



Immunization

State Institute of Health & Family Welfare, Jaipur



Why Immunization?

- Key strategy to child survival
- Protecting infants from VPDs
- Lowers morbidity and mortality rates in children
- Can lead to lower birth rates
- Indicator of a strong primary health care system



Immunization: common terms

Immunization:

Process of inducing immunity by stimulating immune system through antigens.

Immunity :

Resistance of a host to a specific agent, characterized by measurable and protective surface or humoral antibody and by cell-mediated immune responses.



Vaccine:

A preparation of a weakened or killed pathogen, such as a bacterium or virus, or of a portion of the pathogen's structure that upon administration stimulates antibody production or cellular immunity against the pathogen but is incapable of causing severe infection.

Vaccination:

Administration of antigenic material (the vaccine) to produce immunity to a disease.



➤ **Full immunization:**

Beneficiary child (12-23 months) - 3 doses of DPT and OPV each, 1 dose of BCG & measles each.

Mother - two doses or 1 booster dose of tetanus toxoid during her last pregnancy.

➤ **Partial immunization:**

Child- missed any vaccine or one or more doses

Mother- received just one dose of primary tetanus toxoid during last pregnancy.

➤ **Non immunization:**

Child and/or mother- not received a single dose of vaccine.



➤ **Ring immunization:**

Vaccination of people in close contact with an isolated infected patient.

➤ **Mop-up rounds:**

When the final pockets of poliovirus transmission have been identified through standard surveillance, door-to-door immunization in high-risk districts.

➤ **Catch up rounds:**

Additional effort besides routine immunization to cover left outs

Herd immunity?



- Resistance to spread of infectious disease in a group because of few susceptible members, making transmission unlikely.
- The immunologic status of a population, determined by the ratio of resistant to susceptible members and their distribution.



Herd immunity

- Works only when:
 - Probability of an infected person encountering **every other individual** in the population (*random mixing*) is the same; (not likely to happen)

- **Does not** work when:
 - An infected person interacts **only** with people who are susceptible (*no random mixing*); likely to transmit the disease to those people



Mile Stones in immunization program in India

- 1978: EPI
- 1985: UIP, Measles vaccine added
- 1986: Technology mission
- 1990: Vitamin A
- 1992: CSSM
- 1995: Polio National Immunization days
- 1997: RCH-I
- 2005: RCH-II and NRHM



Child health

In World	In India
Under 5 mortality	
9.7 million	2.1 million
Under weight	
156 million	54.6 million
Neonatal mortality (first 28 days)	
4 million	1 million
Low birth weight (<2.5 kg)	
19 million	8.3 million

Source: State of the World's Children 2009:UNICEF report

- 47% of total children in India are malnourished.
 - Developed countries 26%
 - Rest of south Asia 42%.



