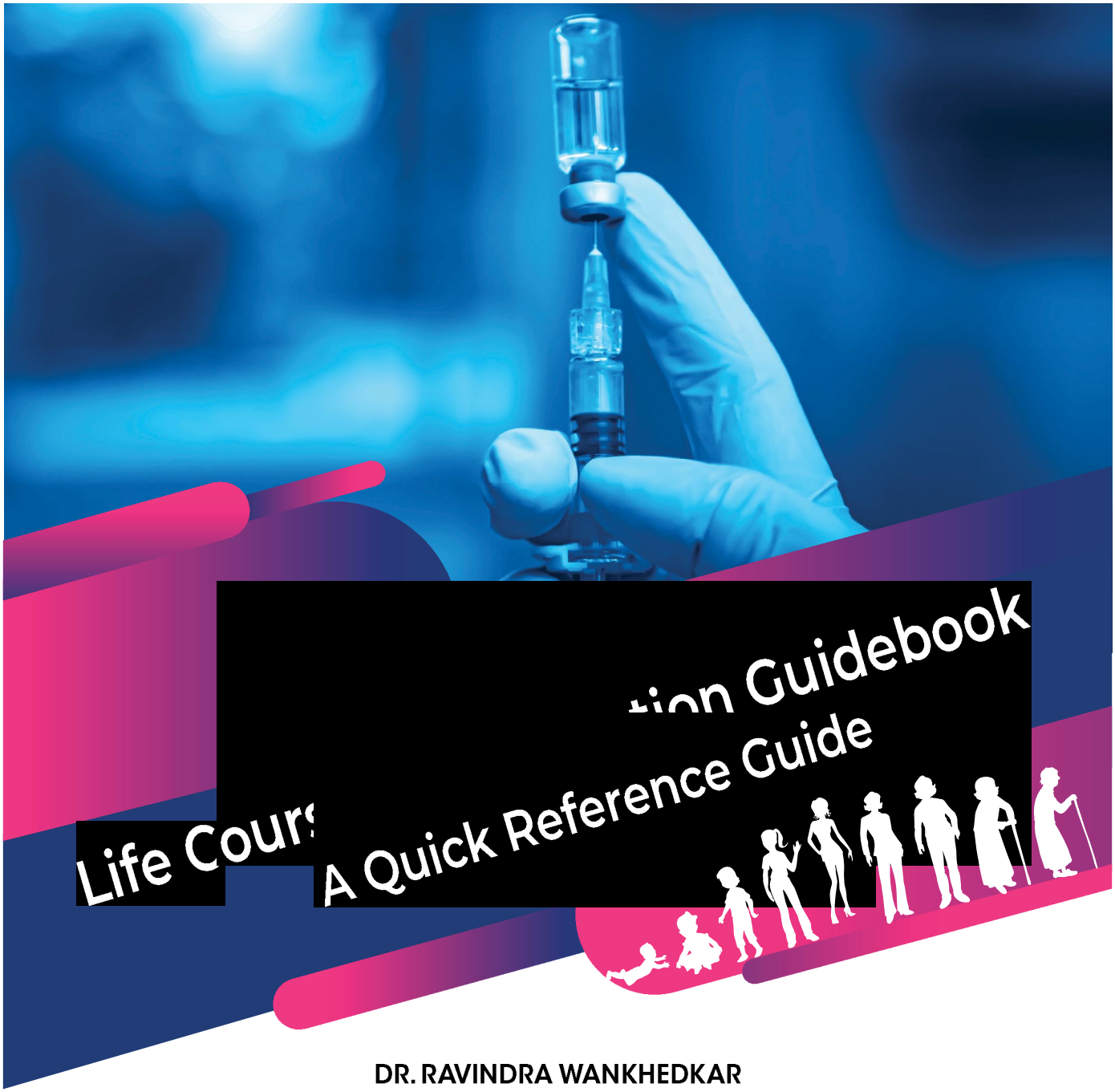
Indian Medical Association

Health First... Healthy Profession for Healthy Nation...



Life Cours tion Guidebook

A Quick Reference Guide

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PUBLICATION OF INDIAN MEDICAL ASSOCIATION

The President's Message

Dear Doctor,

On behalf of the IMA, I welcome all the esteemed members on this new journey of **'Life Course Immunization.'**

As you are aware, currently, immunization against most Vaccine Preventable Diseases (VPDs) has largely been restricted to the infants and young children in India, while other vulnerable population groups (viz. adolescents, adults, pregnant women, and elderly) continue to be deprived of the potential benefits of immunization against many VPDs. Furthermore, due to the increase in the average life expectancy, the VPDs are becoming more critical (as the elderly population will reach ~2 billion people and of them, 3/4th will be in developing countries) in the next few decades. As being confirmed and documented in various global studies, several VPDs are the important causes of morbidity, disability, and mortality in the elderly, and are the key factors leading to dependence along with institutionalization (and this challenge of 'immunosenescence' is significant in the backdrop of the expected 'Population Pyramid Inversion' in India in the coming decades). Therefore, in 2002 WHO developed a global policy framework on 'Healthy Aging', which promotes interventions that maintain and improve health throughout the 'Life Course.'

Therefore, IMA has planned to develop this concept on **'Life Course Immunization',** to understand the status of immunization across various age groups in India. In this journey, we have reviewed the current knowledge and gaps in information about the epidemiology of VPDs in different age groups, their contribution to disability, the deterioration of the immune system with age and possible ways to counteract it. We have considered specific insights from the participating members, initiated the potential immunization strategies across all the age groups to maintain or improve health through the life course. Furthermore, we have identified focus areas to concentrate our efforts in regards to the 'Unmet Medical Needs', which is well aligned with the IMA medical strategy on **'Life Course Immunization.'** Also, we have explored this opportunity to get some insights for consolidation of immunization strategies against some important endemic VPDs in India (e.g., rabies).

As an outcome of the Advisory Board interactive discussion on this topic, IMA has developed a 'Strategy Roadmap for Life Course Immunization' for India for the coming decades. These approaches helped us to develop concept of a 'Life Course Immunization Schedule' to sustain protective immunity against VPDs beyond childhood, and strategies to strengthen the possible robust immune responses for **'Life Course Immunization.'** We need to secure faster vaccine introduction and adaption of currently approved vaccines.

I thank GSK Biologicals for their Independent Medical Educational Support. I also thank **BioQuest Solutions Pvt Ltd, Bengaluru,** for printing this book in record time.

I also acknowledge the efforts put in by **Dr. Jayesh Lele,** right from conceptualizing, coordinating with all, till getting this book printed.

I wish everyone an enjoyable learning experience on **'Life Course Immunization'** through this Guide Book.

Saving Lives, Saving Money- *"Vaccines and immunization have created a healthier world. Immunization is one of the most successful and cost-effective health interventions."*

Regards,
Dr. Ravindra Wankhedkar
National President, IMA

Expert Panel

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- **Dr. R N Tandon**
  Hon. Sec. Gen. Surgeon, Delhi
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LIFECOURSE IMMUNIZATION: PEDIATRIC TO GERIATRIC VACCINES

Dr. Bhaskaran
Chairman

Dr. Jayesh Lele
Convener

Dear members,

It gives us great pleasure and pride to present this
GUIDEBOOK ON LIFE COURSE IMMUNIZATION: PEDIATRIC TO GERIATRIC.

Indian Medical Association is always in forefront in doing pioneering work in the field of Health. This year's theme being **HEALTH FIRST! Healthy Profession for Healthy Nation,** we have aptly published this Vaccine guidebook for all sections of society right from pediatrics to geriatric population. We have also taken care of newly introduced vaccines for 3rd trimester pregnant women.

This book shall serve all healthcare professionals as a ready reckoner and handy while understanding vaccinations. Many newer vaccines are available but the usage is much less compared to that used in rest of the world. Today, all vaccines have pivotal role in reducing the future cost of healthcare to any patient. A vaccine not only prevents diseases and complications, but lessens huge financial losses.

We also propose to start a Vaccinology Certificate course for doctors. The courses shall be online as well as in the form of CMEs. This will help all to understand and use vaccine effectively.

IMA is also planning to have subsidized vaccine distribution to members which shall go a long way as many rural households have problems procuring the vaccines.

We thank National President, Dr. Ravindra Wankhedkar, and TEAM IMA 2018 for allowing this very important initiative.

We also thank GSK Biologicals for their Independent Medical Educational Support and BioQuest Solutions Pvt Ltd, Bengaluru, for printing this book in record time.

Jai IMA

Dr. Bhaskaran
Chairperson

Dr. Jayesh Lele
Convener

Learning Objectives

After completing this module, you should gain

- An understanding of the general aspects of vaccination
- Knowledge on the immunization schedule recommended by IMA
- Knowledge about indications, schedule, site, dose, and route of individual vaccines
- Knowledge of adverse effects following vaccination, and immediate emergency measures to overcome the same

Contents

Section 1: General Aspects of Vaccination

Administration of Vaccines[1,2]

An appropriate technique for preparing and administering vaccines should be followed in order to ensure its effectiveness and avoid an adverse event following immunization.

Route of Administration

The route of administration of a vaccine is the key factor influencing successful immunization. The various routes of vaccine administration are as follows:

- **Intramuscular (IM):** The vaccine is injected into the muscle mass. Vaccines containing adjuvants are administered via this route.
- **Subcutaneous (SC):** The vaccine is administered into the subcutaneous layer, i.e. above the muscle but below the skin.
- **Intradermal (ID):** The vaccine is administered in the outermost layer of the skin.
- **Oral:** The vaccine is administered through mouth; eliminates the need for a needle and a syringe.
- **Intranasal spray application:** The vaccine is administered through the nasal mucosa (Figure 1).

Examples of vaccines administered through different routes are given in Table 1.

Figure 1: Various routes of vaccine administration.[1]

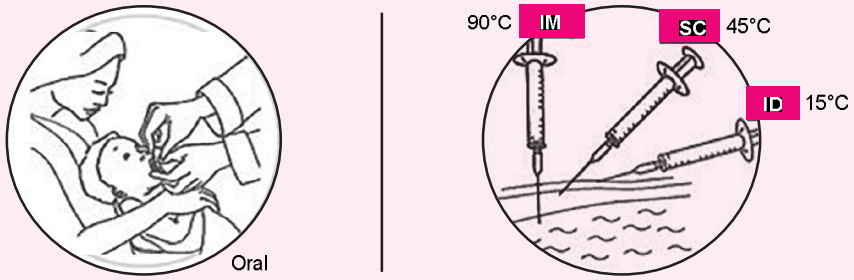


Table 1: Vaccines administered through different routes[1]

Intranasal	Oral	Intramuscular (IM)	Subcutaneous (SC)	Intradermal (ID)
LAIV	OPV	DTwP/DTaP/TT/Tdap/Td/DT	Measles	BCG EPI (Expanded Program of Immunization)
	Rotavirus	Hepatitis B	MR	
	Cholera	Hib	MMR	
		IPV	MMRV	
		PCV- 10/13	Varicella	
		Hepatitis A (killed)	Hepatitis A (live)	
		IIV		
		Meningococcal		
		Typhoid		
		HPV		
		Japanese encephalitis		
		Rabies		

LAIV: Live, attenuated influenza vaccine; OPV: Oral polio vaccine; DTwP: 3 Diphtheria tetanus whole cell pertussis; DTaP: Diphtheria tetanus acellular pertussis; Tdap: Tetanus diphtheria (acellular) pertussis; Td: Tetanus diphtheria; DT: Diphtheria tetanus; Hib: *Haemophilus influenzae*; IPV: Inactivated polio vaccine; IIV: Inactivated/Injectable influenza vaccine; PCV: Pneumococcal conjugate vaccine; HPV: Human papilloma virus vaccine; MR: Measles-Rubella; MMR: Measles, mumps, and rubella; MMRV: Measles, mumps, rubella varicella; BCG: Bacillus Calmette–Guérin.

The length of the needle used for vaccination is determined by the size of the limb and muscle bulk; whether the tissue is bunched or stretched; and the vaccinator's professional judgment (Table 2).

Table 2: Needle gauge and length by site and age[2]

Age	Site	Needle gauge and length	Remarks
Intramuscular (IM) injection			
Birth	Vastus lateralis (anterolateral aspect of thigh)	23–25 G × 16 mm	An insertion angle of 90 degrees is recommended.
6 weeks–2 years	Vastus lateralis	23–25 G × 16 or 25 mm	Choice of needle length will be based on the vaccinator's professional judgment.
			A 25 mm needle will ensure deep IM vaccine deposition.
2–7 years	Deltoid or Vastus lateralis	23–25 G × 16 mm 23–25 G × 25 mm	The vastus lateralis site remains an option in young children when the deltoid muscle bulk is small and multiple injections are necessary.
			A 16 mm needle should be sufficient to effect deep IM deposition in the deltoid in most children.
Older children (7 years and older), adolescents and adults	Deltoid[b]	23–25 G × 16 mm, or 23–25 G × 25 mm	Most adolescents and adults will require a 25 mm needle to effect deep IM deposition.
Subcutaneous (SC) injection			
Subcutaneous injection	Deltoid region of the upper arm	25–26 G × 16 mm	An insertion angle of 45 degrees is recommended. The needle should never be longer than 16 mm or inadvertent IM administration could result.
Intradermal (ID) injection: BCG vaccine			
Intradermal injection	Slightly above the insertion of the deltoid muscle on the lateral surface of the left arm. The arm should be gently but firmly supported.	**Drawing-up:** Tuberculin syringe (attach a drawing-up needle), or a single-use insulin syringe with a needle attached **Administering:** If using a tuberculin syringe, change the needle to a sterile 26 G × 13 or 16 mm needle (no needle change required if using an insulin syringe)	The syringe should be held with the bevel uppermost, parallel with the skin of the arm. The bevel should be fully inserted but visible under the skin. Inject the vaccine slowly and gradually to form a white 'bleb' or wheal of 5 mm then gradually withdraw the needle. An inserion angle of 15 degrees is recommended.

[a]The vastus lateralis may be considered as an alternative vaccination site, provided that it is not contraindicated by the manufacturer's data sheet.
[b]For females weighing <60 kg, use a 23–25 G ×16-mm needle; for 60–90 kg use a 23–25 × 25-mm needle; for >90 kg use a 21–22 G × 38-mm needle. For adolescent and adult males, a 23–25 G × 25-mm needle is sufficient.

Note: There is no need for aspiration before injecting vaccine.

