

# Need to Study the Health Impact and Economics of Adult Vaccination with India in Focus

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## Abstract

Vaccination is undoubtedly the most effective and economical way of dealing with the diseases which can affect masses. Pediatric immunization against vaccine preventable disease (VPD) is being supported by most of the international health agencies, making them accessible and affordable to even the poorest of the countries. However, adult vaccination is needed to protect the most productive age group and improve the quality of life of the aging population and is left to those who can afford it. In most of the low- and middle-income countries including India, adult vaccination did not even find a mention in national vaccination policies. Although recommendation exists from various health associations in India for adult vaccination, they have not been given enough publicity as data on burden of VPDs and cost-effectiveness of these vaccines in adults are not available. Most of the general population and a substantial proportion of health care professionals in India lack awareness on the availability and need for these adult vaccinations. Now with improved childhood immunization and increased life expectancies, many diseases are showing epidemiological shift to the later part of life, thereby bringing the focus on adult immunization through the life course approach to reduce morbidity and mortality because of VPDs in adults and improve the quality of life of those left vulnerable because of aging or their existing medical condition.

**Keywords:** Adult vaccination, health economics, India

## INTRODUCTION

Vaccines are key components for keeping morbidity and mortality at low levels, thus allowing the worldwide economy to thrive. Globally, the volume of the vaccine market is estimated to be 5.5 billion doses (excluding travel and military market), mainly toward the paediatric population against vaccine preventable diseases (VPDs). However, vaccination is governed primarily by the public sector in industrialized and developing countries. In more than 140 countries, the vaccines are procured through the United Nations International Children's Emergency Fund and Pan American Health Organization, which procure vaccines at a concessional price through a pooled mechanism.<sup>[1]</sup> Although the public sector purchases the bulk of childhood vaccines, it has a very limited share of adult vaccines. However, the ongoing coronavirus disease (COVID) pandemic has changed the perception.

An adult vaccine is considered important for healthy aging, but still, it has remained an under-used public health

strategy to promote healthy aging. Public hesitancy toward vaccination, brought on by a fear of side effects, is rampant. Adult immunization does not have a clear prioritization in low- and middle-income countries (LMICs) and is a complex program across high-income countries. It is different from pediatric immunization, which has a global program and focused substantial funding. Presently, the focus is shifting toward adult vaccination as populations in most countries are aging, leaving them vulnerable to many diseases because of immunosenescence and a weakened body defence mechanism against infections.

Contrary to increasing awareness of adult vaccination observed in high-income countries, most LMICs do not even have vaccination policies specifically targeting adult populations,

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and vaccine propositions in these countries focus heavily on pediatric immunization.<sup>[2]</sup> Vaccination after infancy is required to improve population (herd) immunity and disease control through catch-up coverage, not vaccinated during childhood, protection against changing strains, protecting at-risk populations after childhood, protection through the life-course, vaccination of travellers, preventing chronic and latent infection, prevention of non-communicable disease, deterioration of the immune system with age, and the need for protection against emerging diseases and pandemics. Only adult immunization under consideration in LMICs is observed in pregnancy, immunization of health-care workers, high-risk occupations, travel vaccines, or regional use and during pandemics, but very rarely recommendations exist for vaccination to protect adults in general against infectious diseases.<sup>[3]</sup>

### Adult vaccination scenario

The introduction of the new vaccine depends on the Government seeing value in it based on recognition of the burden of disease, if the purchaser (Government, donors, private health care workers) feels that it is a priority for the end user and the costs of vaccination do not impose the social and economic burden for the stakeholders, which includes health planners, manufacturers, health care providers, and health care facilities.<sup>[4]</sup> However, despite many advantages, there exist many barriers to vaccination in adults, which is mainly because of the lack of data on the burden of disease and its economic aspect, vaccine hesitancy or lack of awareness, complexity in adult vaccine schedules, limitations in vaccination infrastructure for research and development and implementation, and the society placing a lower value on the health of older people than children.<sup>[5]</sup> The status of various VPDs in South and South east Asian countries is shown in Table 1.<sup>[6-15]</sup>