Child Mortality

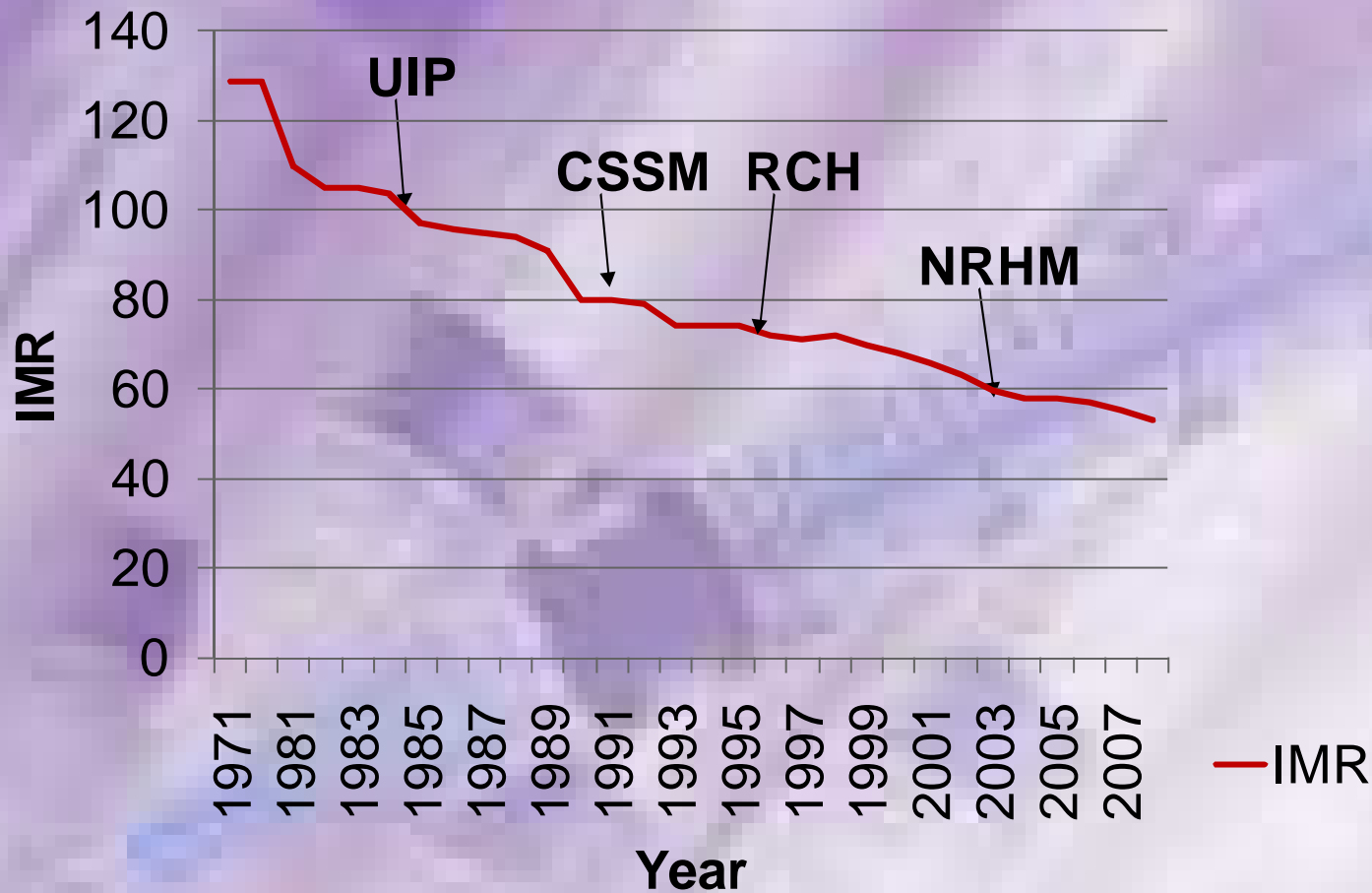
A large black arrow points downwards on the left side of the table, indicating the direction of increasing rank and decreasing mortality rate.

Rank	Country	Under Five Mortality rate
1 st	Sierra Leone	262
43 rd	Pakistan	90
49 th	India	72
58 th	Bangladesh	61
62 nd	Nepal	55
189 th	Sweden	3

Note : 5,700 infants die everyday in India.