Safe Injection Practices[4]

Safe injection practices can be achieved by following a few simple steps:

- Clean hands before administering a vaccine.
  - Wash or disinfect hands prior to preparing injection material.
  - Avoid giving injections if the skin at the site of injection of the recipient is infected or compromised by local infection (skin lesions, cuts, weeping dermatitis or tattoos).
  - Cover any small cuts on the service provider's skin.
- Use sterile injection equipment for each use.
  - Always use auto-disposable syringes for each injection and a new disposable syringe to reconstitute each vial of BCG and measles.
- Prevent the contamination of the vaccine and injection equipment.
  - Prepare each injection in a designated clean area where contamination from blood or body fluid is unlikely.
  - Wash the injection site with water if it is dirty.
  - Use a sterile needle to pierce the rubber cap of the vial.
  - Follow product-specific recommendations for use, storage, and handling of a vaccine.
  - Do not touch the rubber cap of the vial with bare hands.
  - Discard the needle that has touched any non-sterile surface.
- Assume that all used equipment is contaminated.
  - Cut the used syringe at the hub immediately after use (Figure 2).

Figure 2: How to use a hub cutter correctly?[4]

- Practice safe disposal of all medical waste.
- Prevent needle-stick injuries.
  - Do not recap or bend needles.
  - Collect sharps in a puncture-proof container (Hub cutter) (Figure 2).
  - Anticipate sudden movement in children.

Storage of Vaccines[4–6]

Summary of Vaccine Sensitivities

Vaccines when exposed to heat (above+8°C) or cold (below +2°C) and light can lose their potency. The loss of potency due to either heat or cold is irreversible (Table 3).

Table 3: Sensitivity of vaccines to heat, light, and freezing[6]

Vaccine	Exposure to heat/light	Exposure to cold
Heat and light sensitive vaccines		
OPV	Sensitive to heat	Not damaged by freezing
Measles/MR	Sensitive to heat and light	Not damaged by freezing
BCG, RVV, and JE	Relatively heat stable, but sensitive to light	Not damaged by freezing
Freeze sensitive vaccines		
HepB/Penta/PCV	Relatively heat stable	Freezes at –0.5°C (Should not be frozen)
IPV, DPT, and TT	Relatively heat stable	Freezes at –3°C (Should not be frozen)
At the PHC level, all vaccines are kept in the ILR for a period of one month at temperature of +2°C to +8°C		

Vaccines sensitive to heat

Most sensitive

- BCG (after reconstitution)
- OPV
- IPV
- MR
- Rotavirus
- JE
- DPT
- BCG (before reconstitution)
- TT
- Penta, HepB, PCV

Least sensitive

Vaccines sensitive to freezing

Most sensitive

- HepB
- PCV
- Penta
- IPV
- DPT
- TT

Least sensitive

PCV: Pneumococcal conjugate vaccine; RVV: Rotavirus vaccine; JE: Japanese encephalitis; Penta: DTwP+HiB+HepB; DTwP: Diphtheria, tetanus, whole cell pertussis; HiB: Haemophilus conjugate Type B; Hep B: Hepatitis B

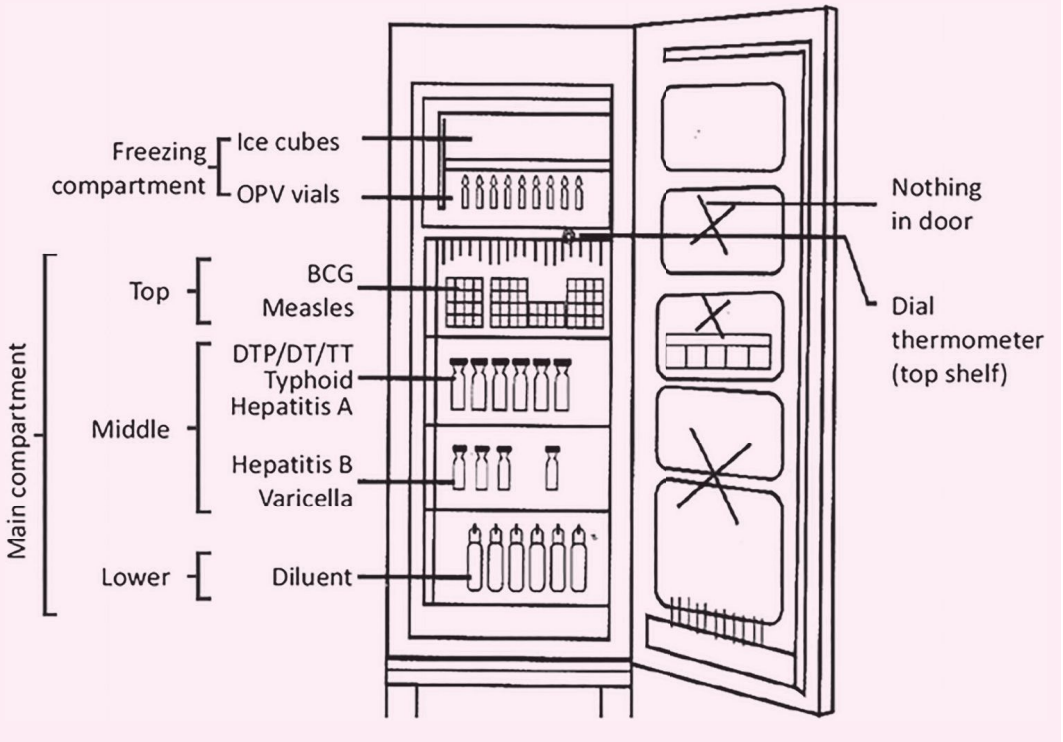
How to Store Vaccine in Front-Load Refrigerators

- Maintain a cabinet temperature of 2–8°C. Strive to maintain 5°C.
- These refrigerators should be used exclusively for vaccines.
- Vaccines should not be stored in the freezer, chiller, door, or basket of the refrigerator.

Vaccine placement in the refrigerator:

- The freezer should contain ice packs and vaccines to be frozen.
- The chiller tray should be empty.
- **Top-most shelf:** The top-most shelf should contain BCG and measles vaccines. The vaccines that are not freeze sensitive can be stored in top-most shelf.
- **Middle shelf:** The middle shelf may contain DTP/DT/TT, typhoid, hepatitis A, hepatitis B and varicella vaccines.
- **Lower-most shelf:** The lower-most shelf contains diluents.
- A dial thermometer should be placed in the top shelf (Figure 3).

Figure 3: Recommended placement of different vaccines in different compartments of a domestic refrigerator[5]



Shake Test[5,6,7]

A shake test of the vials should be conducted if one suspects that a large number of vials at the cold-chain point could have been frozen. The process to perform the shake test is as follows:

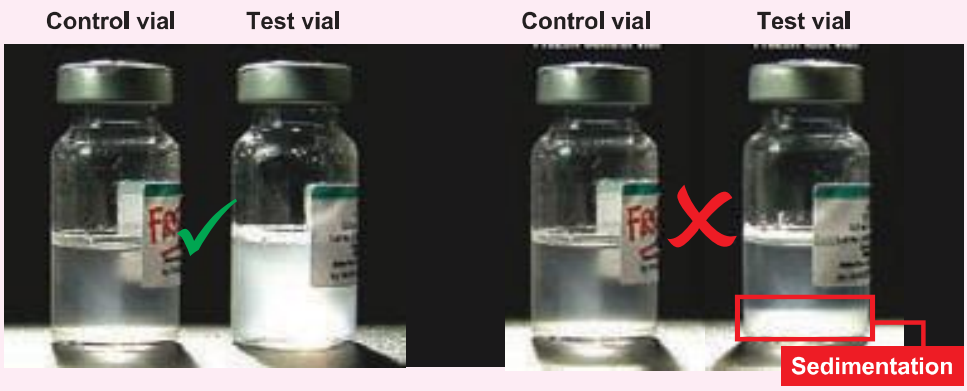
Shake Test—Test Vial

Select the vaccine vial that is suspected to be frozen. This vial is the 'test' vial.

Shake Test—Control Vial

- Take a vaccine vial of the same antigen, same manufacturer, and same batch number as the suspected vaccine vial that has to be tested.
- Freeze solid this vial at −20°C overnight in the DF; consider this as the 'control' vial and label accordingly, to avoid its usage.
- Let it thaw. Do NOT heat it.
- Hold the control and the test vials together between thumb and forefinger and vigorously shake the vials for 10–15 seconds.
- Place both vials to rest on a flat surface, side-by-side, and observe them for 30 minutes.
- Compare the rates of sedimentation in the vials.
- If the sedimentation rate in the test vial is slower than that in the control vial, the vaccine has not been damaged; i.e. it has passed the shake test (Figure 4).
- If the sedimentation rate is similar in both vials or if sedimentation is faster in the test vial than in the control vial, the vaccine is damaged, i.e. it has failed in the shake test. Do NOT use the vaccine, and notify the concerned authorities.

Figure 4: Shake test of the suspected vial.[6]



Guidelines for use of Open Vaccine Vials in an Immunization Program[6]

Implementation of the Open Vial Policy (OVP) allows the reuse of partially used multidose vials of applicable vaccines under the UIP in subsequent sessions (both fixed and outreached) up to 4 weeks (28 days), subject to meeting certain conditions. This policy reduces vaccine wastage. The OVP is **only applicable** to DPT, TT, Hep B, OPV, PCV, and Hib-containing pentavalent vaccine (Penta) and IPV. The OVP **does not apply** to the measles/MR, rotavirus, BCG, and JE vaccines.

Adverse Events Following Immunization[4]

Types of Adverse Event Following Immunization

Any unfavorable event following immunization that does not necessarily have a causal relationship with the usage of the vaccine is defined as an adverse event following immunization. Adverse event following immunization (AEFI) are listed in Table 4.

Signs and Symptoms of Anaphylaxis and Distinguishing Anaphylaxis From Fainting

Anaphylaxis occurs as severe and potentially allergic reactions; however, such reactions occur very rarely. It is important to distinguish anaphylaxis from fainting (vasovagal syncope), anxiety, and breath-holding spells, which are common benign reactions (Table 5).

The more severe the reaction, the more rapid the onset. These reactions begin within 10 minutes of immunization. Therefore, a vaccinee should be kept under observation for at least 30 min after injection of a vaccine (Table 6).

Table 4: Cause-specific categorization of AEFIs[4]

	Cause-specific type of AEFI	Definition	Examples
1	Vaccine product-related reaction	An AEFI that is caused or precipitated by a vaccine due to one or more of the inherent properties of the vaccine product	Febrile convulsion following DTwP within 24 hours.
2	Vaccine quality defect-related reaction (Both 1 and 2 were earlier categorized in vaccine reaction)	An AEFI that is caused or precipitated by a vaccine that is due to one or more quality defects of the vaccine product, including its administration device as provided by the manufacturer	Incompletely inactivated OPV causing paralytic polio.
3	Immunization error-related reaction (formerly "programme error")	An AEFI that is caused by inappropriate vaccine handling, prescribing or administration and thus by its nature is preventable	Local abscess after BCG vaccine.
4	Immunization anxiety-related reaction (formerly "injection reaction")	An AEFI arising from anxiety about the immunization	Fainting after vaccination.
5	Coincidental event	An AEFI that is caused by something other than the vaccine product, immunization error or immunization anxiety	Occurence of malaria after MMR vaccine.

AEFI: Adverse event following immunization.

Table 5: Distinguish anaphylaxis from fainting (vasovagal reaction)[4]

	Fainting	Anaphylaxis
Onset	Usually at the time or soon after the injection	Usually some delay, between 5 and 30 mins, after injection
Systemic		
Skin	Pale, sweaty, cold, and clammy	Red, raised, and itchy rash; swollen eyes, face, generalized rash
Respiratory	Normal to deep breaths	Noisy breathing from airways obstruction (wheeze or stridor)
Cardiovascular	Bradycardia, transient hypotension	Tachycardia, hypotension
Gastrointestinal	Nausea, vomiting	Abdominal cramps
Neurological	Transient loss of consciousness, relieved by supine posture	Loss of consciousness, not relieved by supine posture

Table 6: Signs and symptoms of anaphylaxis[4]

Clinical progression	Progression of signs and symptoms of anaphylaxis
Mild, early warning signs	Itching of the skin, rash, and swelling around injection site. Dizziness, general feeling of warmth. Painless swellings in parts of the body e.g. face or mouth. Flushed, itching skin, nasal congestion, sneezing, tears.
Late, life-threatening symptoms	Hoarseness, nausea, vomiting. Swelling in the throat, difficult breathing, abdominal pain. Wheezing, noisy and difficult breathing, collapse, low blood pressure, irregular weak pulse.

Managing and Reporting AEFI When it Occurs[4]

The following steps are to be followed to manage a serious or severe adverse event after vaccination:

- Immediate first aid should be provided: Lay the affected child flat, ensuring that the airway is clear. Put the child in a semi-prone position if the child is unconscious.
- Refer to the medical officer (PHC) or the nearest AEFI management center for immediate treatment. Accompany the patient if required.
- The medical officer (PHC) should be informed at the health center as early as possible.
- Report and assist in investigation of AEFIs.

The following steps are to be followed to report a serious or severe adverse event after vaccination:

- Inform about all serious/severe AEFIs telephonically/in person immediately.
- Provide details of all AEFIs in your area on a weekly basis. Submit weekly "NIL" reports only after ensuring that adverse events are not occurring in recently vaccinated children.
- Notify that detailed information about all serious, severe, and minor AEFIs are to be recorded in the block AEFI register.
- Communicate and share the results of the investigation with the community, whenever instructed by the medical officer.

Emergency Equipment[4–6]

The contents of an AEFI emergency kit are listed in Table 7. Please report all the AEFIs to the health care service provider as earlier as possible.

Table 7: Contents of an AEFI treatment kit[6]

1. Injection adrenaline (1:1000) solution - 2 ampoules
2. Injection hydrocortisone (100 mg) - 1 vial
3. Disposable syringe -Tuberculin syringes (1 mL) OR insulin syringe (without fixed needle of 40 units) 3 Nos
4. Disposable syringe (5 mL) and 24/25G IM needle - 2 sets
5. Scalp vein set - 2 sets
6. Tab parcetamol (500 mg) - 10 tabs
7. IV fluids (Ringer lactate/normal saline): 1 unit in plastic bottle
8. IV fluids (5% dextrose): 1 unit in plastic bottle
9. IV drip set: 1 set
10. Cotton wool, adhesive tape - 1 each
11. AEFI Case Reporting Form (CRF)
12. Label showing date of inspection, expiry date of Inj. adrenaline and shortest expiry date of any of the components
13. Drug dosage tables for Inj. adrenaline and hydrocortisone
14. In hospital settings, oxygen support and airway intubation facility should be available
15. Ambu bags with mask, endotracheal tube, laryngoscope with spare batteries

SECTION 2: Immunization Schedule Recommended by IMA

Currently Available Vaccines

Vaccines administered to the pediatric population are broadly categorized into:

1. Vaccines for routine use and
2. Vaccines to be used under special circumstances only.

The special categories in which the vaccines must be administered are:

- Individuals with congenital or acquired immunodeficiency (including HIV infection)
- Individuals having chronic cardiac, pulmonary (including asthma if treated with prolonged high-dose oral corticosteroids), hematologic, renal (including nephrotic syndrome), liver diseases, and diabetes mellitus
- Individuals on long-term steroids, salicylates, immunosuppressives, or radiation therapy
- Individuals with diabetes mellitus, cerebrospinal fluid leak, cochlear implant, and malignancies
- Individuals with functional/anatomic asplenia/hyposplenia
- During disease outbreaks
- Laboratory personnel and healthcare workers
- Travelers
- Individuals having pets at home
- Individuals perceived to be at a higher threat of being bitten by dogs, such as hostellers; risk of stray dog menace while outdoors[8]

Table 8 lists vaccines for routine use and vaccines for special circumstances.[8]

Table 8: List of vaccines for routine use and vaccines for special circumstances[8]

Vaccines for routine use	Vaccines under special circumstances
BCG	Influenza
OPV	Meningococcal
HepB	Japanese Encephalitis
DTP	Cholera
IPV	Rabies
Hib	Yellow fever
Rotavirus	Pneumococcal polysaccharide vaccine
PCV	
MMR	
Typhoid vaccine	
HepA	
Varicella	
Tdap/Td	
HPV	

BCG: Bacillus Calmette–Guérin; OPV: Oral polio vaccine; DTP: Diphtheria tetanus pertussis; IPV: Inactivated polio vaccine; Hib: *Haemophilus influenzae*; PCV: Pneumococcal conjugate vaccine; MMR: Measles, mumps, and rubella; Tdap: Tetanus diphtheria (acellular) pertussis; HPV: Human papillomavirus vaccine.

