# Quarterly Medical Review

Vol. 63, No. 2  
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**Review: Immunization Update**

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Review: **Immunization Update**

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IMMUNISATION PRACTICES:

Immunisation is one of the most beneficial and cost effective disease prevention measures.

As a result of effective and safe vaccines, smallpox has been eradicated, polio is close to worldwide eradication, and measles and rubella are no longer endemic in certain parts of the world.

The incidence of most other vaccine preventable disease of childhood has also reduced considerably.

Immunisation is an important part of childcare practice. With the introduction of newer, safer and more effective vaccines, knowledge and concepts in the field of immunology need continuous updating.

Health professionals need to be committed to follow ideal immunisation practices as formulated by the government and endorsed by Indian Academy of Pediatrics (IAP).

In this booklet we have compiled all relevant and updated information on vaccines and immunisation practices. We hope it will be a source of information for implementation.
BCG VACCINE

Childhood Tuberculosis constitutes 15-20% of all Tuberculosis cases, and is also estimated to be responsible for over 10% of all hospital admissions in India. Thus preventing childhood tuberculosis is a priority, and BCG vaccine even with its limited efficacy, continues to be the only vaccine available today.

VACCINE:

This is a live attenuated vaccine and induces cell-mediated immunity.

It is available as a lyophilized powder which has to be reconstituted with a diluent and protected from light and heat. After reconstitution it has to be used within 4-6 hrs.

Efficacy:

It has 50% efficacy for pulmonary tuberculosis, but is more effective in preventing severe illness like miliary and meningeal T.B., where it has an efficacy of 50-80%.

Dose:

Recommended dose is 0.1ml or 0.05 ml, as suggested by the manufacturer.

It is given intradermal, with a tuberculin syringe and 26/27G gauge needle on the convex tip of the left shoulder. This site has the maximum lymphatic drainage. No antiseptic or spirit should be applied.

After the injection a small papule appears after 2-3 weeks, which increases to 4-8mm by the end of 5-6 weeks. The papule heals by ulceration and scarring after 6-12 weeks. These are normal events and need no treatment.

Adverse events:

Secondary infection at site may require antibiotics for a short period.

Ipsilateral cervical lymph node enlargement may be seen after a few months. This needs no treatment.

Caseation and abscess formation of the ipsilateral node may need surgical removal but no antitubercular treatment is recommended.

RECOMMENDATIONS:

Age for administration is birth-6weeks.

Catch up vaccination for those who missed the dose is recommended up to 5 years of age. No Tuberculin testing needed prior to this.

If there is no scar or reaction after vaccination, repeat dose can be given. No prior testing is needed while
administering second dose. Third dose is not recommended.

It can be given with all vaccines on the same day or any interval except MMR/Measles vaccine, where a gap of 4 weeks is recommended between the vaccines.

**Vaccine available in India:**
Tubervac by Serum Institute of India

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**POLIOMYELITIS VACCINES**

The last case of paralytic Poliomyelitis from India was reported on Jan 13th 2011.

Now only Pakistan, Afghanistan and Nigeria are endemic for this virus. Wild virus type 2 has not been isolated from anywhere in the world since 1999.

This gigantic feat was possible due to the availability of two effective vaccines and the Global Polio Eradication Initiative launched in 1988. We as physicians have to participate and ensure high vaccine coverage.

**VACCINES:**
Two vaccines are available:
- Live Attenuated Oral Polio Vaccine (OPV), and
- Inactivated Injectable Polio Vaccine (IPV)

**ORAL POLIO VACCINE**

Available as:
- Trivalent (live attenuated Polio types 1, 2, 3)
- Bivalent (types 1 & 3)
- Monovalent (types 1 or 3)

Bivalent and monovalent are 2.5 - 3 times more efficacious than trivalent OPV, as competition among viruses is eliminated.

The Trivalent vaccine is used in all routine vaccinations as well as on all National Immunisation Days (NID), whereas the Monovalent as well as the bivalent is used in the Sub National Immunisation Days (SNIDs).

The vaccine is administered orally.

**Efficacy:**
The onset of action of OPV is fast. However multiple doses are needed before 90 - 95% children develop seroconversion for all three virus types.

Seroconversion rates after 3 doses of OPV average 65% for Type I Virus, 96% for Type II Virus, & 63% for Type III Virus.
Adverse effects:

**VAPP (Vaccine Associated Paralytic Poliomyelitis)** where the vaccinee or his contact may develop paralysis within 4-40 days after vaccination.

**VDPV (Vaccine Derived Paralytic Poliomyelitis)** where there is a small outbreak of poliomyelitis in the community following vaccination. This is due to mutation of the vaccine virus to a neuropathogenic strain which behaves like the wild virus.

Fortunately both VAPP and VDPV are rare in our country.

**INACTIVATED POLIO VACCINE:**

All presently used vaccines are enhanced potency vaccines (eIPV) which contain selected antigen units of all three virus types.

**Efficacy:** Highly immunogenic. Seroconversion rates are 90-100% after 2 doses given after 2 months of age, or 3 doses given at 6, 10, 14 weeks

**Dose:** 0.5ml SC/IM.

**Adverse effects:** Very safe vaccine. Rare allergic reactions to antimicrobials in the vaccine are seen.

**RECOMMENDATIONS:**

IAP recommends continuing OPV use for birth dose, for routine immunization at 6, 10 and 14 weeks, 18-24mths and at 5yrs and on all National Immunisation Days and Mop Up rounds.

Also recommended: Additional use of IPV along with OPV in all children.

**Dose and Schedule:**

*Child not received any polio vaccination so far:*

<table>
<thead>
<tr>
<th>First Schedule</th>
<th>Second Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPV 6 months</td>
<td>OPV Birth</td>
</tr>
<tr>
<td>OPV + IPV 6 months</td>
<td>OPV 6 weeks</td>
</tr>
<tr>
<td>OPV + IPV 12 months</td>
<td>OPV + IPV 10 weeks</td>
</tr>
<tr>
<td>OPV 15-18 months</td>
<td>OPV + IPV 14 weeks</td>
</tr>
<tr>
<td>OPV + IPV 18 months</td>
<td>OPV + IPV 15-18 months</td>
</tr>
<tr>
<td>OPV 24 months</td>
<td>OPV + IPV 5 years</td>
</tr>
<tr>
<td>OPV 5 years</td>
<td></td>
</tr>
</tbody>
</table>

The second schedule has three instead of four doses, but has an extra visit at 18 weeks and will be difficult when combination vaccines are used.

*If child has completed primary vaccination series of OPV:*

IAP recommends, IPV may be offered as catch up vaccinations for children less than 5 years of age given in two doses 2 months apart.

IAP recommends, IPV may be offered as catch up vaccinations for children less than 5yrs of age given in two doses 2 months apart.
OPV need not be given with these doses. However OPV to be given with 1st & 2nd DPT boosters and all NIDs and SNIDs.

**Vaccines available in India:**

<table>
<thead>
<tr>
<th>VACCINES</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral Polio Vaccine</td>
<td>Bippolio</td>
<td>Bharat Biotech</td>
</tr>
<tr>
<td></td>
<td>Primipol</td>
<td>Chiron Panacea</td>
</tr>
<tr>
<td>Inactivated Injectable Polio Vaccine</td>
<td>Imovax</td>
<td>Sanofi Pasteur</td>
</tr>
<tr>
<td></td>
<td>Polprotec</td>
<td>Chiron Panacea</td>
</tr>
</tbody>
</table>

**DIPHTHERIA, TETANUS, whole cell PERTUSIS (DTwP) VACCINE**

Popularly known as Triple Antigen its introduction in the National Immunisation schedule has significantly reduced the incidence of Diphtheria, Tetanus and Pertussis in our country.

**VACCINE:**

It contains Diphtheria Toxoid, Tetanus Toxoid and killed whole cell Pertusis bacilli adsorbed on Aluminum salts which act as adjuvants.

**Efficacy:** The efficacy is 70-90% (efficacy against Pertussis is least)

Immunity wanes over 6-12 years and regular boosting is required

**Dose:** 0.5 ml intramuscular on anterolateral aspect of thigh or deltoid

**Adverse Effects:**

*Minor effects like:*
- Pain, swelling, redness at local injection site.
- Fever, irritability seen in almost half of vaccinees

*Serious side effects are rare and include:*
- Fever >40.5°C
- Persistent crying, hypotonic, hyporesponsive episodes
- Seizures and encephalopathy

**RECOMMENDATIONS:**

IAP unequivocally endorses the continued use of DTwP vaccine in the national immunization schedule because of its proven efficacy and safety.

The standard schedule is 10, 14, 18 weeks and Boosters at 15-18mo and 5 yrs.

The second booster is not required if the last dose is given after 4 years of age.

The schedule for catch up vaccination is three doses 0, 1 and 6 months.

DTwP is not recommended after 7 yrs of age, due to increased risk of side effects.

It is essential to immunize even those recovering from Diphtheria, Pertussis and Tetanus as natural illness does not offer complete protection.
History of anaphylaxis and development of encephalopathy to previous doses is a contraindication to further doses.

**DIPHTHERIA, TETANUS, acellular PERTUSIS (DTaP) VACCINE**

The introduction of the whole cell vaccines resulted in significant reduction in disease morbidity and mortality.

Once disease rates declined concern over the adverse effects of the Pertussis component led to development of the acellular Pertussis vaccine.

**VACCINE:**

This vaccine essentially is composed of the Pertussis Toxin and other components of the Pertussis Bacilli, unlike DTwP in which the whole cell of Pertussis bacillus is used.

**Efficacy:** The efficacy and duration of protection is similar to that afforded by the whole cell vaccine.

**Dose:** 0.5 ml intramuscularly.

**Adverse effects:** The DTaP vaccines score over the whole cell vaccine in terms of adverse effects

Serious adverse effects though less likely as compared to DTwP vaccines are still likely to occur.

