D Y PATIL DENTAL SCHOOL

DEPARTMENT OF

PUBLIC HEALTH DENTISTRY

COLD CHAIN

DATE: 01/02/2007

DURATION: 30 MINUTES

TARGET GROUP: POST GRADUATE STUDENTS

CONTENTS

- The cold chain system is a means for storing and transporting vaccine in a potent state from the manufacturer to the person being immunized.
- Vaccine failure may occur due to failure to store and transport under strict temperature controls.
- It is thus a major task for health workers to maintain the correct temperatures.

- Cold chain comprises of three major elements:

a) Personnel who use and maintain the equipment and provide the health service.

b) Equipment for safe storage and transport of vaccines.

c) Procedures to manage the programme and control distribution and use of the vaccines.

- Competent personnel and efficient procedures are a vitally important part of the cold chain system.
- All vaccines must be stored under the conditions recommended by the manufacturer, otherwise they may become denatured and totally ineffective.

- Recommended vaccine storage temperatures for different levels of the cold chain:

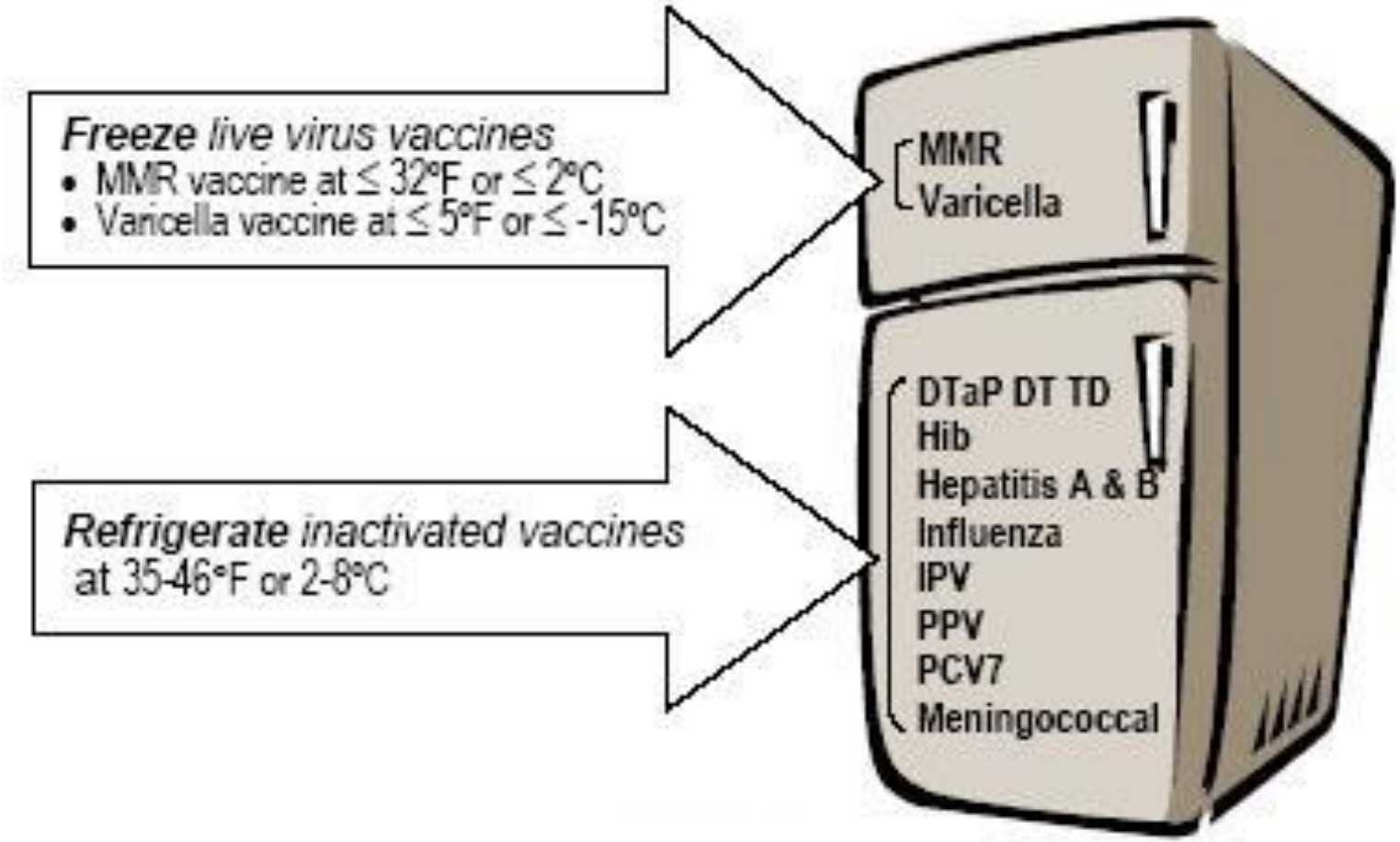
a) **At the national level**

Keep the vaccine for maximum of 6 months.

- Store OPV, measles and mumps vaccines at -15°C to -25°C.

store Hepatitis B,DPT,TT and BCG at 0°C to +8°C.

Vaccine storage



b) **At the regional level**

Keep vaccines for a maximum of 3 months.

Store OPV, measles and mumps vaccines at -15°C to -25°C.

Store Hepatitis B,DPT,TT and BCG at 0°C to +8°C.

Send the vaccines to districts in insulated containers at 0°C to +8°C.

c)**At the district level:**

