



Developing Adult Vaccination Ecosystem in India: Current Perspective and the Way Forward

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Abstract

Introduction: A high burden of vaccine-preventable diseases, increasing elderly population, immunosenescence, and emerging drug resistance emphasize the need for robust adult immunization in India. While immunization guidelines from various societies exist, there is inadequate implementation of the same.

Aim: We undertook this narrative review of the adult vaccination ecosystem in India to (i) gain insights into existing adult vaccination practices, (ii) identify barriers to adult vaccination and possible solutions, and (iii) improve collaboration between various stakeholders to help establish adult vaccination centers in the country.

Results: Besides the high cost and lack of insurance coverage, the lack of adult vaccination centers contributes to the low coverage of adult immunization.

Discussion: These challenges can be addressed through multiple approaches including community awareness and immunization programs, setting up mobile vaccination vans, patient/consumer education, and adequate training of healthcare providers. Successful implementation of these strategies requires active collaboration between the government, hospitals, different stakeholders, and policymakers.

Keywords

adult vaccination, vaccine-preventable diseases, adult vaccination centers, healthy aging, immunosenescence, recommendations

Introduction

Infectious diseases significantly contribute to morbidity, disability, and mortality,¹ especially in a developing country like India. Infectious diseases not only affect those with weakened immune response but also children and patients with chronic illness for example diabetics. Hence these can occur in people belonging to all age groups irrespective of their immune status.² Currently, approximately 6.6% of the Indian population is above 65 years of age³; with the size of this population continuously increasing. Vaccination has been used successfully in prevention of disease and promoting health. Besides protecting the individual from health hazard, vaccination also decreases healthcare utilization and preserves economic productivity.⁴ Hence it is of utmost importance to promote adequate vaccination in developing economies like India.

Although traditionally, the concept of vaccination was limited to infants and children, recent years have witnessed an increasing awareness of the need for adult vaccination.⁵ The significant delay in the societal acceptance of adult vaccination

is mirrored at both the levels of implementation and coverage.^{2,6} Because immunosenescence is common among the elderly, it is essential to immunize the adult population at the earliest.^{7,8} The guidelines of all key societies in India, such as the Association of Physicians in India,⁹ Indian Society of Nephrology,¹⁰ Indian Medical Association¹¹ and Geriatric Society of India,¹² and the Research Society for the Study of Diabetes in India (RSSDI),¹³ discuss adult vaccination.⁷ Specific recommendations exist for immunizing adults with comorbid conditions, such as lung disease and chronic kidney failure. Moreover, the recent guidelines emphasize on earlier

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administration of certain vaccines to avoid the risk of disease and complications.

In this review we discuss the present scenario of adult vaccination in India, existing obstacles, and possible solutions. Furthermore, we attempt to provide insights on establishing tangible and productive vaccination centers to offer preventive healthcare in hospitals and institutes. We will also discuss the necessary steps to be implemented to enhance the collaboration between different stakeholders and policymakers to create awareness about adult vaccination.

“Aging” World Population and the Concept of Healthy Aging

Aging is an irreversible and inevitable demographic reality.¹⁴ Globally, the number of individuals aged 65 years was more than those aged <5 years in 2018.¹⁵ Furthermore, by 2050, there would be 2 individuals \geq 65 years of age for every child aged <5 years.¹⁶ A similar trend is expected in India, where the proportion of elderly population is anticipated to increase from 8% in 2015 to 19% by 2050.⁵ One of the major concerns regarding the aging population worldwide is the increased burden of diseases including infectious diseases in the elderly population, which in turn increases the likelihood of complications, hospitalization and mortality rates.¹⁷ The elderly population is more susceptible to infections due to age-related decline in their immunity—termed as immunosenescence. Moreover, the presence of one or more comorbid conditions in the elderly, such as cardiovascular diseases (heart failure, chronic heart disease, stroke), pulmonary disorders (chronic obstructive pulmonary disease, asthma), diabetes mellitus, and chronic kidney disease, renders them more vulnerable to infectious diseases.² The increasing proportion of elderly globally has introduced the concept of “healthy aging.” The World Health Organization (WHO) recognizes vaccination throughout an individual’s life as a significant component of healthy aging.¹⁷

