



# 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



# Milestones 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
<b>Under 5 mortality rate</b>	
57	63
<b>% of under 5 suffering from underweight</b>	
16	43
<b>Neonatal mortality rate (first 28 days)</b>	
23	32
<b>% of infants with Low birth weight (&lt;2.5 kg)</b>	
15	28

Source: State of the World's Children 2012:UNICEF report

# Child Mortality

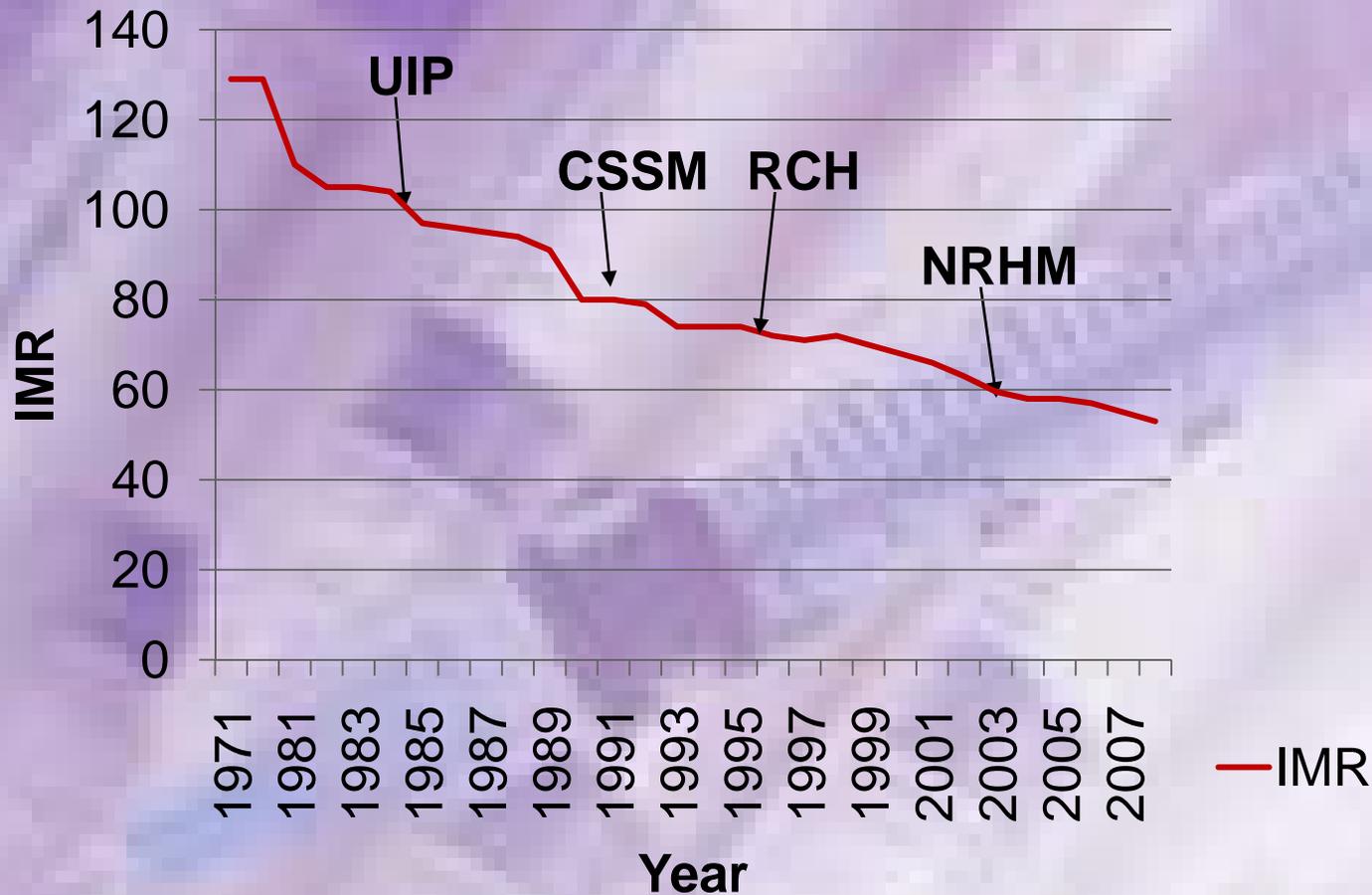


Rank	Country	Under Five Mortality rate
1 <sup>st</sup>	Somalia	180
33 <sup>rd</sup>	Pakistan	87
46 <sup>th</sup>	India	63
59 <sup>th</sup>	Nepal	50
61 <sup>st</sup>	Bangladesh	48
193 <sup>rd</sup>	San Marino	2