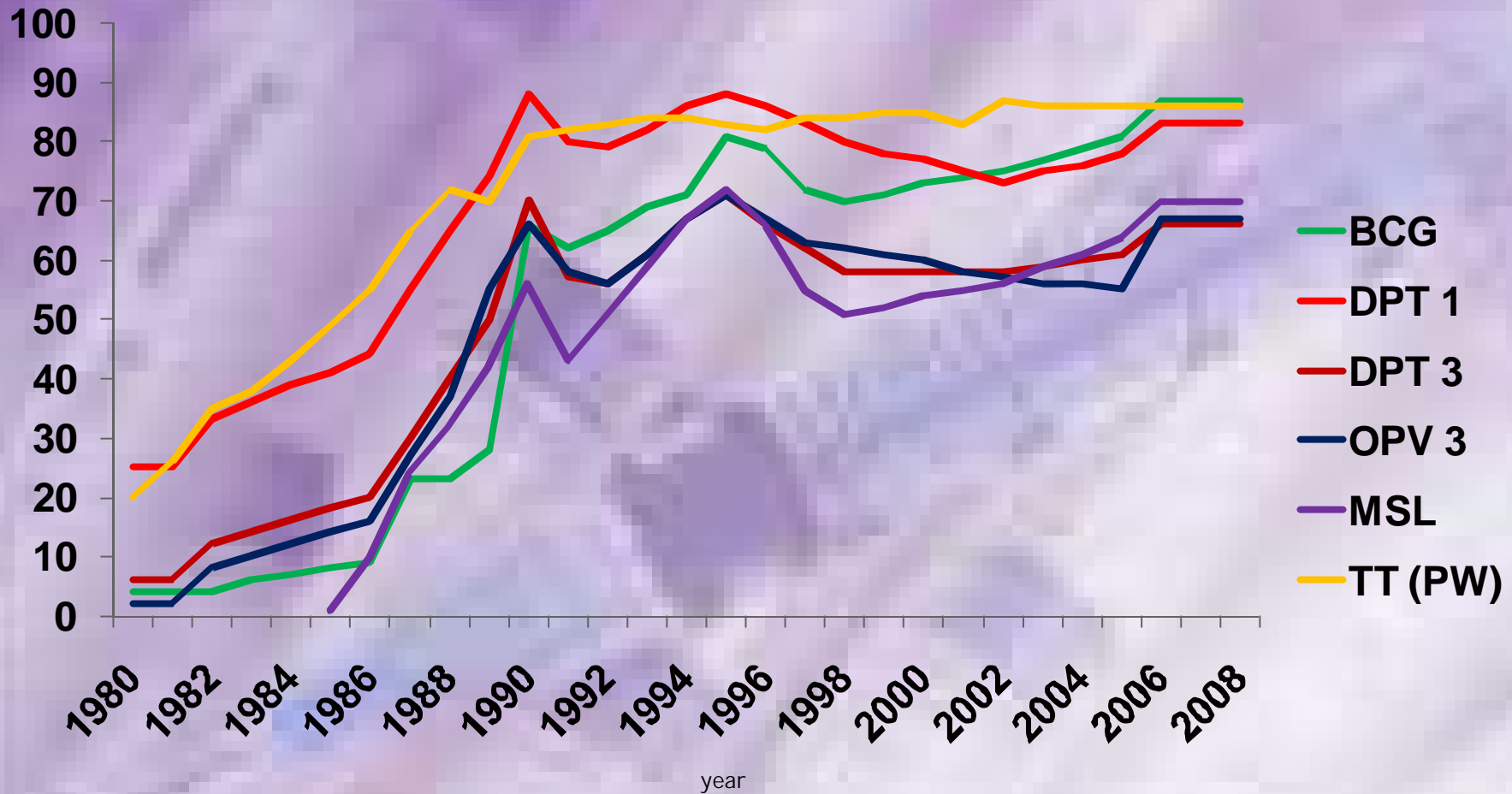
Source: State of the World's Children 2009 UNICEF

Impact of various interventions Infant Mortality Rate : 1971 - 2008



Source: SRS Oct.2009

Reported Immunization Coverage 1985 - 2008



Source: WHO/UNICEF Review of National Immunization Coverage 1980-2008

National immunization schedule



Vaccine	When to give	Dose	Route	Site
For Pregnant Women				
TT-1	Early in pregnancy	0.5 ml	Intra-muscular	Upper Arm
TT-2	4 weeks after TT-1*	0.5 ml	Intra-muscular	Upper Arm
TT-Booster	If pregnancy occur within three yrs of last TT vaccination*	0.5 ml	Intra-muscular	Upper Arm