Keep vaccines for maximum of 1month.

Store OPV, measles and mumps vaccines at -15°C to -25°C.

Store Hepatitis B,DPT,TT and BCG at 0°C to +8°C.

Send the vaccines to health facilities in insulated containers at 0°C to +8°C.

d) **At the health facility level**:

Keep all vaccines for a maximum of 1 month.

Store all vaccines at 0°C to +8°C.

If the cold chain equipment is not reliable , storage time and amounts stored should kept to minimum.

Vaccine stock quantities

- Correct quantity of vaccine stock is to be kept at each level of the cold chain.
- If you keep *too little* vaccine, health facilities may run out of stock and immunization programmes may be interrupted.
- If you keep *too much* vaccine, there may be insufficient storage space.

- Estimate the quantity of vaccine needed by the following:

  -Number of children in the area to be immunized during the next 12 months.

  -The number of doses needed per child for each vaccine.

  - The number of vaccine deliveries planned during the next 12 months.

  -The amount of reserve vaccine stock (%) to be kept in the main store of the area.

Cold chain equipment

- Each level requires different storage equipment :

- Equipment for vaccine transportation

  a) cold boxes

  b) vaccine carriers

- **Cold boxes**

  A cold box is an insulated container with a tight fitting lid.

  The ‘cold life’ of a cold box or vaccine carrier is the number of hours it will keep the vaccines at a safe temperature.

  According to WHO it is the number of hours the cold box will maintain a temperature below +10°C after it has been loaded.

- The cold box is designed for:

