
UNIT 1 IMMUNIZATION

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1.0 OBJECTIVES

After going through this unit, you should be able to:

- list and manage activities for organizing an immunization session;
- administer various vaccines under national immunization programme;
- demonstrate safe use of injection, equipment and its safe disposal;
- record immunizations on the card and mother and child care register; and
- interpret immunization card and register.

1.1 INTRODUCTION

You have learnt the theoretical concept underlying immunity and immunization in MME-103, Unit 21 of Block 5. Now is the time to put these into practice. Pause for a minute and recall the important practical components. Yes, you are conducting immunization sessions,

evaluating immunization coverage and conducting disease surveillance. In this unit, you will learn about these components. Many of these concepts and practices that we discuss with you may already be known to you. At the same time, you will also learn about some desirable practices, which will be new to you. You have to maintain a record of all the activities in the worksheets given in this manual and have them countersigned by your respective counsellors. These will be required for calculating your final grade at the end of the course.

1.2 ORGANISING AN IMMUNIZATION SESSION

Your counsellor will arrange a day and fix up an area for you to organize an immunization session in and around the Medical College/Programme Study Centre.

You should prepare yourself a day in advance and should :

- Inform the local resource persons and seek their help. Request anganwadi worker, helper and other resource persons to be present during the session. They will help you in calling the beneficiaries and arranging the venue of the session.
- Workout the vaccine requirements, find out dose-wise, vaccine-wise number of eligibles. Arrange vaccines and other supplies accordingly.
- Use one syringe and one needle for each injection, which should be pre-sterilised using an autoclave or a steam sterilizer.
- Carry enough immunization cards (as per expected number of beneficiaries) and immunization register.
- Bring vaccines from the PHC/other fixed facility on the day of immunization in a vaccine carrier. Also check for expiry date and see that DPT, TT, DT are not frozen. Do not forget to carry the diluents for BCG and measles.
- Conduct immunization preferably in a room, if not in a cool shady place.
- Open the vaccine carrier only when necessary.
- Take out one vial of a vaccine at a time and keep it in cup with ice cubes or in the ice pack.
- Keep the BCG ampoules covered with a foil or black paper.
- Transfer the vaccines back to the carrier, if no beneficiary is expected for a long time.
- Record immunization on the cards and register.
- Inform when to come for next dose, probable side reactions and where to seek doctor's help in case of need and hand over immunization card to the mother.
- Reply to all queries of mothers, which are commonly regarding feeding growth or common ailments of the infants.

1.3 HOW TO ADMINISTER VACCINES

Before administering the vaccines you must see the expiry date for DPT, DT, TT. You must also check that these are not frozen as freezing can damage these vaccines. This is done by shake test.

Shake test: Shake the vial so that all the contents are completely mixed up. Wait for 15 minutes. If there are floccules/sediment at the bottom, this vaccine has been frozen. Do not use such vaccine.

Dose of DPT, DT and TT is 0.5 ml each. DPT, DT are given by deep intramuscular route at the anterolateral aspect of mid thigh. TT is given intramuscularly above the insertion of deltoid muscle.

Polio vaccine is given by oral route. Two drops are put directly in the mouth of the child.

Measles and BCG vaccines are freeze dried and they need to be reconstituted before use. Therefore, you must reconstitute them with diluent before you can use them. Diluent for BCG is normal saline and for Measles, it is pyrogen free double distilled water.

- You must always keep the diluent with the vaccine in the middle compartment of the refrigerator/basket of ILR, in the cold box or vaccine carrier.
- By doing so, you are sure that it is cold enough when you need it but do not freeze diluent because the ampoule will break.

Reconstitution of a freeze dried vaccine:

Wait till some children have arrived and you are ready to use the vaccine.

Choose a sterile 5 ml syringe and a sterile mixing needle.

You have to use this syringe and needle for mixing only not for injecting.

- Open an ampoule of diluent. Draw the required quantity of the diluent into the syringe (2 ml for 20 dose ampoule of BCG and 5 ml for 10 dose vial of measles).
- Check the label and open the vaccine vial/ampoule.
- **Steps for BCG vaccine**
 - Tap the ampoule sharply (Fig. 1.1) before you open it, to make all the vaccine powder fall to the bottom. If you do not do this, vaccine may fall out when you break the ampoule neck.



Fig. 1.1: Tapping the ampoule

- Insert the mixing needle into the ampoule or vial of vaccine.
- Empty the diluent into the vaccine container.
- To mix the vaccine and diluent, gently roll the vaccine container between palms of your hands till the vaccine and diluent are well mixed. There is no need to shake the contents.
- Keep the BCG vaccine ampoule covered with a foil or black paper.
- Use the reconstituted vaccine for only one session preferably within 4 hours.

BCG Syringe

To give BCG vaccine, you need to measure very small doses of vaccines and to give it intradermally (into the skin). You need special syringes and needles to do this. As mentioned earlier, use separate syringe and a needle for each injection.

This is a narrow glass syringe. It has 2 scales. Use the scale which shows “.20, .40, .60, .80, 1.00 ml”. One division, or mark, is for 0.01 ml. So one (0.1 ml) dose of vaccine fills 10 divisions. Do not use the scale which shows 4, 8, 12, 16. BCG Syringe can be used for other purposes than immunization also; e.g. Allergy test and Insulin injection to diabetic patients etc.

