

Immunization is one of the most beneficial and cost-effective disease prevention measures. Successes of immunization include worldwide eradication of smallpox, control of poliomyelitis with hopes of eradication, and elimination of measles and rubella. Although childhood immunization programs have been very successful, adult immunization is a neglected and underpublicized issue in India. Adults too need vaccinations to boost efficacy of childhood vaccines, aid immunity for newer comorbidities and afford protection when immunity is suppressed due to acquired illnesses. The CDC has come out with recommendations for adult vaccines¹.

INFLUENZA VACCINATION

Trivalent inactivated influenza vaccine (TIV) and live attenuated influenza vaccine (LAIV) are available for use in adults. Vaccination is indicated for all persons over the age of six months. WHO recommends annual vaccination for (Figure 1):

- pregnant women at any stage of pregnancy
- children aged 6 months to 5 years
- elderly individuals (≥65 years of age)
- individuals with chronic medical conditions (disorders of the cardiovascular or pulmonary systems, including asthma; chronic metabolic diseases, including diabetes mellitus; renal or hepatic dysfunction, hemoglobinopathies, or the immunocompromised
- health-care workers


The TIV is administered by an annual, single intramuscular dose of 0.5 ml. The LAIV is administered by the intranasal route. The vaccine is contraindicated for persons who had severe reaction to the initial dose and for persons having egg allergy. From this year, a quadrivalent vaccine having two strains of influenza A and two of influenza B is available.


Recommended Adult Immunization Schedule—United States - 2016


Note: These recommendations must be read with the footnotes that follow containing number of doses, intervals between doses, and other important information.

VACCINE ▼	AGE GROUP ►	19-21 years	22-26 years	27-49 years	50-59 years	60-64 years	≥ 65 years
Influenza ^{2,2}		1 dose annually					
Tetanus, diphtheria, pertussis (Td/Tdap) ^{3,3}		Substitute Tdap for Td once, then Td booster every 10 yrs					
Varicella ^{4,4}		2 doses					
Human papillomavirus (HPV) Female ^{5,5}		3 doses					
Human papillomavirus (HPV) Male ^{5,5}		3 doses					
Zoster ^{6,6}						1 dose	
Measles, mumps, rubella (MMR) ^{7,7}		1 or 2 doses depending on indication					
Pneumococcal 13-valent conjugate (PCV13) ^{8,8}		1 dose					
Pneumococcal 23-valent polysaccharide (PPSV23) ^{8,8}		1 or 2 doses depending on indication					
Hepatitis A ^{9,9}		2 or 3 doses depending on vaccine					
Hepatitis B ^{10,10}		3 doses					
Meningococcal 4-valent conjugate (MenACWY) or polysaccharide (MPSV4) ^{11,11}		1 or more doses depending on indication					
Meningococcal B (MenB) ¹¹		2 or 3 doses depending on vaccine					
<i>Haemophilus influenzae</i> type b (Hib) ^{12,12}		1 or 3 doses depending on indication					

*Covered by the Vaccine Injury Compensation Program

 Recommended for all persons who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection; zoster vaccine is recommended regardless of past episode of zoster

 Recommended for persons with a risk factor (medical, occupational, lifestyle, or other indication)

 No recommendation

Report all clinically significant postvaccination reactions to the Vaccine Adverse Event Reporting System (VAERS). Reporting forms and instructions on filing a VAERS report are available at www.vaers.hhs.gov or by telephone, 800-822-7967.

Information on how to file a Vaccine Injury Compensation Program claim is available at www.hrsa.gov/vaccinecompensation or by telephone, 800-338-2382. To file a claim for vaccine injury, contact the U.S. Court of Federal Claims, 717 Madison Place, N.W., Washington, D.C. 20005; telephone, 202-357-6400.

Additional information about the vaccines in this schedule, extent of available data, and contraindications for vaccination is also available at www.cdc.gov/vaccines or from the CDC-INFO Contact Center at 800-CDC-INFO (800-232-4636) in English and Spanish, 8:00 a.m. - 8:00 p.m. Eastern Time, Monday - Friday, excluding holidays.

Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

The recommendations in this schedule were approved by the Centers for Disease Control and Prevention's (CDC) Advisory Committee on Immunization Practices (ACIP), the American Academy of Family Physicians (AAFP), the American College of Physicians (ACP), the American College of Obstetricians and Gynecologists (ACOG) and the American College of Nurse-Midwives (ACNM).

Fig. 1: Recommended Immunization schedule for adults aged 19 years or older by vaccine and age group1

DIPHTHERIA, TETANUS, (TD) AND ACCELLULAR PERTUSSIS (TDAP) VACCINE

Adults who have completed their primary vaccination series should receive a Td vaccine every 10 years till the age of 65 years; one dose of Tdap vaccine may be administered in place of Td vaccine at any time².