Out of 194 World Health Organization (WHO) Member States in 2017, the adult influenza vaccination program is present in 114 countries (59%), whereas adult pneumococcal vaccine program is there in 50 countries (26%), and out of 77 low- and lower-middle-income countries, only 15 (19%) have adult influenza programs and two (3%) have adult pneumococcal programs.<sup>[17]</sup> Even in countries where adult vaccination is free or covered by insurance, the coverage has remained low. In 2015, influenza vaccination was 69% among US adults aged  $\geq 65$  years in 1 year, and it was just 34% for the herpes zoster vaccine.<sup>[18]</sup> The reasons often cited for low adult vaccine uptake have been the lack of appropriate infrastructures, resources, availability, and vaccine knowledge in the general public and in health care workers.<sup>[19]</sup> The current standing and recommendations of WHO and Centers for Disease Control and Prevention (CDC), Atlanta, on adult vaccination are provided in Table 1.<sup>[6,16]</sup>

### Adult vaccination needs in India

The adult population often neglects the need for vaccinations, particularly if the risk of infection is low, and considers

them to be optional. In India, there may be many adults, particularly elderly people, who have either lost immunity over time or were never vaccinated. Its only when mandated by the travel requirement or special health conditions that adults get vaccinated. There are about 85 Food and Drug Administration-approved vaccines against 29 diseases; CDC recommends adult vaccination against 15 diseases: influenza, diphtheria, tetanus, pertussis, varicella, human papillomavirus (HPV), zoster, mumps, measles, rubella, pneumococcal disease, meningococcal disease, hepatitis A, hepatitis B, and *Haemophilus influenzae* B.<sup>[20]</sup> However, the Expert Group of the Association of Physicians of India on Adult Immunization in India has also recommended a similar vaccination schedule with addition of vaccination against typhoid.<sup>[21]</sup> Most of these vaccines are not universally recommended in adults but are based on age and special situation criteria. The popular recommended vaccines for healthy adults in India are TDap, MMR, influenza, pneumococcal ( $>65$  years), HPV (6–26 years), and Zoster ( $>60$  years). Recommended in high-risk individuals or special situations are Hepatitis B, Hepatitis A, Meningococcal, Varicella, HiB, Typhoid, Cholera, and Rabies. Because of the lack of concrete data and cost-effectiveness studies, most of the above recommendations are limited to personal choices and awareness of health care workers and the value seen by the individuals depending on his affordability and health conditions. So far, the policies on vaccination at the national level in India rarely give any attention to adult vaccinations. The global agencies such as WHO and UNICEF also did not see as much value in adult vaccination as is there in pediatric vaccination.

### VPDs in Adults: India

With the increase in childhood vaccination coverage, many outbreaks of the vaccine preventable childhood diseases are now being reported in adults. Studies from India have revealed that 12–30% of women in the reproductive age group remain susceptible to rubella infection and the prevalence of clinical Congenital rubella syndrome because of rubella infection during pregnancy is estimated as 6 per 1000 under-5 children.<sup>[22]</sup> Hepatitis A viral infection is now putting higher clinical and economic burden in the  $>15$  years age group as it is estimated that among acute viral hepatitis cases, it increased from 3.4% in 1999 to 12.3% in 2003 and more so in high socio-economic status 13–20 years: 27% in 1999 to 62% in 2003.<sup>[23]</sup> The number of HBsAg carriers in India has been estimated to be over 40 million and chronic HBV infection accounts for 40% of hepato-cellular carcinoma (HCC) and 20–30% cases of cirrhosis in India.<sup>[24]</sup> National viral surveillance data for 2010–2013 found 13% nasopharyngeal sample specimens sent for influenza virus testing to be positive and death estimates in the  $>65$  years age group to be 51.1/100,000 population.<sup>[25]</sup> Several major epidemics of meningococcal disease have been reported, predominantly from the major cities and particularly from New Delhi. In a systematic review of 32 studies, regardless

