

Adult immunization—Need of the hour

P. Srinivas Chakravarthi, Avani Ganta¹, Vivekanand S. Kattimani, Rahul V. C. Tiwari

Department of Oral and Maxillofacial Surgery, Sibar Institute of Dental Sciences, Andhra Pradesh, India, ¹Department of Internal Medicine, Division of Allergy Immunology and Gastroenterology, Tufts Medical Center, Boston, Massachusetts, United States of America

Corresponding author (email: <drvivekanandsk@gmail.com>)

Dr. Vivekanand S. Kattimani, Department of Oral and Maxillofacial Surgery, Sibar Institute of Dental Sciences, Guntur - 522 509, Andhra Pradesh, India.

Received: 07-05-16

Accepted: 30-06-16

Published: 25-07-16

Abstract

Immunization is the process or the act of making individuals immune, which is usually done during childhood. Everyone is aware about immunization during childhood, however, very few know about adult immunization. This led us to review the adult immunization literature for the preventive strategies through various vaccination protocols. Adults do require vaccination protocols with booster doses for hepatitis B, Shingles, communicable diseases, traveler’s diseases, etc. In this context, this article revises much of the available adult immunization literature and presents comprehensive guidelines. This article will increase the awareness regarding the importance of vaccination for adults to prevent a variety of conditions prevalent in our country as well as epidemics. The article comprehensively provides insights into the available vaccination and preventive strategy of human papilloma virus (HPV), hepatitis, and human immunodeficiency virus (HIV) infection in this part of the review. We strongly recommend all the health care professionals to educate their co-professionals and the public to use the benefits of adult immunization. It is the need of the hour and reduces the burden of treatment and increases productivity.

Key words: *Communicable diseases, hepatitis, human immunodeficiency virus, human papilloma virus, prevention, vaccination*

INTRODUCTION

Vaccinations or immunization is of great importance for public health and is the success story of the 21st century. Immunization or vaccination is the prime mode for the prevention of diseases among infants and children to prevent mortality and morbidity. Elimination of deadly diseases can be prevented successfully through immunization or vaccination. Vaccination is an important part of public health programs all over the world. The most recent success story in India is the eradication of polio. The prevention is not only relevant for children and infants but also for adults. In the elderly population, because of the changing

demographics and significant increase in the life expectancy, the concept of adult immunization was thought of. Vaccination of adults should become a new national health priority because of the economics involved in disease treatment. Immunization minimizes morbidity and mortality, which is time tested. Promoting lifestyle through the prevention of disease, early detection, and prompt management are going to help in longevity of life. Unfortunately, adult immunization remains untapped in India. Data on adult vaccination is still scanty. This article reviews the principles and technical aspects of vaccination. The emphasis of this article is on special classes of

Access this article online	
Quick Response Code:	Website: www.jispcd.org
	DOI: 10.4103/2231-0762.186797

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Chakravarthi PS, Ganta A, Kattimani VS, Tiwari RV. Adult immunization—Need of the hour. J Int Soc Prevent Communit Dent 2016;6:272-7.

people such as pregnant women, immigrants, and travelers. The article focuses on newer vaccination on hepatitis, including the recommendation for the Indian population. This comprehensive update will provide evidence-based practice guidelines for vaccination strategy in the Indian population.

Several diseases are still a major health problem in India, as well as in other developing countries. The burden of diseases and reliable epidemiological data in regards to infectious diseases are still lacking. Keeping this in mind, the literature search for adult immunization for various diseases such as anthrax, cancer, chikungunya, cholera, dengue fever, hepatitis, influenza, human papilloma virus (HPV), malaria, and leprosy was carried out and comprehensively reviewed for HPV, hepatitis, and human immunodeficiency virus (HIV) infection in this section of the review.