Understanding the Need for Vaccination in the Elderly

Increasing Burden of Vaccine-Preventable Diseases in Adults in India

Vaccine-preventable diseases (VPDs) are associated with high rates of morbidity and disability in developing countries. More than 95% of VPD-associated deaths have been reported in adults in India, with deaths due to infectious diseases exceeding those caused by noncommunicable diseases.¹⁸ An Indian study reported pneumonia and meningitis as the most common clinical syndromes associated with invasive pneumococcal disease (IPD), accounting for 39% (146/374) and 24.3% (91/374) of IPD cases, respectively.¹⁹ Moreover, with 38,811 confirmed cases and 2,266 deaths reported in 2017, influenza has been a cause of concern among healthcare practitioners in India.²⁰ Even the invasive disease, meningococcal meningitis, has an alarming

prevalence of approximately 60 to 80 cases per 100,000 population.²¹ Furthermore, a report by the Insurance Information Bureau of India on the health insurance claims for the year 2016-17 stated that “certain infectious and parasitic diseases” was the highest insurance claim category.²² Under these circumstances, the control of VPDs through vaccination requires immediate and urgent attention.

Comorbidities in the Aging Population

A significant proportion of the adult population is hospitalized annually due to VPDs. The presence of risk factors and comorbidities in adults, such as cardiovascular and respiratory diseases, diabetes, and cancer, further aggravate the risk of VPDs, thereby posing a serious obstacle for management by our current healthcare system.¹⁷ The underlying comorbidities can increase the risk of severe respiratory syncytial virus (RSV) disease in the elderly.²³ Furthermore, the risk of developing pneumonia among elderly patients is directly proportional to the severity of the underlying comorbid diseases, such as chronic obstructive pulmonary disease (COPD), asthma, diabetes, heart diseases, and immunocompromised conditions.⁷ Comorbid conditions such as cardiovascular and chronic respiratory diseases, Parkinson’s disease, cerebrovascular disease, dementia, epilepsy, chronic liver or renal disease, and HIV are associated with 2- to 4-fold increase in the risk of community-acquired pneumonia.²⁴ The incidence of pneumonia is 3- to 9-fold in patients with cardiovascular disease alone.^{25,26} Vaccination is the basic health intervention to prevent pneumococcal pneumonia and invasive pneumococcal disease in these patients.²⁶ Vaccination in the elderly attenuates the disease severity and ameliorates the complications and comorbidities. A study demonstrated that both influenza and pneumococcal vaccines can cause up to a 50% reduction in myocardial infarction.²⁷ Similarly, Herpes zoster is associated with an increased risk of stroke, which can be evaded through effective vaccination.²⁸

It must be noted though, that the presence of comorbidities and frailty in the elderly may further decrease the responsiveness toward vaccines. Antibody concentrations following influenza vaccination have been reported to be lower in the elderly as compared to younger adults.²⁹

Emerging Drug Resistance

Although antibiotics are highly effective in treating bacterial infections, resistance to antibiotics is widespread. Drug-resistant infections result in more than 100,000 deaths annually worldwide, which is projected to reach 10 million per year by 2050.³⁰ Vaccination can resolve the multidrug resistance crisis by reducing the antibiotic requirement thus supporting their appropriate use and curtailing their unnecessary usage. Vaccines may also be helpful to target drug-resistant variants of pathogens, for example, pneumococcal conjugate vaccine reduces antimicrobial resistance of the pathogen *S. pneumoniae*.³¹

Age

Another determining factor for adult vaccination is age; it is recommended to lower the age of vaccination against *Pneumococcus*, influenza, and herpes zoster virus from ≥ 65 years to ≥ 50 years owing to their relevance since that age.² Although a single booster can be sufficient in adults, elderly individuals often require more potent vaccines due to their aging immune systems.³²

Other reasons that account for the need for vaccination in adults are the availability of newer vaccines, not receiving vaccines that are usually administered during childhood, decline of acquired immunity developed through vaccination during childhood, and the increased susceptibility of the elderly, particularly those with chronic illness to VPDs.³³

Current Recommendations for Adult Vaccination: Importance of Risk-Based Stratification