Giving BCG vaccine: the Intradermal Injection

Reconstitute the vaccine, position the child, load the syringe.

- Expel a drop or two of vaccine through the needle to make sure that there is no air in the needle and the needle is not blocked.
- BCG vaccine should be given in the left arm. Hold the child’s arm with your left hand so that:
 - Your hand is under the arm
 - Your thumb and fingers come around the arm and stretch the skin
- Hold the syringe in your right hand, with the bevel and the scale pointing up towards you.
- Lay the syringe and needle almost flat along the child’s arm.
- Insert the tip of the needle into the skin—just the bevel and a little bit more.
 - Keep the needle flat along the skin, so that it only goes into the upper layers of the skin. Keep the bevel facing upwards.
 - Do not push too far; and do not point downwards, or the needle will go under the skin. Then it will be subcutaneous instead of an intradermal injection.
- Now put your left thumb over the needle end of the syringe to hold it in position.
 - Hold the plunger end of the syringe between the index and middle fingers of your right hand and press the plunger in with your right thumb (Fig. 1.2).

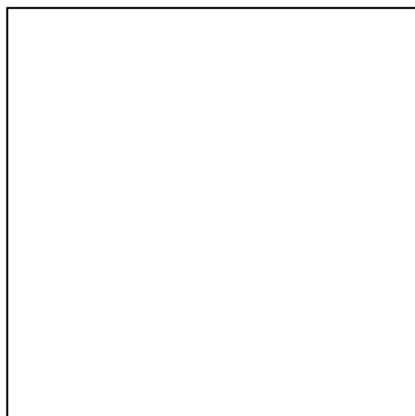


Fig. 1.2

- Inject 0.1 ml of vaccine and withdraw the needle.
 - Make sure that the syringe does not leak around the adaptor. If it leaks, you must fix on the needle more firmly.

If you inject BCG under the skin by mistake. You see that the skin does not swell or that there is a round bump under the skin. You may feel that the vaccine is going in too easily. You have to push the plunger harder for an intradermal injection. Your counsellor will arrange for you to give BCG vaccine to children. Practice it yourself on number of children till you feel confident.

What to do if you inject the vaccine under the skin by mistake

- Stop injecting and correct the position of the needle.
- Give the remainder of the dose, but no more.
- If you already have the whole dose under the skin, consider the child injected.
- Do not repeat the injection.
- Follow up the child carefully because side effects, like abscess and enlarged glands, are more likely in such cases.

Giving Measles Vaccine: the Subcutaneous Injection

Reconstitute the vaccine, position the child, load the syringe.

- Inject into the outer part of the child’s upper arm.
- Pinch up the skin with your fingers.
- Push the needle into the pinched up skin—Not straight in but sloping.
 - Do not push the needle far in
 - To control the needle, support the adaptor end of the syringe with your thumb and finger while you push the needle in (Fig. 1.3).

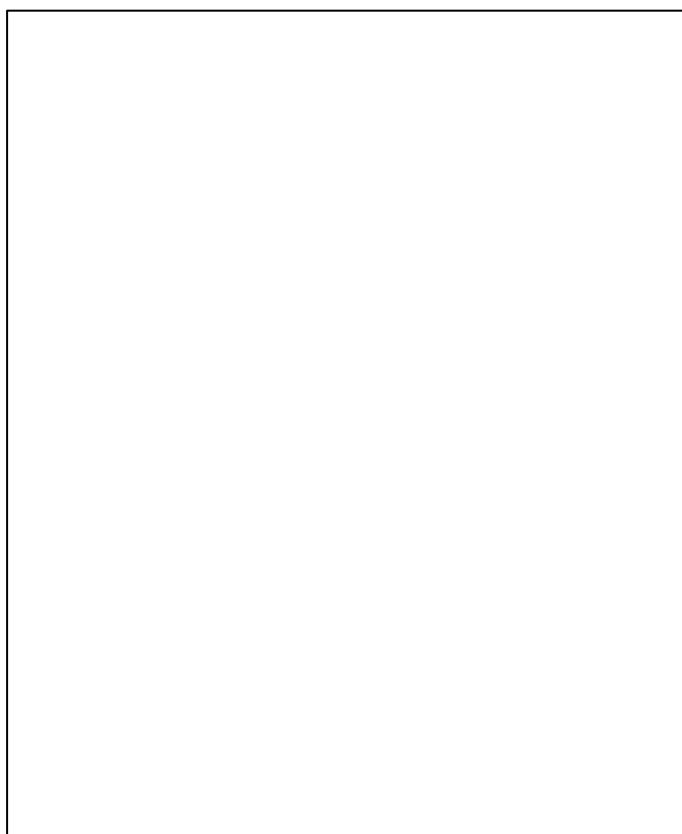


Fig. 1.3: Giving measles vaccine

- Withdraw the plunger to check for blood.

If the needle has entered a vein, blood will come into the syringe. Withdraw the needle, check and inject again.

- Press the plunger with your thumb to inject the vaccine.
- Withdraw the needle.
- Use reconstituted measles vaccine for 4 hours only.