**Note** : 5,700 infants die everyday in India.

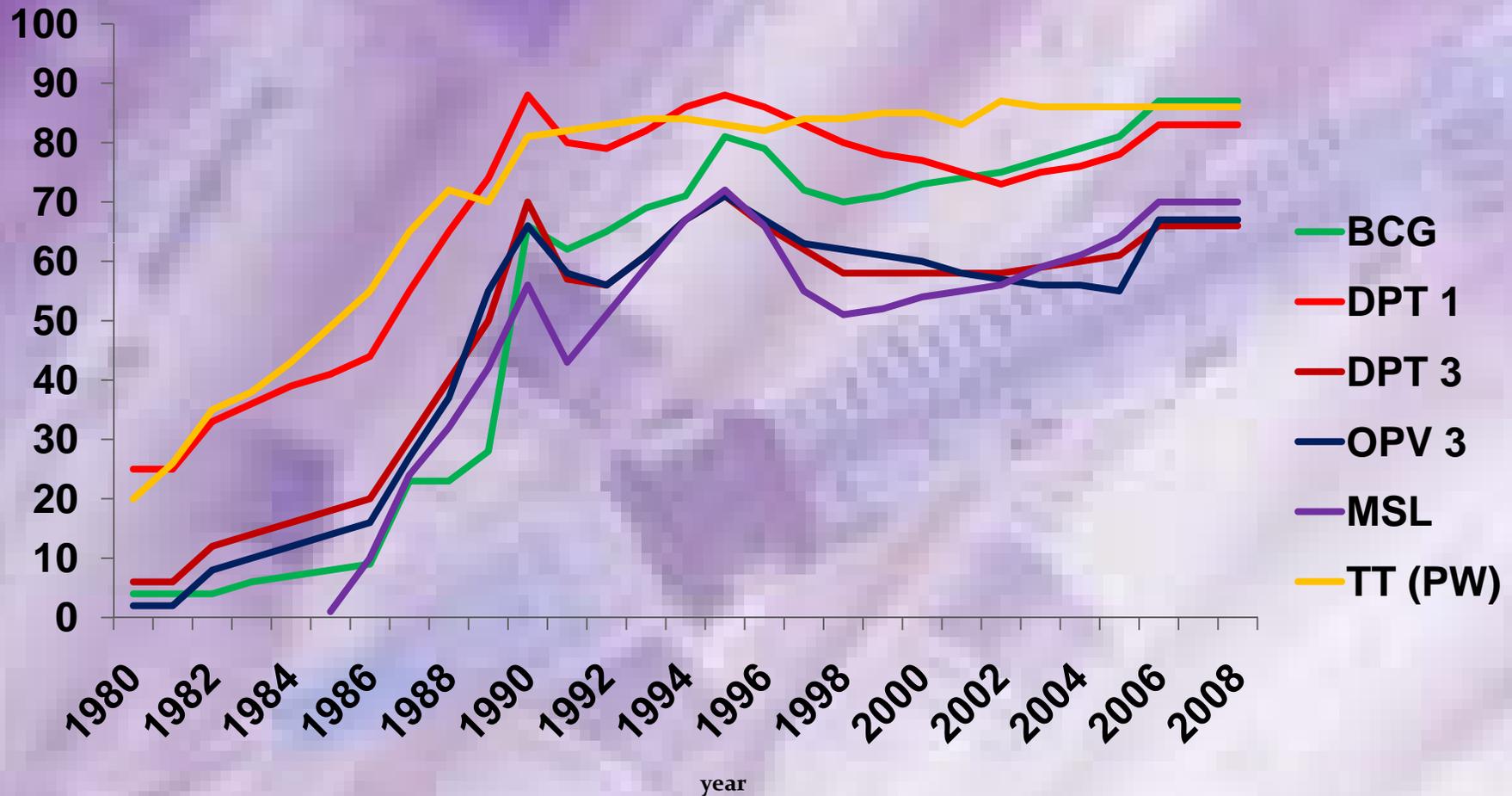
Source: State of the World's Children 2012 **UNICEF**