**Table 1: Vaccine Preventable disease burden in Southeast Asia region and WHO/CDC standing on Adult Vaccination**

Vaccines Preventable diseases	Burden of VPDs in population of South & South east Asia		Base year	WHO Standing for Adult vaccination, <sup>[6]</sup>	CDC Recommendation for Adult vaccination, <sup>[19]</sup>
	Incidence	Mortality			
Typhoid, <sup>[7]</sup>	148-160/100000 in ≥15 years	CFR-1%	2010	High Risk population	Travellers to South Asia
Hepatitis B, <sup>[8]</sup>	138000 cases/annum	30000 deaths/annum	2010	For high-risk groups if not previously immunized	All adults aged 19 to 59 years. For 60 years & older with risk factor
Hepatitis A, <sup>[8]</sup>	400000 cases/annum	800 deaths/annum	2010	Basis - incidence of acute hepatitis A, change in the endemicity from high to intermediate, and consideration of cost-effectiveness	If not vaccinated previously and want to be protected
Diphtheria, <sup>[9]</sup>	10224 cases, Incidence 0.52/100000 (All ages)	-	2019, >37% cases in >15 year age gp	To be completed in childhood given in combination with tetanus toxoid	After primary immunization, booster every 10 years in combination with tetanus (Td)
Varicella, <sup>[10]</sup>	40-60% of adults remain susceptible	-	-	Vaccinate adults without evidence of varicella immunity	Vaccinate who never had chickenpox and were never vaccinated
Cervical Cancer, <sup>[11]</sup>	17.8/100000 (Age standardized Rates)	10/100000 (Age Standardized Rates)	2018	Age>15 years, recommended only if feasible, affordable, cost-effective, and does not divert resources from vaccination of the primary target population or from effective cervical cancer screening programmes.	Recommended through age 26 years, from 27 to 45 years on discussion with their clinician
Measles, <sup>[12]</sup>	3,803,800 cases, incidence 1.49/100000	39,100 deaths	2018	measles vaccination should be routinely administered to potentially susceptible, asymptomatic HIV adults	For adults who do not have presumptive evidence of immunity
Rubella, <sup>[13]</sup>	10361 Rubella cases with 361 Congenital Rubella Syndrome	-	2016	Women of child-bearing age if not previously vaccinated	For adults who do not have presumptive evidence of immunity
Lower Respiratory Tract Infection, <sup>[14]</sup>	Episodes: 45.9-48.8/1000 population (All age group) Episodes: <i>Streptococcus pneumoniae</i> 26.7/1000* population Episodes Influenza 5.3/1000* population	30.8-34.7/100000 population (All age group) <i>Streptococcus pneumoniae</i> 16.1/100000 (All ages), deaths highest 122/100000 in >70 year age gp Influenza 0.8/100000 (All ages), deaths highest 6.1/100000 in >70 year age gp	2016	Pneumococcal vaccine: In resource limited settings not recommended for adults for routine immunization Influenza vaccine: pregnant women should have the highest priority, elderly persons ≥65 years of age, individuals with specific chronic medical conditions, and health-care workers	Age 19 to 64 years with certain chronic medical conditions or other risk factors. Age 65 years or older recommended for all groups annually
Meningococcal disease, <sup>[15]</sup>	40-60 case/100,000 population	Case fatality Rate- 10%	2016	Recommended with Conjugate vaccines preferred over polysaccharide vaccines	Recommended for adults who are at increased risk

Note: CDC, USA also recommends single dose of live zoster vaccine for all people 60 years old or older

of age or study design, N. meningitidis is found in 4.5–23.4% and 0.1–7.6% of suspected meningitis cases in outbreak and non-outbreak settings. However, because of the lack of surveillance systems, poor reporting of meningococcal disease remain grossly under-estimated and under-reported in India.<sup>[26]</sup> Chickenpox is common in adolescents and adults in whom it causes greater morbidity and mortality. Reports have suggested that close to 30% of adolescents above 15 years

are susceptible to VZV infection.<sup>[27]</sup> The pooled estimates for incidence of typhoid for India were 377 (178–801) per 100,000 person years, whereas in people above 15 years of age, the estimated incidence is 120/100,000 population/year.<sup>[28]</sup> Presently, with increasing life expectancy and growing elderly population in the country, the incidence of invasive pneumococcal disease (IPD) and Herpes Zoster is also expected to rise.