Different Needle Positions

Different needle positions for immunization are given in Fig. 1.4 below:



Fig. 1.4: Different needle positions

Note: The approximate angle of the needle to the injection site is:

- Intra-dermal injection: 15° (BCG)
- Sub-cutaneous: 45° (Measles)
- Intra-muscular: 90° (DPT, DT, TT, Hepatitis)

The immunization schedule is given in MME-103, Unit 2 of Block 5. If needed please discuss the schedule with your counsellor. For example if a child comes at 9 months without any immunization; you can give all vaccines at a time in one go at different sites.

1.4 INJECTION SAFETY

In this section of the unit, you will learn about the various safety measures while carrying out immunization.

1.4.1 Using Glass Syringes and Needles

For immunization, either reusable syringes and needle or single use syringes and needles are used.

Reusable glass syringe and needles: Under the National Immunisation Programme, reusable glass syringes and needles are in use. A sterile syringe and needle must be used for each injection. Before use, these syringes and needles must be steam sterilized.

Before sterilizing reusable glass syringes and needles, you must flush, soak and clean them and make sure they are working properly. Flush them immediately after every time you use.

Immediately after use, flush needles and syringes with cold water. This prevents the needles from becoming blocked.

Single use syringes and needles (disposable): These are to be used for one injection and destroyed immediately after use to prevent re-use. Before disposing them, soak them in 1% bleach or 1% hypochlorite solution to prevent infection resulting from needle stick injuries. Now these are safe for disposal.

Soak the Syringes and Needles

- Keep a separate container for used syringes and needles.
- Put 1% bleach or 1% hypochlorite solution in it.
- After flushing a used syringe, separate the needle, barrel and plunger carefully.
- Put them into the container of bleach/hypochlorite solution for getting disinfected.
- After one hour, replace bleach/hypochlorite solution by clean water.
- The water prevents dirt and organic matter from sticking. So it will be easier to clean instruments later on.
- Do not put too many syringes and needles in one container for soaking as they may bleed easily and also soaking does not work well.
- To prevent needle-stick injuries, lay the syringes side-by-side in the plastic container, with all the needles pointing in the same direction.

Clean the Syringes

- Allow them to be soaked in clean water till the cleaning starts.
- Draw clean water into the syringe and then empty it out (as if you are injecting). Repeat it several times.
- Take plunger out of barrel and wash or rinse each part thoroughly as well as carefully.
- Just before sterilizing, pour away the water in which the syringes and needles are soaked and refill the plastic container with the clean water.

Cleaning removes most microorganisms and avoids contamination

Clean the Needles

- Using forceps, separate the needle from the syringe. Leave the needle in the wash basin until you are ready to clean it.
- Take a clean 10 or 5 ml syringe. Fill it with clean water and wash through each needle several times—as if you are injecting.
- If water does not go through the needle, it is blocked.

Before loading into the syringe, check the potency of the needle and that plunger seal fits inside the barrel of the syringe properly.

Test point of each needle for bluntness and barbs:

- Test each needle for barbs by drawing it carefully across some cotton wool or gauze. If the needle is barbed it will catch in the cotton wool or gauze (Fig. 1.5).
- Put barbed needles in a puncture-proof container for disposal. An injection with a barbed needle is painful; it also damages tissues and causes infection. Do not use it.



Fig. 1.5: Testing for barbs

Never test a needle for barbs with your finger or on your skin. Never give an injection with a barbed needle.

1.4.2 Sterilisation

The most efficient way to sterilize reusable injection equipment is to steam it at a temperature between 121°C to 126°C for 20 minutes, in accordance with the manufacturer's instructions. The combination of time, pressure and temperature kills tetanus spores and bacteria causing abscess as well as viruses such as Hepatitis B virus and human immunodeficiency virus (HIV). Under UIP, special pressure cookers with separators for needles and syringes were provided to all health units. The DYCMO/PHC MOs/ Immunization officer of the district will help your counsellor to show you the equipment. Your counsellor will make arrangements to show these equipment at various health units.

Only boiling is not sufficient for sterilization and therefore it is not recommended for sterilizing syringe and needle.

Make sure that the stove is on a firm surface and out of children's reach before lighting the stove. Light the stove and put the burner on high or full flame. Place the sterilizer on the stove. When steam comes from the pressure valve wait for 20 minutes. You may turn the burner down but not too low. After 20 minutes turn off the burner, open the pressure valve and remove the sterilizer from the stove. Open the pressure valve by lifting it with a forceps or a spoon. Steam escapes with noise which is normal. In the field condition if sterilizer pressure cooker is not available, boil the syringe and needles for 30 minutes after the boiling of water starts with bubbles.

- Do not use the syringe and needle until it is cold, otherwise vaccines will lose potency.
- Do not open the sterilizer until you need a sterile syringe and needle.

Fitting the barrel, plunger and needle together

- Use forceps to pick up the barrel and put it in your other hand.
- Use forceps to pick up a plunger and put it inside the barrel of same size [Fig. 1.6 (a)].
- Use forceps to pick up a needle of correct size. Hold the needle by its adapter and fit it to the adapter of the syringe.
- Turn the needle 1/4th turn to fix it securely [Fig. 1.6 (b)].

Now hold the syringe carefully in your hand.

Be careful all the time not to touch adapter of the barrel, seal of the plunger and shaft or bevel of the needle. Pick up correct size of the plunger or barrel as well as needle.