For infants

Vaccine	When to give	Dose	Route	Site
BCG	At birth (for institutional deliveries) or along with DPT-1	0.1 ml (0.05ml for infant up to 1 month)	ID	Left Upper Arm
OPV-0	At birth if delivery is in institution	2 drops	Oral	Oral
OPV- 1,2 & 3	At 6, 10 & 14 weeks	2 drops	Oral	Oral
DPT- 1,2 & 3	At 6, 10 & 14 weeks	0.5 ml	IM	Antero-lateral side of mid-thigh
Hep B 1,2 & 3	At 6, 10 & 14 weeks**	0.5 ml	IM	Antero-lateral side of mid-thigh
Measles	9-12 months	0.5 ml	SC	Right upper Arm
Vitamin-A (1st Dose)	At 9 months with measles	1 ml (1 lakh IU)	Oral	Oral

National immunization schedule



For children

Vaccine	When to give	Dose	Route	Site
DPT Booster	16-24 months	0.5 ml	IM	Outer Mid-thigh (Antero-lateral side of mid-thigh)
OPV Booster Vitamin-A (2nd to 9th Dose)	16-24 months <ul style="list-style-type: none"> • 16 months with DPT/OPV booster • Then, one dose every 6 months up to the age of 5 years. 	2 drops 2 ml (2 lakh IU)	Oral Oral	Oral Oral
DPT Booster	5 years	0.5 ml	IM	Upper Arm
TT	10 years & 16 years	0.5 ml	IM	Upper Arm

* TT-2 or booster dose to be given before 36 weeks of pregnancy.
 ** For institutional deliveries, give at birth, 6 weeks and 14 weeks.



Barriers to Immunization

- Physical barriers
 - Waiting time
 - Distance
 - Discomfort

- Psychological barriers
 - Discourtesy
 - Endangered privacy

Reasons for Low Immunization Coverage



- Failure to provide immunization
- Dropouts
- Un-reached populations:-
 - Unawareness
 - socio-economic barriers
 - geographic access
- Resistant populations
- Missed Opportunities
- Improper logistics management

Strategies for increasing coverage of immunization



- Record keeping
- Recommendations and reinforcement
- Reminder and recall to patients
- Reminder and recall to providers
- Reduction of missed opportunities

Why focus on strategies to increase immunization?



- Immunization levels are not optimal
- Cost effectiveness is a concern
- Sustainability is a concern

Strategies to minimize drop outs



- Each planned immunization session to be held in spite of holiday/leave and Re-schedule session timings
- Maintaining list of children with partial/ no immunization.
- Reaching migrant populations in service delivery area.
- Informing parents about next immunization date.
- Taking help of community teams (AWW/ASHA/NGOs etc.)
- Developing solutions based on the responses of parents.

Settings where missed opportunities occur



- Settings that traditionally offer immunizations (e.g., primary care offices or public health clinics)

- Settings that do not traditionally offer immunizations
 - health care settings (e.g. Emergency dept.)
 - public health settings (e.g., WIC)

Causes of missed opportunities



- Lack of simultaneous administration
- Unawareness about need for additional vaccines
- Invalid contraindications
- Avoidance of accelerated schedule
- Inappropriate clinic policies
- Reimbursement deficiencies

Strategies for reducing missed opportunities



- Standing orders
- Provider education with feedback
- Provider reminder and recall systems

What should not hold Routine Immunization



- Minor illnesses such as upper respiratory infections or diarrhea, mild fever ($< 38.5^{\circ}\text{c}$)
- Allergy, asthma
- Prematurity, underweight newborn child
- Malnutrition
- Child being breastfed
- Family history of convulsions
- Treatment with antibiotics
- Dermatitis, eczema or localized skin infection
- Chronic diseases of the heart, lung, kidney and liver
- Stable neurological conditions, such as cerebral palsy and Down's syndrome
- History of jaundice after birth



Micro planning for Routine Immunization



What is a Micro plan?