NEED FOR ADULT IMMUNIZATION

A major public health concern among adults is the prevention of health complications, which is a serious matter and sometimes potentially fatal. Therefore, immunization is the prime mode of prevention. The approaches to adult immunization is through raising awareness among the public and professionals. The administration of immunization has to follow certain guidelines toward patients, type of vaccines, route, site, and dose of administration. The documentation is important for vaccination, which includes the date of administration, name of the vaccine, and date for booster doses, with the signature of the authorized personnel. One should provide the knowledge about vaccine services and trusted health care professionals for mass vaccination program.^[1,2] Immunization is of two types, namely, active and passive. The immunization strategies and basics of immunization can be read elsewhere.^[3-5]

The world health organization (WHO) is involved in the prevention of major communicable diseases. The WHO and United Nations Children Emergency fund (UNICEF) consider 10–19-year-old individuals as adolescents. This adolescent group is more vulnerable toward many communicable diseases and requires special attention. Reproductive age group plays a significant role in determining the future of India, even though they might have been vaccinated during their childhood. Because of the shift in epidemiological diseases among the adolescent age group, many developed countries have introduced immunization guidelines.

Concepts of immunization of adolescents

The concepts have been developed for proper vaccination coverage for adolescents. Immunization for adolescence is recommended as a routine and follow-up before administering vaccines. It is necessary to complete any incomplete vaccination prior to affliction with diseases, which can be prevented through vaccination. Patients should be enquired about other conditions, previous adverse effects, and allergies. This will also reveal lifestyle practices that will help health care professionals in prevention.

HUMAN PAPILLOMA VIRUS VACCINE

The burden of HPV in the Indian population is associated with oncogenic HPV, which includes cervical, oral, vaginal, pineal, and oropharyngeal cancers, ranging from 100 to 40%.^[6] Respiratory papillomatosis is rare but preventable through vaccination.^[7] Four hundred thirty two million Indians of 15 years as well as older women are at a risk of developing cervical cancer. Based on Indian studies, in general, HPV detection in cervical samples is 7.9%. HPV16 or HPV18 contributes to to 84.1% of cervical cancer.^[8-9] High prevalence of the association of HPV types 16, 18, 31, 33, 35, 45, 52, and 58 are designated as high risk.

Need for human papilloma virus vaccine

The prophylactic HPV vaccine has been used for primary prevention of cervical cancer and other HPV-associated diseases.^[10] HPV is a common sexually transmitted disease. The vaccination will reduce the burden of HPV-associated cancers, including subsequent risk reduction among women, as well as young men to reduce the risk of HPV infection. The vaccines available for prophylaxis are bivalent HPV (BHPV) and quadrivalent HPV (QHPV). Both are effective against precancerous lesions and type 6, 11, 16, and 18 viruses. The future of HPV vaccine is gaining importance. The two dose schedule has been tested,^[11,12] and one more randomized trial has been tested for three doses.^[13] Quadrivalent vaccine is recommended against HPV for males aged between 11 and 21 years. Catch up vaccine is recommended for 13 to 21 year old individuals. In addition, routine use is recommended for males aged between 20 and 26 years who have had sexual contact with HIV-positive individuals.^[14]

Recommendation for human papilloma virus vaccination

BHPV and QHPV are licensed for use in female and one HPV for use in males. For females, HPV4

and HPV2 is recommended in three dose series.^[15-18] Routine vaccination should be administered to females at an age of 11 or 12 and those aged between 13 and 26 years, if not vaccinated previously.^[15-18] For males, HPV4 in three doses at the age of 11 or 12 years and those aged between 13 and 21 years, if not vaccinated previously.^[15-18] Males aged between 20–26 years may be vaccinated. The vaccine recommended for immunocompromised patients including HIV infection through the age of 26 years, the series of HPV4 or HPV2 consist of three doses.^[15-18] The second dose should be administered 1 or 2 months after the first dose and the third dose after 6 months of the first dose.^[15-18] In India, the academy of pediatrics recommends initiation for vaccination at 10–12 years and catch up is permitted up to 45 years.^[19] The obstetrics and gynecology society of India recommends 10–12 years for females permitted till 45 years.^[20] The physician association of India indicates QHPV vaccine for women aged 9–45 years.^[21] Bivalent vaccine is for women aged 10–45 years as well as for cervical cancer patients caused by HPV16 and HPV18.^[22] Both the vaccines are given in three dose schedule.