The risk-based stratification of adult vaccination is crucial in several aspects and should be followed while immunizing adults. For individuals with chronic health conditions, such as diabetes mellitus and heart or lung disease, obtaining the right vaccine is crucial. Certain health conditions, such as pneumococcal disease or flu, lower an individual's immune system to fight off other VPDs and increase the complications.³⁴ Similarly, individuals at an increased risk of certain diseases, such as healthcare workers, gay or bisexual men, pregnant women, people with health conditions, travelers, and military members need additional vaccines.³⁵

Apart from vaccination for healthy adults, the Advisory Committee on Immunization Practices (ACIP) recommends vaccines based on risk.^{36,37} High-risk individuals are those >65 years of age; pregnant women; healthcare workers working under high-risk conditions; patients with coronary heart disease or emphysema, diabetes, certain immunocompromised diseases such as HIV/AIDS, congestive heart failure, heart attack, angina, arrhythmia, chronic obstructive pulmonary disease, bronchitis, asthma, hepatitis B, hepatitis C, cirrhosis, chronic liver disease, and moderate to severe renal disease; and current smokers. However, the vaccination rates are considerably lower than the expected targets even in the high-risk groups.³⁸ At-risk individuals include those predisposed to certain medical conditions, such as laboratory staff, dialysis staff, nurses working in intensive care units and operation theaters, and other surgeons and doctors, who are occupationally exposed to infectious diseases, such as hepatitis B and varicella-zoster.³⁹

Adult Immunization Guidelines in India

Several guidelines are followed in India for adult immunization: the WHO guidelines,⁴⁰ guidelines of the Geriatric Society of India,¹¹ the ACIP guidelines from Centers for Disease Control,⁴¹ and Association of Physicians of India—Expert

panel guidelines.⁴² The vaccines recommended for all healthy adults in India are influenza (>50 years), pneumococcal vaccine (>65 years), human papillomavirus (9–26 years), Zoster (>60 years), DPT (diphtheria, pertussis, and tetanus), and MMR (measles, mumps, and rubella) vaccines.⁴² The recently updated ACIP guidelines will facilitate clinical decision-making about adult vaccination by the physicians. Moreover, physicians can actively contribute to improving adult vaccination coverage.⁴³

Certain vaccines have a defined sequence of administration, which has been recommended by the guidelines. For instance, the RSSDI (2020) recommends that diabetic individuals in the age range of 2 to 64 years should be administered pneumococcal vaccine. For those with age ≥ 65 years should be administered pneumococcal vaccine irrespective of their vaccination history.⁴⁴

The high morbidity and mortality associated with infectious diseases are preventable through proper vaccination.⁴⁵

Adult Immunization in India: Challenges and Opportunities

The current deficit in adult vaccine coverage is attributed to lack of awareness and knowledge about the benefits of vaccination, uncertainties about costs and benefits, low vaccine effectiveness in the elderly, accessibility and inconsistent recommendations by the healthcare providers (HCPs).¹⁷ In the aging population, evolving vaccines, lack of awareness in patients and providers, economic burden, lack of insurance coverage, vaccine delivery problems, and lack of adequate adult vaccination centers add to the existing challenges. Concerted efforts are required to improve the awareness of public and HCPs regarding VPDs and the benefits of adult vaccination and address the issue of low coverage.

Barriers in Adult Vaccination

Lack of awareness. The awareness about adult vaccination is poor in India despite the heavy disease burden. A survey revealed that $>80\%$ of adults lacked awareness about adult vaccination.¹⁸ Over 2/3 of Indian adults are not aware of adult vaccination, many still think that vaccines are only for children.⁴⁶ This highlights the need to improve awareness regarding adult vaccination both at the patient level and at the level of HCPs and community settings via the involvement of different stakeholders and both the government and private health sectors.