You can only touch the safe parts of the syringe and needle i.e. outside of barrel and top of the plunger. Otherwise, they may get contaminated.

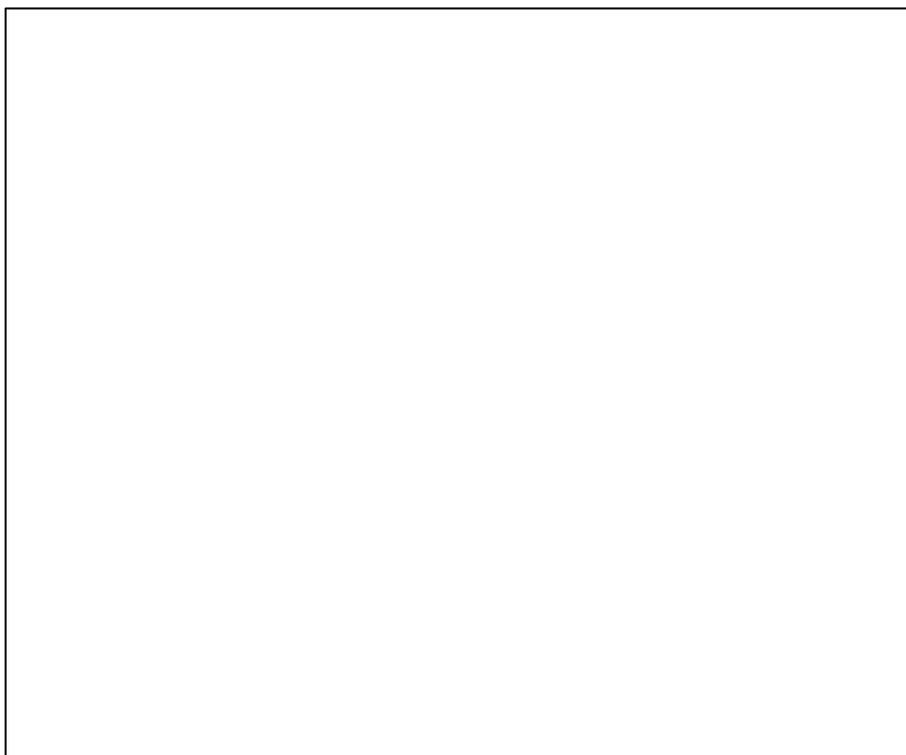


Fig. 1.6 (a): Putting a plunger into a barrel, using sterile forceps

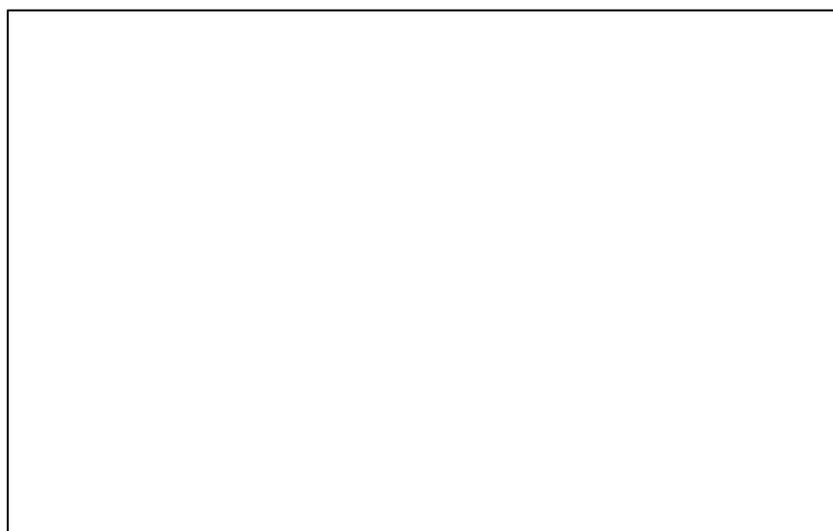


Fig. 1.6 (b): Twisting the needle to secure it

1.4.3 Disposal of Syringes and Needles

All disposable syringes and needles are disposed off after one use only, while reusable one are discarded when they are no longer usable.

For disposal needles should be placed in a puncture proof container.

After disinfection, disposable plastic syringes are collected in bag and sent to a site where they are shredded and the plastic material recycled. The disinfected needles are either incinerated or disposed off as metal scrap.

1.5 RECORDING IMMUNIZATION

Immunization is recorded on:

- Mother-infant immunization card; and
- Mother and child care register

They form the backbone of health information generated at sub-centre and higher levels.

You should ensure that these records are properly filled and updated regularly. The sample of these two records are mentioned in Annexure 1 and 2.

1.5.1 Mother Infant Immunization Card

Your counsellor will demonstrate this card. See carefully. Attach a photocopy of one of the cards you see in your field visit.

- 1) This card is to be used for the mother during her antenatal period. After delivery same card is to be used for immunization of the child.
- 2) On outer side of the card you will fill up identification data of the mother and on two foils.
- 3) On one foil, besides identification data, there are three boxes in the 1st row and 3 boxes in the second row.
- 4) On first box you will fill up date of giving DPT booster and in the second date of polio booster. From 3rd to 6th box you will fill up dates of giving second to sixth dose of vitamin A.
- 5) On inner side of this foil you will record second antenatal care and infant immunization. In the first row three boxes are meant for recording dates of antenatal check up, in second row dates of giving iron folic acid tablets and third row for recording 1st and 2nd dose of tetanus toxoid.