CHANGING PARADIGMS IN HUMAN IMMUNODEFICIENCY VIRUS

Acquired immune deficiency syndrome (AIDS) caused by HIV is prevalent in India with 2.5 million affected people.^[23] Even with the advent of antiretroviral drugs for the treatment of HIV, it continues to be one of the most communicable infections. The development of HIV vaccine has few obstacles.^[24] However, in 2009, in Thailand, the vaccine trial was completed with 31% efficacy.^[24,25] India is in an urgent need of vaccines because of the high burden of opportunistic infections. The development of a vaccine has major limitations because of the highly mutagenic genetically variable subtypes, lack of suitable animal model for vaccine development, and limited natural response to the virus. Lack of clear correlation of protective immunity to the viral components is entirely unknown; these factors cause the difficulty in the development of vaccines. The challenges posed by HIV virus prove difficult to develop a vaccine. The present scenario of HIV vaccine is still under a trial phase.^[26-30] The partial success of RV144 vaccine has provided a much needed impetus. India hosts the third largest pool of HIV-positive patients, and hence there is an urgent need for vaccination. National AIDS research institute and tuberculosis research center have conducted phase-1 trials in Pune and Chennai, respectively. All the volunteers followed for one year after booster dose administration were well tolerated.

Availability of a large pool of patients and unique molecular epidemiological profile attracted many organizations for vaccine initiative. All the conventional vaccine development methods have been used to develop an effective vaccine. The partial success of the vaccine provided some hope for future success. The current vaccine is in the experimental stage, which will take a long time before it is available in the market.

CURRENT STRATEGY OF HEPATITIS B VACCINE

Hepatitis B vaccine (HBV) is indicated for universal immunization, adults, and high risk groups who have missed HBV vaccination. HPV elimination is possible through universal vaccination of an infant at birth. Prevention of perinatal infection through screening of pregnant females, vaccination of children, adolescent inmates, staff of developmentally disabled individuals, unvaccinated adults, drug abusers, and household contacts.^[31-34]

Recommendation for hepatitis B vaccine

- Individuals at risk by sexual exposure. HBSAg positive sex partners, sexually active personnel, homosexual (males), and individuals seeking treatment for sexually transmitted diseases
- Individuals who are at risk for infection by percutaneous injections and mucosal exposures to blood. Drug users, household contacts of HBSAg positive persons, residents and staff of facilities for disabled persons, health care and public safety workers, persons with end-stage renal diseases, and individuals requiring blood transfusions
- Individuals with chronic liver diseases, HIV infection, and all individuals seeking protection from HBV virus.

Recommended schedule

In the Indian scenario, 20 µg at 0, 1, and 6 months and immunocompromised 0, 1, 2, and 12 months. Double the dose of 40 µg in chronic renal failure, renal transplant, post-transplant, and hemophilia. Anti-HBV titers should be estimated 1–2 months after the last date of vaccination. If it is less than 10 mIU/ml, a booster dose is required. In nonresponder of HBSAg, the vaccination should be repeated with a schedule of 0, 1, 2, and 12 months.

HEPATITIS C VACCINE

It affects more than 170 million people globally.^[35] India has a moderate prevalence of hepatitis C virus (HCV)

infection in general population.^[36] Vaccination is needed to prevent or attenuate primary infection. The prophylactic vaccine prevents and the therapeutic vaccine aims to get rid of the infection.

The challenges for the development of a vaccine are posed by antigenic diversity with six genotypes, 30–35% of dissimilarity across the genome, and the need for the vaccine to be genotype specific. Therefore, it is important to identify the antigen against which the vaccine needs to be developed. Lack of proper experimental animal model limits the testing efficacy of vaccines. Currently, four vaccine strategies have been investigated in human clinical studies. These are as follows: Recombinant protein, peptide, DNA, and vector vaccine. Recombinant vaccine is a potential vaccine that will produce an immune response to eliminate a number of viral epitopes, which are efficient to develop protective immunity. In general, protein based approaches induce antibody and CD4+T cell response. Experimental vaccines are safe and well-tolerated with no significant effects. However, larger studies are required to establish safety and cost-effectiveness of the vaccine. In India, research is lacking which needs to be promoted. The impact of disease is high in relation to morbidity and mortality. Therapeutic vaccines are promising but not preventive. Recombinant vaccines of 20 µg at 0, 3, and 6 months are safe and well-tolerated, which stimulate hormonal and cell-mediated immune response.^[37-40]

