specify quality of access and utilization: poor or good

[b]Category 1: No problem: drop-out rates low, coverage high.
Category 2: Problem: drop-out rates high, coverage high.
Category 3: Problem: drop-out rates low, coverage low.
Category 4: Problem: drop-out rates high, coverage low.

Note: For simplicity this table uses DTP1, DTP3 and Measles immunization data. The same format can be used for other antigens including TT1, TT2+, Hep1, Hep3 etc.

Table 7.4 Analyse problems of access and utilization



4. Taking corrective action

In this section, you will identify problems and plan corrective action in your area.

4.1 Identification of problems

Problems can be broadly associated either with access or with utilization. A problem may be related to one or more villages/areas or may apply to the entire district.

4.1.1 Problems related to poor access to service

Infants and pregnant women do not attend immunization sessions. The reasons may be:

- Sessions not conducted as planned
- Session site and times inconvenient or not advertised
- Cultural, financial, racial, gender or other barriers preventing use of immunization services.

4.1.2 Problems related to poor utilization of services

Parents do not bring infants back to complete the full series of immunizations. The reasons maybe:

- Parents lack information about the complete immunization schedule
- Supply shortage
- Incorrect contraindications applied
- Problems of relationship between health workers and community
- Tetanus toxoid not available for women at all sessions (according to national policy).

4.1.3 Examples of problems

Examples of problems are listed in Table 7.6. This is not an exhaustive list of all problems but it includes some common ones and can serve as a guide.

4.2 Finding solutions and adding corrective actions to your workplan

The purpose of this section is to help you decide what corrective action is needed. Follow the steps given below to list corrective actions that can be added to the workplan as part of your coverage improvement plan.

Step 1: Health facility level: Review your health facility workplan

- Look at your workplan for the last quarter and identify the sessions that were not held.
- Identify the problem that led to each of these sessions not being held. List these problems.
- Suggest appropriate solution(s) for each problem (use Table 7.6 as a guide).

Step 2: District level: Discuss the problems and possible solutions at a meeting

- Discuss the problems faced in the last quarter and suggested solutions. Together with district staff decide corrective action(s) to address each problem.

- Categorise the problems according to whether they affect all areas or only some areas.

Step 3 Prioritization of activities

- Solutions for those problems that impact the whole district should be implemented before area-specific solutions.

- Using the area priority developed in Table 7.3 (based on number of unimmunized infants), prioritize the order in which you will implement the area-specific solutions.

Step 4 Adding corrective actions to the workplan

After developing a list of solutions and prioritizing them, the next step is to add these to the workplan for the next quarter (Table 7.5 and Module 5, Annex 2).

- Some problems will result in all workplans (district and all health facilities) to be modified, while others will be specific to workplans of one or more health facilities (Table 7.5) and/or the district (Module 5, Annex 2).

- Include at least one solution per month in the workplan and implement it during that month.

- The problems that cannot be realistically addressed during one quarter should be addressed in the following quarter.

4.3 Ensure quality of sessions

Sessions should be completed as planned but they must also be of good quality. Decide what corrective action is needed to ensure the quality of every session. The following modules provide further guidance on:

- Adequate safety measures regarding immunization practices — Module 4

- Adequate safety measures for safe waste disposal — Module 4

- Community involvement in providing immunization services — Module 8.

Remember: All solutions should be activities that can be done with existing resources. These can be added to the workplan. The workplan needs to be reviewed every quarter.

Table 7.5: Sample quarterly workplan of health facility M that includes corrective action to solve problems

Village	Session plan	Jan	Feb	Mar
M	Fixed session 1st Wednesday	Date scheduled 1 Jan Date held _____	Date scheduled 5 Feb Date held _____	Date scheduled 5 Mar Date held _____
K	Outreach every 2nd Wednesday at community centre	Date scheduled 8 Jan Date held _____ Transport: motorbike	Date scheduled 12 Feb Date held _____ Transport: motorbike	Date scheduled 12 Mar Date held _____ Transport: motorbike
L	Outreach every 3rd Wednesday at community centre	Date scheduled 15 Jan Date held _____ Transport: bicycle	Date scheduled 19 Feb Date held _____ Transport: bicycle	Date scheduled 19 Mar Date held _____ Transport: bicycle
P and N	Outreach every 4th Wednesday at community centre at village P	Date scheduled 22 Jan Date held _____ Transport: motorbike	Date scheduled 26 Feb Date held _____ Transport: motorbike	Date scheduled 26 Mar Date held _____ Transport: motorbike
New activities planned for this quarter (based on data analysis and monitoring)		1. Training in AD syringe use 2. Meeting community leaders to discuss migrant issues	1. Ensure pregnant women get TT at outreach	1. Follow up on defaulters in village M

Table 7.6: Common problems associated with high dropout and poor access and their solutions