Below this are boxes for infant immunization and vitamin A. In the first box, you will record date of giving BCG vaccine. In the 2nd row, dates of giving 1st, 2nd and 3rd dose of DPT. In the 3rd row, you will record dates of giving 1st, 2nd and 3rd dose of OPV. In the last row you will record second date of giving measles vaccine and 1st dose of vitamin A.

You will easily see that blank boxes that serve as a reminder of the due doses.

You will tear off and keep this foil with you for follow up to ensure that antenatal care and immunizations are provided as per schedule.

- 6) On inner side of other two foils, you will fill up dates of service given during antenatal period and doses of different vaccines. Similar to the earlier foil, you will give this part of the card to the mother. It serves as an educational and motivational tool for her to get her child all the doses as per immunization schedule.
- 7) On the outer side of this card, central foil is meant for record of children 12-36 months of age. In this first two boxes you will record dates of giving booster dose of DPT and OPV, followed by 2nd to 5th dose of vitamin A. Below those boxes, national immunization schedule has been printed to provide information to the mother.

1.5.2 Mother and Child Care Register

When you visit the sub-centre along with your counsellor, observe that:

- 1) This register has been developed to record all MCH activities of the sub-centres area.
- 2) Separators are provided to separate the records of each village.
- 3) On the separators, the details of the village is filled in.
- 4) On the top of every page the year is entered. For example enter 2002-03 for cases to be registered during 1st April, 2002 to 31st March, 2003, and so on for coming years too.

- 5) Col. 2

During the field visit ANM should identify all pregnant women and register them in column 3 after giving a serial number.

- 6) The same Serial No. should also be entered in the MCH Card. The year of registration is indicated in the card for example a case listed at Serial No. 2 in 2002-03 should be written on the card as 2002-03.

- 7) Col. 5

The number of pregnancies the women had including the present one should be entered in the column 5 of the register.

- 8) Col. 10, 14 and 18

While examining the pregnant women ANM looks for certain danger signs which may require her personal continuous supervision and/or referral. These danger signs are:

- a) Anaemia
- b) B.P. above 140 mm Hg.
- c) Abnormal weight gain (>5 kg/month)
- d) First pregnancy with age less than 20 and more than 30 years
- e) More than 4 pregnancies
- f) Bleeding during pregnancy (APH)
- g) Ceasarian operation during previous pregnancy
- h) Abnormal/lack of movements
- i) Convulsion

Appropriate code from the above list is entered in column 10, 14 and 18.

- 9) In Col. 19 ANM is supposed to enter the place of delivery. For this purpose ANM needs to choose the appropriate code from the following:

- a) at home
- b) at sub-centre
- c) other institution including private hospitals

- 10) Col. 20 of the register deals with the person who has conducted the delivery. She enters appropriate code from the following:

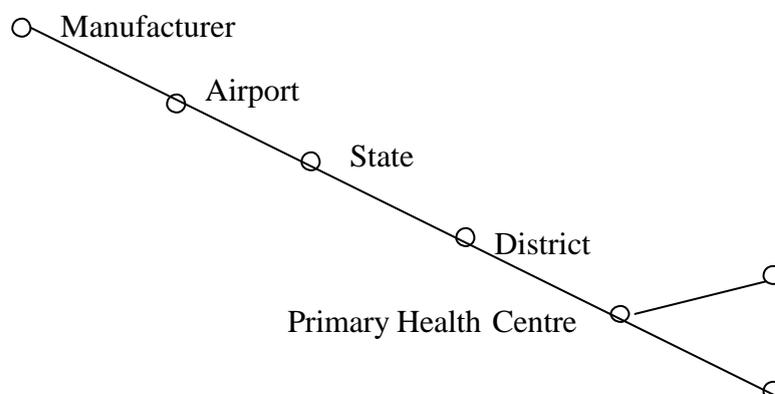
- a) Doctor
- b) ANM/LHV/Nurse
- c) Trained Dai
- d) Untrained Dai and/or others (relations etc.)

- 11) Col. 21 deals with the health status of mother and newborn.
ANM chooses the appropriate code from the following and enters in this column:
 - a) mother and child healthy
 - b) mother died
 - c) child died
 - d) dead child born
- 12) Col. 23 deals with status of newborn. For this purpose ANM needs to choose from following options:
 - a) If the child was healthy up to 7 days;
 - b) If the child was healthy up to 28 days;
 - c) If the child dies within 7 days, and
 - d) If the dies after 7 days but before 28 days.
- 13. You are aware that the primary vaccination i.e. one dose of BCG, three doses of DPT and OPV each, one dose of measles and the first does of Vitamin A should be given before the completion of the first year of the child. Column 36 deals with immunization status of infant at the age of one year.
 - a) If primary immunization was completed before the first year of the child;
 - b) If primary immunization was not completed before the first year of the child.
- 14. Other columns are self explanatory. One can read these in the register and fill up easily.

1.6 MANAGING THE COLD CHAIN

Imagine a situation, an infant who had received all the doses of OPV develops polio. In all likelihood, this may have been due to administration of a vaccine, which was not potent. Amount of bad publicity generated by such instances will neutralize the goodwill that took many years to build. One of the prime reasons for vaccines losing their potency is storing them without following a proper protocol. The cold chain system is responsible for maintaining the potency of vaccines from the manufacturer to the user.