Lack of dedicated adult vaccination centers. It is crucial to set up dedicated adult vaccination centers that cater to adults, the elderly, adolescents, pregnant women, travelers, adults with chronic health conditions, and HCPs to sensitize the population about the significance of adult vaccination. An effective approach to bridge the gap between the expected and actual rates of adult vaccination is to use non-traditional vaccination delivery sites equipped with special walk-in service and extended hours. Pharmacies can successfully increase the adult

vaccination coverage owing to their convenience, ease of access, and expanded hours.⁴⁷ Apart from local pharmacies, adult vaccination facility is available at the doctor's office, health departments and centers, and travel clinics.⁴⁸ Because a change in the conventional venue could improve the rates of adult vaccination coverage, setting up an adult vaccination center, well-equipped with handling and storage facilities, and routine maintenance of vaccination records can immensely benefit adult vaccination.⁴⁹ Such a center could be a medication room, a wellness clinic, or a place near the emergency room; or any other designated place can be used as a temporary vaccination room. Such a setup should be within the hospital premises and accessible to patients, with a visible signboard.

In addition, a common vaccination card containing information on all vaccines, especially for those with comorbid conditions (e.g., the vaccines required for patients with chronic kidney disease) should be available. Moreover, the vaccination card should provide visibility across multispecialty departments and should be easy to understand. The vaccination card can be individualized later as per the specialty.

In addition, we need dedicated and experienced personnel (vaccine champions), such as doctors, nurses, and pharmacists, to administer vaccines.

Adult Vaccination Costs and Lack of Insurance Coverage

Although vaccination is recognized by reputed organizations, including the WHO, as one of the most cost-effective strategies to protect individuals from VPDs,⁵⁰ the cost of vaccines and the lack of insurance coverage are the major barriers to vaccine uptake in adults in India. To make quality healthcare accessible to the poorest of poor families in India, Government of India (GOI) launched the Ayushman Bharat Yojna (PMJAY Scheme). This covers a majority of diagnostics, medicines, pre-hospitalization costs, and medical treatment expenses⁵¹ and aims for increased accessibility, availability and affordability of primary-, secondary- and tertiary-care health services in India.⁵² Vaccination for all age groups should be mainstreamed into package of services offered through government primary healthcare facilities and that of health & wellness centers (HWCs) under Ayushman Bharat program of India.⁵²

A study suggested that PCV13 vaccine prevented 10,360 cases of pneumococcal disease (7,411 inpatient pneumonia) and 699 deaths (14,736 life years gained) in a cohort of individuals aged 65 years. Moreover, this study suggested that vaccination costs of €36.5 million can be offset by a reduction in medical costs of €41.5 million, yielding a net saving of €3.8 million.⁵³ It is important to create awareness among HCPs and patients about the potential cost-saving benefits of vaccines. Furthermore, companies should work toward reducing the cost of vaccines. Because of the cost implications associated with setting up a vaccination center, the HCPs should apprise the concerned management about the return-on-investment benefits of vaccination so that resources could be allocated judiciously to harvest full benefits.^{54,55}

Furthermore, insurance companies can categorize patients and customize their premiums based on their vaccination status. This would benefit not only the insurance companies in reducing the insurance claim costs but also the patients in terms of a lesser insurance premium. In addition, vaccination can be recommended at discharge with the cost covered by insurance companies.^{56,57}

Improving Adult Vaccination Access in India

Creating Opportunities for Vaccine Access

Antimicrobial stewardship (AMS) programs, wellness centers, and annual health checks can significantly promote people's access to vaccination.⁵⁸ In addition, advising specific vaccination before major surgeries or procedures improves access. For example, a patient undergoing cochlear implants is recommended pneumococcal vaccines to prevent infections and reduce the length of hospital stay.⁵⁹

Mobile vaccination vans are a convenient way to provide healthcare services at the doorstep. In addition to improving vaccination coverage in remote areas, these vans can reduce hospitalizations during a disease outbreak.⁶⁰ To facilitate the process further, homecare nurses could visit patients' homes to administer vaccines.

Educating the patients during a routine consultation about the benefits of vaccination can improve their uptake. For instance, a pulmonologist can recommend a pneumococcal vaccine to a patient with COPD or asthma. Moreover, allied health professionals such as dialysis and pulmonary function test (PFT) technicians could be a part of the vaccine-counseling team. Counselors/consultants can advise patients on vaccines. Intensivists can counsel relatives of patients in acute emergencies and advise them on the preventive benefits of vaccines.⁶¹

Digital or written prescriptions, short message service (SMS), or app-based reminders are excellent ways to remind patients about the importance of vaccines.⁶² Artificial intelligence integrated into the hospital information systems can assist in recommending vaccines based on a patient's profile. Outpatient and inpatient records can have a question (for example, "Are you aware of adult vaccination?") and the details of the person to contact can be provided as a footnote.