**RECOMMENDATIONS:**

DTaP vaccines are not more efficacious than DTwP vaccines, but have fewer side effects.

The use of DTaP vaccines should be following one to one discussion with parents

This vaccine may be preferred to DTwP vaccines in children with history of severe adverse effects with DTwP vaccines or in children with neurological disease, if resources permit

The schedule is the same as DTwP vaccine

DTaP is not to be used above the age of 7yrs because of increased reactogenicity

**TETANUS TOXOID (TT)**

Tetanus toxoid vaccine administration forms an important part of wound management, and has played an important role in reducing the incidence of Tetanus.

While the vaccine has good seroconversion rates, antibodies to Tetanus decline over time and hence regular boosting is needed to ensure adequate levels of
antibodies during any possible exposure.

**VACCINE:**

TT is one of the most commonly used vaccine, its safety and efficacy is time tested.

**RECOMMENDATIONS:**

Children who have completed primary and booster vaccination with DTwP or DTaP, TT boosters every 10 years provide adequate protection.

However the role of standalone TT vaccine is diminishing and replacement with Td or Tdap is recommended for comprehensive protection.

For children who are completely unimmunized, or with unknown or undocumented history, catch up vaccination should be provided with 3 doses of TT/ DTwP/ DTaP/ Td/ Tdap at 0, 1, 6 months. The vaccine to be administered will depend on the age of the child and nature of previous doses received.

For partially vaccinated children 3 doses should be administered including previous doses.

TT/ Td/ Tdap vaccine boosters should be administered at time of wound management.

**WOUND MANAGEMENT:**

Cleaning of wound, removal of devitalized tissue, irrigation and drainage is important to prevent Tetanus infection as part of wound management.

Evaluation of Tetanus vaccination status is recommended and administered as indicated below:

**TT vaccination in wound management:**

<table>
<thead>
<tr>
<th>Status</th>
<th>Clean, minor wounds</th>
<th>All other wounds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TT/ Td</td>
<td>TT/ Td</td>
</tr>
<tr>
<td>Unknown &lt;=3, immunodeficient</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>&gt;=3 doses</td>
<td>No**</td>
<td>No</td>
</tr>
</tbody>
</table>

* TIG Tetanus Immune Globulin  **Yes, if more than 10 years since last dose
*** Yes, if more than 5 years since last dose.
TT vaccination in pregnancy:

<table>
<thead>
<tr>
<th>Status</th>
<th>1st pregnancy</th>
<th>2nd pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not previously immunised</td>
<td>2 doses 1 month apart 1st dose at 1st contact, 2nd at least 2 weeks before delivery</td>
<td>1 dose if within 5 years 2 doses after 5 years</td>
</tr>
<tr>
<td>Received 5 doses over 2.5 yrs</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Received 3 primary doses</td>
<td>2 doses in 1st pregnancy</td>
<td>1 dose</td>
</tr>
<tr>
<td>Received 3 primary + 1 booster</td>
<td>1 dose</td>
<td>1 dose</td>
</tr>
<tr>
<td>Received 3 primary + 2 boosters</td>
<td>1 dose</td>
<td>None</td>
</tr>
<tr>
<td>3 primary + 2 childhood boosters + 1 adolescent booster</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

DIPHTHERIA, TETANUS VACCINE (DT) OR DUAL VACCINE

This vaccine comprises of Diphtheria and Tetanus toxoid.
It is a safe and effective vaccine, given 0.5 ml intramuscularly.
It is recommended in children below 7 yrs of age where Pertussis vaccination is contraindicated.
No longer used for 2nd booster in EPI.
Government of India has replaced DT with DTwP for the 2nd childhood booster.

Government of India has replaced DT with DTwP for the 2nd childhood booster.

Td VACCINE

This vaccine contains the usual dose of Tetanus Toxoid and only 2 Lf of Diphtheria Toxoid instead of 20-30 Lf per dose (as in DTwP).
The Diphtheria antibody levels decline over time and need regular boosting along with Tetanus every 10 years, to prevent outbreaks in adults.
The DTwP, DTaP and DT vaccines cannot be used in
children above the age 7 years due to increased reactogenicity due to higher Diphtheria and Tetanus toxoid components. This vaccine is recommended for catch up vaccination in children above the age 7 years, and as replacement for TT in all situations where TT is given.

**Tdap VACCINE**

Immunity against Pertussis wanes over 6-12 years after primary and booster vaccinations. In the absence of natural boosting, adolescent and adult Pertussis showed a gradual increase in the developed countries. Several countries have started booster vaccinations of adolescents and adults with standard quantity tetanus toxoid and reduced quantity diphtheria and acellular Pertussis.

The standard strength DTwP and DTaP vaccines cannot be used for vaccination of children 7 yrs and above due to increased reactogenicity.

**VACCINE:**

Currently two brands of Tdap are available in India.

**Efficacy:** Efficacy against clinical disease exceeds 90%.

**Dose:** It is given intramuscular as 0.5 ml dose.

**Adverse effects:** Common side effects are local pain, redness and swelling. Fever headache and fatigue are rarely seen. Serious adverse events have not been reported.

**RECOMMENDATIONS:**

IAP recommends offering Tdap vaccine instead of Td/TT vaccine to all children or adolescents who can afford it.

**Schedule:**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Tdap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary 3 doses+ 2 boosters given</td>
<td>1 dose at 10-12 yrs</td>
</tr>
<tr>
<td></td>
<td>Catch up vaccination up to 18 yrs</td>
</tr>
<tr>
<td>Adult not received Tdap in past</td>
<td>1 dose at 1st contact</td>
</tr>
<tr>
<td>Wounded patients with Age &gt;10 years,</td>
<td>1 dose instead of TT/ Td</td>
</tr>
<tr>
<td>Not received Tdap or &gt; 5 years since TT/ Td</td>
<td></td>
</tr>
<tr>
<td>Missed 2nd booster, age&gt;7yrs</td>
<td>Tdap at 1st contact</td>
</tr>
<tr>
<td>Not completed primary vaccination</td>
<td>1 dose of Tdap and 2 doses of Td at 0, 1, 6 months</td>
</tr>
<tr>
<td>Adult boosters</td>
<td>Single Tdap followed by Td every 10 yrs</td>
</tr>
</tbody>
</table>
Vaccines available in India:

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRAND</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTwP</td>
<td>Triple</td>
<td>Serum Institute of India</td>
</tr>
<tr>
<td>DTaP</td>
<td>Inflanrix</td>
<td>GSK Biologics</td>
</tr>
<tr>
<td></td>
<td>Tripacel</td>
<td>Sanofi Pasteur</td>
</tr>
<tr>
<td>DT</td>
<td>Dual</td>
<td>Serum Institute of India</td>
</tr>
<tr>
<td>TT</td>
<td>Tetanus Toxoid</td>
<td>Serum Institute of India</td>
</tr>
<tr>
<td></td>
<td>Athaytox</td>
<td>Biological Evans</td>
</tr>
<tr>
<td></td>
<td>BETT</td>
<td></td>
</tr>
<tr>
<td>Td</td>
<td>Tolvac</td>
<td>Serum Institute of India</td>
</tr>
<tr>
<td>Tdap</td>
<td>Boostrix</td>
<td>GSK Biologicals</td>
</tr>
<tr>
<td></td>
<td>Adacel</td>
<td>Sanofi Pasteur</td>
</tr>
</tbody>
</table>

COMBINATION VACCINES

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRAND</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTwP +Hib</td>
<td>Quadrovac</td>
<td>Serum Institute of India</td>
</tr>
<tr>
<td></td>
<td>Tetra ActHib</td>
<td>Sanofi Pasteur</td>
</tr>
<tr>
<td></td>
<td>Easy Four</td>
<td>Chiron Paracea</td>
</tr>
<tr>
<td>DTwP + HepB</td>
<td>QVac</td>
<td>Serum Institute of India</td>
</tr>
<tr>
<td>DTaP + Hib</td>
<td>Infanrix+ Hiberix</td>
<td>GSK Biologics</td>
</tr>
<tr>
<td></td>
<td>Tripacel +ActHib</td>
<td>Sanofi Pasteur</td>
</tr>
<tr>
<td>DTwP + HepB + Hib</td>
<td>Pentavac SD</td>
<td>Serum Institute of India</td>
</tr>
<tr>
<td></td>
<td>Easy Five</td>
<td>Chiron Paracea</td>
</tr>
<tr>
<td></td>
<td>Comvac 5</td>
<td>Bharat Biotech</td>
</tr>
<tr>
<td>DTaP +Hib +IPV</td>
<td>Pentaxim</td>
<td>Sanofi Pasteur</td>
</tr>
</tbody>
</table>

HEPATITIS B (Hep B) VACCINE

In India 1-4 % of individuals are chronic carriers of Hepatitis B Virus (HBV).

Horizontal route (child to child) and the vertical route (mother to child) are the major routes of transmission of HepB.

Infection with HepB is one of the most important causes of chronic hepatitis, cirrhosis of liver and hepatocellular carcinoma and these outcomes are all preventable by early childhood immunization.

The Hepatitis B vaccines are of public health importance. The government of India initiated universal Hepatitis B vaccination since June 2002.

VACCINE:

The currently available vaccine contains the surface antigen of Hepatitis B, produced by recombinant technology in yeast. It is adjuvated with aluminum salts
and preserved with thiomersol.
Thiomersol free vaccines are also available.

**Efficacy:** Seroconversion rates are greater than 90% after a three dose schedule routine.
Boosters are not needed in healthy children and adults as lifelong immunity is generated.

**Dose:**

<table>
<thead>
<tr>
<th>AGE</th>
<th>DOSE</th>
<th>SITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18 yrs</td>
<td>0.5 ml (10 ug)</td>
<td>IM, anterolateral thigh/deltoid</td>
</tr>
<tr>
<td>&gt;18 yrs</td>
<td>1.0 ml (20 ug)</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

**Adverse effects:** This is a very safe vaccine and mild local reactions may be seen.

**HEPATITIS B Immunoglobulin (HBIG):**
This provides passive immunity and is indicated along with Hep B vaccine in the management of perinatal, occupational, sexual exposures in susceptible individuals.