Let us take a look at the route adopted by a vaccine.



The safe passage of a vaccine (i.e. in a potent state) depends on transport, equipment and personnel. Together, these three constitute what is called a cold chain. You will appreciate those chances of cold chain failure. In this unit, we shall limit ourselves activities to be undertaken at sub-centre (SC), Primary Health Centre (PHC) and district level.

1.6.1 Obtaining the Vaccines

Requirement for one month for a PHC can be estimated by totalling the requirements of all sessions to be held in a month. This method gives accurate requirements of vaccines and is preferred method. You can also calculate vaccine requirements for a PHC or a district as below:

Estimate Vaccine requirements for an immunization session:

- Estimate number of beneficiaries
- Estimate number of doses of each vaccine required in each session
- Estimate number of vials of each vaccine ampoules required per session

Example 1

In a village with 1000 population, there will be a monthly immunization session. If birth rate is 25 per 1000 population and infant mortality rate is 70.

$$\text{Number of births} = 1000 \times 25 / 1000 = 25$$

Number of infants alive at 1 year of age = number of live births - number of infant deaths

$$= 25 - (25 \times 70 / 1000)$$

$$= 25 - 1.75 = 23$$

$$\text{Number of doses of DPT/OPV (4 per child)} = 23 \times 4 = 92.$$

$$\text{Total number of session in year} = 12$$

$$\text{Number of doses of DPT/OPV required per session} = 92 / 12 = 8$$

Thus, you need to have one vial each of DPT and OPV for every session. Similarly you will estimate requirements for other vaccines.

For this, you need to know:

- population of the PHC
- birth rate
- infant mortality rate (IMR)

Not only you need the population data, but you have to update it frequently, say once a year to make correct estimates.

The number of pregnant women is calculated by the formula:

$$\text{Population} \times \text{Birth Rate}$$

The number of infants is estimated by the formula:

$$\text{Population} \times \text{birth rate} \times (1 - \text{IMR})$$

Let us illustrate it by an example.

Example 2

An area with population of 30,000, birth rate of 25/1000 and IMR of 70/1000, will have:

$$\text{Pregnant women: } 30,000 \times 25 / 1000 = 750$$

$$\text{Infants : } 30,000 \times 25 / 1000 \times 0.93 = 697.5 \text{ or } 698 \text{ \{0.93 is derived as } [1 - \frac{70}{1000} = 0.93^*] \}$$

Thus, the annual requirements of vaccines will be :

$$\text{Eligibles} \times \text{No. of doses.}$$

The annual requirement of TT vaccine for pregnant women will be:

$$750 \times 2 = 1500 \text{ doses}$$

Similarly, the annual requirement for DPT vaccine for infants will be:

$$698 \times 4 = 2792 \text{ doses}$$

Sometimes, a vial may not be used up in one session and there may be some wastage. To account for wastage, we need to multiply the vaccine requirement with waste multiplication factor (WMF). It is 25% for DPT, DT and TT and 33% for OPV, BCG and measles. It means that you will need 25% additional doses of DPT, DT and TT to account for wastage.

Another factor which influence vaccine requirements is the proposed coverage. Thus for 85% coverage of infants with DPT, requirement of vaccine will be:

$$\text{Number of beneficiaries} \times \text{proposed coverage} \times \text{number of doses} \times \text{WMF}$$

As per above example, for the PHC

$$698 \times 85/100 \times 4 \times 1.25 = 2967 \text{ doses}$$

Once you have calculated annual requirements of a vaccine, you should divide it by the periodicity of supply. In other words, for a PHC of 30,000 population, $2967/12 = 247$ doses. Since each vial of DPT has 10 doses, you need to have 25 vials of DPT per month.

The wastage will depend on the frequency of sessions and attendance at these sessions. WMF indicates the maximum allowable wastage. This does not mean that wastage of WMF level should be taken for granted. All efforts should be made to minimize wastage of vaccines as far as possible.

1.6.2 Taking Out the Vaccines

The vaccine and the diluents are taken out in a vaccine carrier for transporting to a sub-centre or out reach session. Vaccine carrier is a well insulated container. The inside of a carrier is kept cold by frozen ice packs, while a tight lid prevents outside hot air from entering the carrier. Contact your counsellor at SDC to demonstrate you the correct technique of packing a carrier, which we are describing for you:

- Place fully frozen ice packs in the carrier.
- Put vaccine vials and ampoules in a polythene bag and close it with a rubber band.
- Stack the vaccine and diluents in the carrier.
- Keep DPT/TT away from ice packs to prevent freezing. You can put a small piece of newspaper between the vaccine and ice packs.
- Secure the lid tightly.
- Always keep the vaccine carrier in shade.

To optimise their functioning, ensure that the carriers are cleaned and dried after each use. Check for cracks inside and outside. The carriers should be opened only when absolutely necessary and should be kept away from direct sunlight. And remember not to drop the carriers or sit on them.

A vaccine carrier with 4 frozen ice packs and packed as per directions can maintain the vaccines for 2 days (48 hrs) if its lid is not opened. A smaller version of vaccine carrier is called 'day carrier' — it contains only 2 ice packs, one at the top and one at the bottom. It can maintain the vaccine for 6-8 hours. If duration of storing vaccines is likely to be more than 6 hours, day carriers should not be used.