Helps to identify

- **What needs to be provided**
- **Who** will provide
- **Where** to provide (including hard to reach)
- **When** to provide
- **How** to provide
- **How many** to provide for (beneficiaries)
- **How much** to provide (vaccines & logistics)

Estimating Beneficiaries In a Sub-centre Area



1. No. of Live Births the Area = Birth Rate x Population of $30/1000 \times 5000 = 150$
2. No. of Pregnant Women = No. of Live Births + 10%
 $150 + 15 = 165$
3. No. of Infants alive at 1yr. = $150 - \{150 \times 60/1000 = 9\}$
 $= 141$
4. No. of Children <3 yrs. of age = 8% of population
 $= 8/100 \times 5000 = 400$
5. No. of Children <5 yrs. of age = 13% of total population
 $= 13/100 \times 5000 = 650$

Calculating beneficiaries for each Vaccine



- TT = No. PW x 2
- BCG = No. infants x 1
- OPV = No. infants x 4
- DPT = No. infants x 4
- Measles = No. infants x 1
- DT = No. children at 5 yrs x 1



Estimation of Vaccine Vials

- Each session should have one vial of BCG

- $$\text{TT} = \frac{\text{No. beneficiaries / session}}{10} * 1.33$$

- $$\text{BCG} = \frac{\text{No. beneficiaries / session}}{10} * 1.33$$

- $$\text{OPV} = \frac{\text{No. beneficiaries / session}}{10} * 1.33$$



Estimation of Vaccine Vials

- DPT =
$$\frac{\text{No. beneficiaries / session}}{10} \times 1.33$$
- Measles =
$$\frac{\text{No. beneficiaries/ session}}{5} \times 1.33$$
- DT =
$$\frac{\text{No. beneficiaries/ session}}{10} \times 1.33$$
- Vitamin A Solution
 - Children below 1 year of age (1 dose of 1lakh unit) = 141
 - Children between 1-5 yrs. (8 doses of 2 lakh units) = $509 \times 2 = 1018$



Estimation of ADS and Disposable Syringes and Diluents with Vaccines

- $0.1 \text{ ml} = (\text{No. of beneficiaries for BCG}) + 10 \%$
- $0.5 \text{ ml} = (\text{Beneficiaries of DPT} + \text{Measles} + \text{DT} + \text{TT}) + 10 \%$
- $5 \text{ ml reconstitution} = (\text{No. of BCG vials} + \text{No. of Measles vials}) + 10 \%$
- $\text{No. of Sodium chloride ampoules} = \text{No. of BCG vials}$
- $\text{No. of Double distilled water ampoule} = \text{No. of Measles vials}$



How to Plan Number of Sessions

Fixed Sites (PHC / CHC etc.)

- 40 – 70 injections = one session per month
- > 70 injections = two sessions per month

Outreach:

- 25-50 injections = one session per month
- > 50 injections = two sessions per month
- < 25 injections = one session in alternate month

Steps in Preparation of Micro Plan



- **Step 1** – List all villages and hamlets
- **Step 2** – Write the population of each village
- **Step 3** – Write the number of beneficiaries
- **Step 4** - Prepare a map of the sub center / PHC

Preparation of Micro Plans at PHC and District



- **PHC-** Compile micro plans from all SC; Add components of alternate vaccine delivery; plan for supervision; plan for immunization waste disposal etc.
 - **District-** Compile plans from PHC and additional components of plans for deployment of human resources, supplies and logistics, training, IEC, monitoring, supervision, surveillance, Inter-sectoral coordination etc added to prepare District micro plan.
- **Don't :**
- Cancel any planned session
 - Leave any community meeting without communication about next immunization session days.