# 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

SIHFW: an ISO 9001: 2008 certified institution

# National Immunization Schedule



Vaccine	When to give	Dose	Route	Site
<b>For Pregnant Women</b>				
<b>TT-1</b>	Early in pregnancy	0.5 ml	Intra-muscular	Upper Arm
<b>TT-2</b>	4 weeks after TT-1*	0.5 ml	Intra-muscular	Upper Arm
<b>TT-Booster</b>	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
<b>BCG</b>	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
<b>OPV-0</b>	At birth if delivery is in institution	2 drops	Oral	Oral
<b>OPV- 1,2 &amp; 3</b>	At 6, 10 & 14 weeks	2 drops	Oral	Oral
<b>DPT- 1,2 &amp; 3</b>	At 6, 10 & 14 weeks	0.5 ml	IM	Antero-lateral side of mid-thigh
<b>Hep B 1,2 &amp; 3</b>	At 6, 10 & 14 weeks**	0.5 ml	IM	Antero-lateral side of mid-thigh
<b>Measles</b>	9-12 months	0.5 ml	SC	Right upper Arm
<b>Vitamin-A (1<sup>st</sup> Dose)</b>	At 9 months with measles	1 ml (1 lakh IU)	Oral	Oral

# National Immunization Schedule



<i>For children</i>				
Vaccine	When to give	Dose	Route	Site
<b>DPT Booster</b>	16-24 months	0.5 ml	IM	Outer Mid-thigh (Antero-lateral side of mid-thigh)
<b>OPV Booster Vitamin-A (2<sup>nd</sup> to 9<sup>th</sup> Dose)</b>	16-24 months <ul style="list-style-type: none"> <li>• 16 months with DPT/OPV booster</li> <li>• Then, one dose every 6 months up to the age of 5 years.</li> </ul>	2 drops 2 ml (2 lakh IU)	Oral Oral	Oral Oral
<b>DPT Booster</b>	5 years	0.5 ml	IM	Upper Arm
<b>T1</b>	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

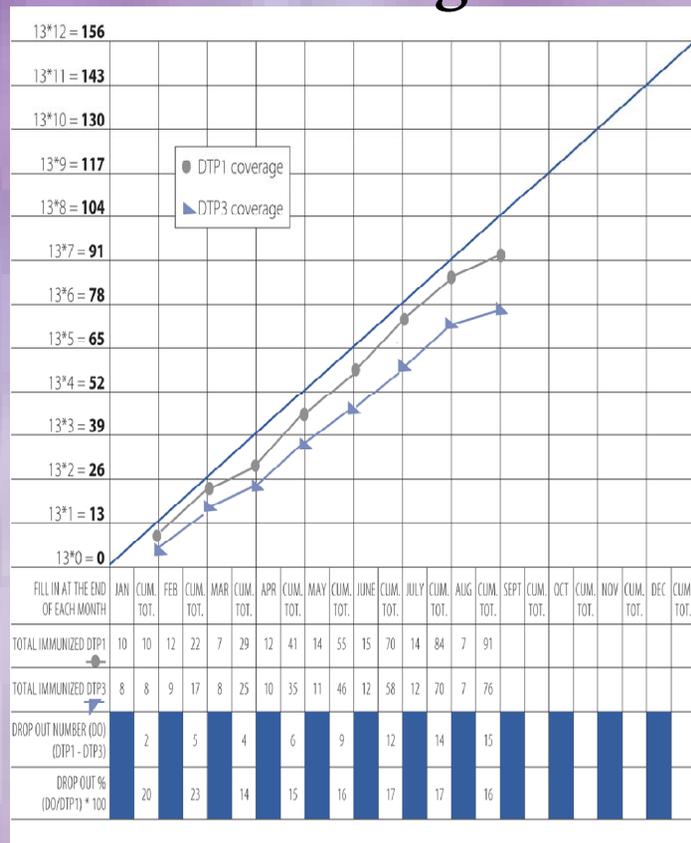
- **PHC-** Compile micro plans from all SC; Add components of alternate vaccine delivery; plan for supervision; plan for immunization waste disposal etc.
  - **District-** Compile plans from PHC and additional components of plans for deployment of human resources, supplies and logistics, training, IEC, 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**