	Examples of common problems	Examples of solutions: activities to be included in workplan
Supply quantity	Stock-outs of vaccine(s), AD syringes, diluents, safety boxes; immunization cards	• Request immediate supplies from district level. • Review stock recording system. (Module 5, Section 4) • Review vaccine usage and wastage rates and take action. (Module 5 Annex 3, Module 7 Section 2) • Review method of estimating needs. (Module 5, Section 3)
Supply quality	• Expired vaccine(s) in stock • VVMs show that vaccine has reached the discard point • Frozen DTP and HepB containing vaccines in refrigerator	• Review stock recording system. (Module 5, Section 4) • Review method of estimating needs. (Module 5, Section 3) • Review management of cold chain equipment. (Module 3, Section 4)
Staffing quality	Some staff have not had recent training	Inform supervisor and select subjects for "on-the-job" training/supportive supervision, for example: • Using AD syringes (Module 6, Section 3.5) • New vaccines (Module 2) • Reading Vaccine Vial Monitors (VVM) (Module 3, Section 3) • Implementing Multi dose vial policy (MDVP) (Module 3, Section 4)
	Irregular supervisory visits	• Include supervisory visits' schedule in district workplan (Module 5, Annex 2)
Staffing quantity	Vacant position of health worker, general staff shortage	• Inform supervisor and district authorities and take steps for recruitment. • Request temporary assignment from district level and consider volunteers for some duties. • Ensure staff available for each session. (see district workplan, Module 5, Annex 2)

	Examples of common problems	Examples of solutions: activities to be included in workplan
Service quality and demand	Poor attendance at sessions and poor utilization in some areas	• Meet with the community to discuss possible reasons for low attendance and suggested solutions. (Module 8, Section 1) • Consult the community and change workplan to make sessions more convenient for the community. (Module 5, Section 5 and Module 8) • Check whether all planned sessions have been held, aim to improve reliability by holding all planned sessions. (Module 5, Section 2) • Screen all infants for immunization whenever they visit the health facility and give all of the vaccines they are eligible to receive (Module 6, Section 2) • Review use of true contraindications to ensure that infants are not missed (Module 6, Section 2)
	Mothers lose or do not bring the immunization cards	• Set up a defaulter tracking system to keep complete records (register, reminder cards) at the health facility and take these along during outreach sessions. (Module 7, Section 1). Provide new cards and update from other records. (Do not restart schedule because of lost cards)(Module 7, Section 1)
	Parents fear side-effects and there are rumours that Injection practices are not 100% safe	• Inform parents about benefits of immunization and reassure about side-effects. (Module 2) • Review safe injection practices: ensure AD syringes supply, use safety boxes, use safe disposal practices.(Module 4) • Meet community to discuss rumours (Module 8, Section 4) • Review information on AEFI (Module 2) and how to report AEFI cases (Module 7, Section 2)

	Examples of common problems	Examples of solutions: activities to be included in workplan
Service quantity and demand	Unreliable information about catchment population	• Request community to list of all households, families, newborns (Module 8) • Map your catchment area to include all populations (Module 5, Section 1) • Compare population data from various sources including data from National Immunization Days (use the NID <5 population and divide by 5 for infant target).
	Inaccurate coverage data	• Check record keeping and reporting systems for completeness (Module 7, Section 1 and 2) • Review all tally sheets and reports (Module 7, Section 1), does numerator include all areas?
	Some areas distant and underserved	• Discuss with supervisor and organize mobile team approach from district/province, minimum 4 sessions per year. (Module 5, Section 2) • Discuss service with the communities and arrange adequate sessions, dates and timings.(Module 8)
	Transport not available for some outreach sessions	• Identify which sessions were not held due to lack of transport • Look for alternative transport e.g. public transport , sharing with other programs • Request next level for vehicle for outreach/mobile
	Poor attendance at antenatal care (ANC) clinics and/or poor TT2+ coverage	• Promote value of antenatal care including TT immunization during any contact with pregnant women. • Inform the community about dates of ANC clinics. Find out if session timing or venue is inconvenient, if so make appropriate changes in next quarter's work-plan. • Use all opportunities to give TT immunization including when mothers accompany infants for childhood immunizations.

4.4 Supervising the activities

Quick checklist for supervising activities at the health facility level.

Every facility that provides immunization services should have basic planning and monitoring tools. It is helpful to list these as a simple checklist:

- a map of the catchment area
- session plan
- workplan (updated every quarter)
- stock cards or book
- cold chain temperature log (if applicable)
- immunization register
- monitoring chart
- chart of reported cases
- system for tracking defaulters.

A supervisory checklist is provided in Annex 5. This checklist is useful for supportive supervision.

Checking data quality

Look for the following data quality problems and take action to improve the quality:

- coverage rate over 100% (maybe due to a denominator problem)
- large month to month variations in total doses given (may indicate a completeness problem, e.g. were all the tally sheets correctly filled?)
- negative dropout rate – some doses are not being tallied correctly or infants may receive DTP1 at one health facility and DTP2 and DTP3 at other places, or older children included for DTP3
- discrepancy between doses which are theoretically given at the same time, e.g. DTP1 and OPV1, measles and yellow fever, etc.
- discrepancy between the number of persons immunized and number of vials used during the period
- decrease in the target population compared to previous years (in most developing countries, the birth rate is increasing, not decreasing).