Immunization Schedule Recommended by IMA[2,8]

The following is the recommended immunization schedule for children from birth through 18 years according to the recommendations based on recent evidence for licensed vaccines in our country (Table 9).

Table 9: Recommended immunization schedule for children aged 0–18 years[2,8]

Age	Vaccine	Dose	Route	Site	Remarks
Birth (within 24–72 h of birth)					
	BCG	0.05 mL	ID	Left upper arm	Conventionally given on this site
	OPV-0	2 drops	Oral		
	Hep B-0	0.5 mL	IM	Left thigh	Mandatory before discharge (preferably within 24–72 hours of birth)
6 weeks	DTwP/DTaP1	0.5 mL	IM	Anterolateral aspect of thigh	Use combination vaccines whenever possible
	Hib-1				
	IPV-1				
	Hep B				
	PCV10/13-1				
	Rota-1	0.5–2 mL	Oral	Squirt toward buccal mucosa	• If RV5/RV116E, 3 doses one month apart • If RV1, 2 doses one month apart • First dose of rotavirus vaccine not be administered after 16 weeks • Last dose of rotavirus vaccine not to be administered after 6 months for RV1, and not after 32 weeks for others
10 weeks	DTwP/DTaP2	0.5 mL	IM	Anterolateral aspect of thigh	
	Hib-2				
	IPV-2				2 doses of IPV instead of 3 doses if started at 8 weeks' age. If so, 2 dose to be administered 8 weeks apart
	Hep B				
	PCV10/13-2				
	Rota-2	0.5–2 mL	Oral	Squirt toward buccal mucosa	2 doses for RV1
14 weeks	DTwP/DTaP3	0.5 mL	IM	Anterolateral aspect of thigh	
	Hib-3				
	IPV-3				
	Hep B				
	PCV10/13-3				

	Rota-3	0.5–2 mL	Oral	Squirt toward buccal mucosa	RV5/RV116E is administered as 3 doses
6 months	Hep B	0.5 mL	IM		If following 0, 1, & 6 months schedule
	OPV-1	2 drops	Oral		
	IIV-1	0.25 mL	IM		High-risk groups
7 months	IIV-2	0.25 mL	IM		
9 months	OPV-2	2 drops	Oral		
	MMR-1/MR	0.5 mL	SC		After 270 completed days
	Meningococcal conjugate vaccine-1	0.5 mL	IM		High-risk groups
10 months	Typhoid conjugate vaccine-1	0.5 mL	IM		At least 1-month gap between MMR and TCV
12 months	Hepatitis A (killed or live)	0.5 mL	IM (killed) or SC (live)		Single dose for live hepatitis A
	JE-1	0.25 mL	IM		In endemic areas <3 years age
	Cholera vaccine		Oral		Hyperendemic/outbreaks: 2 doses administered 2 weeks apart and a booster dose after 2 years
13 months	JE-2	0.25 mL	IM		In endemic areas <3 years age
15 months	MMR-2	0.5 mL	SC		
	Varicella -1	0.5 mL	SC		
15–18 months	PCV- booster	0.5 mL	IM		
16–18 months	DTwP/DTaP (**Booster 1**)	0.5 mL	IM		Combination vaccines preferred
	IPV –Booster	0.5 mL	IM		
	Hib –Booster	0.5 mL	IM		
18 months	Hepatitis A (killed)-2	0.5 mL	IM		2nd dose only for killed vaccine

2 years	Typhoid conjugate-2 or Typhoid polysaccharide	0.5 mL	IM	Upper arm	• Polysaccharide typhoid vaccines repeated every 2–3 yearly • If a typhoid conjugate vaccine is being given the first time at/after 2 years, a single dose will suffice.
	Meningococcal-2	0.5 mL	IM		If meningococcal conjugate vaccine is being given at first time at/after 2 years, a single dose will suffice
4–6 years	DTwP/DTap/Tdap (**Booster 2**)				OPV up to 5 years of age
	MMR 3				
	Varicella-2				2nd dose of varicella may be given 3 months after first dose
	OPV-3				
9 years onwards (girls)	HPV				• If started before the 15th completed birthday, give 2 doses 6 months apart. • If started after the 15th completed birthday, 3 doses to be given. • If HPV4 -0, 2, 6 months. • If HPV2- 0, 1, 6 months.
10 years	Tdap/Td	0.5 mL	IM		Tdap is preferred over Td
16 years	Td/TT	0.5 mL	IM		Repeat every 10 yearly

OPV: Oral polio vaccine; DTwP: Diphtheria tetanus whooping cough pertussis; DTaP: Diphtheria tetanus acellular pertussis; Tdap: Tetanus reduce dose of diphtheria (acellular) pertussis; Td: Tetanus diphtheria; DT: Diphtheria,Tetanus, and whole cell pertussis; Hib: *Haemophilus influenzae;* IPV: Inactivated polio vaccine; IIV: Inactivated influenza vaccine; Hep B: Hepatitis B; Rota: Rotavirus; iPCV: Pneumococcal Conjugate Vaccine; HPV: Human papilloma virus vaccine; MR: Measles-Rubella; MMR: Measles, mumps, and rubella; MMRV: Measles, mumps, rubella varicella; BCG: Bacillus Calmette–Guérin.

General Instructions for Immunization

- Vaccination at birth means as early as possible within 24–72 hours after birth or at least not later than 1 week after birth.
- If multiple vaccinations are to be administered simultaneously, they should be given within 24 hours if simultaneous administration is not feasible due to some reasons.
- The recommended age in weeks/months/years means completed weeks/months/years.
- Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible.
- The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines.
- Second dose of varicella can be given after 3 months of 1st dose in place of 4–6 years as a short schedule. Combination of MMR + Varicella (MMRV) is available.

- Combination of MMR + V is preferred if Varicella vaccine 2nd dose is not given as a short schedule.
- When two or more live parenteral/intranasal vaccines are not administered on the same day, they should be given at least 28 days (4 weeks) apart; this rule does not apply to live oral vaccines.
- Any interval can be kept between live and inactivated vaccines.
- If given <4 weeks apart, the vaccine given second should be repeated.
- The minimum interval between two doses of the same inactivated vaccine is usually 4 weeks (exception rabies). However, any interval can be kept between doses of different inactivated vaccines.
- Vaccine doses administered up to 4 days before the minimum interval or age can be considered valid (exception rabies). If the vaccine is administered >5 days before the minimum period, it is considered as an invalid dose.
- This is not applicable to live vaccines (Minimum 4 weeks gap is essential).
- Any number of antigens can be given on the same day.
- Changing needles between drawing the vaccine into the syringe and injecting it into the child is not necessary.
- Once the protective cap on a single-dose vial has been removed, the vaccine should be discarded at the end of the immunization session, because it may not be possible to determine whether the rubber seal has been punctured.
- Different vaccines should not be mixed in the same syringe unless specifically licensed and labeled for such use.
- Patients should be observed for an allergic reaction for 15–20 minutes after receiving immunization.
- When necessary, two vaccines can be given in the same limb at a single visit with a gap of 1 inch to look for injection site reactions.
- The anterolateral aspect of the thigh is the preferred site for two simultaneous IM injections because of its greater muscle mass.
- Do not repeat the entire schedule if recommended intervals are not maintained. Give remaining doses only.
- Repeat the dose if expired/non-potent vaccines are administered inadvertently.
- If evidence of BCG administration, there is no need to repeat the dose even if the scar is absent.
- Please see the individual vaccine section for more information.
- Acute febrile illness is a precaution for most vaccines; vaccination can be postponed in individuals with acute febrile illness.

Section 3: Vaccines

General Vaccines

Bacillus Calmette–Guérin (BCG) Vaccine[2,4,5,8,9]

NAME: BCG vaccine (Bacillus Calmette–Guérin vaccine)	**DOSE AND ROUTE OF ADMINISTRATION:** 0.05 mL <1 month age; 0.1 mL >1 month age; administered ID on left upper arm-deltoid region
INDICATIONS: Provides protection against severe forms of tuberculosis caused by *Mycobacterium tuberculosis* such as TB meningitis and Miliary TB. Additionally, evidence also suggests that BCG vaccine contributed to a significant decline in leprosy, which is caused by *Mycobacterium leprae*.	**SCHEDULE:** BCG vaccine is administered at birth (within 24–72 hours after birth).
TYPE OF VACCINE: Live, attenuated vaccine	**CATCH-UP IMMUNIZATION:** At first contact or up to an age of 5 years
AVAILABILITY/DILUENT: Freeze-dried powder form in amber-colored vial with specific diluent—0.4 % NaCl. To be reconstituted just before administration and used within 4 hours.	**ADVERSE EFFECTS:** a) Keloid formation b) Infection c) Non-suppurative regional lymphadenopathy d) Abscess e) Osteomyelitis (rare) f) BCG-osis (disseminated Koch's) in an immunosuppressed patient
STORAGE: 2–8°C. Do not freeze.	**SPECIAL COMMENTS:** • Bleb of 5 mm should be created while ID injection (may use BCG syringe/insulin syringe) • Explain evolution of vaccine reactions, papule-pustule or scar formation to parents.
CONTRAINDICATIONS: • Severe congenital/acquired immunodeficiency, including symptomatic HIV • Malignancy, steroids, chemotherapy	

Polio Vaccine[5,8]

NAME: Polio vaccine

DOSE AND ROUTE OF ADMINISTRATION:

- Dosage of OPV: Two drops administered through mouth
- Dosage of IPV: 0.5 mL of intramuscular injection on anterolateral (outer) mid-thigh in infants and children

INDICATIONS:

Provides protection against poliomyelitis (or polio) caused by poliovirus types 1, 2, or 3

SCHEDULE:

- OPV is administered at birth (within 24–72 hours after birth or at least not later than 1 week after birth).
- IPV 1, 2, and 3 are administered at 6, 10, and 14 weeks, respectively, followed by a booster dose at 15–18 months.
- The second, third, and fourth doses of OPV are administered at 6 months, 9 months, and during 4–6 years of age, respectively.

TYPE OF VACCINE:

a) OPV: Live, attenuated vaccine (Sabin, Bivalent)

b) IPV: Inactivated polio vaccine (Salk, trivalent)

CATCH-UP IMMUNIZATION:

- Inactivated polio vaccine can be administered in two doses 2 months apart, followed by a booster after 6 months of the previous dose.

AVAILABILITY/DILUENT:

- Available as OPV and IPV
- Inactivated polio vaccine is available as a stand-alone injection or as a combination with diphtheria, tetanus, pertussis, hepatitis B, and/or Hib.

ADVERSE EFFECTS:

- With OPV, vaccine-associated paralytic polio (VAPP) can occur in approximately 1 in 2.7 million doses.
- IPV may cause injection-site redness, swelling, and soreness.

STORAGE:

- OPV is very heat-sensitive; it must be kept frozen (up to –20°C) during long-term storage. (After thawing, it can be kept between +2°C and +8°C for a maximum of six months or can be refrozen).
- IPV is stored at +2°C and +8°C; do not freeze.

SPECIAL COMMENTS:

- Postpone vaccination if the child has moderate-to-severe illness (with temperature ≥39°C).
- Always check color of inner square on the vaccine vial monitor (VVM) on the OPV vial. If it changes to same color as outer circle or darker, discard the vaccine.

CONTRAINDICATIONS:

Known hypersensitivity (allergy) or anaphylaxis to a previous dose

Hepatitis B Vaccine[2,4,5,8]

NAME: Hepatitis B vaccine	**DOSE AND ROUTE OF ADMINISTRATION:** 0.5 mL (10 µg) IM- anterolateral thigh/deltoid (never in gluteal region) 1 mL (20 µg) in >18 years age IM
INDICATIONS: Provides protection against infection caused by hepatitis B virus	**SCHEDULE:** • Birth (0), 1 month, 6 months (best schedule) • Birth, 6 weeks, 10 weeks, 14 weeks • 6 weeks, 10 weeks, and 14 weeks • Birth, 6 weeks, and 6 months • Birth, 6 weeks, and 14 weeks
TYPE OF VACCINE: Recombinant DNA or plasma-derived, inactivated subunit vaccine	**CATCH-UP IMMUNIZATION:** 0, 1, 6 months schedule
AVAILABILITY/DILUENT: Available in monovalent and pentavalent forms (diphtheria + pertussis + tetanus + hepatitis B + *Haemophilus influenzae* type b) and hexavalent (along with IPV)	**ADVERSE EFFECTS:** • Mild adverse events: Injection-site pain, redness, or swelling with headache and fever • Severe adverse events: Anaphylaxis
STORAGE: • Between +2°C and +8°C • Do not freeze.	**SPECIAL COMMENTS:** Antibody titers greater than 10 mIU/mL signify a response and are considered protective. Non-responders should be tested for hepatitis B carrier status. If found to be negative, the same 3-dose schedule should be repeated.
CONTRAINDICATIONS: • Known hypersensitivity (allergy) or anaphylaxis to a previous dose. • Allergy to baker's yeast. • Infant weight <2 kg.	

Diphtheria, Tetanus, and Pertussis Vaccine[4,5,8,11,12]

NAME: Diphtheria, tetanus, and pertussis vaccine

DOSE AND ROUTE OF ADMINISTRATION:

0.5 mL administered IM anterolateral thigh or deltoid

INDICATIONS:
Provides protection against diphtheria, tetanus, and pertussis, caused by *Corynebacterium diphtheriae*, *Bordetella pertussis*, and *Clostridium tetani*, respectively.