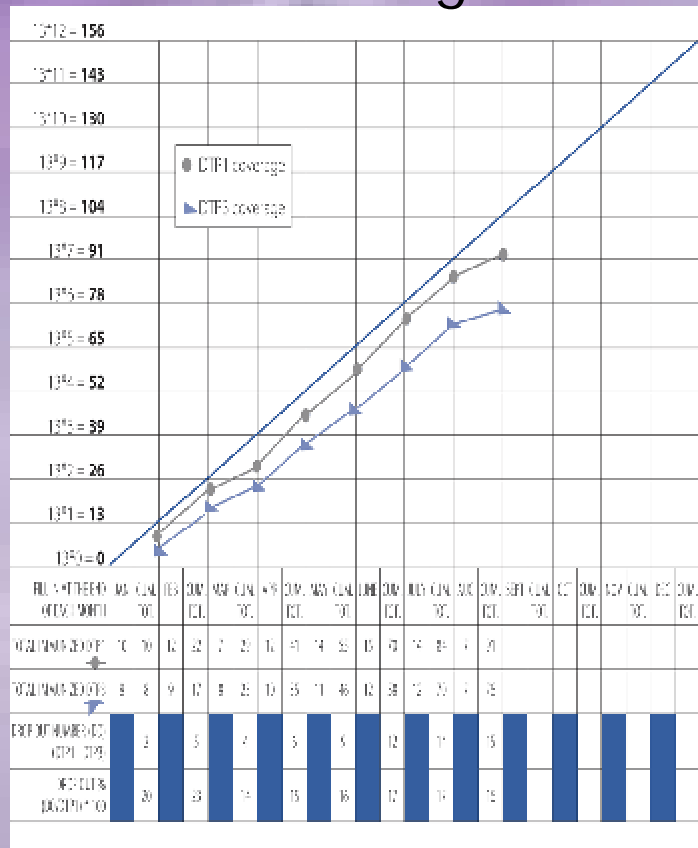
Urban Micro Plan

- Demarcation of areas
- Site for immunization session
 - Slums/Aanganwadi centers
 - District Hospital
 - Private Hospital
 - Dispensary
- Human resources
- Vaccine delivery
- Tracking beneficiaries
- IEC and Social mobilization



Regular Monitoring and Review of Micro Plan

Monitoring Chart



- **Monthly reports**
 - coverage monitoring chart
- **Quarterly Review meeting**
 - review missed sessions
 - other problems
 - revise session plan and work plan (if needed)
- **Supportive supervisory visits**
 - monitoring the work in the field
 - providing on-the-job training
 - taking notes for future discussion at review meetings.



Community Mobilization

- Communication with community.
- Involvement of community and community leaders for education.
- Gathering information regarding misconception and its resolution.
- Arranging for interaction between resistant groups and satisfied beneficiaries for promoting immunization.
- Using loudspeakers, discussion sessions at farmers' meetings, ad at religious places, radio and TV spots, newspaper articles and drama shows.
- Providing prompt and quality services.



Dealing with Rumours and Misinformation

- Serious threats to success of immunization program.
- Some examples of rumours:
 - “Vaccine 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.”
- Refer the matter to supervisors
- Action may even need to be taken at the national level.



Records

- Must be easy to write, compile & read
- Must be available at the time of the visit
- Must be accurate
 - reflect all vaccines given



Cold Chain

- A system of transporting and storing vaccines at recommended temperature from the point of manufacture to the point of use.
- Essential Elements:
 - Personnel to organize and manage vaccine distribution
 - Equipment for storage and transport of vaccines
 - Transport facilities
 - Maintenance of equipment and Monitoring
- Responsibility – District/ Block Managers
 - Cold chain equipment installation, operation and maintenance

Cold Chain Equipment



Name of Equipm ent	Place of Installation	Temperatu re	Utilization
ILR MK 300	Regional & district HQ	+2 C to +8 C	BCG, DPT, DT, TT, Measles, Hep-B Vaccine
Deep Freezer 300	Regional & district HQ	-18 C to -20 C	Preparation of ice packs, and storing OPV vaccines
ILR MK 140 litres	PHC	+2 C to +8 C	BCG, OPV, DT, DPT, TT, Measles, Hep-B Vaccine
Deep Freezer 140 litres	PHC	-18 C to -20 C	Preparation of ice packs

No Cold Chain Equipment should be installed without a voltage stabilizer



Name of Equipment	Place of Installation	Temperature	Utilization
Cold Box 20 litres	State, Regional, district HQ & PHC	+2 C to +8 C	Vaccines can be stored for transportation or in case of power failure
Cold Box 5 litres	District HQ & PHC	+2 C to +8 C	Vaccines can be stored for transportation or in case of power failure
Vaccine carrier (1.7 litres)	PHC/Sub Centre	+2 C to +8 C	Vaccines can be carried in small quantity for vaccination sessions