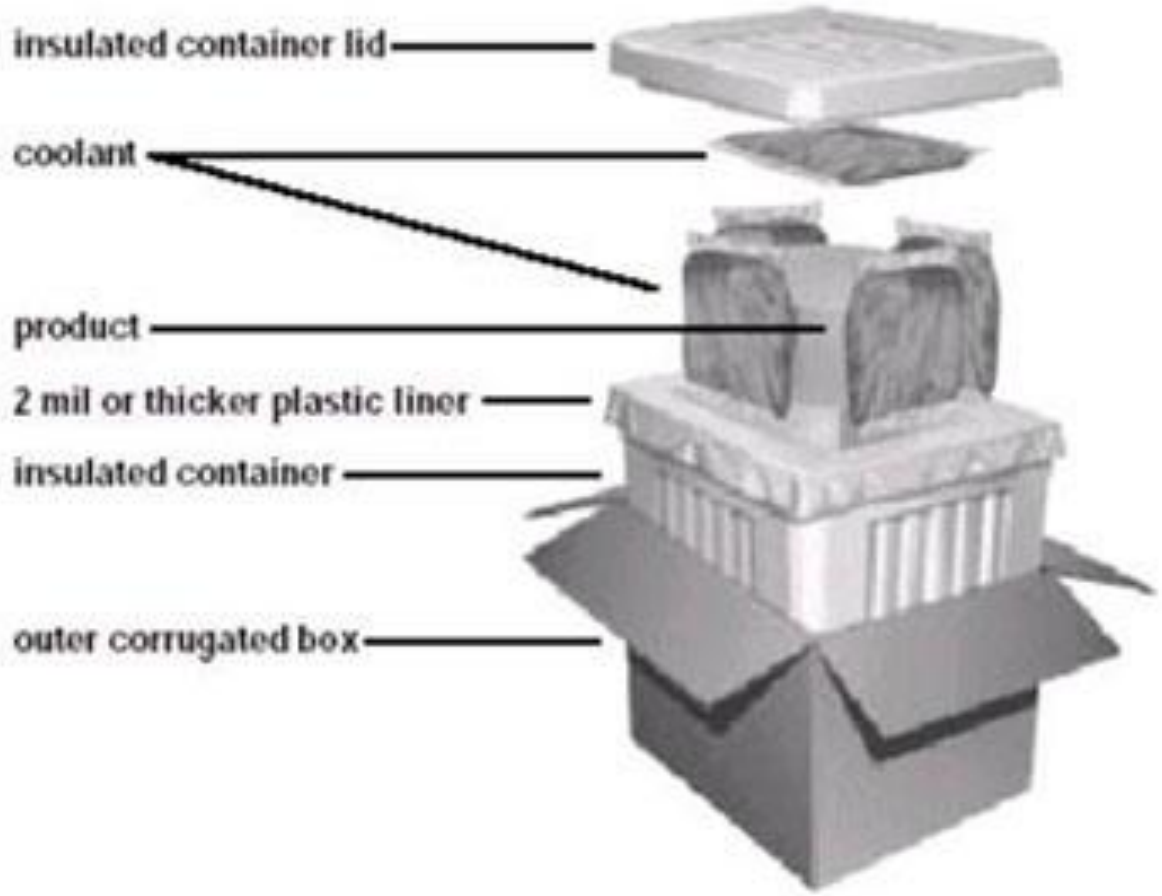
a) collection and transport of large quantities of vaccine at temperatures between 0°C to +8°C.

b) storage of vaccine during maintenance periods. Eg: when cleaning or defrosting a refrigerator.

c) emergency storage of vaccines. Eg: power failures.

- Do not include diluent for freeze dried vaccines in the cold box.

Cold box


insulated container lid
coolant
product
2 mil or thicker plastic liner
insulated container
outer corrugated box

Vaccine carriers:

A vaccine carrier is an insulated box with a tight fitting insulated lid.

It is designed for:

a) Transportation of small quantities of vaccine at a temperature between 0°C to +8°C within one working day.

b) Storage of small quantities of vaccine in emergency situations.

c) Storage of small quantities of vaccine thus avoiding frequent opening of refrigerator

- Diluents for freeze dried vaccines should be packed with the vaccines.

- **Ice packs:**

They are rectangular plastic containers to be filled with plain water.

WHO recommends two sizes:

-0.4 litre to be used with vaccine carriers

-0.6 litre to be used with cold boxes.

- Vaccine carrier

Equipment for vaccine storage

- This cold chain equipment has two major requirements :

a) It must ensure optimum temperature conditions for vaccine storage all year round.

b) It must be large enough to hold the maximum vaccine stock to be stored at the level of the cold chain where it will be used.

At the national level

- The following equipment is normally used:

a) Cold rooms

b) Freezer rooms

c) Icepack freezers

Cold rooms

- A cold room is a store where a refrigerating unit generates and maintains the temperature conditions between 0°C to +8°C required to cool the vaccines.
- They are used for :

a) Storage of very large quantities of vaccine between 0°C to +8°C

b) Providing a national or sub national distribution point.

- Remember the following for maintenance:
- Leave spaces between each row of vaccine boxes to allow free circulation of cool air.
- Do not place DPT,TT and Hepatitis B vaccine in direct airflow from the cooling machine.
- If there is a standby generator, ensure that it always has an adequate fuel supply.