SCHEDULE:
- Primary: 3 doses at 6, 10, 14 weeks
- 1st booster: 15–18 months
- 2nd booster: 4–6 years
- Tdap/Td: 10–12 years, 16 years

TYPE OF VACCINE:
With whole-cell pertussis (wP) vaccine or acellular pertussis vaccine (aP).

CATCH-UP IMMUNIZATION:
Gap in series (missed)
- Complete the series
- Do not restart

Below 7 years
- DTwP/DTaP- 0, 1, 2, 6 months
- 2nd booster not required if last dose administered at >4 years

Above 7 years
- Tdap 0 dose, then Td 1, 6 months
- Td every 10 years after this

11–18 years
- Tdap: 1 dose
- Later Td every 10 years

AVAILABILITY/DILUENT:
The following forms of the diphtheria, tetanus, and pertussis vaccine are available in India.
- DTwP: Diphtheria, tetanus, and whole-cell pertussis vaccine, commonly known as triple antigen. Different combinations of DTwP are available, such as:
  - → Quadrivalent (DTwP + Hib)
  - → Pentavalent (DTwP + Hib + HB)
  - → Hexavalent (DTwP + Hib + HB + IPV)
- DTaP: Diphtheria, tetanus, and acellular pertussis vaccine
- Different combinations of DTaP vaccines are available such as:
  - → Pentavalent (DTaP + Hib + HB)
  - → Hexavalent (DTaP + Hib + HB + IPV)
- Tdap: Diphtheria, tetanus, and acellular pertussis vaccine (reduced antigen content)
- DT: Diphtheria and tetanus vaccine
- Td: Diphtheria (reduced-dose) and tetanus vaccine

ADVERSE EFFECTS:
Mild adverse events
Mild adverse events: Fever, irritability, drowsiness, loss of appetite, and vomiting
Severe adverse events
High fever, persistent crying, seizure, hypotonic–hyporesponsive episode (HHE), encephalopathy, Dravet's syndrome, anaphylaxis and Guillain Barré Syndrome (GBS)

STORAGE:
- Between +2°C and +8°C
- Do not freeze.
- Pentavalent/Hexavalent vaccine is freeze-sensitive. If freezing is suspected, the shake test should be performed to determine whether a vial is safe to use.

CONTRAINDICATIONS:
Known hypersensitivity (allergy) or anaphylaxis to a previous dose

SPECIAL COMMENTS:
- DTaP may be preferred to DTwP in children with a history of severe adverse effects after previous dose/s of DTwP or children with neurologic disorders.
- DTwP/DTaP vaccines must not be used in children 7 years or older because of increased reactogenicity (Use Tdap/Td instead).
- In principle, the same type of wP/aP-containing vaccines should be given throughout the primary course of vaccination. However, if the previous type of vaccine is unknown or unavailable, any wP/aP vaccine may be used for subsequent doses.

Haemophilus influenzae Type B Conjugate Vaccine[5,8,13]

NAME: *Haemophilus influenzae* type B (Hib) conjugate vaccine	**DOSE AND ROUTE OF ADMINISTRATION:** 0.5 mL IM on anterolateral thigh or deltoid
INDICATIONS: Provides protection against Hib disease in infants that is caused by *Haemophilus influenzae* type B	**SCHEDULE:** Primary series (along with DPT) • 6, 10, 14 weeks Booster • 15–18 months
TYPE OF VACCINE: Lyophilized killed, conjugate vaccine (capsular polysaccharide bound to a carrier protein)	**CATCH-UP IMMUNIZATION:** • Recommended until 5 years of age • In children aged 6–12 months, two primary doses at an interval of 4 weeks and one booster dose at 15–18 months. • In children aged12–15 months, one primary dose and one booster dose 18 months be administered. • In children aged more than 15 months, a single dose is advised.
AVAILABILITY/DILUENT: A pentavalent/bivalent combination or separate hexavalent injection (with a diluent).	**ADVERSE EFFECTS:** Injection-site pain, redness, swelling, and fever
STORAGE: • Between +2°C and +8°C • Do not freeze	**SPECIAL COMMENTS:** • Hib conjugate vaccine reduces nasopharyngeal carriage and thus provides herd immunity.
CONTRAINDICATIONS: Known hypersensitivity (allergy) or anaphylaxis to a previous dose	

Pneumococcal Vaccine[5,8,14]

NAME: Pneumococcal vaccine	**DOSE AND ROUTE OF ADMINISTRATION:** 0.5 mL IM in the anterolateral aspect of the thigh or deltoid.
INDICATIONS: Provides protection against pneumococcal diseases caused by a bacterium called *Streptococcus pneumoniae*	**SCHEDULE:** • PCV 10/13: 3 doses at 6, 10, and 14 weeks • Booster at 15–18 months • PPSV: Above 2 years of age and is reserved for high-risk cases only.
TYPE OF VACCINE: a) Killed inactivated, conjugate (pneumococcal polysaccharide bound to a carrier protein; does not contain any live bacteria) b) Killed inactivated polysaccharide unconjugated vaccines (PPSV)	**CATCH-UP IMMUNIZATION:** • For children who are not completely immunized with vaccines required for their age, administer one dose of PCV13 or PCV10 to all healthy children aged 24 through 59 months. • For PCV 13, the vaccination schedule is as follows: 6–12 months: two doses in an interval of 4 weeks and one booster dose; 12–23 months: two doses in an interval of 8 weeks; ≥24 months: single dose. • For PCV10, the vaccination schedule is as follows: 6–12 months: two doses in an interval of 4 weeks and one booster dose; 12 months to 5 years: two doses in an interval of 8 weeks. • Above 50 years, PCV13 is administered as single dose.
AVAILABILITY/DILUENT: • Pneumococcal polysaccharide vaccine (PPSV) • Pneumococcal conjugate vaccine (PCV): PCV10 and PCV13 • Available as ready-to-use liquid formulations	**ADVERSE EFFECTS:** Soreness at the injection site and fever
STORAGE: • Between +2°C and +8°C • Do not freeze	**SPECIAL COMMENTS:** • Interchangeability between PCV10 and PCV13 has not yet been documented. However, if it is not possible to complete the series with the same type of vaccine, the other PCV product can be used. • Based on the available evidence, both PCV10 and PCV13 offer almost comparable safety and efficacy, particularly for mass use. Nevertheless, the choice of formulation will depend on the prevalence of vaccine serotypes in the country, as well as vaccine supply and pricing. • Conjugate vaccines eradicates nasopharyngeal carriage. Thus gives herd immunity also.
CONTRAINDICATIONS: Known hypersensitivity (allergy) or anaphylaxis to a previous dose	

Pneumococcal Polysaccharide Vaccine (PPSV)[5,15]

The minimum age to administer PPSV is 2 years.

- This vaccine is not recommended for routine use in healthy individuals. It is recommended only for the vaccination of individuals with certain high-risk conditions.
- PPSV vaccines should be administered at least 8 weeks after the last dose of PCV in children aged 2 years or older with certain underlying medical conditions, such as anatomic or functional asplenia (including sickle cell disease), HIV infection, cochlear implant, or cerebrospinal fluid leak.
- An additional dose of PPSV should be administered after 5 years in children with anatomic/ functional asplenia or those suffering from an immunocompromising condition.
- PPSV should never be used alone for prevention of pneumococcal diseases in high-risk individuals.
- Children aged 24 through 71 months with the following medical conditions for which PPV23 and PCV13 are indicated:
  - Immunocompetent children with chronic heart diseases (particularly cyanotic congenital heart disease and cardiac failure); chronic lung diseases (including asthma, if treated with high-dose oral corticosteroid therapy); diabetes mellitus; cerebrospinal fluid leaks; or cochlear implant
  - Children with anatomic or functional asplenia (including sickle cell disease and other hemoglobinopathies; congenital or acquired asplenia; or splenic dysfunction)
  - Children with immunocompromising conditions, such as HIV infection, chronic renal failure, and nephrotic syndrome; diseases associated with treatment with immunosuppressive drugs or radiation therapy, including malignant neoplasms, leukemias, lymphomas, and Hodgkin disease; solid-organ transplantation; and congenital immunodeficiency

Adults at Risk for Pneumococcal Disease

- Adults aged 65 years and above are at an increased risk for pneumococcal disease.
- Some adults aged 19 through 64 years are also at an increased risk for pneumococcal disease, including those:
  - With chronic illnesses (chronic heart, liver, kidney, or lung [including chronic obstructive lung disease, emphysema, and asthma] disease; diabetes; or alcoholism)
  - With conditions that weaken the immune system (HIV/AIDS, cancer, or damaged/absent spleen)
  - With cochlear implants or CSF leak (escape of the fluid that surrounds the brain and spinal cord)
  - Who smoke cigarettes

Dosage and Route of Administration (in at Risk Cases)

- 0.5 ml PCV13 injection administered IM, followed by 0.5 mL PPSV after 8 weeks.
- PPSV may be repeated once after 5 years if required.

Rotavirus Vaccine[5,8]

NAME: Rotavirus vaccine	**DOSE AND ROUTE OF ADMINISTRATION:**
	All available rotavirus vaccines are to be given ORALLY (between 0.5 mL–2 mL depending on the brand)
INDICATIONS: Provides protection against strains of rotavirus that cause a highly infectious diarrheal disease called rotavirus gastroenteritis (RVGE).	**SCHEDULE:** • Only two doses of RV-1 are recommended at 6 and 10 weeks. • All other rotavirus vaccines are administered at 3 doses at 6, 10, and 14 weeks.
TYPE OF VACCINE: Live, attenuated vaccine	**CATCH-UP IMMUNIZATION:** • The maximum age for the first dose in the series is 16 weeks. • Vaccination should not be initiated for infants aged 15 weeks or older. • The maximum age for the final dose in the series is 8 months (6 months for RV1).
AVAILABILITY/DILUENT: • The following rotavirus vaccines are available in India • RV1: Live, attenuated human rotavirus vaccine (G1, P8) • RV5: Live, attenuated human-bovine reassortant pentavalent vaccine (G1, G2, G3, G4, P8) • Live attenuated, naturally-reassorted human-bovine single-strain (G9P11 (11GE) • Human-bovine reassortant pentavalent vaccine 5 reassortant strains (G1, G2, G3, G4, G9) • Available as lyophilized powder and in liquid forms	**ADVERSE EFFECTS:** • Mild adverse events include irritability, runny nose, ear infection, vomiting, and diarrhea. • There is a low risk of intussusception.
STORAGE: • Between +2°C and +8°C • A certain brand can be kept at 25°C	**SPECIAL COMMENTS:** • Rotavirus vaccines do not provide protection against other causes of diarrhea. Therefore, people should be educated about the vaccine.[18] • As most rotavirus infections are caused during the early years, early completion of vaccination is recommended. • Can be given along with OPV or at any gap after OPV. • Complete series with same brand of vaccine, if previously given vaccine is not known, complete the whole series with another brand available.
CONTRAINDICATIONS: • Severe allergic reaction to previous dose • Severe immunodeficiency (but not HIV infection)	
PRECAUTIONS: Risk of intussusception and severe adverse reactions Should not be injected	

Measles, Mumps, and Rubella Vaccine[5,8,16]

NAME: Measles, mumps, and rubella vaccine	**DOSE AND ROUTE OF ADMINISTRATION:** 0.5 mL subcutaneously in the anterolateral thigh or upper arm
INDICATIONS: Provides protection against measles, mumps, and rubella	**SCHEDULE:** • The minimum age at which the vaccine can be administered is 9 months or 270 days (completed). • 3 doses first dose of MMR vaccine is administered at 9 months, 15 months, and 4–6 years.
TYPE OF VACCINE: • Live, attenuated vaccine	**CATCH-UP IMMUNIZATION:** • All school-aged children and adolescents should have received at least two doses of the MMR vaccine (three doses if the first dose is received before 12 months). • The minimum interval between the two doses is 4 weeks. • One dose should be given if previously vaccinated with one dose (two doses if the first dose is received before 12 months). • Second dose must follow in the 2nd year of life, but may be given after 4–8 weeks from 1st dose.
AVAILABILITY/DILUENT: The measles vaccine is available as: • Measles only (M) • Combination of a) Measles and rubella (MR) b) Measles, mumps and rubella (MMR) c) Measles, mumps, rubella and varicella (MMRV) Available as a freeze-dried powder with diluents in separate vials.	**ADVERSE EFFECTS:** • Mild adverse events, such as lymphadenopathy, urticaria, rash, malaise, sore throat, fever, headache, arthralgia, and arthritis. • Severe adverse events include thrombocytopenia, anaphylaxis, and encephalitis. • Febrile seizures in 2nd week after vaccination.
STORAGE: • Between +2°C and +8°C • Do not freeze.	**SPECIAL COMMENTS:** • If an individual is unsure about the administration of the MMR vaccine, it is recommended to revaccinate with 1 or 2 doses of MMR, depending on the age of the vaccinee. • No need to administer stand-alone measles vaccine. • Stand-alone measles/any measles containing vaccine or MMR can be administered in infants aged 6 through 8 months during outbreaks. However, this dose should not be considered as a primary dose.
CONTRAINDICATIONS: • Known allergy to vaccine components (including neomycin and gelatin) • Pregnancy • Severe congenital or acquired immune disorders, including advanced HIV infection/AIDS	
PRECAUTIONS: Acute illness, recent receipt of antibody product/blood transfusion, active untreated TB.	