The dose of HBIG is 0.5 ml IM in neonates and infants and 0.06ml/kg in adults.
HBIG provides temporary protection lasting 3-6 months.

**RECOMMENDATIONS:**

**Routine Vaccinations**
Hepatitis B is now included in the routine vaccination schedule in India. It can be used in any of the schedules given below.

**Schedule:**

<table>
<thead>
<tr>
<th>Birth, 1 and 6 months (Classical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6, 10 and 14 weeks</td>
</tr>
<tr>
<td>Birth, 6 and 14 weeks</td>
</tr>
<tr>
<td>Birth, 6 weeks, 6 months</td>
</tr>
<tr>
<td>Birth, 6 weeks, 10 weeks, 14 weeks</td>
</tr>
</tbody>
</table>

The last schedule is important when combination vaccines are used.
Catch up vaccination with HepB vaccine as a 0, 1, 6 Schedule should be offered to all children/adolescents who have not been previously vaccinated.
All available brands of Hepatitis B vaccine are equally safe and effective.
Interchange of Brands is permitted but not routinely recommended.
Management of a newborn infant:

If the mother’s HBsAg status is not known:

It is important that HepB vaccination should begin within a few hours of birth, so that perinatal transmission can be prevented.

If the mother is HBsAg positive (and especially HBeAg positive):

The baby should be given Hepatitis B Immune Globulin (HBIG), 0.5ml, along with HepB vaccine within 12 hours of birth. Use two separate syringes and separate sites for injection.

Post Exposure Prophylaxis to Prevent Hepatitis B Virus Infection:

At risk population

a) Health care workers (HCW) exposed to infected blood, tissue or other potentially infectious body fluids with a cut or needle-stick injury.
b) Lab Technicians.

HBsAg-positive Exposure Source:

• A single vaccine booster dose for those already completely immunized.
• Persons who are in the process of being vaccinated receive the appropriate dose of Hepatitis B immune globulin (HBIG) and should complete the vaccine series.
• Unvaccinated person should receive both HBIG and Hepatitis B vaccine as soon as possible after exposure, preferably within 24 hours.

Exposure Source with Unknown HBsAg Status:

• Persons with written documentation of a complete Hepatitis B vaccine series require no further treatment.
• Persons not fully vaccinated, should complete the vaccine series.
• Unvaccinated person should receive the Hepatitis B vaccine series with the first dose administered as soon as possible after exposure, preferably within 24 hours.
• The vaccine series should be completed in accordance with the age-appropriate dose and schedule.

Vaccines available in India

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
</table>
| Hepatitis B | Genevac B  
Engerix B  
Revac B | Serum Institute of India  
GSK Biologics  
Bharat Biotech |
HEPATITIS IMMUNE GLOBULIN:
Available as Hepabig 100 units in 0.5ml and 200 units in 1.0 ml vials by VHB Pharmaceuticals.

HEMOPHILUS INFELUENZA TYPE B (HIB) CONJUGATE VACCINE
H. Influenza B (Hib) is an important invasive pathogen causing diseases such as meningitis, bacteremia, pneumonia, cellulitis, osteomyelitis, septic arthritis and epiglottitis.
The disease burden of Hib is sufficiently high in India to warrant prevention by vaccine.

VACCINE:
All Hib vaccines are conjugate vaccines, where the Hib capsular polysaccharide is conjugated with a protein carrier.
HbOC & PRP-T vaccines are currently available in India.

Efficacy:
90-100% efficacy against invasive Hib disease for one year after vaccination.

Countries where the vaccine was introduced for universal immunisation have witnessed virtual elimination of Hib disease with no serotype replacement.

**Dose:** 0.5 ml intramuscular.

**Dose schedule:**

<table>
<thead>
<tr>
<th>Age</th>
<th>Primary</th>
<th>Booster</th>
</tr>
</thead>
<tbody>
<tr>
<td>6wks – 6 mo</td>
<td>3 doses at 4-8 wks</td>
<td>At age 12-15 mo or at least 2 mo after last dose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If with DPT at age 15-18mo</td>
</tr>
<tr>
<td>7 – 11 mo</td>
<td>2 doses</td>
<td>1 dose at age 15-18mo</td>
</tr>
<tr>
<td>12 – 15 mo</td>
<td>1 dose</td>
<td>1 dose 2 mo after last dose</td>
</tr>
<tr>
<td>Above 15 mo</td>
<td>—</td>
<td>1 dose only</td>
</tr>
</tbody>
</table>

**Adverse Reactions:** These are mild & local.

**RECOMMENDATIONS:**
IAP recommends offering the Hib vaccine to all children in the routine vaccination schedule.
The interval between doses for primary
Vaccination is 4-8 weeks. The interval for doses given between 12-15 months is 8 weeks.

Not recommended for children above 5 yrs of age. However vaccine should be given to all individuals with functional or anatomic hyposplenia irrespective of age.

Hib is now commonly used as a combination vaccine with DTwP/DTaP/HepB/IPV.

**Vaccines available in India:**

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hib</td>
<td>Hibpro</td>
<td>Serum Institute of India</td>
</tr>
<tr>
<td></td>
<td>Hiberix</td>
<td>GSK Biologicals</td>
</tr>
<tr>
<td></td>
<td>ActHib</td>
<td>Sanofi Pasteur</td>
</tr>
</tbody>
</table>

**MEASLES VACCINE**

Measles continues to be an important cause of morbidity and mortality in India.

It is potentially an eradicable disease by improving routine vaccine coverage and providing a second dose as combined MMR vaccine.

**Vaccine:**

All currently used vaccines are live attenuated vaccines.

It is a safe and inexpensive vaccine.

Reconstituted vaccine has to be given immediately within one hour.

**Efficacy:** Seroconversion if given at 6mths is 60%, at 9 months is 80-85%, 12-15 months is >95%.

It provides lifelong immunity.

**Dose:** 0.5ml subcutaneous or intramuscular over anterolateral thigh or upper arm

**Adverse Reactions:**

Local pain, tenderness and a mild measles like rash 7-12 days after vaccination can be seen.

It can also cause depressed cell mediated immunity which recovers within 4 weeks

*Measles Vaccine related deaths have occurred due to:*

1) Toxic Shock Syndrome due to vaccine vial contamination. This happens especially when using a multidose vial and delay in administering reconstituted vaccine.

2) Accidental administration of Scoline instead of the vaccine when stored in same refrigerator.
Vaccine related deaths are usually due to human error rather than vaccine adverse effects.

**RECOMMENDATIONS:**
Recommended at 9 months in routine immunization schedule

Administered at 9 months for early protection, although best efficacy when administered between 12-15 months

In measles outbreak can be administered as early as 6 months of age and within 2 days of exposure

Additional dose as MMR vaccine at 15 months gives durable and lifelong protection against measles

The vaccine should be given irrespective of prior history of Measles as any exanthematous illness is often confused as Measles.

**Contraindications:**
- In severely immuno-compromised children.
- In those with severe allergy to vaccine constituents.
- In pregnancy.

**Vaccines available in India:**

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles</td>
<td>M Vac, AbhayM</td>
<td>Serum Institute of India</td>
</tr>
</tbody>
</table>

**RUBEMLLA VACCINE**

Rubella is a mild exanthematous illness in childhood; however if acquired in the first trimester of pregnancy can cause disastrous consequences to the fetus.

WHO estimates that 100,000 cases of CRS occur in developing countries alone.

Hence the real objective of Rubella vaccination is to prevent Congenital Rubella Syndrome (CRS).

**VACCINE:**

Available as freeze dried powder and has to be diluted with sterile diluent.

**Efficacy:** Single dose provides lifelong immunity in 95% of the vaccinees

**Dose:** 0.5 ml subcutaneous.

**Adverse Effects:** Local pain, erythema and rash. Mild arthralgia, arthritis also seen
1-3 weeks after vaccination
Can also cause immune thrombocytopenia.

RECOMMENDATION:
IAP recommends MMR vaccine to be used instead of monovalent Rubella as it additionally protects against Mumps and Measles.

Contraindications: Not to be administered in the severely immunocompromised and in pregnancy.
Pregnancy to be avoided for 3mths after vaccination, but termination not advised if accidentally vaccinated during pregnancy.

MEASLES, MUMPS, RUBELLA VACCINE (MMR)
Most countries all over the world are using MMR Vaccine instead of the monovalent vaccines. The epidemiology of Measles and Rubella has been discussed earlier.

Mumps is a mild childhood illness, however at times can result in complications like deafness, meningoencephalitis and orchitis. Mumps can be effectively stopped with the MMR vaccine; there is no monovalent Mumps vaccine available.

VACCINE:
Two vaccines are available in our country today. One has the Leningrad-Zagreb strain of Mumps which is inexpensive. The other has the RiT strain of Mumps vaccine which is more expensive.

Efficacy: Seroconversion rates against Mumps are more than 90% but clinical efficacy and long term protection with single dose is 60-90%; outbreaks have been noted in previously vaccinated populations after a single dose.

Hence two doses are needed for durable protection.

Dose: 0.5 ml is administered subcutaneously.

Adverse Effects: Adverse effects due to Measles and Rubella components have been discussed earlier.

5% of vaccinees get fever more than 39°C, 7-12 days following vaccination and febrile seizures may occur.

Transient parotitis can occur.

Aseptic meningitis may rarely occur 2-3 weeks following vaccination but is usually mild. This is slightly more common with the Leningrad-Zagreb strain than the RiT strain which is expensive.

Now there is incontrovertible evidence that there is no causal relationship between MMR vaccine and AUTISM, Inflammatory bowel disease or GBS.
causal relationship between MMR vaccine and AUTISM, Inflammatory bowel disease or GBS.