Maintenance of Equipment



- Defrosting/Cleaning:
 - Periodic defrosting & cleaning
- Cold boxes/Vaccine Carriers:
 - Replace or repair locally
- Ice Packs:
 - Fill clean water
 - Leave 10mm room for expansion
 - Cap tightly
 - Keep pack clean & dry

Vaccine's Sensitivity



Vaccine	Exposure to heat/light	Exposure to cold	Temperature at PHC
Heat and light sensitive vaccines			
BCG	Relatively heat stable, but sensitive to light	Not damaged by freezing.	+2°C to +8°C
OPV	Sensitive to heat and light	Not damaged by freezing	+2°C to +8°C
Measles	Sensitive to heat and light	Not damaged by freezing	+2°C to +8°C
<i>At PHC level, all vaccines are kept in ILR in which temperature is maintained at + +2 °C to + 8 °C</i>			



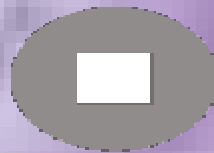
Freeze Sensitive Vaccines

DPT	Relatively heat stable	Freezes at -3° C should not be frozen	+2° C to +8° C
Hepatitis B	Relatively heat stable	Freezes at -5° C Should not be frozen	+2° C to +8° C
DT	Relatively heat stable	Freezes at -3° C Should not be frozen	+2° C to +8° C
TT	Relatively heat stable	Freezes at -3° C Should not be frozen	+2° C to +8° C

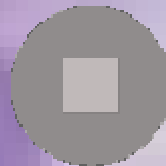


Vaccine Vial Monitor

A label that changes colour when vaccine vial is exposed to heat over a period of time.

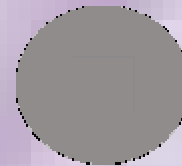


**1 = good:
Utilize**

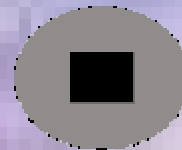


**2 = good:
Utilize**

The central square is lighter than the surrounding circle



**3 = bad:
Don't Utilize**



**4 = bad:
Don't Utilize**



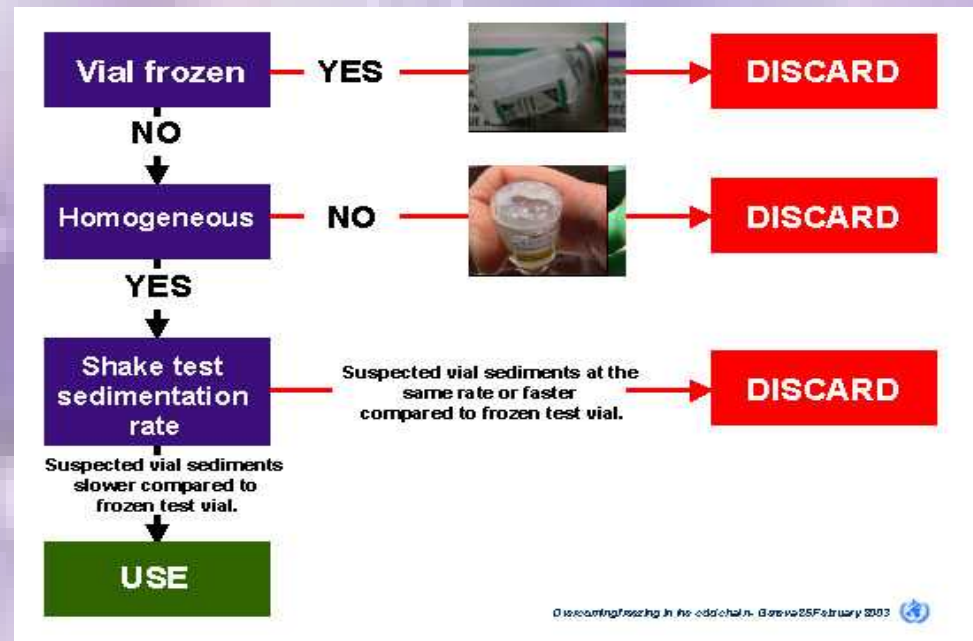
The central square is equal to, or darker than the surrounding circle

Checking for Cold Damage (Freezing)

- Shake Test :- designed to determine whether adsorbed vaccines (DPT, DT, TT or Hepatitis B) have been frozen.