Varicella Vaccine[2,5,8,10,18]

NAME: Varicella vaccine	**DOSE AND ROUTE OF ADMINISTRATION:** 0.5 mL administered subcutaneously in the anterolateral thigh or upper arm
INDICATIONS: Provides protection against Varicella-Zoster virus, which causes two diseases, namely varicella (chickenpox) and herpes zoster (shingles)	**SCHEDULE:** • 1st dose: 15–18 months. • 2nd dose: 4–6 years (can be administered 3 months after 1st dose).
TYPE OF VACCINE: Live, attenuated vaccine (Oka strain)	**CATCH-UP IMMUNIZATION:** • It is recommended that all individuals aged 7 through 18 years without 'evidence of immunity' receive two doses of the vaccine. • The recommended minimum interval between doses for children aged 12 months through 12 years is 3 months. However, if the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid. • For individuals aged 13 years and more, the minimum interval between the doses is 4 weeks.
AVAILABILITY/ DILUENT: It is a monovalent vaccine available as a lyophilized powder, and is supplied along with diluent for reconstitution before use. Also available in combination with MMR vaccine.	**ADVERSE EFFECTS:** • Mild adverse events include pain and redness at the injection site; swelling; erythema; rash; pruritus; hematoma; induration at the injection site; and stiffness of the injection limb. • Systemic adverse events include fever, febrile seizures, and vesicular rash distributing away from the injection site.
STORAGE: Between +2°C and +8°C Do not freeze.	**SPECIAL COMMENTS:** • Vaccine can be given as post exposure prophylaxis within 72 hours of contact (maximum 5 days). • MMR and varicella combination is licensed for use till 12 years of age. Above that, use MMR and varicella separately. • Breakthrough varicella can occur in 10%–15% of patients.
CONTRAINDICATIONS: Known hypersensitivity (allergy) or anaphylaxis to a previous dose Severe congenital or acquired immune disorders, including advanced HIV infection/AIDS	

Hepatitis A Vaccine[1,2,6,8,10]

NAME: Hepatitis A vaccine	**DOSE AND ROUTE OF ADMINISTRATION:** Inactivated Hep A vaccine is administered intramuscularly at a dose of 0.5 mL. Live Hep B vaccine is administered subcutaneously at a dose of 0.5 mL.
INDICATIONS: Provides protection against hepatitis A infection	**SCHEDULE:** • The minimum age required to administer Hep A vaccine is 12 months. • Inactivated: 2 doses 0, 6–12 months (second dose) • Live: Single dose only
TYPE OF VACCINE: a) Inactivated Hep A vaccine b) Live, attenuated H2-strain Hep A vaccine	**CATCH-UP IMMUNIZATION:** • Either of the two vaccines can be used in 'catch-up' schedule beyond 2 years of age. • For catch-up vaccination, pre-vaccination screening for hepatitis A antibody is recommended in children aged above 10 years, as at this age, the estimated seropositive rates exceed 50%.
AVAILABILITY/DILUENT: Available as a monovalent vaccine in a pre-filled syringe or with diluent in vial separately	**ADVERSE EFFECTS:** Mild adverse events include soreness at the site, induration at the injection site, injection-site erythema, and pain after injection.
STORAGE: • Between +2°C and +8°C • Do not freeze.	**SPECIAL COMMENTS:** • Both live and killed vaccines may be used for post-exposure prophylaxis within 2 weeks of exposure.
CONTRAINDICATIONS: • Administration of HAV vaccine should be delayed in individuals affected by acute febrile illness. • HAV vaccine should not be administered to people with a history of an anaphylactic reaction to a prior dose of HAV vaccine or to a vaccine component. • Pregnancy	

Typhoid Vaccine[2,8,19–21]

NAME: Typhoid vaccine	**DOSE AND ROUTE OF ADMINISTRATION:** 0.5 mL IM at anterolateral thigh or deltoid
INDICATIONS: Provides protection against typhoid, a severe disease caused by *Salmonella typhi*	**SCHEDULE:** • Conjugate vaccine: 9 months–12 months followed by booster at 2 years of age. • If given above 2 years, administer a single dose. • Unconjugated vaccine above 2 years, repeat every 2–3 years.
TYPE OF VACCINE: Vi polysaccharide conjugated vaccine and unconjugated vaccine	**CATCH-UP IMMUNIZATION:** Typhoid vaccine is recommended throughout adolescence, up to 18 years of age.
AVAILABILITY/DILUENT: The following typhoid vaccines are available in India: a) Vi-capsular polysaccharide vaccine b) Vi-polysaccharide conjugate vaccine conjugated with tetanus toxoid (TCV)	**ADVERSE EFFECTS:** Pain at the injection site; erythema or induration; fever; rash; urticaria; abdominal pain; nausea; headache; axillary temperature; fatigue; dizziness; and pruritus
STORAGE: • Between +2°C and +8°C • Do not freeze.	**SPECIAL COMMENTS:** • There is no evidence of hyporesponsiveness on repeated revaccination of Vi-polysaccharide vaccine so far. However, typhoid conjugate vaccine should be preferred over unconjugated typhoid polysaccharide vaccine. • An interval of at least 4 weeks with the MMR vaccine should be maintained while administering conjugate typhoid vaccine.
CONTRAINDICATIONS: • Anaphylaxis to previous dose. • Pregnant and lactating women.	
PRECAUTIONS: Delay vaccination in case of fever, severe infection, persistent diarrhea and vomiting.	

Influenza Vaccine[5,8,22]

NAME: Influenza vaccine	**DOSE AND ROUTE OF ADMINISTRATION:**
	IIV a) 6 months to <3 years • 0.25 mL administered IM in the anterolateral thigh b) After 3 years • 0.5 mL administered IM in the anterolateral thigh/ deltoid
	LAIV: Nasal spray into each nostril.
INDICATIONS: Provides protection against influenza virus A and B, which are responsible for causing a respiratory disease called seasonal influenza, including swine flu	**SCHEDULE:** IIV: • Annual vaccine (to be taken every year) • 6 months–9 years: 2 doses 4 weeks apart in the 1st year. • Thereafter, annual booster. • >9 years: 1 dose every year LAIV: • <2 years: Not recommended • 2–9 years: 1–2 doses in each nostril • >9 years: 1 dose each nostril
TYPE OF VACCINE: Live, attenuated (LAIV) Inactivated vaccine (IIV)	**CATCH-UP IMMUNIZATION:** Any age group >6 months age prior to the flu season; with the most recent vaccine available.
AVAILABILITY/DILUENT: Prefilled syringes of: a) trivalent Inactivated vaccine - whole cell newer type split virion, b) quadrivalent inactivated or c) live attenuated nasal spray (lyophilized)	**ADVERSE EFFECTS FOLLOWING IMMUNIZATION:** • Mild adverse events: Local injection-site reactions and fever • Severe adverse events: Anaphylaxis, Guillain-Barré syndrome, and oculo-respiratory syndrome
STORAGE: • Between +2°C and +8°C • Do not freeze.[13]	**SPECIAL COMMENTS:** • Nasal spray influenza vaccine is not preferred over the parenteral vaccine. • Recommended for patients with chronic cardiorespiratory disease, pregnancy, individuals on long-term salicylates and healthcare workers
CONTRAINDICATIONS: a) Known hypersensitivity or anaphylaxis to a previous dose or to a vaccine component such as egg protein. b) LAIV is contraindicated in severe immunocompromied and pregnancy.	
PRECAUTIONS: High risk of GBS within a week of previous dose	

Human Papilloma Virus Vaccine[5,8]

NAME: Human papilloma virus vaccine

DOSE AND ROUTE OF ADMINISTRATION:

A dose of 0.5 mL administered IM in the deltoid muscle of the upper arm.

INDICATIONS:

Provides protection against human papilloma virus (HPV), which is the most common sexually transmitted disease that causes genital warts and 70%–75% of cervical cancer.

SCHEDULE:

- 9–14 years: 2 dose schedule (0, 6 months)
- >15 years–45 years: 3 dose schedule (0, 1–2 months, 6 months)
- Not licensed for use in males in India.
- For adolescent/preadolescent girls aged 9–14 years, only two doses of either of the two HPV vaccines (HPV4 and HPV2) are recommended.
- For girls aged 15 years and older, and for immunocompromised individuals, three doses are recommended.
- For the two-dose schedule, the minimum interval between doses should be 6 months.
- Either HPV4 (0, 2, and 6 months) or HPV2 (0, 1, and 6 months)

TYPE OF VACCINE:

Recombinant protein capsid liquid vaccine

CATCH-UP IMMUNIZATION:

Administered till 45 years of age

AVAILABILITY/DILUENT:

- A bivalent vaccine (HPV2) that protects against HPV types 16 and 18
- A quadrivalent vaccine (HPV4) that protects against four types of HPV (6 and 11, which cause genital warts, and 16 and 18)
- Available as single-use vials or prefilled syringes

ADVERSE EFFECTS:

- Mild adverse events: Local injection-site reactions (pain, redness, and swelling), fever, dizziness, and nausea
- Severe adverse events: Rare anaphylaxis
- Vasovagal attacks.

STORAGE:

- Between +2°C and +8°C
- Do not freeze

SPECIAL COMMENTS:

- A few adolescents may faint after receiving the vaccine; therefore, it is advised for them to be seated during vaccination and for at least 15 minutes thereafter.
- HPV testing is not necessary before vaccination.
- Counsel about avoiding pregnancy for 4 weeks after vaccination.

CONTRAINDICATIONS:

Anaphylaxis or hypersensitivity after previous dose

Pregnancy

Meningococcal Vaccine[5,8]

NAME: Meningococcal vaccine

DOSE AND ROUTE OF ADMINISTRATION:

0.5 mL administered as SC on the upper arm or thigh

0.5 mL administered as IM on the upper arm or thigh

INDICATIONS:

Provides protection against meningococcal disease e.g., meningococcal meningitis, which is caused by bacterium *Neisseria meningitidis*, which infects the meninges.

SCHEDULE:

Conjugate quadrivalent

- 9 months: 1st dose
- 2nd dose at 2 years
- If given at >2 years, single dose is given

Unconjugated polysaccharide

- >2 years of age to high risk groups

Note

1. Conjugated quadrivalent vaccine conjugated to CRM (see "Availability") is approved to be used in children above 2 years of age.
2. Both conjugated quadrivalent vaccines can be used in adults up to 55 years of age.

TYPE OF VACCINE:

a) Purified bacterial capsular polysaccharide

b) Conjugate vaccine

CATCH-UP IMMUNIZATION:

To all age groups at risk (single dose)

AVAILABILITY/DILUENT:

- Meningococcal polysaccharide vaccine (MPSV): A, C, Y, W135
- Meningococcal conjugate vaccine (MCV): Men ACWY conjugated with diphtheria toxoid
- Meningococcal conjugate vaccines (MCV): Men ACWY conjugated with CRM

ADVERSE EFFECTS FOLLOWING IMMUNIZATION:

- Mild adverse events: Local injection-site reactions, and fever
- Severe adverse events: Anaphylaxis and infrequent neurologic reactions, such as seizures

STORAGE:

- Between +2°C and +8°C
- Do not freeze.

CONTRAINDICATIONS:

Anaphylaxis or hypersensitivity after a previous dose

SPECIAL COMMENTS:

- Meningococcal vaccine is recommended for certain populations: high-risk groups of children; during outbreaks; in international travelers, including students going for study abroad and travelers to Hajj and sub-Sahara Africa.
- Conjugate vaccine give herd immunity, as it prevents nasopharyngeal carriage.
- Conjugate vaccines are expected to provide immunity for a longer period than that with polysaccharide vaccine.

PRECAUTIONS:

Severe acute illness

People with previous history of GBS may be at an increased risk

Japanese Encephalitis Vaccine[5,8]

NAME: Japanese Encephalitis vaccine

DOSE AND ROUTE OF ADMINISTRATION:

- Live vaccine: 0.5 mL SC

- Inactivated vaccine: 0.25 mL IM (1–3 years) anterolateral thigh or deltoid
- 0.5 mL IM (>3 years)
- JENVAC 0.5 mL IM (>1 year)

INDICATIONS:

Provides protection against Japanese encephalitis (JE), which is a viral infection that infects the brain of human beings

SCHEDULE:

Live (Govt)

- 1st dose: 9 months
- 2nd dose: 15–18 months

Inactivated

- 2 doses 4 weeks apart
- No boosters needed

TYPE OF VACCINE:

- Inactivated Vero cell-derived vaccine
- Inactivated mouse brain-derived vaccine
- Live, attenuated vaccine available as single and multidose vials
- Live recombinant vaccine

CATCH-UP IMMUNIZATION:

- Upto 18 years: as per schedule
- >18 years: single dose administered IM

AVAILABILITY/DILUENT:

Three types of new-generation JE vaccines are licensed in India:

a) Live attenuated, cell culture-derived SA-14-14-2

b) Inactivated JE vaccines, namely Vero cell culture-derived SA 14-14-2 JE vaccine

c) Vero cell culture-derived, 821564XY, JE vaccine (inactivated)

ADVERSE EFFECTS:

Fever, pain, redness at injection site, headache, and dizziness

STORAGE:

- Between +2°C and +8°C
- Do not freeze.

CONTRAINDICATIONS:

- Hypersensitivity to gelatin, gentamycin, kanamycin
- Pregnancy
- Any condition that results in a decreased or abnormal immune response, including due to an infection, medication, and/or congenital problems

SPECIAL COMMENTS:

- Postpone vaccination for at least 3 months if the person has been given immunoglobulin.
- There should be at least a 1-month interval (either before or after) between JE and other live vaccines.
- Women of childbearing age should avoid pregnancy for at least 3 months after immunization.
- Live, attenuated JE vaccine is not meant to be given during JE epidemic seasons.

Cholera Vaccine[8,23,24]

NAME:	DOSE AND ROUTE OF ADMINISTRATION:
Cholera vaccine	Ready to use liquid administered orally.
INDICATIONS: Provides protection against cholera, which is caused by *Vibrio cholerae*	**SCHEDULE:** • Not recommended for routine use. • It is administered as two doses given over an interval of 2 weeks in individuals aged >1 year. • Booster dose is administered after 2 years.
TYPE OF VACCINE: Inactivated whole-cell killed vaccine (bivalent)	**CATCH-UP IMMUNIZATION:** After 1 year of age— adulthood
AVAILABILITY/DILUENT: • A bivalent inactivated whole cell vaccine containing 2 serotypes (01 and 0139).	**ADVERSE EFFECTS:** Abdominal pain, tiredness or fatigue, headache, lack of appetite, nausea or diarrhea
STORAGE: The vaccine has a shelf-life of 3 years when stored at 2–8°C and remains stable for 1 month at 37°C.	**SPECIAL COMMENTS:** Used in • High risk, highly endemic areas • Pilgrimages, fairs, kumbh melas • Travellers to endemic areas Not useful during an epidemic To be taken 1 week prior to exposure
CONTRAINDICATIONS: • Anaphylaxis to previous dose individuals	
PRECAUTIONS: Intake of food and water should be avoided 1 hour before and after vaccine	

Rabies Vaccine[5,8,25]

NAME: Rabies vaccine

DOSE AND ROUTE OF ADMINISTRATION:

- 1 mL IM in antero-lateral thigh or deltoid (never in gluteal region) for Human Diploid Cell Vaccine (HDCV), Purified Chick Embryo Cell (PCEC) vaccine and Purified Duck Embryo Vaccine (PDEV).
- 0.5 mL for Purified Vero Cell Vaccine (PVRV).

INDICATIONS:

Provides protection against rabies, which is caused by Rabies virus (Lyssa virus family).

PEP is recommended following significant contact with dogs, cats, cows, buffaloes, sheep, goats, pigs, donkeys, horses, camels, foxes, jackals, monkeys, mongoose, squirrel, bears, and others. Domestic rodent (rat) bites do not require post-exposure prophylaxis in India.