HEPATITIS E VACCINE

Hepatitis E is an important agent transmitted enterally, which causes acute viral hepatitis globally. Fourteen million symptomatic cases with 300,000 lakh deaths and 5200 stillbirths occur annually around the world. Mainly, developing countries such as the Indian subcontinent, Africa, northern, western part, and Middle East are more prone to infection. Recently, in Sudan and northern Uganda, the outbreak of Hepatitis E was reported, which necessitates safe and effective vaccine. In India, during 1955–56, in New Delhi, contamination of drinking water with an outbreak had occurred. Hepatitis E is a hepevirus, genus hepevirus in the family hepeviridae. Hepatitis E virus (HEV) genome consists of four major mammalian genotypes and one avian genotype. Hepatitis E protection is required specifically for pregnant females, cirrhotic patients, and travelers on urgent basis. The epidemiological outbreak necessitates safe and effective Hepatitis E vaccine. Current status of vaccine is the successfully launched hecolin for ® (HEV 239 vaccine), following successful

phase 2 and phase 3 clinical trials. The vaccine was tried which gave a shorter duration of immunity and passive immunization with higher titer. HEV antibodies may reduce infection during pregnancy as well as its severity.^[41-44]

CONCLUSION

Vaccine administration is critical for the success of immunization. The HPV, HBV, and HEV are currently available for clinical use, however, those for HCV and HIV are still under trial. It is necessary to educate the public about adult vaccination for use of existing vaccines. The vaccine should be made available, should be cost-effective, and delivery should be simple; it should be easy to use in resource limited countries where the disease is endemic. Both health care professionals and the general public have become frequent travelers all over the world because of ease of transportation. Hence, adult immunization has become the need of the hour to prevent transmission of deadly diseases.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Immunization action coalition (IAC). Adults only vaccination: A step-by-step guide. St. Paul: Centers for disease control and prevention; 2004.
2. World health organization. Welcome to the WHO course on vaccine safety basics. Available from: www.vaccine-safety-training.org/home.html. [Last accessed on 2016 Jun 13].
3. Centre for disease control and prevention. Principles of vaccination. [online] available from: www.cdc.gov/vaccines/pubs/pinkbook/downloads/prinvac.pdf [last accessed on 2016 Jun 13].
4. Principles of immunization. [online] available from: www.pidst.net. [Last accessed in 2016 Jun 13].
5. Principles and considerations for adding a vaccine into a national immunization programme. [Online] available from: <http://www.who.int/mediacentre/factsheets/fs378/en/> [Last accessed on 2016 Jun 13].
6. De Vuyst H, Clifford GM, Nascimento MC, Madeleine MM, Franceschi S. Prevalence and type distribution of human papillomavirus in carcinoma and intraepithelial neoplasia of the vulva, vagina and anus: A meta-analysis. *Int J Cancer* 2009;124:1626-36.
7. Atkinson W, Wolfe C, Hamborsky J (Eds). *Epidemiology and prevention of vaccine-Preventable Diseases. The pink book: Course textbook*, 12th ed. Washington, DC: Public health foundation; 2012.