As at the sub-centre or outreach session, there is no cold chain equipment and power failure is more often, there are more chances of cold chain failure. Therefore, vaccine are

not stored at these sites. Although vaccines are brought to sub-centre/outreach site on the day of vaccination, they still lose potency during transportation. Therefore:

- Supply only required quantity of vaccines.
- Return the unused vials to the PHC the same day.
- Maintain cold chain during transport and immunization session as discussed earlier.

1.6.3 Storage/Disposal of Unused Vaccines

After concluding the session, return all vials to PHC store. Inspect the icepacks. If the ice has not melted, put a rubber band around unused vials and return to referring centre. If the ice is completely melted for less than one day; check the status of VVM on OPV vial. If square in the circle is white or lighter than circle, return it to the refrigerator along with other vaccines. Otherwise discard OPV and return other vaccines to the refrigerator. If the ice is completely melted for more than one day, discard all the vaccines.

What should you do with partially used vials? Partially used vials are kept in a separate box in the refrigerator. These are kept for one week, so that these can be sent to laboratory for testing in case any untoward reactions to vaccines are reported. They are disposed off after one week is over. Remember, for the next sessions, you should take out those vials which have a rubber band around them first of all and use them.

1.7 PRIMARY HEALTH CENTRE

At the PHC, you will have an entirely different set of responsibilities. From your experience, can you enumerate them?

You may have thought of the following: Obtaining vaccines, distributing equipment, maintaining vaccines, distributing vaccines, monitoring cold chain and training your staff. Let us discuss them one by one.

1.7.1 Obtaining Vaccines

The vaccines for PHC are either delivered by or collected from district stores. You can ask the PHC/District/Health unit for the frequency of supply by friendly consultation. A PHC should not store more than one month's stock—which in other words means that frequency of supply should not be less than once a month.

The district health officer has to cover many PHCs. He has to compile the overall requirements and inform the state headquarter well in advance. For calculating the amount of each vaccine to be indented, go through the following steps:

- Estimate requirements of the PHC (session-wise) for one month. Add 25% as buffer stock.
- Utilization during the previous months. You can get this information from the monthly report.
- Find out stock in hand.

You have already learnt how to estimate session-wise vaccine requirements. First two steps given above will help you arrive at quantity of vaccine required for the next month. From this subtract stock in hand. This gives you the quantity of vaccine to be indented.

You will repeat these steps for each the vaccine.

You may be required to go the district store to collect the vaccines. In that case, ensure that you are carrying enough vaccines; carriers or a cold box to keep the vaccines. Check the quantity, type and expiry date of the vials. The vials should be quickly packed in the vaccine carrier. You should take the shortest and quickest route to your PHC and transfer the vaccines to the refrigerator as soon as possible. You should also ensure that the person having the key of the refrigerator is available when the vaccines arrive.

1.7.2 Maintaining Equipment

Vaccines are stored at the PHC at +2 to +8°C.

All PHCs have been supplied with an ice lined refrigerator and a deep freezer and a voltage stabilizer.

Ice Lined Refrigerator (ILR)

This type of refrigerator are top opening because they can hold cold air inside better than a refrigerator with a front opening. Inside the ILR, there is a lining of water containers (ice packs or tubes) fitted all round the walls. When the refrigerator operates, water in these containers freezes. In the event of electricity failure, they help to maintain inside temperature at a safe level. An ILR can keep temperature within safe limits with as little as 8 hours continuous electricity supply in a 24 hour period.

The ILR has two sections—the top and bottom. The bottom of ILR is the coldest place. DPT, DT, TT and BCG are not kept on the floor of the ILR as they can freeze and get damaged. The top portion of the ILR maintains temperature of +2 to +8°C. BCG, DPT, DT and TT vaccines are kept in this portion in the baskets provided with the ILR.

Deep Freezers

Under the programme, top opening deep freezers are provided. The inside temperature of a deep freezer is maintained between -18°C to -20°C. They are used for freezing ice packs at the PHC. At district stores they are also used to store OPV and measles vaccine.

Domestic Refrigerator

As the risk of failure of cold chain with domestic refrigerators is high compared to ILR, these are not supplied under the programme. However, these are being used at the private clinics and in dispensaries in towns and cities. They can also be used at PHC in the event of breakdown of ILR. In a domestic refrigerator:

- OPV and measles vaccines are store in the top shelf.
- DPT, DT, TT, BCG and diluents are stored in the middle shelf.
- At the bottom shelf, keep some containers filled with water. This cold water serves to keep the temperature within safe limits for some time in the event of electricity failure.

For proper functioning of cold chain equipment:

- Keep the stabilizer/freezer in a cool room, away from direct sunlight
- Keep an open space of 10 inches at the back
- Keep the stabilizer/freezer levelled
- Fix the plug permanently to the socket
- Use a voltage stabilizer/freezer
- Keep the stabilizer/freezer locked and open only when necessary
- Defrost periodically
- Record the temperature regularly and take corrective action
- Paste a paper outside refrigerator informing whom to contact in case of a problem.