SCHEDULE:

Post-exposure Prophylaxis:

- 4 doses
- Days 0, 3, 7, between 14 and 28
- For all category II and III bites
- Schedule: Days 0, 3, 14, and 30 with day 0 being the day of commencement of vaccination. A sixth dose on day 90 is optional and may be offered to patients with severe debility or those who are immunosuppressed

Pre-exposure Prophylaxis:

- Two doses on days 0 and 7
- For re-exposure at any point of time after completed (and documented) preor post-exposure prophylaxis, two doses are given on days 0 and 3
- RIG is not required during re-exposure therapy
- Boosters not required

TYPE OF VACCINE:

Concentrated, purified cell culture and embryonated egg-based vaccine

AVAILABILITY/DILUENT:

Available as:

- Human diploid cell vaccine (HDCV)
- Purified chick embryo cell vaccine (PCEC)
- Purified duck embryo vaccine (PDEV)
- Purified verocell rabies vaccine (PVRV)

Available as single-dose vials without addition of any preservative

ADVERSE EFFECTS FOLLOWING IMMUNIZATION:

- Mild adverse events: Local injection-site reactions, and fever
- Severe adverse events: Anaphylaxis and infrequent neurologic reactions, such as seizures

STORAGE:

- Between +2°C and +8°C
- Do not freeze

CONTRAINDICATIONS:

Hypersensitivity to components or excipients in the vaccine

SPECIAL COMMENTS:

- Do not interchange brands
- Try to use same brand of vaccine for whole series
- Practically all children need vaccination against rabies
- The high-risk categories of children in whom rabies vaccination should be offered as Pre-EP include:
  - Children having pets in home
  - Children perceived higher risk of being exposed to dogs, such as hostellers, and risk of stray dogs while outdoors
- Rabies immunoglobin (RIG) (dose: 20 IU Kg) along with rabies vaccines is recommended for all category III bites
- Equine rabies immunoglobin (ERIG; dose 40 U/kg) can be used if human rabies immunoglobin is not available
- Rabies monoclonal antibody (3.33 IU/Kg) is now recommended instead of RIG.

PRECAUTIONS:

Allergic reactions to previous dose

Yellow Fever Vaccine[5]

NAME: Yellow fever vaccine	**DOSE AND ROUTE OF ADMINISTRATION:** 0.5 mL SC in the upper arm (deltoid)
INDICATIONS: Provides protection against yellow fever, a viral disease in humans and other primates that is spread by *Haemahogus* and *Aedes* mosquitoes	**SCHEDULE:** • 9 months onwards (single dose) • Booster: every 10 years • Given at least 10 days before travel to endemic countries
TYPE OF VACCINE: Live, attenuated virus[13]	**ADVERSE EFFECTS FOLLOWING IMMUNIZATION:** • Mild adverse events: Injection-site pain, headache, muscle ache, low-grade fever, itching, hives, and other rashes • Vaccine associated encephalitis if given <6 months
AVAILABILITY/DILUENT: Available as freeze-dried form and requires reconstitution with the diluent provided along with it before administration Use within 1 hour of reconstitution	
STORAGE: • Between +2°C and +8°C • Do not freeze.	**SPECIAL COMMENTS:** • Vaccination is not recommended in children under 6 months and in elderly aged >65 years due to risk of encephalitis • Carry out a risk–benefit assessment before administering to pregnant women
CONTRAINDICATIONS: • Age <6 months; age 6–8 months, except during epidemics • Egg allergy • Pregnancy and lactation • Anaphylaxis to previous dose • Immunocompromised individuals	

Bacterial Lysates[26]

A bacterial lysate is both a specific and non-specific immunostimulating agent indicated for the prevention and treatment of acute and chronic respiratory infections.

Bacterial lysates are constituted by a mixture of bacterial antigens derived from different bacterial species, according to the considered extract. The most often included species are: *Staphylococcus aureus, Streptococcus viridans, Streptococcus pneumoniae* (6 strains), *Streptococcus pyogenes, Klebsiella pneumoniae, Klebsiella ozenae, Moraxella catarrhalis,* and *Haemophylous influenzae.*

Bacterial lysates are formulated in tablets that are to be dissolved under the tongue. One tablet contains 50 mg of freeze-dried bacterial lysate, of which 7 mg contains the active ingredients listed in Table 10.

Table 10: Active ingredients contained in bacterial lysates[26]

Active ingredient	Amount
Staphylococcus aureus	6 billion bacteria
Streptococcus pyogenes	6 billion bacteria
Streptococcus viridans	6 billion bacteria
Streptococcus pneumoniae serotype B	6 billion bacteria
Klebsiella pneumoniae	6 billion bacteria
Klebsiella ozaenae	6 billion bacteria
Haemophilus influenzae	6 billion bacteria
Moraxella catarrhalis	6 billion bacteria

Indications

- For the treatment of recurrent upper and lower respiratory tract infections
- For the prevention of chronic respiratory infections in adults as well as children
- As an adjuvant with antibiotics for the treatment of acute respiratory tract infection
- Elderly patients with frequent URTI

Dosage and Administration

Bacterial lysates should be administered sublingually. They have been shown to be effective both in the treatment and prophylaxis of respiratory infections.

- Both adult and elderly patients have been successfully treated with one tablet daily.
- Treatment of acute cases requires single courses of 10 days.
- Long-term treatment requires administration for 10 consecutive days per month for 3 months.
- The dose is to be repeated once a year or maybe more often, depending on the patient's needs and based on previous response to therapy.

Vaccination in Special Groups

Vaccines for Adolescents and Adults

Recommended vaccination schedule for adolescents and adults is listed in Table 11.

Table 11: Vaccines for adolescents and adults

Vaccine	Dose/s	Schedule
Hepatitis B	3	0-1-6 months
Hepatitis A	2 (killed) 1 (live attenuated)	0–6 months
Tdap/Td	1	10–18 years of age followed by booster of Td every 10 years
Varicella (Chickenpox)	2	2 doses at 4–6 weeks interval
HPV (girls)	2 (9–14 years) 3 (>14 years)	2 doses: 0 and 6 months 3 doses: 0, 1 (HPV 2) or 2 (HPV4) and 6 months.
Influenza	1	1 dose every year
Pneumococcal (PPSV)	2	2 doses 5 years apart in high risk patients
PCV 13	1	>50 years 1 single dose
Typhoid	1 (conjugated)	• Till 18 years age. • Repeat 3 yearly if unconjugated vaccine.
MMR	2	• 2 doses at 4–8 weeks interval. • If previously immunized, give only 1 dose
Japanese Encephalitis	1	Till 18 years of age (in endemic areas)
Meningococcal (ACWY)	1 or 2	• 1 dose (non high risk group) • 2 doses 4 weeks apart in high risk groups
Rabies	3 or 4	• Pre-exposure: 3 doses (0, 7, 28 days) • Post-exposure: 4 doses (0, 3, 7, 14/28 days)

Vaccination for Women (Maternal Immunization)[13]

Immunization of a pregnant women enables a number of important health benefits for mother and the baby. Vaccines containing live, attenuated organisms pose a theoretical risk to the fetus. Therefore, live vaccines are contraindicated during pregnancy. It is advised for women to avoid conception for 4 weeks after vaccination with live vaccines. However, there are more benefits to vaccinating pregnant women than potential risks in the following circumstances: when the likelihood of disease exposure is high, when infection would pose a risk to the mother or fetus, and when the vaccine is unlikely to cause harm (Table 12).

Table 12: Maternal immunization schedule

Vaccine	Dose/s	Schedule	Remarks
Preconception			
Hepatitis B	3	0-1-6 months	Avoid conception for at least 4 weeks after MMR or varicella vaccine
Varicella (Chickenpox)	2	2 doses at 4–8 weeks	
MMR	2	2 doses at 4–8 weeks	
HPV (for girls)	3	0–1 month (HPV2) or 2 months–6 months (HPV4)	
Influenza	1	1 dose every year	
During pregnancy			
TT/Td	2	1 dose early in pregnancy and 2nd dose 4 weeks after 1st dose	Avoid conception for at least 4 weeks after MMR or varicella vaccine
Tdap	1	3rd trimester	
Influenza	1	1 at any stage of gestation	
During lactation			
All vaccines except typhoid and yellow fever can be given as catch-up immunization.			

Recommendations for Vaccination in Pregnant Women

- Tdap is recommended in pregnant women for the prevention of infant pertussis irrespective of whether they have previously received Tdap.
- If pregnant women are not vaccinated with Tdap during pregnancy, then it should be immediately administered postpartum.
- Pregnant women who are not vaccinated or are only partially vaccinated against tetanus should complete the primary series, with at least one of the doses being Tdap.
- Women for whom Td is indicated but who did not complete the recommended three-dose series during pregnancy should receive follow-up after delivery to ensure that the series is completed.
- There is a high risk for severe illness and complications from influenza in pregnant and postpartum women, compared to women who are not pregnant. Thus, routine vaccination with the inactivated influenza vaccine is recommended for all women who are or will be pregnant (in any trimester) during the influenza season.

- Pregnant women who are at a risk for exposure to wild-type poliovirus can be given IPV. The high-risk group includes:
  - Travelers to areas or countries where polio is epidemic or endemic
  - Members of communities or specific population groups with disease caused by wild polioviruses
  - Laboratory workers who handle specimens that might contain polioviruses
  - Healthcare personnel who have close contact with patients who might be excreting wild polioviruses
  - Children, whose parents are unvaccinated against polio, will receive oral poliovirus vaccine
- It is advised to administer vaccines, such as Hep A, pneumococcal polysaccharide, meningococcal conjugate, and meningococcal polysaccharide, to women who are at a higher risk for these infections.
- Pregnant women who have to travel to yellow fever-prevalent areas should receive the yellow fever vaccine, as the limited theoretical risk after receiving vaccination is outweighed by the risk for yellow fever infection. However, appropriate counselling of the same must be done.
- Hepatitis B vaccine can be administered to pregnant women for whom it is indicated.
- It is contraindicated to administer MMR and varicella vaccine-containing during pregnancy. However, if a pregnant woman is vaccinated unknowingly with MMR or varicella, counseling about the theoretical basis of concern for the fetus should be provided. However, MMR or varicella vaccination should not be a reason for terminating the pregnancy.
- There should be no change in the schedule of rotavirus vaccination for infants living in households with pregnant women.
- Evidence of immunity to rubella and varicella and presence of HBsAg should be evaluated during every pregnancy.
- Women should be vaccinated immediately after delivery if there is no evidence of immunity to rubella and varicella. A second dose of varicella should be administered 4–8 weeks later.
- If a pregnant woman is tested to be HBsAg-positive, she should be carefully monitored and the infant should receive HBIG and hepatitis vaccines within 12 hours of birth.

Immunocompromised Individuals of All Ages[1,13]

Altered immunocompetence, or immunosuppression, or immunodeficiency, or immunocompromise are synonymously used terms that are classified as primary or secondary. Primary immunodeficiency is of genetic origin, whereas secondary immunodeficiency is acquired. Secondary immunodeficiency is defined by the loss or qualitative deficiency in cellular or humoral immune components that occurs as a result of a disease process or its therapy.

Recipients of Hematopoietic Stem Cell Transplant (HSCT)

- Factors such as donor's immunity; type of transplant and the interval since the transplant; the continuous use of immunosuppressive drugs; and graft vs. host disease affect the immunization of the transplant recipient (Table 13).
- Complete re-immunization is recommended starting with routine inactivated vaccines 12 months after bone marrow transplant.
- It is recommended to administer pneumococcal (PCV13 followed by 23PPV), meningococcal (conjugate C and quadrivalent conjugate), and hepatitis B vaccines, besides a booster dose of Hib and IPV.

Table 13: Vaccines for recipients of HSCT

Vaccine	Dose/s	Schedule
TD	3	6–12 months after transplantation
Influenza	1	4–6 months after transplantation
IPV	3	6–12 months after transplantation
Conjugated Hib	3	6–12 months after transplantation
Pneumococcal (PPSV)	1	12 months after transplantation
Pneumococcal (PCV)	3	3–6 months after transplantation
Hep B	3	6 months after transplantation
HPV	3	6 months after transplantation
Meningococcal Conjugate	2	6 months after transplantation
MMR	2	2 doses at 4–8 weeks
Varicella (Chickenpox)	2	2 doses at 4–8 weeks

- Healthy survivors of bone marrow transplantation can be given VV not less than 2 years after transplantation, with MMR given 4 weeks later if VV is tolerated.
- Second doses of MMR and VV should be given after 4 or more weeks after the first doses, unless a serological response to measles and varicella is demonstrated after the first dose.
- It is not advised to vaccinate individuals affected by graft vs. host disease because of a risk of a resulting chronic latent virus infection, leading to central nervous system sequelae.

Recipients of Solid Organ Transplantation[2]

An accelerated immunization schedule is recommended for individuals likely to be listed for solid organ transplantation. Advice from specialist should be considered when administering vaccines to such individuals (Table 14).

Table 14: Vaccines for solid-organ transplant recipients[2,13]

Vaccine	Recommendations for		Comments
	Candidates	Recipients	
Non-live vaccines			
Pneumococcal polysaccharide	Yes	Yes	Children >2 years and adults
Pneumococcal conjugate	Yes	Yes	Children and adults
Conjugated Hib	Complete schedule	As in the normal population	
Influenza	Yes	Yes	Adults and children; annually
Hepatitis A virus	Yes	Yes	Adults and children undergoing liver transplantation
Hepatitis B virus	Yes	Yes	Adults and children
Inactivated poliovirus	Complete schedule	Complete schedule	Boosters can be considered posttransplantation
Tetanus and diphtheria toxoid	Complete schedule (children)	Complete schedule (children)	Boosters can be considered posttransplantation

Acellular pertussis	Yes	Older children and adults	
Papillomavirus	Yes	Yes	As in the general population
Meningococcal	Yes	Yes	As in the general population
Live vaccines			
MMR	Complete schedule	No	
Varicella	Yes	No	
Zoster	Age dependent	No	

Hib: *Haemophilus influenzae* type b; MMR: Measles, mumps, and rubella.

Conditions or Drugs That Might Cause Immunodeficiencies

The ability of individuals with secondary immune deficiency to develop an adequate immunological response depends on the type of immunodeficiency and/or and the intensity of immunosuppressive therapy.

- If possible, vaccination should be completed in individuals with rheumatological disease before initiating immunosuppressive therapy.
- In conditions such as chronic renal failure, where immune impairment is likely to be progressive, early administration of vaccines may result in better antibody responses.
- Live viral vaccines are only recommended in patients who are non-immune, or not severely immunocompromised, and ≥4 weeks of time to initiate immunosuppressive therapy. However, VV can be given within a short interval of time at the discretion of the specialist.
- It is recommended to administer influenza vaccine 3–4 weeks after chemotherapy. For malignant neoplasm it is recommended when both the peripheral granulocyte and lymphocyte counts are >1.0×10^9/L.[2]
- All immunocompromised individuals, regardless of their age, who receive the influenza vaccine for the first time, are recommended to receive two vaccine doses at least 4 weeks apart, and one dose annually after that.

Vaccination for Cancer Patients[2]

Individuals who have received routine immunizations prior to cancer diagnosis do not require full re-immunization. Recommended vaccination schedule for individuals with cancer is listed in Table 15.