RECOMMENDATIONS:
IAP recommends MMR vaccine in routine immunization of infants. Two doses of MMR vaccine are recommended, 1st at 12-15mths and second at 4-6 yrs age or any time 8 weeks after first dose. Any MMR vaccine available can be used. Both MMR vaccines available in India are safe and equally efficacious and any one may be used. No upward age limit for catch up vaccine. Two doses recommended at 8 weeks interval.

Contraindications:
Pregnancy, severe immunodeficiency, those with serious allergy to vaccine or components.
Cautious use in those with Immune Thrombocytopenia.

Vaccines available in India:

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMR</td>
<td>Tresivac Priorix</td>
<td>Serum Institute of India GSK Biologicals</td>
</tr>
</tbody>
</table>

TYPHOID VACCINES

Enteric fever (Typhoid and Paratyphoid) is a major health problem in India. The incidence is highest among children less than 15 years of age and considerably high even between 1-5 years of age. This makes vaccination against typhoid fever of immense importance in our country.

VACCINES:
Several vaccines have been available against typhoid
1) Inactivated whole cell Typhoid/Paratyphoid vaccine
2) Oral Live attenuated Ty21a Vaccine
3) Vi Capsular Polysaccharide vaccine
4) Vi conjugate typhoid vaccine
The last two are the only vaccines available in India.

I) VI CAPSULAR POLYSACCHARIDE VACCINE
This vaccine contains highly purified antigenic fraction of Vi capsular polysaccharide antigen of S. Typhi which is a virulence factor of the bacteria.
Efficacy: Protective efficacy of 70-80%.
Dose: The vaccine is given as 0.5ml dose, IM/SC.
Given as single dose above the age of 2 years.
Revaccination every 3 years, as efficacy drops over time.

**Adverse effects:** Pain and swelling over injection site.
Contraindicated in those with previous history of hypersensitivity.

**II) VI CONJUGATE VACCINE**
The conjugate vaccine available in India has the Vi antigen conjugated with tetanus toxoid.

**Efficacy:** Protective efficacy over 90% from studies in Thailand; no studies available in India.

**Dose:** The recommended is 0.5 ml IM after 6 months of age.
Two doses 4-8 weeks apart, with booster at 10 yrs.
If primary vaccine given less than 2 years then, a booster needed 2 - 2.5 years after 1st dose.

**Adverse effects:** No major local or systemic side effects.

**RECOMMENDATIONS**
IAP recommends routine administration of the Vi Polysaccharide vaccine 0.5 ml, IM every 3 years, beginning at 2 yrs for all children.
Any child with history of suspected or confirmed enteric fever is recommended vaccination 4 weeks after recovery, if has not received vaccine in last 3 years.
Safe in HIV infected children.
IAP has not yet approved of the conjugate vaccine for lack of efficacy studies.

**Vaccines available in India**

<table>
<thead>
<tr>
<th>TYPE</th>
<th>BRAND NAME</th>
<th>MANUFACTURER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vi polysaccharide vaccine</td>
<td>Typhbar</td>
<td>Bharat Biotech</td>
</tr>
<tr>
<td></td>
<td>Typhim Vi</td>
<td>Sanofi Pasteur</td>
</tr>
<tr>
<td></td>
<td>Typhrix</td>
<td>GSK Biologicals</td>
</tr>
<tr>
<td></td>
<td>Biotyph</td>
<td>Biomed</td>
</tr>
</tbody>
</table>

**HEPATITIS-A VACCINE**
India is endemic for Hepatitis A virus infection. This is a relatively benign infection in young children, but infections acquired later in life are of increasing clinical severity.
In our country the incidence of clinical Hepatitis A is increasing. With improving socioeconomic conditions, infections result later in life and immunisation is
important for disease prevention.

**VACCINES:**
Two vaccines are available:
I) Inactivated vaccine
II) Live attenuated vaccine
Combination vaccine of Hepatitis A and Hepatitis B is also available.

I) *Inactivated vaccine:*
Vaccines available are derived from various strains and are inactivated by formalin.

**Efficacy:** Protective efficacy around 90-100%.
Protective antibodies seen within 15-30 days after 1st dose of the vaccination, and nearly 100% antibodies after 2nd dose.
Immunity lasts lifetime. No booster doses are needed.

**Dose:** 0.5 ml given intramuscular. Two doses should be administered 6 months apart.

**Adverse reactions:**
Mild local pain or swelling may be seen.

II) *Live attenuated vaccine:*
This vaccine has been used in China for over a decade.

**Efficacy:** Seroconversion rates of over >98% seen two months after vaccination and persistence of antibodies for 10 years on follow up.
Two doses of the live attenuated vaccine show higher antibody titres and better seroprotection rates than 1 dose.
Not useful as post exposure vaccine.

**Dose:** 0.5ml subcutaneously two doses 6 months apart.

**Adverse effects:** No serious side effects.

---

**RECOMMENDATIONS:**
Hepatitis A vaccine should be included in the routine vaccination schedule of all healthy children.
The minimum age for administration is 12 months and two doses (including live attenuated vaccine) recommended to be given 6 months apart.

*Hepatitis A vaccine is specially recommended for*
**those at high risk:**
- Patients with chronic liver disease.
- Carriers of Hepatitis B and Hepatitis C
- Congenital or acquired immunodeficiency
- Transplant recipients
- Adolescents seronegative for HAV who are leaving home for residential schools
- Travelers to countries with high endemicity for Hepatitis A
- Household contacts of patients with acute Hepatitis A virus infection within 10 days of onset of illness in index case. May not be effective if contact also has same source of infection. **Live attenuated vaccine not recommended for post exposure vaccination.**

**Recommended doses and schedules for Inactivated Hepatitis A vaccine**

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccine</th>
<th>Volume</th>
<th>No. of doses</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-18 yrs</td>
<td>HepA</td>
<td>0.5 ml</td>
<td>2</td>
<td>0, 6-12 months</td>
</tr>
<tr>
<td>19 yrs or&gt;</td>
<td>HepA</td>
<td>1 ml</td>
<td>2</td>
<td>0, 6-12 months</td>
</tr>
<tr>
<td>18 yrs or&gt;</td>
<td>Combined</td>
<td>0.5 ml</td>
<td>2 or 3 doses</td>
<td>Or accelerated schedule*</td>
</tr>
<tr>
<td></td>
<td>HepA &amp; HepB</td>
<td>1 ml</td>
<td></td>
<td>0, 7 days, 21-30 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>followed by booster at 12 months</td>
</tr>
</tbody>
</table>

*the accelerated schedule is administered when travel to an endemic area is planned.

**Catch up vaccination** recommended at any age. Prior testing for Hep A antibody recommended for those >10 years of age.

**Vaccines available in India:**

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactivated HepA</td>
<td>Havrix</td>
<td>GSK Biologicals</td>
</tr>
<tr>
<td></td>
<td>Avaxim</td>
<td>Sanofi Pasteur</td>
</tr>
<tr>
<td>HepA + HepB</td>
<td>Twinrix</td>
<td>GSK Biologicals</td>
</tr>
<tr>
<td>Live attenuated HepA</td>
<td>Biovac A</td>
<td>Wokhardt</td>
</tr>
</tbody>
</table>

**PNEUMOCOCCAL VACCINES**

Responsible for 15-50% of all community acquired pneumonia, 30-50% of Acute Otitis Media, and significant number of meningitis and bacteremia.

Children under the age of 2 years are at greatest risk for invasive pneumococcal
disease.
The mortality rate of invasive disease is 6-20% and there are long term sequel like deafness and neurological deficits in patients with recurrent otitis media and meningitis.

**VACCINES:**

Vaccines are available as:
- Conjugated (PCV13/PCV10).
- Unconjugated (PPSV23).

I) Conjugated vaccines PCV13/PCV10:

**PCV13** (Prevenar13) has 13 common serotypes conjugated to non-toxic diphtheria cross reactive material. It covers around 73% of pneumococcal serotypes prevalent in India.

**PCV10** (Synflorix) has 10 serotypes with three different carrier proteins, and covers 66% of serotypes prevalent in India.

Both PCV13 and PCV10 vaccines appear to provide equal protection against the prevailing pneumococcal diseases.

The vaccines have high immunogenicity in children below the age of 2 years who are at high risk for pneumococcal disease.

**Efficacy:** The vaccines provoke "protective" antibody responses in 90% of infants given these vaccines at 2, 4, 6 months of age, and greatly enhanced responses are apparent after "booster" doses given at 12-15 months of age. Vaccine has greatly reduced invasive infections by vaccine serotypes.

**Dose:** 0.5 ml IM.

**Adverse effects:** local swelling, redness and slightly increased rates of fever when used with other vaccines.

**Schedule:**

Recommended routine vaccination schedule for PCV vaccines among infants and children who have not received previous doses:

<table>
<thead>
<tr>
<th>AGE AT 1st VACCINATION</th>
<th>PRIMARY PCV SERIES</th>
<th>PCV BOOSTER DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-6 months</td>
<td>3 doses</td>
<td>1 dose at 12-15 months</td>
</tr>
<tr>
<td>7-11 months</td>
<td>2 doses</td>
<td>1 dose at 12-15 months</td>
</tr>
<tr>
<td>12-23 months</td>
<td>2 doses</td>
<td>-</td>
</tr>
<tr>
<td>24-59 months (healthy children)</td>
<td>1 dose</td>
<td>-</td>
</tr>
<tr>
<td>24-71 months (children with certain chronic diseases or immunocompromising conditions)</td>
<td>2 doses</td>
<td>-</td>
</tr>
</tbody>
</table>
I) Unconjugated Pneumococcal Polysaccharide Vaccine (PPSV23):
The unconjugated pneumococcal polysaccharide vaccine (Pneumo23 / Pneumovax23) is a 23 valent unconjugated vaccine.

PPSV23 not recommended for routine vaccination in healthy children.

**Efficacy:** Poorly immunogenic below 2 years of age, has low immune memory.

Does not prevent nasopharyngeal carriage or provide herd immunity.