MEASLES MUMPS AND RUBELLA

All adults should receive two doses of MMR vaccine or one dose of measles followed by a dose of MMR, administered at least 4 weeks after the first dose. Since it is a live vaccine, it is contraindicated in pregnant women and the immunosuppressed.

VARICELLA VACCINE

All adults without evidence of immunity to varicella or previous infection should receive 2 doses of single-antigen varicella vaccine or the second dose if they have received only one dose. Minimum interval between first and the second doses should be 4 weeks. Varicella vaccine is contraindicated in pregnant women and those with a compromised immune system.

HERPES ZOSTER VACCINE

Herpes zoster vaccine (Zostavax) is a lyophilized preparation of the Oka strain of live, attenuated varicella zoster virus (VZV). Each 0.65 ml dose contains a minimum of 19,400 plaque-forming units [PFU]. A single dose of zoster vaccine is recommended for adults aged 60 years and older regardless of whether they report a prior episode of herpes zoster.

HUMAN PAPILLOMAVIRUS (HPV) VACCINE:

Two HPV vaccines are commercially available. These include a quadrivalent (HPV4) vaccine containing the HPV virus L1 protein like particles of HPV 6, 11, 16, and 18 and a bivalent (HPV2) vaccine containing L1 VLPs of HPV 16, 18. HPV vaccination is recommended at age 11 or 12 years with catch up vaccination at ages 13 through 26 years. Ideally, vaccine should be administered before potential exposure to HPV through sexual activity. A complete series for HPV4 3 doses are administered as 0.5 ml intramuscular injection at 0, 2, and 6 months.

PNEUMOCOCCAL VACCINATION

There are two types of pneumococcal vaccine, a conjugate vaccine containing 13 serotypes and a polysaccharide vaccine containing 23 serotypes. A combination of these two serially is recommended in adults with certain comorbidities³⁻⁵. The recommendations are given in Tables 1 & Figure 3.

HEPATITIS A (HEPA) VACCINE

Vaccines available for immunization against hepatitis A virus (HAV) include inactivated vaccines such as single antigen (HAV antigen) vaccines, or combination vaccines containing both HAV and HBV antigens. Vaccination is advised for persons with any of the following indications and any person seeking protection from hepatitis A virus (HAV) infection.

1. Persons with chronic liver disease
2. Men who have sex with men and persons who use illegal drugs
3. Persons who work in a restaurant, bar, or other food service
4. Persons infected with other hepatitis virus
5. Persons who receive clotting factor concentrates.
6. Persons who have received, or are awaiting a liver transplant
7. Food handlers

Single-antigen vaccine formulations should be administered in a 2-dose schedule at either 0 and 6–12 months (Havrix®). If the combined hepatitis A and hepatitis B vaccine (Twinrix®) is used, administer 3 doses at 0, 1, and 6 months; alternatively, a 4-dose schedule, administered on days 0, 7, and 21 to 30 followed by a booster dose at month 12 may be used.

HEPATITIS B (HEPB) VACCINE

The hepatitis B virus (HBV) vaccine is available as a single antigen recombinant vaccine or combination with hepatitis A vaccine. Currently it is advised for all adults in India⁶. Administer a 3-dose series of HepB to those persons not previously vaccinated. The second dose should be administered one month after the first dose; the third dose should be administered at least two months after the second dose (and at least four months after the first dose). If the combined hepatitis A and hepatitis B vaccine is used, administer 3 doses at 0, 1, and 6 months; alternatively, a 4-dose schedule, administered on days 0, 7, and 21 to 30 followed by a booster dose at month 12 may be used. Adult patients receiving hemodialysis or with other immunocompromised conditions should receive 1 dose of 40 µg/mL administered on a 3-dose schedule or 2 doses of 20 µg/mL administered simultaneously on a 4-dose schedule at 0, 1, 2 and 6 months.

MENINGOCOCCAL VACCINE

Two types of vaccines are in use for meningococcal meningitis (i) the polysaccharide vaccines and (ii) conjugate vaccines. Bivalent (A+C) and quadrivalent (A,C,Y,W135) vaccines are available. Meningococcal vaccine should be administered to persons with the following indications.