Most of these problems can be checked by good quality record-keeping and reporting (register, tally sheets, reporting forms).

Annex 1

Sample immunization register for infants and mothers (used in some countries)

Village: _____

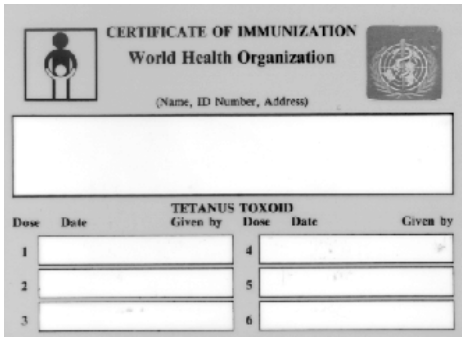
Name of Health Center: _____

No.	Date of visit	Name of infant	DOB[a]	Sex	Name of mother	Address	Vaccinations (dates, day/month/year)													Maternal TT					PAB	
							BCG	OPV0	OPV1	OPV2	OPV3	DTP1	DPT2	DTP3	HepB0	HepB1	HepB2	HepB3	Measles	Vit. A	TT1	TT2	TT3	TT4	TT5	Y	N

Note: Additional columns can be added to include other vaccine, i.e. yellow fever, Hib ...

[a]DOB: Date of birth

Sample TT card for women


CERTIFICATE OF IMMUNIZATION

World Health Organization

(Name, ID Number, Address)

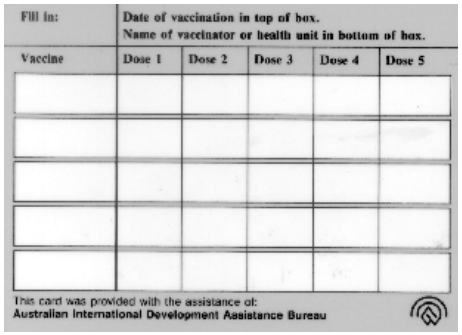
TETANUS TOXOID

Dose Date Given by Dose Date Given by

1 4

2 5

3 6


Fill in: Date of vaccination in top of box. Name of vaccinator or health unit in bottom of box.

Vaccine	Dose 1	Dose 2	Dose 3	Dose 4	Dose 5

This card was provided with the assistance of:
Australian International Development Assistance Bureau

Annex 2
Reporting routine TT immunization for women

1. TT2+ coverage indicator

TT immunization is recorded on tally sheets and cards as TT1, TT2, TT3, TT4, TT5.

When these doses are reported to the next level the indicator used is TT2+.

The numerator is an aggregate of TT doses from the second dose onwards (the first dose is not included in the coverage indicator, but reported separately since it is not protective).

The denominator is the target population of infants under one year of age, since this is simplest and closest to the number of pregnant women. Some countries will use the number of live births as the denominator.

$$\text{TT2+ \%} = \frac{\text{TT2+TT3+TT4+TT5}}{\text{Target population of infants under one year of age or live births}} \times 100$$

2. Protection at birth (PAB) indicator

a) Computation of PAB

The TT2+ indicator works well when coverage with TT is relatively low. However, as TT coverage increases, fewer women will need to receive TT (they are already protected) so the numerator will go down, but the denominator (births) will not. This will lead to an incorrect estimate of programme performance. One way to avoid this problem is by using the protection at birth indicator. This indicator measures the percentage of infants who were protected from NT at birth by the immunization of their mothers with TT before the birth.

$$\text{Protection at birth \%} = \frac{\text{No. of infants whose mothers had protective doses of TT}}{\text{Target population of infants under one year of age or live births}} \times 100$$

b) How to measure protection at birth (PAB)

The best way to measure this indicator is during the first visit of the infant for its DPT1 dose. Ask the mother accompanying the infant if she has a TT record card. If she has not, ask if she can remember receiving doses of TT during pregnancy.

You can consider that the infant was protected from NT at its birth (PAB) if the mother has received:

Two doses of TT during the recent pregnancy or at least three doses of TT in the past.

Note that this is the simplest way to measure PAB. Some countries have adopted more elaborate ways to measure PAB. Ideally, PAB questions should take into account all doses received as well as intervals between these doses. Where this is not feasible, the method mentioned above can be considered as an acceptable alternative.

c) How to record "protected at birth"

Protected at birth can be recorded:

- in a separate column in the infant register together with other information about the infant;
- on the tally sheet when DTP1 is given;
- on each infant immunization card in a separate box.