Freezer rooms

- A freezer room generates and maintains temperature between -15°C to -25°C.
- They are designed to keep very large quantities of vaccines in a frozen state.
- Remember to wear suitable protective clothing when working in a freezer room.

Top opening freezers

- A freezer generates and maintains a temperature between -15°C to -25°C.
- Used at national, regional or district levels .
- Keep the thermostat adjusted to maintain the temperature.

Ice pack freezer

- Special front opening freezer to freeze large quantities of ice packs.
- It can hold up to 136 large icepacks(0.6litres).
- Remember to use as many icepacks as possible at one time .
- Place icepacks at the edge so that the maximum number can be in direct contact with the shelves

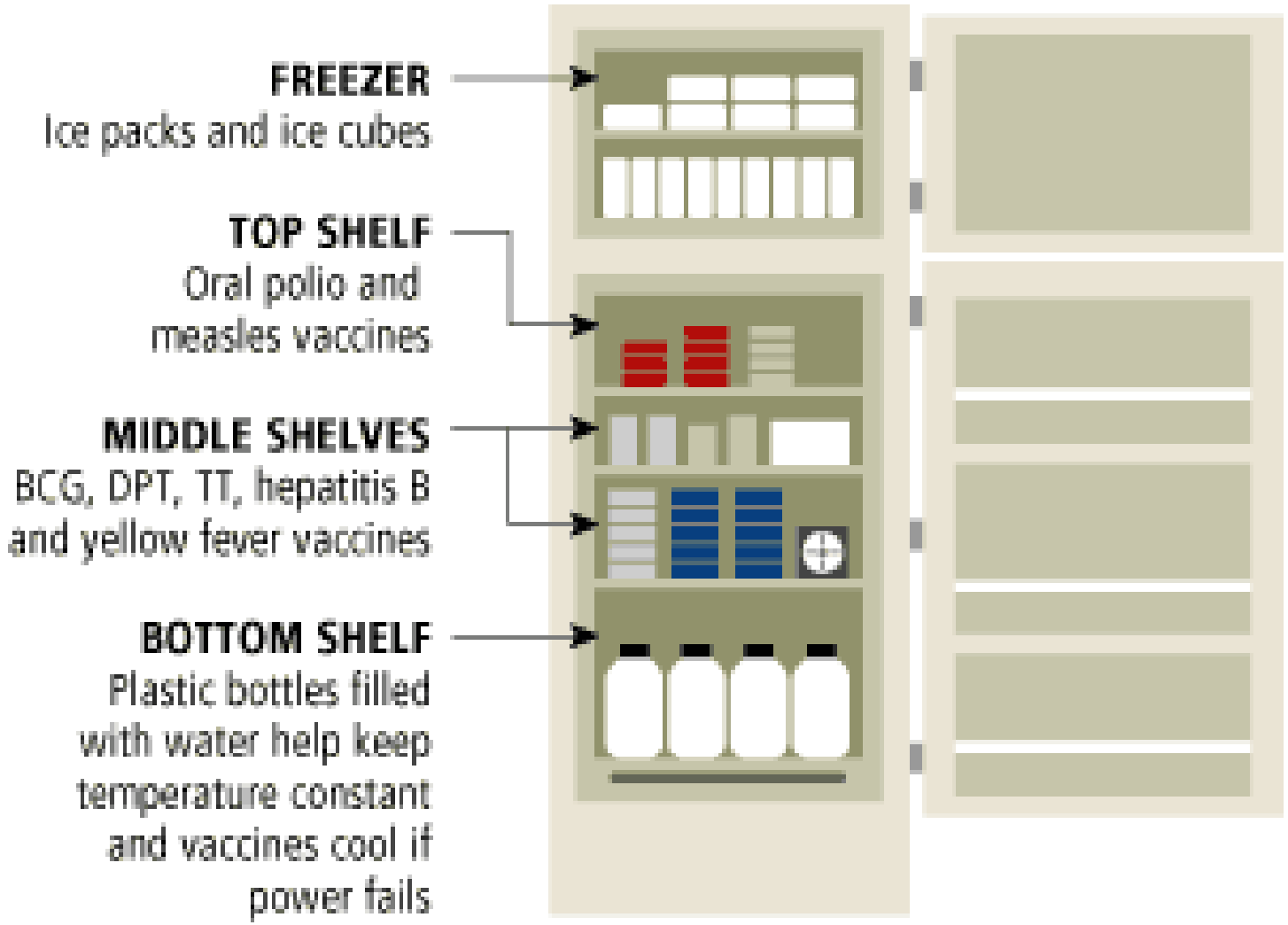
At the regional level

- Large top opening refrigerators, ice lined refrigerators.
- Large top opening refrigerators.
- Icepack freezers.

Ice lined refrigerator

- Specially designed for vaccine storage and is different fro normal top opening refrigerator.
- Inside there is a lining of water containers fitted around the walls and held in place by a frame.
- It has a heavy duty compressor and it continues to operate even if there is a large variation in voltage.

- Remember to install the lining of the water containers completely.
- After adjusting the thermostat allow at least 24 hours for the temperature to change.
- Put OPV, measles and mumps vaccines in the bottom where it is coldest.
- Put Hepatitis B,DPT,TT and BCG in baskets nearer to the top.


FREEZER
Ice packs and ice cubes
TOP SHELF
Oral polio and measles vaccines
MIDDLE SHELVES
BCG, DPT, TT, hepatitis B and yellow fever vaccines
BOTTOM SHELF
Plastic bottles filled with water help keep temperature constant and vaccines cool if power fails

At the district level

- Medium capacity top opening refrigerators, ice lined refrigerators.
- Medium capacity top opening freezers.
- Upright household two compartment refrigerator/freezer.

At the health facility level

- Small ice lined refrigerators
- Upright household two compartment refrigerator/freezer.
- Small top opening freezers

Household refrigerator

- Most often used for vaccine storage.
- Generally much cheaper to buy.