Table 15: Vaccines for individuals with cancer[2]

Vaccine	Dose/s	Schedule
Pneumococcal (PPSV)	1	1 dose at least 8 weeks after PCV
Pneumococcal (PCV)	1	1 dose at not less than 3 months after chemotherapy
Conjugated Hib	1	1 dose at not less than 3 months after chemotherapy
Varicella (Chickenpox)	2	2 doses at 4–8 weeks
MMR	2	2 doses at 4–8 weeks
Influenza	1	1 dose every year
Tdap	1	1 dose at not less than 3 months after chemotherapy
Hep B	3	0–1–6 months

The guidelines for administering live vaccines in individuals on high-dose corticosteroids are listed in Table 16.[2]

Table 16: Guidelines for live virus vaccine administration for individuals on high-dose corticosteroids[1]

	Infants and children <10 kg	Children ≥10 kg and adults	Administration of live viral vaccines after cessation of corticosteroids
High dose <14 days	>2 mg/kg daily or on alternate days	>20 mg/day	Can be given immediately on discontinuation, but delay 2 weeks if possible
High dose >14 days	>2 mg/kg daily or on alternate days	>20 mg/day	Delay for 4 weeks

Vaccination in Individuals With Primary and Secondary Immunodeficiencies[2]

Primary Immunodeficiencies

- It is contraindicated to administer live vaccines to all individuals with T-lymphocyte-mediated immunodeficiencies and combined B- and T-lymphocyte disorders.[2]
- On the recommendation of an internal medicine physician or pediatrician, Hib, PCV13, 23PPV, and Td vaccines may be used for testing primary immunodeficiencies.
- All immunodeficient individuals, regardless of their age, who receive influenza vaccine for the first time, are recommended to receive two vaccine doses at least 4 weeks apart, and one dose annually after that.
- Once an immunodeficiency is recognized, PCV13 should replace PCV10 in the routine schedule.[2]

B-Lymphocyte Deficiencies (Humoral)[2]

- Administration of all inactivated vaccines is safe in individuals with B-lymphocyte deficiencies.
  - Influenza vaccine: Recommended
  - BCG: Contraindicated
  - MMR and VV: Not required, as the individual is on IVIg

Selective IgA Deficiency

- All vaccines are effective:
  - Influenza vaccine is recommended.
  - There are no specific contraindications or precautions.[2]

T-lymphocyte Deficiencies (Cell-Mediated and Humoral)

The efficacy of any vaccine depends on the degree of immunodeficiency.

- Pneumococcal (PCV13 and 23PPV), meningococcal, and influenza vaccines are recommended.
- BCG, MMR, and VV are contraindicated.
- Rotavirus vaccine is contraindicated in SCID.[2]

Complement Deficiencies[2]

Deficiency of early components (C1, C4, C2, and C3)

- All vaccines are effective.
  - Influenza, PCV13, 23PPV, and meningococcal vaccines are recommended.
  - There are no specific contraindications or precautions.

Deficiency of late components (C5–9), properdin, factor B

- All routine vaccines are probably effective.
  - Influenza; meningococcal and pneumococcal conjugate; and polysaccharide vaccines are recommended.
  - There are no specific contraindications or precautions.

Phagocytic Function Deficiencies[2]

- All routine vaccines are effective.
  - Influenza vaccine is recommended.
  - BCG is contraindicated.
  - Live viral vaccines are safe in chronic granulomatous diseases;[9] however, for other conditions, specialist consultation is advised.

HIV Infection[2]

- In children who are HIV-positive, either symptomatic or asymptomatic, it is recommended to receive the routine schedule, including MMR, rotavirus, and HPV vaccines (Table 17).
- MMR vaccination at the age of 12 months is recommended in children who are asymptomatic and are not severely immunocompromised.
- For HIV-infected individuals who are exposed to chickenpox or measles, passive immunization with IG may be required.

Table 17: Vaccines for HIV-infected children and adults

Vaccine	HIV-1 infection	Severe immune suppression	Comments
WHO/UNICEF			
BCG	Not recommended	Not recommended	HIV-1 infection can be difficult to identify in early infancy
DTP	Recommended	Recommended	—
DPV/IPV	Recommended	Recommended	IPV may be used if symptomatic
Measles	Recommended	Not recommended	Administered at 6 and 9 months; revaccination after immune reconstitution with antiretroviral therapy

Hepatitis B	Recommended	Recommended	—
Hib	Recommended	Recommended	—
Pneumococcal	Recommended	Recommended	—
Rotavirus	Recommended	Not recommended	—
Tetanus toxoid	Recommended	Recommended	5 doses
Yellow fever	Recommended	Not recommended	Until safety is further evaluated
ACIP			
DTP	Recommended	Not applicable	—
OPV	Contraindicated	Contraindicated	—
IPV	Recommended	Use if indicated	—
MMR	Recommended	Recommended	Not if severe immune suppression (CD4% T cells <15%). Revaccination with two doses after effective antiretroviral therapy
Hib	Recommended	Considered	Consider risk of disease in adults
Hepatitis B	Recommended	Recommended	—
HPV	Considered	Considered	—
Pneumococcal	Recommended	Recommended	—
Meningococcal	Recommended	Use if indicated	Two doses of conjugate vaccine for all 11–18-year-olds
Rotavirus	Considered	Not applicable	—
Varicella	Recommended	Recommended	Not if severe immune suppression (CD4% T cells <15%)
Influenza, inactivated	Recommended	Recommended	Not for infants <6 months old
Influenza, attenuated	Contraindicated	Contraindicated	—
Td	—	Recommended	—
BCG	Contraindicated	Contraindicated	—
Yellow fever	Contraindicated	Contraindicated	Consider if exposure is unavoidable
Rabies	Use if indicated	Use if indicated	—
Vaccinia	Contraindicated	Contraindicated	—
Anthrax	Use if indicated	Use if indicated	—

In addition, additional vaccines are recommended in certain regions based on the vaccinee's age. The need for these vaccines and vaccination of HIV population can be individualized based on the specialist advice. Tables 18, 19, and 20 list the vaccine recommendations in HIV-infected children aged below 5 years; children aged 5 to <18 years; and adults aged 18 years and older.[2]

Table 18: Children aged under 5 years when diagnosed with HIV: Additional vaccine recommendations[2]

Age at diagnosis	Vaccine	Recommended vaccine schedule
Infants aged under 12 months when diagnosed	PCV13	PCV13[a] at ages 6 weeks, 3, 5, and 15 months or age-appropriate catch-up schedule: • If commencing immunization at ages 7–11 months, give 2 doses of PCV13 at least 4 weeks apart, followed by a booster dose at the age of 15 months • For children aged 7–11 months who have completed the primary course with PCV10, give 1 dose of PCV13, followed by the scheduled PCV13 booster at age 15 months.
	PPSV	Following the completion of the PCV course, give 1 dose of PPSV at age ≥2 years. There must be at least 8 weeks between the last PCV dose and the PPSV dose. Revaccinate once with PPSV, 5 years after the first PPSV.
	Influenza	Annual immunization from the age of 6 months. In the first year, give 2 doses 4 weeks apart, then 1 dose in each subsequent year.
	Meningococcal	Use the age-appropriate Meningococcal schedule: • If aged <6 months at diagnosis, give 2 doses 8 weeks apart, with a booster at age 12 months. • If aged 6–11 months at diagnosis, give 1 dose, with a booster at age 12 months. At age of 2 years, give 2 doses of MCV4-D[b] 8 weeks apart, then a booster after 3 years, then 5 yearly.
Children aged 12 months to <5 years when diagnosed	PCV13	The PCV13[a,c] age-appropriate catch-up schedule is: • If commencing immunization at ages 12 months or older, give 2 doses of PCV13,[c] 8 weeks apart • Children aged >17 months who have completed the primary course of PCV10 but not received PCV13, give 1 dose of PCV13.[c,d]
	PPSV	Following the completion of the PCV course, give 1 dose of PPSV at the age of ≥2 years. There must be at least 8 weeks between the last PCV dose and the PPSV dose. Revaccinate once with PPSV, 5 years after the first PPSV.
	Influenza	Annual immunization In previously unvaccinated children, give 2 doses 4 weeks apart, then 1 dose in each subsequent year.

Children aged 12 months to <5 years when diagnosed	MMR[e]	If CD4+ lymphocyte percentage is ≥15%: • Give the first MMR dose at the age of 12 months, followed by the second dose 4 weeks later.
	Varicella[e,f]	If CD4+ lymphocyte percentage is ≥15%: • Give 2 doses (starting 4 weeks after the second MMR), at least 3 months apart.
	Meningococcal	If aged 12–23 months at diagnosis, give 1 dose of Meningococcal, followed by MCV4-D[b] at the age of 2 years, 2 doses 8 weeks apart, then a booster of MCV4-D after 3 years, then 5 yearly. If aged ≥2 years at diagnosis, give 2 doses of MCV4-D[b] 8 weeks apart, then a booster of MCV4-D after 3 years, then 5 yearly.

[a]PCV13 replaces PCV10 (Synflorix) on the Schedule. [b]Give MCV4-D at least 4 weeks after PCV13. [d]If 23PPV has already been given (prior to any doses of PCV13) to children aged <18 years, wait at least 8 weeks before administering PCV13. [d]There are no safety concerns, regardless of the interval between the last dose of PCV10 and the first dose of PCV13. [e]Only a single viral vaccine is recommended at each visit for individuals with HIV infection. A minimum interval of 4 weeks is required between live vaccine doses administered at different visits. [f]Give VV on the advice of an HIV specialist.

Table 19: Children aged 5 to <18 years when diagnosed with HIV: Additional vaccine recommendations[2]

Vaccine	Recommended vaccine schedule
HPV9	From the age of 9 years, give 3 doses of HPV at 0, 2, and 6 months.[a,b]
PCV13	For children who have not previously received PCV13, give 1 dose of PCV13.[c]
PPSV	1 dose of PPSV at least 8 weeks after the PCV13 dose. Revaccinate once with PPSV, 5 years after the first PPSV.
Influenza	Annual immunization. Regardless of age, if previously unvaccinated, give 2 doses[d] 4 weeks apart. Then give 1 dose in each subsequent year.
MMR[e]	If aged ≤13 years and CD4+ lymphocyte percentage is ≥15%, or if aged ≥14 years and CD4+ lymphocyte count is ≥200 cells/mm^3: • Give 2 MMR doses at least 4 weeks apart.
Varicella[e,f]	If no history of varicella disease or immunization, and if aged ≤13 years and CD4+ lymphocyte percentage is ≥15%, or if aged ≥14 years and CD4+ lymphocyte count is ≥200 cells/mm^3: • Give 2 doses (starting 4 weeks after second MMR), at least 3 months apart.
MCV4-D	Give 2 doses of MCV4-Dg 8 weeks apart, and: • If the first MCV4-D dose was given at the age of <7 years, give a booster after 3 years, then 5 yearly, or • If the first MCV4-D dose was given at the age of ≥7 years, give a booster dose every 5 years.

[a]Individuals who started with HPV4 may complete their remaining doses with HPV9. [b]HPV9 is registered for use from the age of 9 years. [c]If 23PPV has already been given (prior to any doses of PCV13) to children aged under 18 years, wait at least 8 weeks before administering PCV13. [d]The second dose of influenza vaccine is not funded for individuals aged 9 years and older. [e]Only a single viral vaccine is recommended at each visit for individuals with HIV infection. A minimum interval of 4 weeks is required between live vaccine doses administered at different visits. [f]Give VV on the advice of an HIV specialist. [g]Give MCV4-D at least 4 weeks after PCV13.

Table 20: Adults aged 18 years and older when diagnosed with HIV: Additional vaccine recommendations[2]

Vaccine	Recommended vaccine schedule
HPV9	For individuals aged 26 years and under: 3 doses of HPV9 at 0, 2, and 6 months.[a]
PCV13	1 dose of PCV13.[b]
PPSV	Give a maximum of 3 doses of PPSV in a lifetime, a minimum of 5 years apart. The first PPSV dose is given at least 8 weeks after PCV13, the second a minimum of 5 years later, the third dose at the age of ≥65 years.
Influenza	Annual immunization. If previously unvaccinated, give 2 doses[c] 4 weeks apart. Then give 1 dose in each subsequent year.
MMR[d]	If born in 1969 or later and has no record of 2 previous MMR doses and CD4+ lymphocyte count is ≥200 cells/mm^3: • Give 1 or 2 MMR doses 4 weeks apart (so individual has 2 documented doses of MMR).
Varicella[d,e]	If no history of varicella disease or immunization and CD4+ lymphocyte count is ≥200 cells/mm^3: • Give 2 doses at least 3 months apart.
Hepatitis B	If previously unvaccinated, give 4 doses, at 0, 1, 2, and 12 months.[f]
MCV4-D	Give 2 doses of MCV4-D 8 weeks apart, then 1 dose every 5 years.[g,h]

[a]Individuals who started with HPV4 may complete their remaining doses with HPV9. [b]If 23PPV has already been given (prior to any doses of PCV13) to adults aged 18 years and older, wait at least 1 year before administering PCV13. [c]The second dose of influenza vaccine is not funded for individuals aged 9 years and older. [d]Only a single viral vaccine is recommended at each visit for individuals with HIV infection. A minimum interval of 4 weeks is required between live vaccine doses administered at different visits. [e]Give VV on the advice of an HIV specialist. [f]Consider screening for seroconversion after vaccination. The 40 µg HepB dose may be recommended but is not funded. [g]Give MCV4-D at least 4 weeks after PCV13. [h]MCV4-D is registered for individuals aged 9 months to 55 years, but there are are no expected safety concerns when administered to adults older than 55 years.

Other Conditions[2]

Children with the following conditions should be vaccinated with routine vaccines, along with additional vaccines, as described below:

- **Cystic fibrosis or other chronic lung diseases:** Influenza vaccine from the age of 6 months; PCV13 replaces PCV10 on the schedule for these children, and PPV is recommended from the age of 2 years.
- **Metabolic and endocrine disorders** (e.g. congenital diabetes or adrenal insufficiency):
  - **Diabetes:** Influenza vaccine from the age of 6 months; PCV13 replaces PCV10 on the schedule for these children, and PPV is recommended and funded from the age of 2 years.
  - Inborn errors of metabolism at risk of major metabolic decompensation: Influenza and varicella (two doses) vaccines.
  - **Other endocrine disorders:** VV is recommended for a variety of endocrine disorders; discuss with the specialist.
  - **Urinary system:** Pneumococcal vaccines, a Hib booster, conjugate meningococcal vaccines, and annual influenza vaccines are recommended. Dialysis patients must be hepatitis B immune, with administration of repeated courses of HepB, of higher strength if required.