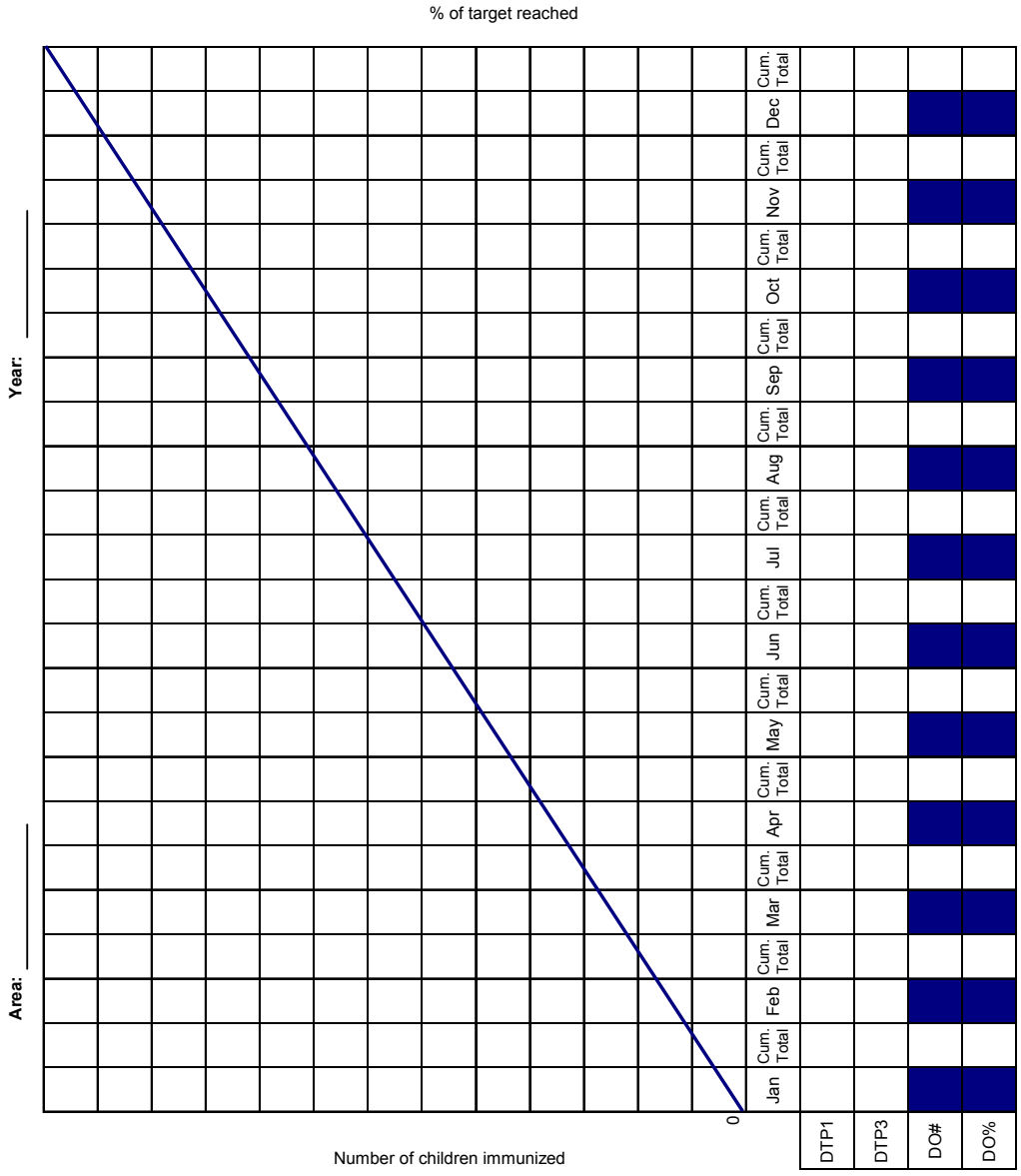
Remember that the information should be obtained by asking the mother at the DPT1 immunization contact, as it will be less reliable at later contacts.

When you need to report the monthly performance for "protection at birth", you can look at the register and total up the number of infants recorded as protected at birth for that month, or you can use the tally sheets.

Finally, it is of utmost importance that every woman who has a child considered to be "not protected at birth" receive a dose of TT during the same immunization session as her child. An appointment for subsequent doses should be made. Likewise, a woman who is eligible for a dose (even if the child was protected at birth), should receive a booster at that very session.

Annex 3
Blank monitoring chart

Chart for monitoring DTP1 and DTP3 doses given and dropouts in infants more than one year of age



Annex 4
Worked example: Analyses of health facility data

Area name	Compile population, immunization coverage data in previous 12 months							Analyse Problem					
Village name	Target population	Doses of vaccine administred			Immunization coverage (%)			Unimmunized (No.)		Drop-out (rates (%)		Identify problem (see table 7.4)	
		DPT1	DPT3	Measles	DPT1	DPT3	Measles	DPT3	Measles	DPT1-DPT3	DPT1-Measles	Access	Utilization
a	b	c	d	e	f	g	h	i	j	k	l	m	n
KIRANE	580	615	352	272	106%	61%	47%	228	308	43%	56%	Good	Poor
FANGA	387	365	232	332	94%	60%	86%	155	55	36%	9%	Good	Poor
DIONCOULANE	362	164	75	25	45%	21%	7%	287	337	54%	85%	Poor	Poor
TAMBACARA	399	447	256	190	112%	64%	48%	143	209	43%	57%	Good	Poor
KERSIGNANE D	134	105	75	41	78%	56%	31%	59	93	29%	61%	Poor	Poor
MARENA	441	263	79	91	60%	18%	21%	362	350	70%	65%	Poor	Poor
BANDIOUGOULA	160	195	76	121	122%	48%	76%	84	39	61%	38%	Good	Poor
DIONGAGA	313	261	92	61	83%	29%	19%	221	252	65%	77%	Good	Poor
KERSIGNAME K	472	273	90	149	58%	19%	32%	382	323	67%	45%	Poor	Poor
CENTRAL	613	649	395	342	106%	64%	56%	218	271	39%	47%	Good	Poor
GORY	236	107	50	71	45%	21%	30%	186	165	53%	34%	Poor	Poor
KODIE	152	116	88	60	76%	58%	39%	64	92	24%	48%	Poor	Poor
TOTAL	4,249	3,768	1,860	1,755	89%	44%	41%	2389	2494	51%	53%	Good	Poor