Gives 70% efficacy in invasive disease in high risk population.

**Dose:** 0.5 ml IM/SC, given after 2 years of age to high risk patients.

One dose is repeated after 5 years, but not more than 2 life time doses are recommended.

**Adverse Effects:** It is a safe vaccine with occasional local side effects.

**Patients included in High Risk Category:**

<table>
<thead>
<tr>
<th>Chronic heart disease, chronic lung disease (including asthma treated with high dose steroids), CSF leak, cochlear implant.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sickle cell disease and other hemoglobinopathies, congenital and acquired asplenia or splenic dysfunction.</td>
</tr>
<tr>
<td>HIV infection, chronic renal failure and nephrotic syndrome, other immune deficient states.</td>
</tr>
</tbody>
</table>

**RECOMMENDATIONS:**

Immunization with PCV is recommended for all infants in a schedule for primary immunization after discussion with parents.

Minimum age for administering first dose of PCV is 6 weeks.

Can be routinely given with other vaccines, at a different site with a different syringe.

Routine use of PCV not recommended for healthy children above 5 years of age, and above 6 yrs for high risk patients.

Minimum interval between two doses of PCV is 4 weeks for children vaccinated at age below 12 months, whereas for those vaccinated at age above 12 months the minimum interval between doses is 8 weeks.

PPSV23 not recommended for routine vaccination in healthy children.

High risk children will benefit from PPSV23 administered at 2 yr of age and more, after priming with the scheduled doses of PCV.
IAPCOI recommends both PCV and PPSV for children at high risk. PCV vaccine provides robust immune response and immune memory while PPV23 provides expanded coverage.

Minimum age for administering PPSV23 is 2 years of age.

If PCV cannot be given at least PPSV23 should be given to high risk children above 2 years of age.

PPSV23 should be given at least 8 weeks after last PCV dose. Both vaccines should not to be given on the same day.

A second dose of PPSV23 is recommended 5 years after the first dose for children who have anatomic or functional asplenia, HIV infection or other immunocompromising conditions.

Children for whom splenectomy or cochlear implant planned, PCV and/or PPSV23 vaccination should be completed 2 weeks before surgery.

**Vaccines available in India:**

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conjugated Pneumococcal Vaccine (PCV)</td>
<td>Prevenar13 Synflorix</td>
<td>Pfizer-Wyeth GSK Biological</td>
</tr>
<tr>
<td>Polysaccharide Pneumococcal Vaccine (PPSV23)</td>
<td>Pneumo23 Pneumovax23</td>
<td>Sanofi Pasteur MSD</td>
</tr>
</tbody>
</table>

**ROTA VIRUS VACCINES**

Rotavirus is a major cause of diarrhea related morbidity and mortality in children worldwide.

In India alone rotavirus cause more than 1,20,000 deaths annually, 4,50,000 hospitalisations, 5 million clinic visits and 25 million diarrheal episodes in children under five year

With this disease burden effective vaccination represents the most promising intervention strategy

**VACCINE:**

Currently two live oral vaccines are available in India

- Human Monovalent Live Vaccine
- Human Bovine Pentavalent Live Vaccine

**Human Monovalent Live Vaccine:**

Administered as 1 ml orally in 2 dose schedule at 2 and 4 mo
Available as lyophilized powder to be reconstituted and administered immediately
Cross protection across genotypes seen

Human Bovine Live Pentavalent Vaccine:
Administered as 2 ml orally in three dose schedule 2, 4, 6 mo
Available as a liquid preparation
Both vaccines have shown excellent protective efficacy against severe Rotavirus disease.

Efficacy:
The vaccines have 85-98% efficacy against severe rotavirus gastroenteritis and 42-59% efficacy against hospitalisation due to any cause. Similar high efficacy extends into the second year of follow up.
Herd immunity also induced by the vaccines.
No interference between Rotavirus vaccines and other childhood vaccines including OPV, IPV, Hib, DTaP, HepB, Pneumococcal vaccine.

Adverse effects:
Extremely safe with no increased risk of Intussusception

RECOMMENDATIONS:
Vaccine should be included in the routine infant immunisation, after discussion with parents.
Regardless of vaccine used:
• First dose should be given between 6 weeks-14 weeks 6 days
• All doses should be completed within 32 weeks of age
The Monovalent vaccine is administered as two doses at 4-8 weeks interval
The Pentavalent vaccine is administered as three doses at 4-8 weeks interval
No restrictions on infant's consumption of food, liquid, breast milk either before or after vaccination

It is not to be injected to the patient.
Clinically stable preterm babies can also be administered vaccine at 6 weeks.
Repeating a dose if infant spits or regurgitates vaccine is not recommended.

Ideally brands not to be interchanged, however if unavailable, vaccination should be continued with available product in three doses.
Contraindicated in severe allergy to vaccine or its components.
Vaccines available in India:

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Monovalent Rotavirus</td>
<td>Rotarix</td>
<td>GSK Biological</td>
</tr>
<tr>
<td>Bovine Human Pentavalent Rotavirus</td>
<td>Rotateq</td>
<td>MSD</td>
</tr>
</tbody>
</table>

**VARICELLA VACCINE**

Varicella (Chickenpox) is caused by Varicella Zoster Virus (VZV)

It's a self limiting and benign disease.

However, complications are seen in neonates, adults, pregnant women and immunocompromised children.

**VACCINE:**

Live attenuated vaccine developed from Oka Strain

**Efficacy:** Seroprotection rates of 86% following single dose. Improves to 99% after administration of 2 doses 3 months to 4-6 yrs apart.

15% of vaccines develop break through Varicella. It is seen between 42 days to 2-3 yrs after vaccination. It's typically a mild disease, with maculopapular rash and <50 skin lesions.

Risk factors for vaccine failure are: age <15 mo, increasing time since vaccination, administration of steroids within 3 mo of break through disease, administering vaccine within 28 days of MMR vaccine but not on same day.

**Dose:** 0.5 ml given subcutaneously.

The vaccine is available as a lyophilized powder. It has to be used within 30mins of reconstitution.

**Adverse Effects:** Local reactions such as pain, redness and swelling at vaccination site.

Fever and Varicella like rash seen in 5% of vaccinees.

Herpes zoster can occur due to vaccine or wild virus.

**RECOMMENDATIONS:**

The vaccine should be offered to all healthy children, with no prior history of chicken pox disease.

Ideal age for 1st dose is 15 mo onwards.

IAP now recommends two doses of Varicella vaccine for children of all age groups.

1st dose at 15 months and the 2nd dose at 4-6 years.

IAP now recommends two doses of Varicella vaccine for children of all age groups.
1st dose at 15 months and the 2nd dose at 4 - 6 years.
Vaccine specially recommended in certain high risk groups like:

- Children with humoral immunodeficiency
- Children with HIV infection with good CD4 count
- Leukemia in remission, and off chemotherapy for 3 mo
- Children on long term salicylates, salicylates stopped for 6 weeks after
- Children likely to be on long term steroids
- Adolescents who have not had Varicella in past if they are leaving for residential school
- Children with chronic heart or lung disease

**Catch up vaccine:**

- <1 yrs 2 doses 3 mo apart
- >13 yrs 2 doses 1-2 mo apart

**Contraindications:**

Vaccine is contraindicated during pregnancy, and if administered to an adult female, pregnancy is avoided for next 3 months.

Vaccine is not given to those who have clinically manifest HIV infection.

**Vaccines available in India:**

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varicella</td>
<td>Varilrix</td>
<td>GSK Biologicals</td>
</tr>
<tr>
<td></td>
<td>Okavax</td>
<td>Sanofi Pasteur</td>
</tr>
</tbody>
</table>

**RABIES VACCINE**

Rabies is endemic in all states of India, except Andaman, Nicobar and Lakshadweep Island.

20,000 people die of Rabies in India every year which is nearly 50% of the world disease burden.

Rabies is transmitted by bites, scratches, licks on mucous membrane, or non intact skin by a rabid animal. 95% of rabid animal bites are due to dogs.

It can infrequently occur due to organ transplant, including corneal transplantation from a rabies victim.

Incubation period may range from 5 days to 6 years.

The disease is uniformly fatal.

**VACCINE:**

All currently available vaccines are modern tissue culture vaccines

They are available as lyophilized powder with sterile diluents.
Efficacy:
All have equal efficacy and any one can be used
99% seroconversion rates among vaccinees following pre and post exposure vaccination.

Dose:
Vaccine can be given Intramuscular or Intradermal. Intradermal route is preferred when large a number of people are to be vaccinated as in a government vaccination centre.
Intramuscular dose is 0.5 ml or 1.0 ml in the anterolateral thigh, or deltoid in old children.
The intradermal dose is 0.1 ml injected in the upper deltoid region.

Adverse effects:
All vaccines are safe, and may cause adverse effects like local pain, swelling and redness and less commonly fever, headache, giddiness and gastrointestinal side effects.

RABIES IMMUNE GLOBULIN:
Two kinds of Rabies Immune Globulin available which contain specific antibodies to neutralize the rabies virus and provide passive immunity.
1. Human Rabies Immune globulin. HRIG – dose 200IU/kg Maximum 1500 IU.
2. Equine Rabies Immunoglobulin. ERIG - dose 40 v /kg Maxim. 3000 IU.
HRIG preferred, but when not available or unaffordable ERIG can be given.
The new formulations of ERIG are potent, safe, hugely purified and less expensive, but carry a small risk of anaphylaxis. Skin testing prior to giving ERIG is not mandatory.

Proper wound care, Post exposure Prophylaxis and RIG is effective in preventing 100% of Rabies cases.
RIG is given as soon as possible. It is effective up to seven days after the bite.
But in selected cases, when indicated may be given whenever patient presents several days, months or years after bite, as Rabies has a long incubation period and the window of opportunity for prevention remains.

RIG is indicated in category 3 wounds. Half the indicated dose is to be infiltrated thoroughly in and around the wound. The other half is injected IM on outer deltoid or anterolateral thigh away from vaccination site.
If the RIG quantity is small, fill with equal amount of normal saline and infiltrate.