- **Sickle cell disease (not trait):** Pneumococcal conjugate and polysaccharide vaccines are recommended. If children have commenced immunization with PCV10, they can complete it with PCV13, followed by PPSV at the appropriate age. Meningococcal C conjugate vaccine is recommended for children aged under 2 years, followed by quadrivalent meningococcal vaccine at age of 2 years. Hib, annual influenza and age-appropriate pertussis-containing vaccines are recommended for all asplenic individuals from 6 months of age.
- **Other hemoglobinopathies that may result in splenectomy or functional asplenia:** Influenza vaccine from the age of 6 months; PPV is recommended from the age of 2 years.
- **Cochlear implants or intracranial shunts, and infants with Down's syndrome:** Influenza vaccine from the age of 6 months; PCV13 replaces PCV10 on the schedule for these infants, and PPV is recommended and funded from the age of 2 years.[2]

Immunization for Travel and Mass Gatherings[26,27]

Immunization for travelers depends on the place of travel, staying conditions, activities at the place of visit, and other risk behaviors. Only one dose of yellow fever vaccines is recommended for a lifetime; however, if the individual is at risk of exposure to the disease, a booster dose is recommended after 10 years. Vaccine recommendations for travelers are listed in Tables 21, 22, and 23.

Table 21: Categories of travel vaccines

Category	Vaccine
Routine	Diphtheria/tetanus/pertussis (DTaP) Hepatitis B virus (HBV) Measles, mumps, rubella (MMR) Inactivated poliomyelitis (IPV)
Recommended	Influenza Hepatitis A virus (HAV) Japanese encephalitis Meningococcal meningitis Pneumococcal disease Rabies Tick-borne encephalitis Typhoid fever Yellow fever (for individual protection) Cholera
Required (mandatory)	Yellow fever (for protection of vulnerable countries) Meningococcal meningitis (for Hajj, Umrah)

Note: Vaccines should be given to travelers at least 2 weeks prior to departure. Yellow fever vaccine needs to be taken at least 10 days prior to departure. Some vaccines like yellow fever and vaccination for students traveling abroad for further education require documentation.

Table 22: Vaccine recommendations for Hajj pilgrims

Vaccine recommendations	Comments
Meningococcal	Mandatory
Influenza	Recommended
Polio (IPV)	<15 years, endemic countries
Yellow fever	Endemic countries
Pneumococcal (PCV13)	Recommended for >65 years
Hepatitis A	Recommended
Hepatitis B	Recommended

Table 23: Vaccine recommendations for kumbh mela

Vaccine recommendations	Comments
Typhoid	Strong recommendation
Hepatitis A	Strong recommendation
Hepatitis B	For prolonged stay
Japanese encephalitis	If stay is over 1 month
Influenza	Strong recommendation
Yellow fever	Travelers coming from endemic countries
Diphtheria, pertussis, tetanus	Should be up to date
Measles, mumps, rubella	Should be up to date
Rabies	Pre-exposure prophylaxis
Polio (IPV)	1 booster (IPV)
Cholera	Oral vaccine advised

Vaccine Recommendations for Healthcare Workers[26,27]

Healthcare workers for whom vaccination is recommended include individuals working in healthcare settings and who have the potential for exposure to patients and/or to infectious materials, including body substances; contaminated medical supplies and equipment; contaminated environmental surfaces; or contaminated air. Healthcare personnel might include (but are not limited to) physicians, nurses, nursing assistants, therapists, technicians, emergency medical service personnel, dental personnel, pharmacists, laboratory personnel, autopsy personnel, students and trainees, contractual staff not employed by the healthcare facility, and people (e.g. clerical, dietary, housekeeping, laundry, security, maintenance, administrative, billing, and volunteers) not directly involved in patient care but potentially exposed to infectious agents that can be transmitted to and from HCPs and patients.

Healthcare personnel have a high risk of acquiring or transmitting infections, such as hepatitis B, influenza, measles, mumps, rubella, pertussis, and varicella.

In India, vaccines listed in Table 24 are recommended for healthcare workers.

Table 24: Vaccines for healthcare personnel

Vaccine	Dose/s	Schedule
Hepatitis B	3	0-1-6 months
Hepatitis A	2	0–6 months or single dose (live vaccine)
Tdap	1	1 dose every 10 years
Varicella (Chickenpox)	2	2 doses at 4–8 weeks interval
Polio (IPV)	1 or 2	If previously unimmunized 2 doses (0, 4–8 weeks)
Influenza	1	1 dose every year
Typhoid	1	Single dose. If unconjugated vaccine, give 3 yearly
MMR	2	2 doses at 4–8 weeks interval
Meningococcal (ACWY)	1	1 dose is sufficient; repeat dose after 3–5 years if still at risk
Rabies	3	Pre-exposure prophylaxis 0, 7, 28 days (especially veterinarians)

Frequently Asked Questions

Which vaccines can be administered during the same visit?

There are no contraindications to administering registered vaccines during the same visit. However, the vaccines should be administered using separate syringes at separate sites. At least a 4-week interval is recommended if two or more parenterally or intranasally administered live vaccines are not given at the same visit. Any time interval is acceptable between administering live oral vaccines and all parenteral vaccines (e.g. rotavirus and BCG vaccines); live and inactive vaccines; or two inactive vaccines.[2]

What are the steps to be followed if the vaccine schedule is interrupted or varied?

Repetition of prior doses is not required even if the schedule is interrupted. The vaccine schedule should be continued as if no interruption has occurred. Special circumstances where the above does not apply are as follows:

- The birth dose of Hep B vaccine administered to infants born to HBsAg-positive mothers does not count as part of a catch-up.
- The two-dose course of rotavirus vaccine (RV1) should be started before the age of 15 weeks (i.e. the latest is 14 weeks and 6 days) and completed by the age of 25 weeks (i.e. the latest is 24 weeks and 6 days); if an infant reaches the age of 25 weeks without receiving the second dose, the first dose already given may offer them some protection against the disease.
- Children who receive MMR vaccines prior to the age of 12 months still require two MMR doses at the ages of 15 months and 4 years.
- Age-dependent conjugate vaccine schedule requirements (e.g. children over 12 months of age do not require a full primary course of Hib or PCV vaccine but do require one or two doses in the second year of life).
- Remember that children who miss one vaccine dose may do so again; therefore, optimizing a catch-up schedule is important.[2]

How should the rest of vaccinations be scheduled if an adverse event has occurred following immunization?

Immunization after an adverse event depends on the type of adverse event and the likelihood that the vaccine caused it. Most adverse events that have occurred after vaccination are not contraindicated to receiving further immunization. The only absolute contraindication to receiving a vaccine is an anaphylactic reaction to a prior dose or an ingredient in the vaccine. However, immune dysfunction can be a contraindication to receiving live vaccines. Seek advice from a specialist (e.g. medical officer, Ministry of Health, if required). Vaccines that are not related to the adverse event can be administered as per the schedule.[2]

What would be the immunization schedule if an infant had a premature or difficult birth?

Prematured birth and low birth weight are not contraindications to vaccination. The recommended vaccination schedule should be followed according to the appropriate age. Advice of the treating

specialist should be sought if the infant is still in hospital or has been recently discharged. Premature infants or infants with a low birth weight may be at a higher risk for some diseases; therefore, timely immunization is important.[2]

What special vaccines are offered to newborn infants?

Infants born to HBsAg-positive mothers should receive:

- 100-IU hepatitis B immunoglobulin (HBIG) neonatal, at or as close as possible to birth
- A birth dose of Hep B vaccine, at or as close as possible to birth (preferably within 12 hours)

If HBIG and/or Hep B vaccine are inadvertently omitted, administer the vaccine as soon as the omission is recognized. HBIG can be administered up to 7 days post delivery. Seek advice from a specialist if there is a delay of more than 7 days. These infants should then continue vaccination as per the schedule at 1 month, 2 months, and 6 months of age. Serological testing is required at 9 months of age.

In infants who are at a higher risk of TB, BCG vaccination is given soon after birth.[2]

What are the vaccine requirements in immigrant children?

The prior vaccine history should be considered, and the immunization status of all immigrant children should be checked. It is recommended to administer vaccines according to the routine schedule if the prior history is unknown.[2]

Can vaccines be administered if a child is unwell on the day of immunization?

If a child has a significant acute illness or temperature >38°C, immunization can be postponed until it is better. This is because the complications of acute illness may be misinterpreted as a complication of immunization, or an AEFI may complicate the clinical picture of the acute illness. Vaccination should not be postponed due to minor illness or if a child is in the recovery phase of an illness. If immunization is postponed, the child can be vaccinated at a later date.[2]

What if the child has to undergo a surgery (elective surgery)?

There is no effect of anesthesia on the immune response to a vaccine. There is no increased risk of AEFI with the use of anesthesia. Inactive vaccines are preferably avoided for 48 hours prior to anesthesia in case post-vaccination symptoms, such as fever, interfere with the preparation for surgery; similarly, live vaccines may induce fever 6–12 days after vaccination. Surgery should not be delayed following vaccination with a live vaccine if the child has no symptoms of being unwell. Vaccination can be administered after surgery, once the child is well and has recovered.[2]

If a child has been scheduled for splenectomy, then the child should be immunized at least 2 weeks prior to surgery. Pneumococcal, meningococcal, Hib, influenza, and varicella vaccines are recommended for these children pre- or post splenectomy.[2]

If the surgery is an emergency, then vaccination should be scheduled after 2 weeks.[2]

What if the child has a chronic disease?

The routine immunization schedule should be followed in children with chronic diseases, as they may be at risk due to severe effects of vaccine preventable disease. Immunization with live vaccines should be carefully considered in case of impaired immunity if being treated with medications that lower immunity. A pediatrician or a general physician should be consulted before immunization in such cases.[2]

What if the child has had seizures?

A diagnosed neurological condition is not a contraindication to any vaccine on the schedule. However, an evolving neurological condition (e.g. uncontrolled epilepsy or a deteriorating neurological state) is considered as a contraindication to pertussis immunization. Until the neurological condition has been diagnosed or stabilized, there is a risk that changes may be attributed to the vaccine. A family history of seizures or epilepsy is not a contraindication to immunization. A febrile reaction may occur after any vaccine and may result in a febrile seizure in a susceptible child. Vaccine-related febrile seizures are rare, although the risk is higher following administration of certain vaccines, such as influenza vaccines. Most of these seizures are benign, with no associated sequelae.[2]

What if the child is allergic?

If a child shows an anaphylactic reaction to a prior dose of vaccine, or to an ingredient in the vaccine, it is contraindicated to administer the vaccine. The routine immunization schedule should be followed in children with asthma, eczema, hay fever, and other allergies. Studies have shown that immunized children have slightly lower rates of atopic diseases.[2]

Can children be immunized if they are known to develop a rash with antibiotics?

Children can be immunized if they are known to develop a rash with antibiotics; however, the vaccine data sheet for the list of components should be checked, as some vaccines may contain traces of antibiotics. The only concern is if a child has had a previous anaphylactic reaction (a rash alone is not anaphylaxis) to a component of a vaccine.[2]

Can all children receive all vaccines?

Children should be vaccinated if they have had an anaphylactic reaction to any component of a vaccine. Children may have an underlying condition that is a contraindication to some vaccines; for example, children with illnesses or treatments that cause immunocompromisation may be unable to receive live, attenuated vaccines.[2]

What if the child's mother or guardian is pregnant or breastfeeding?

Pregnancy or breastfeeding is not a contraindication to giving any of the scheduled vaccines to a child, including live vaccines, such as the MMR vaccine. In addition, consideration should be given to the risks for the mother or guardian and infant from diseases such as pertussis, which can be life-threatening in infants. Pregnancy is an important opportunity to ensure that the infant's siblings have received age-appropriate immunization. Pertussis (as Tdap) and influenza vaccines are recommended for pregnant women.[2]

Are vaccines of different manufacturers interchangeable?

Vaccines of different manufacturers can be interchanged (provided the strains used are the same and the manufacturer's literature states compatibility. Change of brand may be necessary in case of non-availability of the same brand or if precious records are not clear about the brand used. However, same brand should be used in a patient as far as possible.[7]

Can vaccines be administered in post-exposure conditions?

Post-exposure prophylaxis with vaccine should be administered as early as possible after exposure to certain disease conditions. Individuals should be vaccinated within two weeks of last exposure to an infectious case. Example: Rabies, Hepatitis A, Varicella.[2]

What should be done in case of lapsed/or unknown immunization status?

If the vaccination schedule has been elapsed, there is no need to restart the vaccine series regardless of time between individual doses due to immune memory. If immunization status is unknown, then the vaccination status of child is considered as unimmunized and vaccinated accordingly.[7]

What if a vaccine dose in a particular schedule gets inadvertently postponed?

Inactivated vaccines given up to 4 days before minimum interval between 2 doses may be considered valid, but if given before more than 4 days, the vaccine should be repeated. Minimum interval between two live vaccines must be at least 4 weeks.

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Life Course Immunization Guidebook
A Quick Reference Guide

IMA thanks GSK Biologicals for their Independent Medical Educational Support and BioQuest Solutions Pvt Ltd, Bengaluru, for printing this book in record time.

Indian Medical Association

Health First... Healthy Profession for Healthy Nation...

Indian Medical Association is the only representative, national voluntary organization of Doctors of Modern Scientific System of Medicine, which looks after the interest of doctors as well as the wellbeing of the community at large.

The founding fathers way back in 1928, while struggling for liberation of the Motherland from British rule simultaneously, felt the need of a national organization of the medical profession. Before that, some members of the profession—a selected few—were members of the British Medical Association, which had opened branches in India to cater to the local needs. These stalwarts ultimately succeeded in formation of Indian Medical Association and reached an agreement with the British Medical Association that they will have no branch in India, and got mutually affiliated, and the relationship continues till today.

Indian Medical Association in the year 1946 helped in organization of the World body, namely, World Medical Association, and thus became its founder member. As an organization it has been, and continues to play an important role in its deliberations. It hosted the III World Conference on Medical Education under the joint auspices of W.M.A. and IMA in New Delhi in 1966.

Today, IMA is a well-established organization with its Headquarters at Delhi and State/Terr. IMA has branches in 29 States and Union Territories. It has over 3,15,000 doctors as its members through more than 1750 active local branches spread all over the country.

Objectives:

To promote and advance medical and allied sciences in all their different branches and to promote the improvement of public health and medical education in India

To maintain the honour and dignity and to uphold the interest of the medical profession and to promote co-operation amongst the members thereof.

To work for the abolition of compartmentalism in medical education, medical services and registration in the country and to achieve equality among all members of the profession.

Some of our projects:

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- IMA Anaemia Free India
- Clinton HIV/AIDS Initiative
- Training of Medical Officers on issues related to trafficking of Children
- Accessibility and Affordability of Quality Health Services in India.
- IMA Pharmacovigilance Education Programme
- IMA Safe Injection Practices
- Aao Gaon Chalen
- IMA- GFATM-RNTCP-PPM
- CME on Pain Management
- Infant Mortality Rate and IMA Childhood Diarrhoea
- IMA – QCI Survey of Health Care Centre
- IMA END TB initiative