Annex 5

Supervisory checklist during visits to a health facility

Checklist	Explanation
A. Recording practices of routine immunization activities	
1. Are there tally sheets for infant vaccinations and do they have entries for the last immunization day?	Main concern is regular use of tally sheet and monitoring session activities.
2. Are registers used for recording individual information about infant immunizations?	Each health facility should have a book or register where each infant's immunization history can be registered and traced back.
3. Are individual immunization cards used, updated and given to the parent (or guardian) at the time of the immunization visit?	Blank cards should be available in the health facility. Immunization cards are often integrated in "Road to Health" or other health cards. The HU should not keep original vaccination cards.
4. Can an infant's vaccination history be easily and rapidly found in the health facility's books?	A new dose should be entered in the health facility's registers in the location where previous doses have been entered.
5. Is there a mechanism in place to track vaccine doses that are due or to track defaulters?	Check how the health facility's can know when an infant should return for a vaccine dose.
6. Can copies of previous reports from this health unit be found in the health facility's?	Copies of all reports from current and previous year should be available.
7. Are the health unit reports filled in correctly and completely?	Check whether reports have been filled in correctly.
8. Is the book for vaccine stock and syringe supply up-to-date?	Check against available stock (count doses in the fridge).
9. Observe a minimum of five vaccinations. Were all vaccinations correctly registered on the tally sheet, the health facility's register and the infant health card? Are mothers told when the next dose should be received?	Check the tally sheet, the register and the card after immunization as well as the return date.
10. Are health staff aware of how to report an adverse event?	Ask health staff what is supposed to be done if an infant becomes severely ill or dies after a vaccination. Ask to show any forms that are to be used.
11. Is the cold chain temperature monitoring chart completed daily?	Check the chart and compare the latest reported temperature with the actual temperature in the refrigerator.

Checklist	Explanation
12. Is PAB checked at the moment DTP1 is given?	Mothers of unprotected newborns should receive TT and be told when to get next dose. TT dose must be recorded on a vaccination card.
B. Demographic information	
1. Does the health facility have data on the number of infants born in its catchment area, and does it have a target set for the number of infants that should be vaccinated during the calendar year?	Discuss if difference with denominator available at more central level. Discuss ways to collect denominator information from community (e.g. birth register), NIDs data, or other sources. Discuss if the target was setup by the district or health facility level. Compare target to total population (should be around 4% in most countries).
2. Does the health facility have a session plan , with a map showing the catchment area — including the outreach villages, and by strategy:— fixed/outreach/mobile?	It is important to know if the session plan shows how all the target population can be reached regularly. Pick a remote village from the map, and ask the health facility when this village was last visited and will next be visited, according to a written plan.
C. Core outputs/analyses	
1. Does the health facility have an up-to-date chart or table (preferably on display) showing the number of vaccinations by report period for the current year?	Monitoring coverage chart must be up-to-date. Check if available for DTP1, DTP3, and measles.
2. Is there a monthly chart/graph of VPD cases (broken down by VPD)?	How do these data correspond to coverage data (i.e. more cases in areas with poor coverage). When was the last VPD outbreak? Was it investigated? Why did it occur?
3. Is there a monitoring of dropout rate?	Discuss the importance and reasons for dropouts.
4. Is there a monitoring of vaccine wastage?	Discuss the reasons for wastage and any ways it might be reduced. Is the multi-dose vial policy being practised?
D. Evidence of using data for action	
1. Are areas of low access identified and is there evidence of actions taken to deal with it?	If there is low access (evidenced by low BCG or DTP1 coverage) in certain areas, what strategies are being used to reach these areas?
2. Have reasons for any high dropout been identified, and are there plans/actions to deal with it?	Are there any managerial practices that can be changed?
3. Is there a standard system in place to follow up defaulting infants (i.e. who don't come back for subsequent doses); when was the last time a child was followed up?	Is the register being used? Are there reminder cards? Is the community informed? Are there follow-up visits?
4. Are there ever stockouts of vaccine or syringes? How are data used to prevent stockouts?	What action is taken to obtain more supplies when stock levels go below the reserve level?
5. Is there interaction with the community regarding immunization? Ask for information	Are health staff actively involved in any community committees or meetings on health,

on "what" and "when".	follow-up of defaulters, investigations of outbreaks or any rumours of AEFIs, etc.