Involving Key Stakeholders to Improve Adult Immunization Practices

The concept of adult vaccination is new in India, and driving it forward requires strong motivation. All HCPs must compulsorily be vaccinated at all hospitals and teaching institutes, to set an example for and motivate the patients. To further strengthen the drive against VPDs in adults, a national vaccine society including experts from different specialties needs to be set up. The society can act as a representative to put forth the recommendations on adult vaccines to the government and insurance companies and create clinical practice guidelines to guide HCPs on adult vaccination.⁵⁴

Sensitization of government stakeholders and insurance companies to the benefits of adult vaccination can avoid readmissions, prevent infections, and save reimbursement costs. Currently, the government is promoting hepatitis B vaccination aggressively. To highlight the importance of other vaccines to the policymakers, the government could be recommended to include vaccines as a part of the Ayushman Bharat scheme. Further, we need to devise a separate plan to increase the uptake of adult vaccines in rural areas through the HWCs.

Collaborating Toward Establishing Vaccination Centers

Corporate hospitals are not always keen on collaborating to establish a vaccination center; private healthcare organizations should provide a business case to the management on how vaccines can increase revenue.⁶³ It is important to collaborate with the National Accreditation Board for Hospitals & Healthcare Providers (NABH) to make it mandatory for all hospitals to set up adult vaccination centers.⁶⁴ NABH is a constituent board of Quality Council of India (QCI), set up to establish and operate accreditation program for healthcare organizations. Although the existing criteria of NABH mention educating the family members about pediatric immunization and general patients about preventive measures, they do not adequately emphasize adult immunization. Hence, the NABH assessment criteria should include adult immunization to develop an adequate number of adult vaccination centers.

All specialties and stakeholders have an equal role in promoting adult vaccination. Other strategies, although small but effective, include dedicating the Sunday during the world immunization week, celebrated in the last week of April,⁶⁵ to adult immunization. In addition, a day could be dedicated to adult vaccination in continual medical education (CME), conferences, and public awareness programs.

Cost Effectiveness of Adult Immunization

In low- and middle-income countries vaccination brings important economic benefits and proves to be an efficient investment.⁶⁶ COVID-19 (Corona Virus Disease 2019) pandemic has adversely impacted the Indian economy and the GOI initiated the vaccination program. The cost of vaccinating the 18+ population in India is estimated to be USD (United States Dollars) 9175.6 million which is approximately 0.36% of India's Gross Domestic Product (GDP).⁶⁷ But this expenditure would help avoid the impending costs to healthcare. Similarly, GOI should consider large scale implementation for other vaccines in the adult population adopted by high income countries; For example, PCV13 (13 valent pneumococcal conjugate vaccine) vaccination targeting the cohort of 65-year-old immunocompetent Spanish adults expected to result in net savings for the National Health System, thereby decreasing disease burden and averting a substantial number of related deaths.⁵³ Thus, the

impact of vaccines can be measured not just in terms of public health, but also in economic terms: reducing health-care costs, decreasing lost labor force productivity, and contributing to social and economic development.⁶⁸

Conclusion

Stepwise and consistent efforts can successfully implement adult vaccination programs in the country. We propose the following to improve adult vaccination in India:

- Assess the immunization status, recommend relevant vaccines, administer vaccines, and document the vaccines received by patients in state vaccine registries
- Set up adult vaccination centers to increase access to vaccines
- Set up mobile vaccination vans to administer vaccines, especially in the remote areas
- Discuss the importance of adult vaccination and build a strong business case to implement the same with the hospital management.
- Identify the person in charge of the center after discussion with the leadership
- Develop materials and strategies to promote vaccination including CMEs and webcasts at hospital set-ups and cascade meetings at different institutions with the support of HCPs
- Collaborate with different stakeholders, including the government and insurance companies, to address current barriers and help find potential solutions

Authors' Note

Both authors have made substantial contributions to all the following: the conception and design of the study, or acquisition of data, or analysis and interpretation of data. CG drafted the article. GR revised the article critically for important intellectual content and approved the final version to be submitted.


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