- It may have a small freezing compartment located in the upper main cabinet or may have a separate freezing compartment.

- It has two main cooling systems
- Absorption type
- Compression type
- the absorption type works by absorption of refrigerant vapor
- Compression type circulates the refrigerant by a compressor.

- Compression refrigerator is cheaper to buy and operate but expensive to repair.
- It cools faster and more efficiently but can run on electricity only.
- Absorption refrigerator is more expensive to buy but cheaper to maintain and repair.
- It cools slowly and can operate on any type of energy including gas or kerosene.

Maintenance of Cold Chain

- Maintenance rules are essentially similar for all types of refrigeration equipment.
- Regularly clean and defrost the equipment and observe safety engineering rules.
- The better the conditions in which the refrigerator or freezer is working, the longer will be the life of the equipment.

- **Defrosting**

  - Regular defrosting is essential for efficient cooling of the refrigerator.

  - For all equipments, defrost when the frost layer reaches 5mm thick.

  - Remove the vaccines, switch off the refrigerator and collect the ice and water.Wipe the refrigerator dry and clean.

- **Cleaning**

-Clean the refrigerators and freezers after defrosting every month.

-Wash all the shelves with warm water and dry carefully.

-Remove the dust from the condenser using a soft brush or a cloth.

- Safety requirements

-Ask a qualified electrician to check all connections.

-If there is any sign of smoke or spark from any electrical item, turn it off immediately and call an electrician.

-Remember to switch off and disconnect the cold chain equipment whenever it is being cleaned, or being moved to another place etc.

Conclusion

- Most vaccines must be stored between 0°C to +8°C , to maintain their potency.
- Public health staff should conduct regular on site inspection of cold chain management practice at clinics and health care facilities to promote education and ensure safe handling of vaccine.

References

1) Park K.Textbook of Preventive and Social Medicine.18th ed, Bhanot pub,2005:96-97.

2)www2.cdc.gov/nip/isd/shtoolkit/002Chap1.pdf

3) www.cmaj.ca/cgi/reprint/171/9/1050.pdf

THANK YOU