- Adults with anatomic or functional asplenia, or complement component deficiencies
- First-year college students living in dormitories
- Microbiologists routinely exposed to isolates of *Neisseria meningitides*
- Military recruits
- Persons who travel to or live in countries where the disease is hyperendemic or epidemic (sub Saharan Africa)
- All travelers to Mecca during the annual Hajj.
- During an outbreak given to health care workers, laboratory workers and close contacts of cases

Table 1: Recommendations for Pneumococcal Vaccine

Risk group	Underlying medical condition	PCV 13	PPSV23	
		Recommended	Recommended	After first dose
Immunocompetent persons	Chronic heart disease†		✓	
	Chronic lung disease§		✓	
	Diabetes mellitus		✓	
	Cerebrospinal fluid leak	✓	✓	
	Cochlear implant	✓	✓	
	Alcoholism		✓	
	Chronic liver disease, cirrhosis		✓	
	Cigarette smoking		✓	
	Persons with functional or anatomic asplenia	Sickle cell disease/other hemaglobinopathy	✓	✓
Congenital or acquired asplenia		✓	✓	✓
Immunocompromised persons	Congenital or acquired immunodeficiency¶	✓	✓	✓
	Human immunodeficiency virus infection	✓	✓	✓
	Chronic renal failure	✓	✓	✓
	Nephrotic syndrome	✓	✓	✓
	Leukemia	✓	✓	✓
	Lymphoma	✓	✓	✓
	Hodgkin disease	✓	✓	✓
	Generalized malignancy	✓	✓	✓
	Latrogenic immunosuppression**	✓	✓	✓
	Solid organ transplant	✓	✓	✓
Multiple myeloma	✓	✓	✓	

VACCINE ▼	INDICATION ►	Pregnancy	Immuno-compromising conditions (excluding HIV infection) ^{4,6,7,8,13}	HIV infection CD4+ count (cells/µL) ^{4,6,7,8,13}		Men who have sex with men (MSM)	Kidney failure, end-stage renal disease, on hemodialysis	Heart disease, chronic lung disease, chronic alcoholism	Asplenia and persistent complement component deficiencies ^{8,11,12}	Chronic liver disease	Diabetes	Healthcare personnel
				< 200	≥ 200							
Influenza ²							1 dose annually					
Tetanus, diphtheria, pertussis (Td/Tdap) ³		1 dose Tdap each pregnancy					Substitute Tdap for Td once, then Td booster every 10 yrs					
Varicella ⁴			Contraindicated				2 doses					
Human papillomavirus (HPV) Female ⁵							3 doses through age 26 yrs			3 doses through age 26 yrs		
Human papillomavirus (HPV) Male ⁵							3 doses through age 26 yrs			3 doses through age 21 yrs		
Zoster ⁶			Contraindicated				1 dose					
Measles, mumps, rubella (MMR) ⁷			Contraindicated				1 or 2 doses depending on indication					
Pneumococcal 13-valent conjugate (PCV13) ⁸							1 dose					
Pneumococcal polysaccharide (PPSV23) ⁸							1, 2, or 3 doses depending on indication					
Hepatitis A ⁹							2 or 3 doses depending on vaccine					
Hepatitis B ¹⁰							3 doses					
Meningococcal 4-valent conjugate (MenACWY) or polysaccharide (MPSV4) ¹¹							1 or more doses depending on indication					
Meningococcal B (MenB) ¹¹							2 or 3 doses depending on vaccine					
Haemophilus influenzae type b (Hib) ¹²							3 doses post-HSCT recipients only			1 dose		

*Covered by the Vaccine Injury Compensation Program
 Recommended for all persons who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection; zoster vaccine is recommended regardless of past episode of zoster
 Recommended for persons with a risk factor (medical, occupational, lifestyle, or other indication)
 No recommendation
 Contraindicated

Fig. 2: Vaccine that might be indicated for adults aged 19 years or older based on medical and other indications¹