Annex 6

Simple questionnaire to investigate reasons for low coverage and dropouts

This questionnaire will assist you to gather feedback about the status of immunization services in areas close to the health facility. It investigates the number of infants and their mothers (for TT immunization) who did not complete their immunization schedule, the number of people who are never reached, why infants and women do not go or return for immunization, and how women think services can be improved. You will not need much time to do this. It can be carried out in one day. It is an opportunity to discuss these subjects directly with child caretakers and find out how services could be improved and why they are not used.

The results of this survey are not representative of any population other than the households you interview. It is intended to supplement, not replace, routine reporting.

The purpose is to investigate at least *five* infants under two years of age and their mothers of childbearing age not vaccinated or who did **not** complete their immunization schedule.

Follow the steps below:

1. Use the tally sheet and the questionnaire presented on the following page for the interviews and to compile data. If needed you can modify this questionnaire to fit your needs.

2. Collect and compile data.

    a) Visit the households that are closest to the health facility until you identify at least five infants under two years of age, and their mothers, who are not vaccinated or who are overdue for the next vaccine dose ("partially immunized"). The households do not have to be randomly selected and they may be interviewed in any order. In each household having any infants under two years of age and their mothers, ask for the infant's and mother's immunization card(s). If the infant or mother is not completely immunized, each mother should be asked to give one reason why. Enter this information in Item C of the tally sheet. Each woman should also be asked for her suggestions on how to improve the health services: enter this in Item D.

    b) Add up the number of households visited from Item A and the immunization status of infants and mothers interviewed in the survey from Item B. Record the totals in the appropriate space on the form.

3. Analyse the data.

    c) Investigate why the infants and mothers were not, or were only partially, immunized.

    d) Make a list of all the reasons given (Item C) and of suggestions for improvement (Item D).

    e) Discuss possible solutions with your team given current resources as well as with extra resources (see Section 4 “Identify causes of the problems”). What step does this refer to?

Tally sheet and questionnaire for the convenience households survey

Infants under two years of age (0 – 23 months) and their mothers for TT

Health facility: _____ Date of questionnaire: _____

Response	Place tally marks here		Total	
A. Tally the number of households visited				
B. Immunization status:	Tally children (c)	Tally mothers (m)	(c)	(m)
Not immunized				
Partially immunized				
Adequately or fully immunized				
C. Child name	Reasons given for being partially or not immunized			
1.				
2.				
3.				
4.				
5.				
C. Mother's name	Reasons given for being partially or not immunized with TT			
1.				
2.				
3.				
4.				
5.				
D. Suggestions for improvement				
1.				
2.				
3.				

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Immunization in practice

Module 8: Building community support for immunization

Contents

About this module

This module explains how to make the immunization service responsive to community needs and how to gain community support for immunization. The module details how to:

1. hold meetings with the community to build support for immunization services;

2. plan suitable immunization sessions;

3. mobilize the community using suitable methods and messages;

4. deal with rumours and misinformation.

Other modules that include important issues for improving relationships with the community include:

Module 4, Section 3: Disposing used syringes and needles

Module 5, Section 5: Involving community in planning

Module 6, Section 5: Communication with parents

Module 7, Annex 6: Guidelines for community feedback on immunization services.

1. Meeting with the community to build support for immunization services

It is very important to meet with the community to build strong support for immunization services.

1.1 Meeting with community leaders

Arrange a meeting with each of the leaders in your community.

Find out:

- what they already know about immunization;
- any concerns the leaders may have about immunization;
- any concerns families in their community may have;
- any traditional beliefs about disease or vaccination;
- what barriers their people may face in accessing services (e.g. distance, seasonal work commitments, traditional festivals or customs, lack of money for transport, unsuitable session days or times);
- number of families or households in the community;
- number of new births, special groups etc within the community;
- appropriate times and locations for sessions;
- if they already motivate parents to attend immunizations sessions and how;
- ideas on how to immunize more children in their community.

1.2 Meeting with religious leaders

Religious leaders are similar to community leaders in many ways, but there are some important differences. Their position can make them the most effective influences of all. They may, however, hold strong views on some issues and, in a minority of cases, they may have religious concerns about immunization. In extreme cases they may even advise families not to immunize. Building good relationships with the religious leaders of every group in your community in advance is essential and will bring the programme many benefits for years to come.

In addition to the questions for community leaders in general (listed above) find out the following from religious leaders:

- specific religious beliefs about disease or vaccination;
- any religious customs that may be a barrier to immunization;
- what special efforts can be made to provide immunization services to this religious group;
- if they will promote vaccinations sessions regularly at religious gatherings;
- if there are any volunteer groups willing to help with immunization efforts.

1.3 Meeting with parents

One of the most effective ways to get a range of opinions in a short space of time is to arrange small "focus" or discussion groups, each of around ten people. Try to include a good cross-section of the community: especially include those you think may not regularly benefit from immunization. You may need to schedule separate sessions for men and women as in some communities women may not talk freely in front of men.