<b>Name of Equipment</b>	<b>Place of Installation</b>	<b>Temperature</b>	<b>Utilization</b>
Cold Box 20 litres	State, Regional, district HQ & PHC	+2 C to +8 C	Vaccines can be stored for transpiration 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
<b><i>At PHC level, all vaccines are kept in ILR in which temperature is maintained at + +2°C to + 8°C</i></b>			

## 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.

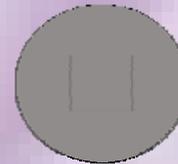


**1 = good:  
Utilize**

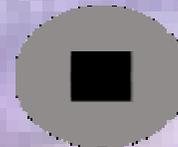


**2 = good:  
Utilize**

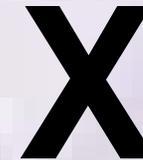
The central square is lighter than the surrounding circle



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



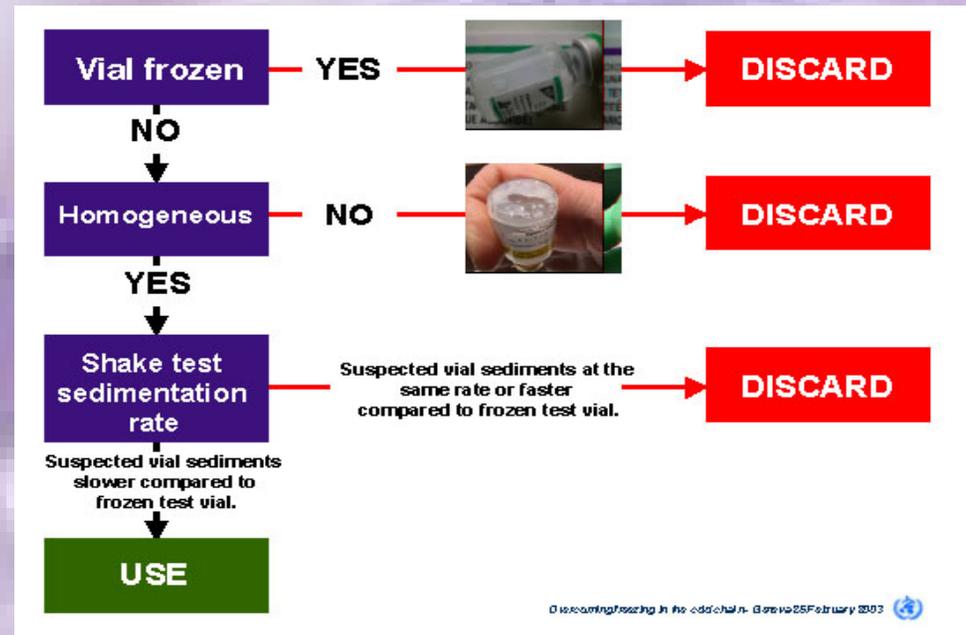
**4 = bad:  
Don't Utilize**



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.



# Programmatic Errors Causing AEFIs



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

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

# 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"> <li>• Cold cloth at injection site</li> <li>• Give Paracetamol</li> </ul>	<ul style="list-style-type: none"> <li>• In case of an abscess</li> </ul>
Fever > 38.5° C	<ul style="list-style-type: none"> <li>• Give extra fluids</li> <li>• Wear cool clothing</li> <li>• Give tepid sponging</li> <li>• Give Paracetamol</li> </ul>	<ul style="list-style-type: none"> <li>• When accompanied by other symptoms</li> </ul>
Irritability, malaise and systemic symptoms	<ul style="list-style-type: none"> <li>• Give extra fluids</li> <li>• Give Paracetamol</li> </ul>	<ul style="list-style-type: none"> <li>• When severe or unusual</li> </ul>

# 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

For more details log on to  
[www.sihfwrajasthan.com](http://www.sihfwrajasthan.com)

or

contact : Director-SIHFW on  
[sihfwraj@yahoo.co.in](mailto:sihfwraj@yahoo.co.in)