RECOMMENDATION:
Pre exposure Prophylaxis recommended for:
1. Lab personal working with rabies biologics
2. Veterinarians, paramedical staff of vets, dog catches, Zoo keepers, Forest officer staff
3. Postmen, Policemen, Couriers personnel.
4. Travelers to rabies endemic countries who intend to backpack to forest areas
5. Most Indian children.
   • Any vaccine brand can be used.
   • Doses on 0, 7, 28 days.
   • 0.5 ml or 1.0 ml IM.
   • Booster after 5 years.
   • If exposed to bite at any point of time after completion of primary doses, 2 doses are given on day 0 & 3.

**Post exposure prophylaxis**
A medical urgency, when there has been significant contact with any warm blooded animal.

Warm blooded animals include dog, cat, cows, buffaloes, sheep, goat, pig, donkey, horses, camels, foxes, jackals, monkey, bears and mongoose. Bats are included in some countries.

They do not include rats, mice, hamsters and gerbils.

Post exposure prophylaxis is started immediately. Pregnancy, infancy, lactation are no contraindication.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Touching or feeding of animals, lick on intact skin</td>
<td>None, if reliable case history is available</td>
</tr>
<tr>
<td>2.</td>
<td>Nibbling of uncovered skin, minor bites or scratches</td>
<td>Administer vaccine</td>
</tr>
<tr>
<td>3.</td>
<td>Single or multiple transdermal bites or scratches, contamination of mucous membrane with saliva (licks), or exposure to bats</td>
<td>Administer RIG and vaccine immediately</td>
</tr>
</tbody>
</table>

**Management of patient after animal bite:**
- First clean the wound with soap and water for 10 minutes.
- Irrigate wound with virucidal agent like 70% alcohol or Povidone Iodine
- Tetanus Toxoid vaccine and antibiotics should be given when indicated
- Infiltrate RIG around the wound in category III bites.
- Suturing of wound is avoided. If indicated for hemostasis, do so after infiltration with RIG
• All category II and III bites merit rabies vaccination.
• Rabies vaccine is injected into anterolateral thigh or deltoid, never in the gluteal region.
• Dose is same for all brands- 1 ml Intramuscular
• Schedule: days 0, 3, 7, 14 and 30, (Day 90 optional for those with severe debility or immunosuppression)
• If RIG not available 2 doses of vaccine given on day 0 (not a substitute for RIG), followed by rest of schedule
• If exposed to bite at any point of time after completion of primary doses, 2 doses are given on day 0 & 3.

Vaccines available in India:

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabies</td>
<td>Rabivac (HDCV) Rabipur (PCEC) Abhayrab (PVRV) Verorab Vaxirab (PDEV)</td>
<td>Serum Institute of India Novartis Abhay Sanofi Pasteur</td>
</tr>
</tbody>
</table>

Rabies Immunoglobulin available as:
KamRAB Human Rabies Immune Globulin marketed by Kamada Pharmaceuticals.
Equine Rabies Immune Globulin available as 1500 units in 5 ml marketed by Bharat Serum & Vaccines.

INFLUENZA VACCINES
There are three types of Influenza viruses A, B, C
The Influenza type A virus causes moderate to severe illness in all age groups
The illness caused by type B is usually a milder disease in humans and affects children
Type C rarely causes disease in humans
The Influenza vaccine has to be changed periodically as the Influenza virus undergoes antigenic shifts due to mutations
The WHO reviews data from Labs world over, including from India and recommends the vaccine composition

VACCINES:
The vaccines available in India are:
• Inactivated Influenza vaccine.
• Live attenuated Monovalent vaccine.
Inactivated Influenza vaccine:
The vaccines available in India are trivalent inactivated vaccines which contain two Influenza A strains and one Influenza B strain.
It can be used for infants 6 months and older.
It is injected Intramuscular.
It provides 70-90% efficacy against viruses which have good antigenic match to circulating viruses.
It may cause mild local pain, fever and rash.
It is to be avoided by patients with GBS in the past.

Monovalent live attenuated vaccine:
This vaccine was available during the H1N1 epidemic and is a Human Live Attenuated vaccine. It is administered by intranasal spray.
Each single dose of 0.5 ml is given divided in two doses in each nostril with the supplied syringe and vial adapter.
Contraindicated in any chronic disease, pregnant women and children less than 2 yrs.
It is also avoided in children <5 yrs of age with reactive airway disease or egg allergy.
It can cause mild fever, runny nose and sore throat.

RECOMMENDATIONS:
USA has recommended universal influenza vaccination for the entire population.
IAP recommends use of Influenza vaccine in children with risk factors of severe disease.
However, IAP recommends liberal use of vaccine during epidemics.

At risk individuals:
- Congenital or acquired immunodeficiency
- Chronic cardiac, pulmonary, hematological, renal, hepatic disease or diabetes mellitus.
- Long term aspirin therapy
- Neurologic disease with respiratory compromise
- Asthma requiring steroids.

Trivalent killed vaccine is administered during routine vaccination and live monovalent vaccine during pandemic situations.
Vaccine is given during Influenza peak in June – September. It should be given as soon as new vaccine is released in market or when presented to health care worker.
Dose and schedule:

<table>
<thead>
<tr>
<th>Age</th>
<th>6-35 mo</th>
<th>3-8 yrs</th>
<th>&gt;9 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose</td>
<td>0.25 ml</td>
<td>0.5 ml</td>
<td>0.5 ml</td>
</tr>
<tr>
<td>No. of doses</td>
<td>1 or 2*</td>
<td>1 or 2*</td>
<td>1</td>
</tr>
</tbody>
</table>

*For children who have not been previously vaccinated a second dose should be given after an interval of at least 4 weeks.

Revaccination recommended with single annual dose irrespective of age and vaccine composition.

Vaccines available in India

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trivalent inactivated influenza</td>
<td>Vaxigrip (0.25 &amp; 0.5 ml) Agripal Influvac Fluarix</td>
<td>Sanofi Pasteur Chiron Panacea Solvay GSK Biologicals</td>
</tr>
</tbody>
</table>

HUMAN PAPILLOMA VIRUS VACCINES

Prevalence of HPV infection in general population of India is 7.9%.

Worldwide cervical cancer is the second most common cause of cancer death among women.

HPV infection is responsible for cervical cancer in women of age group 40-50 yrs and affects women of all socio-economic strata. It is responsible for ano-genital warts in men as well.

HPV vaccine is effective in preventing cervical cancer in studies conducted.

VACCINES:

Two vaccines available

- Quadrivalent with serotypes 16, 18, 6, 11
- Bivalent with serotypes 16, 18

Manufactured by recombinant DNA technique of the major capsid protein of HPV

Induces protection by involving both cellular and neutralizing antibodies

Both serotypes 16, 18 responsible for cervical cancers and serotypes 6, 11 for ano-genital warts

Quadrivalent Vaccine:

The vaccine includes serotypes 16, 18, 6, 11
Three doses 0, 2, 6 months shows 99% efficacy, with persistent protection and good immune memory.
Also shows additional efficacy against vaccine type related genital warts

**Bivalent Vaccine:**
This vaccine is a mixture of HPV serotypes 16, 18 with an adjuvant.
Three doses 0, 1, 6 months show good efficacy and sustained immunity.
Both vaccines equally efficacious and safe for preventing cervical cancers.

**Dose:** 0.5 ml intramuscularly into the deltoid.

**Adverse effects:** No serious adverse effects seen, local reactions with pain, swelling and erythema. Systemic effects like fever may also be seen.

**RECOMMENDATIONS:**
IAP recommends offering HPV to all girls in schedule as given:

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadrivalent</td>
<td>0, 2, 6</td>
</tr>
<tr>
<td>Bivalent</td>
<td>0, 1, 6</td>
</tr>
</tbody>
</table>

**Preferable age group for vaccination 10-12 yrs.** Catch up vaccination till 45 years of age.

Can be given with other vaccines at that age like Tdap and HBV.
Should be introduced as a cervical cancer preventing vaccine and not a vaccine against STD.
Not a replacement for screening.
Can be given to immunocompromised children.
Cost is the factor which prevents it being included in the National Immunisation Schedule.
Contraindicated when there is hypersensitivity to vaccine or its components.

**Vaccines available in India:**

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MARKETED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPV Quadrivalent vaccine</td>
<td>Gardasil</td>
<td>MSD</td>
</tr>
<tr>
<td>HPV Bivalent vaccine</td>
<td>Cervarix</td>
<td>GSK Biologicals</td>
</tr>
</tbody>
</table>
CHOLERA VACCINE

Cholera is endemic in certain parts of India. Although cases have been reported from all states, maximum burden is West Bengal, Orissa, Chhattisgarh, Assam, Andaman and Nicobar Islands.

The incidence in the slums of Kolkata is 1.6/1000 person years with highest incidence below the age of 2 yrs 8.6/1000 person years.

VACCINE:

The vaccine is available in India as a bivalent oral dose based on serogroups 01 and 0139.

The vaccine is inexpensive and has no cold chain requirements.

**Efficacy:** The vaccine has 50-67% efficacy up to 2 yrs after vaccination.

**Dose:** It is administered orally as 2 doses 2 weeks apart with a booster every 2 years.

It can be used for children above 1 year of age; protection starts 2 weeks after receipt of 2nd dose.

**Adverse effects:** No adverse effects.

**RECOMMENDATION:**

Along with improvement in sanitation and water supply, vaccination is used as disease control in endemic areas and in outbreaks.

Recommended for all children above 1 yr of age in endemic states like West Bengal and Orissa.

To be used by travelers to highly endemic areas or circumstances like Kumbh Mela and other pilgrimages.

To be used during Cholera outbreak.

**Vaccines available in India**

Shanchol marketed by Shanta Biotech.