First meet with the parents who visit the centre and find out about their experiences (good and bad) with the services provided. Note, however, that these parents will by and large be already convinced about immunization and have some trust in the services offered in the centre. You should therefore plan to reach those parents in the community who for one reason or another do not attend the health centre. Interview the mothers attending the centre first since they are readily accessible and are often willing to talk about the services. In addition they may suggest ways of reaching those who do not use the centre.

When meeting with parents, find out:

- what they already know about immunization;
- what concerns they themselves may have about immunization;
- about traditional beliefs about disease or vaccination;
- about any constraints to accessing existing services;
- if the times and locations of sessions are appropriate;
- what they think about the quality of the service;
- how the service could be improved;
- if they already motivate friends, relatives and neighbours to have immunizations and how.

1.4 Meeting with teachers

Teachers can be very useful allies. They can educate their students about immunization and encourage them to take this learning home to their parents. Older children will shortly be starting their own families, so it is vital they have good knowledge and skills about immunization. Many teachers may already serve as volunteers during national immunization days.

When meeting with teachers, find out:

- what immunization activities they have already been involved in;
- any concerns they themselves may have about immunization;
- if they already include health education sessions on diseases and immunization;
- if so, what they teach and to what age groups; if not, how this could be achieved;
- if students could be encouraged to remind parents about immunization when there are new babies in the family;
- any ideas about how they could contribute further to improving immunization rates in the community .

1.5 Meeting with other groups (NGOs, private health practitioners etc.)

Remember to meet with any other person or community group who can help to improve the service. This will depend on your own community, but could include groups such as traditional birth attendants (TBAs), traditional healers, private health practitioners, local medical associations, volunteer groups and NGOs.

1.6 Meetings with special groups

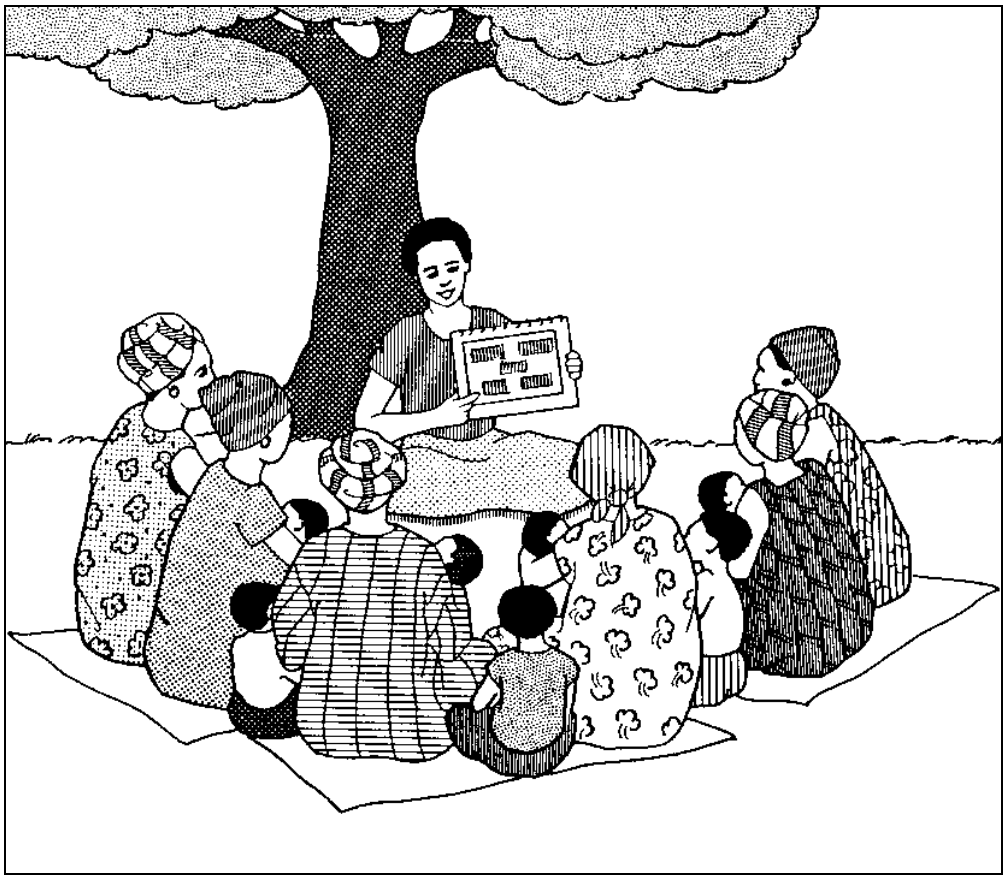
In your community there may be some special groups who have been largely unreached by immunization services, or choose not to participate in them. In all cases you should include them in your meetings and planning process right from the start.

Some examples of special groups:

- Nomadic groups
- Migrant workers
- Ethnic or other minority groups
- Families that fear contact with government, for example if they lack proper documents
- Groups with difficult physical/geographical access

- Religious or traditional sects that refuse vaccination
- Refugees
- Homeless families or families in dense urban areas
- Street children.

Figure 8A: Meeting with mothers to promote immunization services



2. Planning suitable sessions

You must involve the community to plan when and where to hold immunization sessions and who can help.