8. Walboomers JM, Jacobs MV, Manos MM, Bosch FX, Kummer JA, Shah KV, *et al.* Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. *J Pathol* 1999;189:12-9.
9. Bosch FX, de Sanjose S. Chapter 1: Human papillomavirus and cervical cancer—Burden and assessment of casualty. *J Natl Cancer Inst Monogr* 2003;31:3-13.
10. Bosze P. The first vaccine against cancer: The human papillomavirus vaccine. *Orv Hetil* 2013;154:603-18.
11. Konno R, Dobbelaere KO, Godeaux OO, Tamura S, Yoshikawa H. Immunogenicity, reactogenicity, and safety of human papillomavirus 16/18 AS04- adjuvanted vaccine in Japanese women: Interim analysis of a phase II, double blind, randomized controlled trail at month 7. *Int J Gynecol Cancer* 2009;19:905-11.
12. Sow PS, Watson-Jones D, Kiviati N, Changalucha J, Mbaye KD, Brown J, *et al.* Safety and immunogenicity of human papillomavirus-16/18 AS04- adjuvanted vaccine: A randomized trial in 10-25 year old HIV-seronegative African girls and young women. *J Infect Dis* 2013;207:1753-63.
13. Romanowski B, Schwarz TF, Ferguson LM, Peters K, Dionne M, Schulze K, *et al.* Immunogenicity and safety of the HPV-16/18 AS04-adjuvanted vaccine administered as a 2-dose schedule compared with the licensed 3-dose schedule: Results from a randomized study. *Hum Vaccine* 2011;7:1374-86.
14. Campos-Outcalt D. HPV vaccine is now routinely indicated for males. *J Fam Pract* 2012;61:38-40.
15. Marin M, Güris D, Chaves SS, Schmid S, Seward JF; Advisory Committee on Immunization Practices, *et al.* Prevention of varicella: Recommendations of the advisory committee on immunization practices (ACIP). *MMWR Recomm Rep* 2007;56(RR-4):1-40.
16. Advisory committee on immunization practices. Recommended adult immunization schedule: United States, 2012. *Ann Intern Med* 2012;156:211-7.
17. Centers for disease control and prevention (CDC). Recommendations on the use of quadrivalent human papillomavirus vaccine in males-Advisory committee on immunization practices (ACIP), 2011. *MMWR Morb Mortal Wkly Rep* 2011;60:1705-8.
18. Centers for Disease Control and Prevention. Recommended adult immunization schedule: United States, 2013. *J Midwifery Womens Health* 2013;58:215-20.
19. Indian Academy of Pediatrics, Advisory Committee on Vaccines and Immunization Practices (acvip), Vashishtha VM1, Kalra A, Bose A, Choudhury P, *et al.* Indian academy of pediatrics (IAP) recommended immunization schedule for children aged 0 through 18 years, India, 2013 and updates on immunization. *Indian pediatr* 2013;50:1095-108.
20. Human papillomavirus (HPV) vaccine. Available from: <http://www.vaccines.gov/diseases/hpv/>. [Last Accessed on 13 June 2016].
21. FDA Approves Merck's HPV Vaccine, GARDASIL®9, to Prevent Cancers and Other Diseases Caused by Nine HPV types – Including Types that Cause About 90% of Cervical Cancer Cases. Available from: <http://www.mercknewsroom.com/news-release/prescription-medicine-news/fda-approves-mercks-hpv-vaccine-gardasil9-prevent-cancers-an>. [Last Accessed on 2016 Jun 13].
22. Our prescription medicines and vaccines. Available from: <http://us.gsk.com/en-us/products/prescription-medicines-and-vaccines/#vaccines> [Last Accessed on 13 June 2016].
23. Koff WC, Russell ND, Walport M, Feinberg MB, Shiver JW, Karim SA, *et al.* Accelerating the development of a safe and effective HIV vaccine: HIV vaccine case study for the decade of vaccines. *Vaccine* 2013;18:13(suppl 2):B204-8.
24. HIV Declining in India Available from: <http://pib.nic.in/newsite/PrintRelease.aspx?relid=67983>. [Last Accessed on 2016 Jun 13].
25. Burton DR, Poignard P, Stainfeld RL, Wilson IA. Broadly neutralizing antibodies present new prospectus to counter highly antigenically diverse viruses. *Science* 2012;337:183-6.
26. Jones NG, DeCamp A, Gilbert P, Peterson ML, Gurwith M, Cao H. AIDSVAX immunization induces HIV- specific CD8+T-cell responses in high-risk, HIV-negative volunteers who subsequently acquire HIV infection. *Vaccine* 2009;27:1136-40.
27. Pérez-Losada M, Jobes DV, Sinangil F, Crandall KA, Arenas M, Posada D, *et al.* Phylogenetics of HIV-1 from a phase III AIDS vaccine trial in Bangkok, Thailand. *PLoS One*. 2011;6:e16902.
28. Buchbinder SP, Mehrotra DV, Duerr A, Fitzgerald DW, Mogg R, Li D, *et al.* Efficacy assessment of a cell-mediated immunity HIV-1 vaccine (the step study): A double blind, randomized, placebo-controlled, test of concept trial. *Lancet* 2008;372:1881-93.
29. Gray GE, Allen M, Moodie Z, Churchyard G, Bekker LG, Nchabeleng M, *et al.* Safety and efficacy of the HVTN 503/ Phambili study of a clade-B-based HIV-1 vaccine in South Africa: A double blind, randomized, placebo-controlled, test of concept 2b study. *Lancet infect Dis* 2011;11:507-15.
30. Rerks-Ngarm S, Pitisuttithum P, Nitayaphan S, Kaewkungwal J, Chiu J, Paris R, *et al.* Vaccination with ALVAC and AIDSVAX to prevent HIV-1 infection in Thailand. *N Engl J Med* 2009;361:2209-20.
31. Saraswat VA, Somani SK. Vaccination against hepatitis A and B in patients with chronic liver disease. In: Sarin SK, Singal AK, Editors. *Hepatitis B in India prevention and management*, 1st Ed. New Delhi: CBS Publishers and distributors; 2004. p. 397-411.
32. Sarin SK. Summary, recommendations and Issues: INASL'96. *Hepatitis B*, New Delhi: CBS Publishers and distributors; 1996. p. 224.
33. Sarin SK; Indian Association for Study of the Liver (INASL). Summary and recommendations of single theme conferences on hepatitis B and C: Indian association for study of the liver (INASL). *J Gastroenterol Hepatol* 2002;17(suppl 3):S197-S203.
34. Introducing hepatitis B Vaccine in universal immunization program. Available from: http://www.searo.who.int/india/topics/routine-immunization/Operational_Guidelines_for_HepatitisB_vaccine_introduction_in_UIP_2011.pdf?ua=1. [Last Accessed on 2016 Jun 13].
35. Hepatitis C-Global prevalence. *Wkly Epidemiol Rec* 1999;74:425-7.
36. Mohd Hanafiah K, Groeger J, Flaxman AD, Wiersma ST. Global epidemiology of hepatitis C virus infection: New estimates of age-specific antibody to HCV seroprevalence. *Hepatology* 2013;57:1333-42.
37. Alvarez-Lajonchere L, Shoukry NH, Grá B, Amador-Cañizares Y, Helle F, Bédard N, *et al.* Immunogenicity of CIGB-230, a therapeutic DNA vaccine preparation, in HCV-chronically infected individuals in a Phase I clinical trial. *J Viral Hepat* 2009;16:156-67.
38. Folgori A, Capone S, Ruggeri L, Meola A, Sporeno E, Ercole BB, *et al.* A T-cell HCV vaccine eliciting effective