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MENINGOCOCCAL VACCINES

Incidence of meningococcal disease in India is less than that due to Streptococcal infections and H. Influenza B. Hence routine vaccination with meningococcal vaccine is not considered a priority.

There have been epidemic outbreaks at 20 yrs periodicity in New Delhi, Mumbai, Kolkata and North Eastern States.

The common serotypes isolated from India during epidemics were Group A and C.
VACCINES:
The available vaccines in India are the Meningococcal Polysaccharide vaccine:
They are:
- Quadrivalent vaccine
- Bivalent vaccine

Quadrivalent vaccine contains serotypes A+C+Y+W135
Bivalent vaccine contains serotypes A+C

Efficacy: Effectiveness of the vaccine is 88% -98%. It provides good herd immunity.

Dose: 0.5 ml is administered IM/SC

Adverse effects: Minor, local effects like pain and swelling

RECOMMENDATIONS:
In USA the meningococcal vaccine is routinely administered to all children between the ages 10-11 years, with a booster administered at 16 years.

IAP recommends this vaccine for children only in special circumstances like:
- Students going abroad to US or UK
- Lab personnel handling N. Meningitis cultures
- Travelers to the HAJ, or African countries
- During an outbreak of meningitis

In these situations a single dose of 0.5 ml is administered IM/SC

- Terminal complement component deficiency
- Functional or anatomical asplenia
- HIV infection

In the above three situations 2 doses are administered 8 weeks apart, with a booster every 5 years.

Vaccines available in India

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>BRANDS</th>
<th>MANUFACTURER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadrivalent vaccine</td>
<td>Quadrimeningo</td>
<td>Biomed</td>
</tr>
<tr>
<td></td>
<td>Mencivax</td>
<td>GSK</td>
</tr>
<tr>
<td>Bivalent vaccine</td>
<td>Biomeningo</td>
<td>Biomed</td>
</tr>
</tbody>
</table>
JAPANESE ENCEPHALITIS (JE) VACCINE

Japanese encephalitis is the leading viral cause of acute encephalitis in Asia. 70% of those who develop illness either die or survive with a long term neurological disability.

Countries like Japan, Korea, Taiwan, Vietnam, Thailand and China routinely immunise children against Japanese Encephalitis. India has 2000-3000 cases every year with 500-600 deaths.

Highly endemic states include W. Bengal, Bihar, Karnataka, Tamil Nadu, Andhra Pradesh, Assam, U.P., Manipur and Goa.

JE vaccination remains the single most important control measure in JE endemic states of India.

VACCINE:

Cell culture derived live vaccine is available in India.

It is a live attenuated vaccine.

Safe and efficacious when given with measles vaccine at 9 mo.

The dose is 0.5 ml SC for all ages 1-15 yrs.

Age of vaccination 9 mo onwards.

No serious adverse effects noted.

RECOMMENDATIONS:

IAP recommends the vaccine for routine universal immunisation in JE endemic states in India.

WHOM ELSE SHOULD GET JE VACCINE?

- Visitors who plan to spend at least a month in areas where JE occurs.
- Visitors who spend less than a month in JE areas but plan to visit rural areas there or engage in outdoor activities.
- Travelers to areas with an outbreak of JE.
- Lab workers at risk for JE virus exposure.

YELLOW FEVER VACCINE

Mosquito borne illness, confined to sub-Saharan Africa, and central, and South America.

The illness varies in severity from mild influenza like illness to severe hepatitis and
hemorrhagic fever.
Yellow Fever does not exist in India

**VACCINES:**
Live attenuated.
Available only in some government centers.
**Dose:** 0.5ml subcutaneous. Safe with other vaccines
**Immunogenicity** and efficacy >90%
Protection lasts 10 years.
**Adverse effects:** Local pain and erythema. Rare serious neurologic adverse effects are seen.

**RECOMMENDATIONS:**
**Mandatory for all travelers to yellow fever endemic zones**
Certificate issued to international travelers which is valid from 10th day after vaccination upto 10 years.
It is administered to all above 6 months of age, entering the country after travelling to Yellow Fever endemic zones.

**YELLOW FEVER VACCINE IN MUMBAI GIVEN AT:**

**AIRPORT**
Chhatrapati Shivaji International Airport, New Building,
Besides Ambassador Flight Kitchen,
Airport Approach Road,
Andheri East, Mumbai 400099.
10-11.30am for inquiries.
Please call and go
Phones: 022-2681200/ 022-28392429.
Website: www.mohfw.nic.in

**BALLARD ESTATE**
Seamans Clinic,
Navbhavan Building, Ground Floor,
Opposite GPO, Vaju Kotak Marg,
Ballard Estate, Mumbai- 400038
Vaccination Timings 2.30pm.
For Information call at 4pm.
Vaccination to only Merchant Navy Employees
Phone: 022-22612256
GENERAL GUIDELINES FOR IMMUNISATION:

STERILE TECHNIQUE:
Hand wash with soap and water or with alcohol based antiseptic prior to vaccine filling and administering
Needles used should be preferably disposable
Separate syringe and needle for each vaccination
Could change needle between drawing from vial and injecting, however not mandatory
If multidose vials used swab septum before withdrawing vaccine

MAINTAINING COLD CHAIN:
Maintaining correct temperature is the most important factor in maintaining the potency of vaccines.
All vaccines currently available are safe at 2-8°C and at this temperature have a shelf life of 24 months
Vaccines should be transported only in cold boxes or vaccine carriers. Vacuum flasks should never be used for this purpose

SAFETY:
Mixing of different brands not to be done unless recommended by manufacturer.
The gluteal region not used for vaccination for danger of sciatic nerve injury and reduced efficacy.
When used at recommended sites, pulling back of the syringe to check for blood is not recommended, as at these sites there are no major blood vessels.
Withdraw the needle a few seconds after injecting to prevent backflow of vaccine into the needle track
Keep injection site firmly pressed, should not be rubbed.

SITE AND ROUTE:
For young infants the ideal site is the anterolateral thigh for intramuscular injections, in older children and adolescents the deltoid muscle can also be used.
Subcutaneous injections are best injected into anterolateral thigh in young infants and outer triceps in older children
Intradermal injections are best injected into the left deltoid
If multiple injections are to be administered at the same time and on the same limb, the injections should be separated by an inch or more if possible. Anterolateral thigh is the best site for this.

Separate anatomic sites should be used when vaccine and immunoglobulin are administered simultaneously. E.g. HepB vaccine and HepB immunoglobulin should be injected separately on both the thighs.

**PAIN:**
Topical and oral analgesics, cooling of injection site can help relieve pain associated with vaccine. Acetaminophen @ 15mg/kg/dose helps reduce fever and discomfort.

Pretreatment with topical lidocaine-prilocaine can cause superficial analgesia and decrease injection pain

**MEDICO-LEGAL ASPECTS:**
The doctor should explain in detail the anticipated side effects of the vaccine in detail to the parents before administering the vaccine.
The child should be observed for at least 15 mins in the clinic after vaccination

The doctor should have minimum resuscitative equipment at the clinic for handling any emergencies arising out of vaccination adverse effects.

**VACCINATION IN SPECIAL CIRCUMSTANCES:**
It is important to follow certain guidelines to maximize benefits and minimize cost and risks associated with vaccination.

**SIMULTANEOUS ADMINISTRATION OF VACCINES:**
The rate of adverse reactions seen with the combination is also similar to that given separately.

Most childhood vaccines can safely and effectively be administered simultaneously.

> Individual vaccines should not be mixed in the same syringe unless advocated by the manufacturer

This improves compliance and results in improvement of immunisation rates.

Individual vaccines should not be mixed in the same syringe unless advocated by the manufacturer.

**SPACING OF VACCINES AND ANTIBODY CONTAINING PRODUCTS:**
Inactivated vaccines can be safely administered simultaneously at a different site and at any time with an antibody containing product with no loss of efficacy (e.g. HepB vaccine and HepB immunoglobulin).

Live vaccines including **MMR** and **Varicella** should be avoided for at least 3 months after antibody containing product. And after administering live vaccines, antibody containing product should be avoided for 2 weeks.
If vaccination outside this prescribed period has occurred, serologic response should be checked and **revaccination** done if indicated.

**OPV** may be given at any time in relation to antibody containing products.

**Rotavirus vaccine** should be avoided for 5 weeks after giving antibody containing products. However, if this results in vaccine being postponed beyond its recommended age of administration, then the vaccine may be given.

**SPACING OF DIFFERENT VACCINES:**

An **inactive vaccine** can be administered at any time with, before or after a live vaccine or other inactive vaccines.

**Live vaccines like MMR and Varicella** should be administered on the same day or after an interval of at least 4 weeks. These vaccines also do not interfere with OPV.

**Live oral vaccines** can be given at any time before or after live injected vaccines.

**SPACING MULTIPLE DOSES OF SAME VACCINES:**

Doses of a vaccine should be given at the recommended interval, given earlier than that could reduce effectiveness.

Too frequent administration of vaccines such as tetanus toxoid can result in increased rates of reactions.

**INTERCHANGEABILITY OF VACCINES:**

When the same vaccine cannot be used to complete an immunisation series, similar vaccines produced by different manufacturers or same manufacturer in different countries can be considered acceptable.

There is sufficient data that brands of Hib, HepB and HepA may be safely interchanged with no compromise in efficacy.

Robust data for efficacy of vaccination with different brands of DTaP is lacking, however if same brand is no longer available any brand may be used.

**LAPPED IMMUNISATIONS:**

There is no need to restart a vaccine series regardless of the time that has elapsed between individual vaccine doses due to immune memory.

Immunisations should be given at next visit as if the usual interval had elapsed and the schedule completed at next opportunity.