2.1 When to hold immunization sessions

- Try to schedule sessions at a convenient time for parents.
- If possible, organize an immunization session to coincide with market day when mothers are coming to the village centre anyway.
- Avoid any session clashes with religious services or important events such as sporting events. At the same time, a major event in the community can be an opportunity to inform people about inmmunization.

2.2 Where to hold outreach sessions

- Hold sessions in a place that is most convenient and accessible for the parents.
- It is also desirable to hold sessions at the same time and location each time to make it easier for people to remember.

2.3 Who can help you

You need helpers to encourage parents to come for immunization, to educate them while they are waiting, and generally to help out during the sessions.

These helpers can include:

- Older school children, as part of school project
- Local youth groups, e.g. scouts, young leaders or political youth organizations
- Local businessmen's clubs
- Community volunteers.

When immunization services are reliable, they are well attended. If a change in session plan is needed, inform the community in advance.

3. Mobilizing your community using suitable message and methods

There are many ways to mobilize your community. The best idea is to use a mix of methods so that you can reach the widest range of people.

3.1 Use clear, simple and accurate messages

Creating effective messages is not easy; you need to give truthful, technical, practical and motivational information in a way that can be easily understood by the different audiences at different times. You must be very clear so that you cannot easily be misinterpreted.

Below are some generic messages about immunization for parents. It is essential that each message is adapted to your own setting. Therefore the messages below should be considered **suggestions** as to the content but not to the actual wording of messages.

Routine immunization

- Immunization protects your infant from certain diseases like polio and measles.
- Know when and where to take your child for his or her next immunization. Check your baby's immunization card or ask your health worker.
- To get good protection against some diseases, infants need to have some vaccines repeated three times. Ensure that your infant completes the basic series of immunizations by his or her first birthday.
- Ask your health worker if you and your children need additional vaccinations.
- Pregnant women need protection from tetanus for themselves and their babies.
- Some injections may cause mild side-effects such as light fever, soreness and redness. If this happens, ask your health worker for advice about what to do.

Vitamin A supplementation

- Vitamin A helps the body fight infections like measles and diarrhoea.
- Lack of vitamin A can cause night blindness.
- Ask your health worker about where and when to take your children for their next vitamin A dose. Each child should receive a dose of vitamin A every six months.

New vaccines

- The national immunization service now offers protection against an additional disease(s): (name of disease[s]). This is free of charge and can be had at (location) (date, time).

- Hepatitis B vaccine protects against serious diseases of the liver. The vaccine prevents infections in children that can cause death when they reach adulthood many years later.

- Hib vaccine protects against pneumonia and meningitis — two diseases that kill many, many children.

- Your children will receive the new vaccine at the same time they already receive protection against other diseases (diphtheria, tetanus, and whooping cough) [if quadrivalent or pentavalent is being used in the same injection also]. Therefore, the new vaccine is like a bonus for your children — more protection with no more effort.

- The new vaccine is extremely safe and causes no new side-effects.

AD Syringes

- These new syringes and needles can only be used once and are the safest type of syringe available.

3.2 Using suitable methods to mobilize the community

Methods to use when you have limited resources

For district and health facilities staff with limited resources, the best method of communication is by personal interaction with the community. Sometimes it is helpful to have some prepared messages in written form, but it is always good to spend time discussing immunization face to face in order to make sure that the service meets the community needs.

Methods to use when you have extra resources available

With the help of district/province staff you could organize:

- community meetings

- the diffusion of messages in religious places

- loudspeaker messages for the community

- discussion sessions at farmers' meetings, in the market place and other places

- the distribution of material such as posters and leaflets

- radio and TV spots

- newspaper articles and drama shows.

4. Dealing with rumours and misinformation[1]

Rumours and misinformation about immunization are amongst the most serious threats to the success of your immunization programme. Once rumours start they can be very hard to stop.

Some examples of rumors:

- "Vaccines are a contraceptive to control population or to limit the size of a certain ethnic group."
- "Vaccines are contaminated by the AIDS virus or mad cow disease."
- "Children are dying after receiving vaccines."

Unless the rumour can very easily be contained and addressed you must refer the matter to your supervisors **as quickly as possible**. You will need to work under their direction - action may even need to be taken at the national level. The consequences of rumours can be serious and, if unchecked, they can travel quickly beyond your local area.

4.1 What you can do at the health facility

Under the direction of your supervisor:

- Meet with key opinion leaders (politicians, traditional and religious leaders, community leaders, other health workers).
- Organize meetings at sites where the individuals/groups are comfortable and feel at ease to ask questions.
- If there is a national mass media response, encourage your community members to watch and talk about it.

[1] Adapted from checklist 10 - "Communication for polio eradication and routine immunization – Checklists and easy reference guides"

4.2 Words of advice

- React swiftly and adapt your ongoing activities to give a quick response.
- Develop strong relationships and trust with your community in advance (religious, social and media groups).
- Give clear and consistent messages.
- Take the time to deal with rumours. Doing so will benefit routine immunization as well as campaigns.