### Adult immunization status: India

Adult vaccination in India is mainly limited to travellers going abroad, visiting large gatherings such as Kumbh, high-risk/vulnerable populations because of their occupation (health care workers, veterinarians, military pers), or special situations (injuries, asplenia, complement deficiency, transplant, immunosuppressed). The study at the Adult Vaccination Center, AIIMS, Jodhpur, observed that over a period of 1 year, an adult vaccine was mainly used for post-exposure prophylaxis; out of the total adults vaccinated, 42% were given TT vaccines, and 20% received anti-rabies vaccines. The remaining were vaccinated under the pre-exposure category; the vaccines utilized were yellow fever (15%), hepatitis B (8%), pneumococcal vaccine (7%), typhoid (3%), and influenza (1%); other 4% people were given meningococcal vaccine, hepatitis A, varicella, and OPV.<sup>[29]</sup> In a study on adult vaccination from a tertiary hospital in western India, it was observed that among adults in need of adult vaccination, only 56% were advised vaccination by doctors, and among those advised vaccination for influenza, tetanus, and pneumococcal pneumonia, only 22%, 77%, and 6% were actually vaccinated, respectively.<sup>[30]</sup> Four decades since Expanded Program on Immunization (EPI) was launched in India in 1978 and immunization has been further up scaled with introduction of Universal Immunization Program (UIP) in 1985, infrastructure, manpower, and resources all are in place in India, but except for immunization with Td in pregnancy and selective Japanese encephalitis (JE) vaccination for the adult population in endemic districts, no other national policy for vaccination in adults exists. In India, even after so many years of UIP implementation, we are yet to achieve childhood vaccination goals; therefore, the adult vaccination is not even considered important for discussion at the national level. The current pandemic situation with COVID-19 has brought vaccination in adults against COVID-19 to forefront with researchers, scientists, administrators, and even common men realizing the importance of vaccination and the need for capacity building for vaccine research and their production. The adult vaccination with COVID-19 vaccines is the largest drive ever undertaken to protect the adult population against serious effects of any disease. It highlighted the need to create infrastructure and resources, remove fear, and develop an understanding of vaccination importance among the adult population.

### Cost-effectiveness studies for adult vaccination

Vaccination is considered the most cost-effective way to save lives and improve health, and the same have been proved through cost-effectiveness studies on vaccination. However, most cost-effective studies are performed on pediatric age group vaccination, and it is rare to find cost-effectiveness studies on adult vaccination, especially from LMICs. Adult vaccination in LMICs is considered to be of low priority and is only targeted toward the population who can easily afford it or are in need because of their medical condition. In adults,

the cost under consideration because of illness is not just cost of illness but also its socio-economic costs, and because of improvement in childhood vaccination, an epidemiological shift of many childhood diseases in adults is being observed, for example, diphtheria, measles, Hepatitis A, and so on. The data available from high-income countries suggest adult vaccination to be cost-effective/cost-saving, and the same will be true for LMICs which have even higher burden of infectious disease. A systematic review on costing-effectiveness studies on adult vaccination in the US and Canada showed that the cost savings (cost benefit) were 56% for influenza, 31% for pneumococcal, and 23% for tetanus-diphtheria-pertussis vaccinations.<sup>[31]</sup> The most cost-effective approach is to vaccinate in the early part of the life; however, vaccination of those who missed their childhood dose of vaccines needs to be prioritized and provisions have to be made to immunize them with vaccines such as Td, Mesales, Hepatitis B, and Rubella in women at the first opportunity whenever they come in contact with the health care system. Other than those mentioned above, provisions should be made to immunize priority groups with vaccines such as the elderly with pneumococcal and influenza vaccines and meningococcal in college students and military recruits.

### CONCLUSION

In LMICs, because of a huge number of people in the adult age group, it may not be feasible to implement adult vaccination in national programs, especially when data on the burden of these diseases and cost-effective analysis of these vaccines are not available. The acceptance of most adult vaccines may still be far from reality at the current juncture. However, its use in certain high-risk categories and people with medical conditions would continue. There is a need to increase awareness about the availability and merits of adult vaccination not only among the general population but also among health-care professionals. The COVID-19 pandemic has brought the issue in the forefront once again. With increasing life expectancies, there is a need to introduce the life course approach to vaccination for improving their quality of life as now, many countries have a high aging population, which are left vulnerable with compromised quality of life.

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### Conflicts of interest

There are no conflicts of interest.

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