**CHILDREN WITH UNKNOWN OR UNCERTAIN IMMUNISATION STATUS:**

In case of unknown immunisation status, the child should be considered unimmunized and vaccinated accordingly.
SITE AND ROUTE OF VACCINATION:

<table>
<thead>
<tr>
<th>ORAL</th>
<th>IM</th>
<th>SC</th>
<th>IM/SC</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPV,</td>
<td>DTwP, DTaP,</td>
<td>Measles,</td>
<td>Pneumococcal,</td>
<td>BCG, sometimes</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>HepB, HepA,</td>
<td>MMR,</td>
<td>IPV</td>
<td>Rabies</td>
</tr>
<tr>
<td>Vaccine,</td>
<td>Typhoid, HPV,</td>
<td>Varicella,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholera</td>
<td>Meningococcal</td>
<td>JE, Yellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vaccine</td>
<td>conjugate vaccine</td>
<td>Fever</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IMMUNISATION OF CHILDREN WITH BLEEDING DISORDERS OR THOSE RECEIVING ANTICOAGULANTS:

Use subcutaneous route in vaccines like IPV and Pneumococcal Vaccine.

Adjuvated vaccines need to be given only IM; they should be scheduled after factor replacement, preferably.

Needles used for injection should be less than 23 gauge, and firm pressure should be applied for 5mins after injection. Injection site should not rubbed.
### IMMUNISATION SCHEDULES:
**EXPANDED PROGRAMME OF IMMUNISATION (Government of India):**

<table>
<thead>
<tr>
<th>AGE</th>
<th>VACCINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td>BCG, OPV</td>
</tr>
<tr>
<td>6 weeks</td>
<td>DTwp, OPV, HepB, Hib*, (BCG if not given at birth)</td>
</tr>
<tr>
<td>10 weeks</td>
<td>DTwp, OPV, HepB, Hib</td>
</tr>
<tr>
<td>14 weeks</td>
<td>DTwp, OPV, HepB, Hib</td>
</tr>
<tr>
<td>9-12 mo</td>
<td>Measles</td>
</tr>
<tr>
<td>16-24 mo</td>
<td>DTwp, OPV, MMR*</td>
</tr>
<tr>
<td>5-6 yrs</td>
<td>DTwp**, OPV</td>
</tr>
<tr>
<td>10 yrs</td>
<td>TT***</td>
</tr>
<tr>
<td>16 yrs</td>
<td>TT***</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>TT1 early in pregnancy, TT2 1 month later, TT booster if vaccinated in past 3 yr</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>9, 18, 24, 36 mo</td>
</tr>
</tbody>
</table>

* MMR and Hib available in some states only  ** DTwp second dose after 1 mo if no clear history of previous vaccination  ***2nd dose of TT after 1 mo if no clear history of previous immunisation with TT, DT, DTwp

### IAP RECOMMENDED VACCINATION SCHEDULE

<table>
<thead>
<tr>
<th>AGE</th>
<th>VACCINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIRTH</td>
<td>BCG, OPV0, HepB1</td>
</tr>
<tr>
<td>6 weeks</td>
<td>DTwp1 /DTap1, OPV1*/ OPV1+IPV1</td>
</tr>
<tr>
<td></td>
<td>HepB2, Hib1, Rotavirus1^, PCV1</td>
</tr>
<tr>
<td>10 weeks</td>
<td>DTwp2 /DTap2, OPV2 / OPV+IPV2</td>
</tr>
<tr>
<td></td>
<td>Hib2, Rotavirus2, PCV2</td>
</tr>
<tr>
<td>14 weeks</td>
<td>DTwp3 /DTap3, OPV3 / OPV+IPV3</td>
</tr>
<tr>
<td></td>
<td>Hib3, Rotavirus3, PCV3</td>
</tr>
<tr>
<td></td>
<td>HepB3**</td>
</tr>
<tr>
<td>9 mo</td>
<td>Measles</td>
</tr>
<tr>
<td>12 mo</td>
<td>HepA1</td>
</tr>
<tr>
<td>15 mo</td>
<td>MMR1, Varicella1, PCV B</td>
</tr>
<tr>
<td>16-18mo</td>
<td>DTwp B1 /DTap B1, OPV4 / OPV+IPV B1, Hib B</td>
</tr>
<tr>
<td>18 mo</td>
<td>HepA2</td>
</tr>
<tr>
<td>2 yrs</td>
<td>Typhoid1****</td>
</tr>
<tr>
<td>5 yrs</td>
<td>DTwp B2 /DTap B2, OPV 5, MMR 2^*, Typhoid2, Varicella2^</td>
</tr>
<tr>
<td>10-12 yrs</td>
<td>Tdap /Td****, HPV^**</td>
</tr>
</tbody>
</table>

*OPV alone if IPV cannot be given  ^Rotavirus vaccine 2 or 3 doses depend on the brand, at 4-6 weeks interval  **HepB 3rd dose can be given at 6mo  ^The second dose of MMR can be given at any time after 4-8 weeks  ^Varicella 2nd dose can be given any time after 3mo of 1st dose  **Typhoid revaccination every 3 yrs  ****Tdap preferred to Td, followed by repeat Td every 10 yrs  ^ Only females, three doses, 0, for 2mo, 6mo, depending on brand used
### SCHEDULE FOR VACCINATION OF UNIMMUNISED CHILD:

<table>
<thead>
<tr>
<th>VISIT</th>
<th>SUGGESTED SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>DTwP1 / DTaP1 (Tdap if 7 yrs or more)</td>
</tr>
<tr>
<td></td>
<td>OPV1 / IPV1 (only if less than 5yrs)</td>
</tr>
<tr>
<td></td>
<td>Hib 1 (only if less than 5 yrs)</td>
</tr>
<tr>
<td></td>
<td>HepB 1, Measles (MMR if&gt;12mo)</td>
</tr>
<tr>
<td>Second visit</td>
<td>BCG (only if less than 5yrs)</td>
</tr>
<tr>
<td>(1mo after 1st visit)</td>
<td>DTwP2 / DTaP2 (Td if 7 yrs or more)</td>
</tr>
<tr>
<td></td>
<td>HepB 2</td>
</tr>
<tr>
<td></td>
<td>Hib 2 (if less than 15 mths)</td>
</tr>
<tr>
<td>Third visit</td>
<td>OPV3 / IPV2</td>
</tr>
<tr>
<td>(1 mo after 2nd visit)</td>
<td>MMR (if &gt;12 mo)</td>
</tr>
<tr>
<td></td>
<td>Typhoid (if&gt;2yrs)</td>
</tr>
<tr>
<td>Fourth visit</td>
<td>DTwP3 / DtaP3 (Td if 7yrs or more)</td>
</tr>
<tr>
<td>(6 mo after first visit)</td>
<td>OPV4 / IPVB1</td>
</tr>
<tr>
<td></td>
<td>HepB3</td>
</tr>
</tbody>
</table>

### SCHEDULE FOR ADOLESCENT IMMUNISATION:

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ROUTINE VACCINATIONS</strong></td>
<td></td>
</tr>
<tr>
<td>Tdap / Td</td>
<td>10 yrs</td>
</tr>
<tr>
<td>HPV</td>
<td>10- 12 yrs</td>
</tr>
<tr>
<td><strong>CATCH UP VACCINATIONS</strong></td>
<td></td>
</tr>
<tr>
<td>MMR</td>
<td>2 doses at 4-8 weeks</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>3 doses at 0, 1, 6 mo</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>2 doses at 0, 6 mo (prior check for antibodies may be cost effective)</td>
</tr>
<tr>
<td>Typhoid</td>
<td>1 dose every 3 yrs</td>
</tr>
<tr>
<td>Varicella</td>
<td>2 doses at 4-8 weeks</td>
</tr>
</tbody>
</table>

**VACCINES FOR ADOLESCENT TRAVELERS**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningococcal Vaccine</td>
<td>USA, UK, Endemic areas, Saudi, Africa, 2 doses 4-8 weeks apart</td>
</tr>
<tr>
<td>Yellow Fever</td>
<td>Yellow fever endemic zones, 10 days before travel</td>
</tr>
<tr>
<td>Oral Cholera Vaccine</td>
<td>Endemic areas 1 week apart areas or in outbreak, 2 doses 1 week apart</td>
</tr>
<tr>
<td>Japanese Encephalitis</td>
<td>Endemic areas for JE, single dose up to 15 yrs</td>
</tr>
<tr>
<td>Rabies Vaccine</td>
<td>Adolescents going trekking, 0, 7, 28 days schedule</td>
</tr>
</tbody>
</table>
SCHEDULE RECOMMENDED BY AAP:

Figure 1: Recommended immunization schedule for persons aged 0 through 6 years - United States, 2012

This schedule includes recommendations in effect as of December 23, 2011. 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. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement for detailed recommendations, available online at http://www.cdc.gov/vaccines/pubs/acip-list.htm. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS) online (http://www.vaers.hhs.gov) or by telephone (800-822-7967).

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RESOURCES FOR IMMUNISATION INFORMATION (INTERNET):

<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>WEB ADDRESS</th>
<th>SALIENT CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Library of Medicine</td>
<td><a href="http://www.pubmed.com">www.pubmed.com</a></td>
<td>Abstracts and full texts of vaccine related articles published in indexed journals</td>
</tr>
<tr>
<td>IAPCOI</td>
<td><a href="http://www.iapcoi.com">www.iapcoi.com</a></td>
<td>Electronic copy of guidebook, Q &amp; A facility</td>
</tr>
<tr>
<td>WHO</td>
<td><a href="http://www.who.int/immunization/en/index/html">www.who.int/immunization/en/index/html</a></td>
<td>WHO position papers</td>
</tr>
<tr>
<td>Centers for Disease Control (CDC)</td>
<td><a href="http://www.cdc.gov/vaccines/">www.cdc.gov/vaccines/</a></td>
<td>ACIP vaccine recommendations, travel immunization</td>
</tr>
</tbody>
</table>

Books:
IAP Guidebook on Immunization by Indian Academy of Pediatrics; ed. Dr. Vijay Yewale, Dr. Panna Choudhary, Dr. Naveen Thacker, Red Book;
Report of the committee on Infectious Diseases by American Academy of Pediatrics

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