In addition of these, there are certain things which you must avoid. These include

Don't:

- Open the door unless necessary
- Keep vaccines in the door compartment of a domestic refrigerator
- Keep food or drinking water in the refrigerator
- Keep more than a month's supply

- Keep date expired vaccines
- Keep any other medicines/injections

1.7.3 Defrosting

Whenever a thick layer of ice is formed on the freezer, efficiency of the refrigerator goes down and the temperature goes up (Remember Igloos—the home of the eskimos, which are made up of ice blocks but keep them hot!). You should defrost the refrigerator at least once a week or earlier if layer of ice is thicker than 6 mm. If it needs to defrost the refrigerator very often, it indicates that the door is not airtight and needs to be inspected by a mechanic.

Most refrigerators have an auto defrost system. When you may be wondering what should be done to the vaccine during this period. The ice packs should be kept on the shelves but vaccines should not be disturbed. Be careful, not to open the door till the refrigerator starts working again.

1.7.4 Monitoring the Temperature

The temperature in the refrigerator should stay between 2-8°C and should be recorded twice daily. The best way to do so is by using a dial thermometer. It should be kept on the top shelf or in the basket of an ILR. The temperature should be recorded in the form provided for the purpose. If the temperature goes outside the specified range, adjust the thermostat switch accordingly.

1.7.5 Maintaining Vaccines

All vaccines removed from the refrigerator must either be used or returned to the refrigerator after the session, vaccines returned unused must be used during the following session or failing this during third session after which they should be discarded. How will you identify such vaccines? By putting a rubber band around it every time it is taken out. Also ensure that vaccines with nearest expiry date and those which were issued first are the first ones to be used. Don't forget to keep the diluent also at requisite temperature.

Before you issue vaccines to sub-centre, ensure that you issue only the required amount. Deal with the returned vaccines as discussed in sub-section 1.6.3.

1.7.6 Ice Packs

Ice packs are used for lining the walls of vaccine carriers or cold box to keep them cold. They are plastic bottles filled with water. They are prepared by keeping them in deep freezer or freezer compartment of domestic refrigerator.

Preparing ice packs:

- Fill the ice pack with water upto the mark on it and cap it tightly.
- Hold it upside down and shake it to make sure that it does not leak. If it leaks, tighten the cap and check again if it leaks.
- Put the ice packs on its side in the freezer compartment/deep freezer. You can freeze 16-24 ice packs at a time. After about 24 hours when these are frozen, add same number.
- Leave the ice packs overnight to freeze solid.
- Do not put 6 ice packs for freezing at the same time in the freezer compartment of a domestic refrigerator.
- The ice packs should stand with their edges and not flat on one another. This will reduce the time taken to freeze the ice packs. Salt should not be added to the water as it lowers the temperature to sub-zero level. This is not recommended for DPT, DT, TT and BCG.

1.8 DISTRICT STORE

You will be performing activities similar to PHC as far as cold chain is concerned. However, the scale of operation will be much larger. In addition, you will be required to coordinate with a large number of PHCs on one hand and state headquarter on the other. Let us enumerate the various activities, focussing on the salient features at a district hospital.

1.8.1 Obtaining Vaccines

You will be supplying vaccines to PHCs and outreach activities at your hospital. The vaccines are supplied from the state stores. The periodicity of supply should not be more than 3 months—because vaccines should not be stored longer than 3 months at the district hospital.

The process of estimating required doses is same as described in section 1.6.1. You should take 25% extra into account to provide a buffer—but don't forget to check your stocks before you place an order. Do you remember the task to be performed when you collect vaccines? You may like to go back to section 1.6.1 to revise them.

1.8.2 Maintaining Cold Chain

The equipment at district hospital will consist of ice lined refrigerator, deep freezer, a cold box and vaccine carrier. In addition some district hospitals have been provided with walk-in-coolers (WIC).

Walk-in-coolers are cold rooms for storing larger quantities of the vaccine. They should have an assured supply of electricity and regular monitoring of temperature. They need to be monitored because in case of a problem, a very large quantity of vaccines is at risk.

At district stores DPT, DT, TT and BCG are stored in ILRs or walk-in-cooler at +2° to +8°C. OPV and measles are stored at –20°C in the deep freezers.

1.8.3 Controlling Stocks

You need to know the quantity of vaccine received and issued. Follow the principle of 'first in-first out' in issuing vaccines. It is preferable to mark the arrival date of each vaccine so that period of its stay can be monitored. Also first issue a vaccine with earlier expiry.

Before distributing vaccines, check the following for each PHC requirements: utilization during previous months and estimated balance in hand. If the utilization pattern remains low, discuss the matter with the health team at PHC.

1.8.4 Monitoring Cold Chain

For effective functioning of cold chain system, you need to monitor supplies; temperature during transport, storage temperature, functioning of cold chain equipment and sometimes potency tests.

The ultimate test of efficacy of a cold chain system is its effectiveness in keeping a vaccine potent till its point of use. Generally OPV is taken as the 'indicator' vaccine since it is most liable to damage. The samples of OPV should be collected from various points, properly packed in ice and sent for potency test. The facility of potency testing is available at these centres:

- Central Research Institute, Kasauli;
- National Institute of Communicable Diseases, New Delhi;
- Enterovirus Research Centre, Bombay and
- Medical Colleges at Calcutta, Varanasi, Ahmedabad and Jaipur.