- immunity against heterogeneous virus challenge in chimpanzees. *Nat Med* 2006;12:190-7.
39. Di Bisceglie AM, Janczweska-Kazek E, Habersetzer F, Mazur W, Stanciu C, Carreno V, *et al.* Efficacy of immunotherapy with TG4040, peg-interferon, and ribavirin in a Phase 2 study of patients with chronic HCV infection. *Gastroenterology*. 2014;147(1):119-131.
 40. Kao JH, Chen DS. Global control of the hepatitis B virus infection. *Lancet Infect Dis* 2002;2:395-403.
 41. Wang L, Zhuang H. Hepatitis E: An overview and recent advances in vaccine research. *World J Gastroenterol* 2004;10:2157-62.
 42. Wu T, Zhu FC, Huang SJ, Zhang XF, Wang ZZ, *et al.* Safety of the hepatitis E vaccine for pregnant women: A preliminary analysis. *Hepatology* 2012;55:2038.
 43. Zhang J, Liu CB, Li RC, Li YM, Zheng YJ, Li YP, *et al.* Randomized-controlled phase II clinical trial of a bacterially expressed recombinant hepatitis E vaccine. *Vaccine* 2009;27:1869-74.
 44. Zhu FC, Zhang J, Zhang XF, Zhou C, Wang ZZ, Huang SJ, *et al.* Efficacy and safety of a recombinant hepatitis E vaccine in healthy adults: A large-scale, randomized, double-blind placebo-controlled, phase 3 trial. *Lancet* 2010;376:895-902.