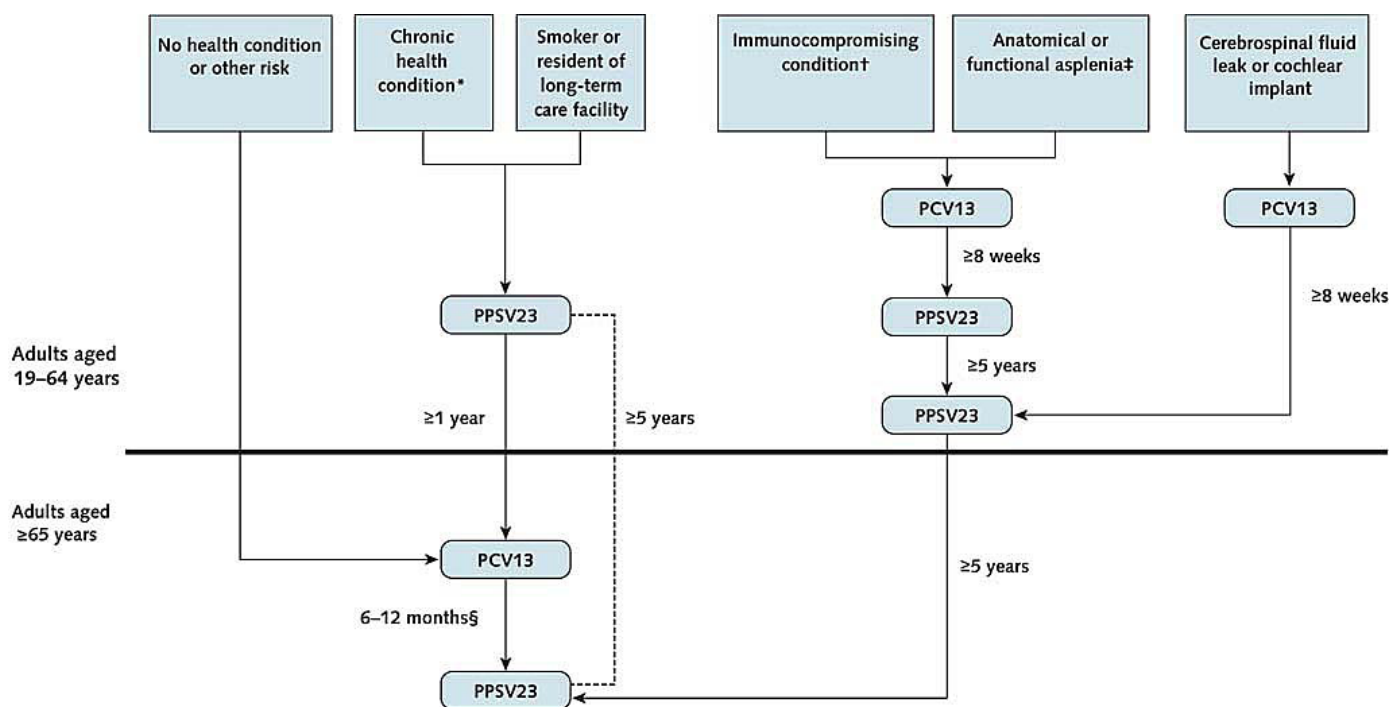


Fig. 3: Recommended pneumococcal vaccination schedule and intervals, by age, health condition, and other risks.

Table 2: 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)

(family members and immediate neighbors).

A single dose of 0.5 ml of the reconstituted vaccine is administered subcutaneously in the deltoid region.

TYPHOID VACCINE

Vaccines available for typhoid fever include the live oral Ty21a vaccine and an injectable Vi polysaccharide vaccine. Typhoid vaccine is recommended as part of routine

Table 3: Vaccine recommendations for Hajj pilgrims	
Vaccine recommendations	Comments
Meningococcal	Mandatory
Influenza	Recommended
Polio	< 15 years, endemic countries
Yellow fever	Endemic countries
Pneumococcal	Recommended for > 65 years
Hepatitis A	Recommended
Hepatitis B	Recommended

Table 4: 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	From endemic countries
Diphtheria, pertussis, tetanus	update
Measles, mumps, rubella	Update
Rabies	Pre-exposure
Polio	1 booster
Cholera	Oral vaccine advised

immunization in adolescents. It is also recommended to the entire community at risk during an outbreak situation and to immunocompromised individuals. Three

34 doses of Ty21a capsules/sachets (liquid formulation) are administered on alternate days. It is also recommended that this series should be repeated once in every 3 years as a booster dose. The Vi vaccine is given as a single subcutaneous or intramuscular dose of 0.5 ml. A booster is recommended once in every 3 years. The live vaccine should not be given to immunocompromised individuals including those affected with HIV.

Apart from routinely recommended adult vaccines, certain vaccines are indicated in persons with underlying co-morbidities. The following table highlights vaccines in persons with certain underlying risk factors^{1,7}.

VACCINES FOR TRAVELLERS (TABLES 2, 3 AND 4)

Indications for vaccinating travellers depend on the place of travel, staying conditions, activities at place of visit and other risk behaviours. Current recommendations for yellow fever vaccine mandate only one dose for lifetime unless persistent exposure to high risk conditions prevails, when a booster is indicated after 10 years. Travel vaccine recommendations for Indians are given in the following tables⁶.

VACCINES FOR PREGNANT WOMEN

Pregnant women are recommended to have one dose of Tdap and influenza vaccine after the 26 week unless the risk of flu is high, as in epidemics, when the flu vaccine can be given earlier during pregnancy.

VACCINES FOR HEALTH CARE WORKERS

The following vaccines are advised for all susceptible health care workers

- Hepatitis B
- Influenza
- MMR
- Varicella
- Tdap

Adult vaccines are an integral part of the approach to comprehensive well-being. It is high time that practicing physicians in India resort to this safe and effective intervention for all their patients to ensure that their patients stay healthier and happier.

REFERENCES

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