Discard



Programmatic Errors causing AEFIs



Programmatic Errors	Possible Adverse event that may occur
<p><i>Non-Sterile injection:</i></p> <ul style="list-style-type: none"> • Improperly sterilizing syringe • Contaminated vaccine or diluents • Re-use of reconstituted vaccine at subsequent sessions • Wiping the needle with a swab • Administering injection over clothes 	<ul style="list-style-type: none"> • Infection such as local abscess at site of injection sepsis, toxic shock syndrome or death.
<p><i>Re-use of disposable syringe and needle</i></p>	<ul style="list-style-type: none"> • Transmission of blood-borne infections such as Heb B, HIV, Hep C
<p><i>Reconstitution Error/ Wrong vaccine preparation</i></p> <ul style="list-style-type: none"> • Reconstitution with incorrect diluents • Drug substituted for vaccine diluents • Inadequate shaking for T-series vaccines 	<ul style="list-style-type: none"> • Vaccine ineffective • Negative effect of drug, e.g. insulin causing death • Local abscess



Programmatic Errors	Possible Adverse event that may occur
<i>Injection at incorrect site</i> <ul style="list-style-type: none">• BCG given sub-cutaneously• DPT/DT/TT given superficially• Injection into buttocks	<ul style="list-style-type: none">• Local reaction or abscess• Local reaction or abscess• Sciatic nerve damage
<i>Vaccine transportation/storage</i>	<ul style="list-style-type: none">• Local reaction from frozen vaccine• Vaccine ineffective
<i>Contraindications ignored</i>	<ul style="list-style-type: none">• Avoidable serious reaction



AEFI----- Rare, more severe reactions

- Seizures,
- Thrombocytopenia,
- Hypotonic-hypo responsive episodes,
- Persistent inconsolable screaming -in most cases they are self-limiting and lead to no long-term problems
- Anaphylaxis, while potentially fatal, is treatable without any long-term effects

Minimizing AEFIs



- **Instruction for the health workers**
 - Selection of separate site
 - One syringe & one needle/AD syringe
 - Ensure sterilization
 - Reconstitute vaccines only with diluents
 - Use Reconstituted vaccines within 4 hours
 - Keep diluents of BCG and measles vaccine separate
 - Do not keep needles in the rubber cap (stopper) of vaccine vials.
 - Do not store other drugs or substances in the ILR or deep freezer.
- **What to do if an AEFI Occurs?**
 - immediately inform MO and accompany if needed.



Minor reactions due to vaccines

(normal and not required to be reported)

Mild vaccine reactions	Treatment	When to report
Local reaction (pain, swelling, redness)	<ul style="list-style-type: none">• Cold cloth at injection site• Give Paracetamol	<ul style="list-style-type: none">• In case of an abscess
Fever > 38.5° C	<ul style="list-style-type: none">• Give extra fluids• Wear cool clothing• Give tepid sponging• Give Paracetamol	<ul style="list-style-type: none">• When accompanied by other symptoms
Irritability, malaise and systemic symptoms	<ul style="list-style-type: none">• Give extra fluids• Give Paracetamol	<ul style="list-style-type: none">• When severe or unusual



Vaccine Preventable Disease Outbreak

- During outbreak Ensure the following:-
 - Adequate supply
 - Adequate staff

- **Pertusis** :- Prophylactic antibiotic (erythromycin or ampicillin) for 10 days and booster dose of DPT or DT

- **Measles** :- Ring immunization within 2 days of exposure

- **Polio** :- Ring immunization with use of Oral(Sabin) Polio vaccine



In case of diphtheria outbreak, if the epidemiological situation demands;

- Mass immunization- Entire adult population
- Mass immunization in schools and preschool institutions to ensure-
 - all children are protected against the disease
 - completion of primary series in non-immunized or incompletely immunized children
 - booster dose for fully immunized children if the last injection was given >five years ago.



Thank You

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