Adult Immunization!

Alaka Deshpande[1]
[1]*Former Professor and Head, Department of General Medicine, Grant Government Medical College and Sir JJ Group of Hospitals, Mumbai, Maharashtra, India*
E-mail ID: alakadeshpande@rediffmail.com

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The human race has faced the scourge of various pandemics for over 3000 years! Literature shows documentation of smallpox from 1350 Before Christ (BC). Millions of people succumbed to various pandemics! Spanish flu killed 50 million people, the plague took a toll of 75 to 200 million, and the deadliest of all was smallpox pox, which killed 300 million people since 1900 alone!

The breakthrough came in 1746 when Edward Jenner's observations, that milkmaids with cowpox did not have smallpox led to the discovery of the First smallpox vaccine! The Latin word for cow is *vaca*; cowpox is *vaccinia*. Jenner inoculated the material from a pustule of cowpox to another person who was protected against smallpox[(1)]. He called the new procedure **Vaccination!** This was the beginning of a new discipline of Vaccinology! Over the years, Vaccine-preventable Diseases (VPD) have been identified, and various vaccines have been developed to prevent these infections.

A child's immune system functionally matures after three months of life, so pediatric guidelines were developed. **Childhood vaccination significantly reduces morbidity, mortality, and disability caused by VPDs. Different types of vaccines operate in distinct ways, yet they all aid the immune system to fight against infectious agents.**

The global incidence of Pertussis reduced by 93% from 1980 to 2019. A similar reduction was seen in the incidence of Meningococcal Meningitis and Haemophilus influenza. Annually 399,000 childhood deaths due to pneumococcal diseases are estimated to be prevented.

The human body, whenever invaded by microbes, defends itself with a counterattack against microbes through Cellular Immunity i.e., Natural Killer cells, and Humoral immunity i.e., Immunoglobulins. Invading pathogens are taken up by macrophages and presented to helper CD4 cells. These cells proliferate and differentiate into B cells, which produce antibodies (immunoglobulins) and killer T8 cells. Some of these cell types are preserved as Memory cells, which immediately produce humoral and cellular immune responses upon re-exposure to the same pathogens. It was believed that in most of the VPDs, immunity is lifelong.

However, the population's changing demography, lifestyle changes, and emerging new infections have created a rational need for **adult immunization**! Vaccinations have saved millions of lives and reduced the incidence of VPDs all over the world. Additionally, it has decreased the morbidity of these infectious diseases. One may argue that pneumococcal pneumonia is treatable (though not always!). Just to cite the impact of co-morbidities in advancing age, Pneumococcal Pneumonia are reported /100,000 as

- 8.8 in healthy adults
- 51.4 in Type 2 Diabetes Mellitus (T2DM)
- 62.9 in Chronic Lung Diseases
- 93.7 in heart disease

Recent experience with the H1N1 Pandemic revealed that there was a three-fold risk of hospitalization in diabetics, a four-fold risk of Intensive care Unit (ICU) management, and two-fold mortality. Adverse outcomes also were higher.

Another advantage of immunization is a reduction in antimicrobial resistance! Prevention of infectious disease itself will curb the use of antimicrobials (mostly inadvertent use in our country) and indirectly prevent/decrease the emergence of antimicrobial resistance.

The lesson learned from these experiences is **Adult immunization**!

Centers for Disease Control and Prevention (CDC) has identified vaccine-preventable adult diseases as follows[(2)]: Chicken Pox, Diphtheria, Influenza, Hepatitis A, Hepatitis B, Human Papillomavirus (HPV), Haemophilus influenzae, Measles, Chikungunya, Dengue, Meningococcal Meningitis, pneumococcal diseases, rubella, shingles, tetanus, typhoid, and Pertussis.

In India, the shift in population demographics is noticeable. In 2019, the population in the age group of less than 15 years was 25 percent, and that above 50 years was 19 percent. It's predicted that, in 2031 it will be 22 and 24 percent, respectively.

The aging population is increasing in India. Due to better health conditions, the longevity of the population has increased. Earlier, the life expectancy was 58 years. Now, it is 66.9 years for men and 70.3 years for women. With advancing age, there is immune senescence. Chronic illnesses like Diabetes, Hypertension, Coronary Artery Disease (CAD), Chronic Obstructive Pulmonary Disease (COPD), and Asthma increase the susceptibility to

infections. These illnesses cause immune compromise. In addition, long-term steroid use for certain diseases contributes to immune suppression.

The epidemiology of infectious diseases is changing. Many **new infections** are emerging. As we talk about 'Global Hut,' new infections in any part of the world assume pandemic proportion in a very short time, e.g., bird flu, swine flu, SARS-COV-2, etc. The infectious diseases which were earlier contained or controlled are **re-emerging**. Although it was once believed that post-vaccinated immunity is lifelong, it is now realized that childhood vaccine immunity is waning[3].

As per CDC parameters, age groups for adult immunization are 19 to 26 years, 27 to 49, 50 to 64, and more than 65 years. Other considerations include lifestyle, nature of job, and history of frequent domestic and international travel. One may also inquire about immigrants, refugees, and international adoptions. Healthcare providers and pregnant women are special categories[4]. HPV has been incriminated for Cervical cancer in women and other diseases in both young males and females.

A detailed clinical history of various co-morbid conditions is crucial before a decision, e.g. Type 1 Diabetes Mellitus (T1DM), T2DM, Heart Diseases, Strokes, Liver disorders, End Stage Renal Disorder, COPD, Asthma, etc. Any condition necessitating long-term steroid therapy or immune suppression should be noted. History of splenectomy or functional asplenia warrants consideration. Immunodeficiency due to Human Immunodeficiency Virus (HIV) infection is a special category. Antiretroviral therapy has increased the longevity of these cases.

Prior to immunization, any adverse reaction to the same can guide further course of action.

In India, infectious diseases rule supreme; there is a lack of authenticated data on these diseases. The surveillance system is deficient. Therefore, the adult immunization schedule is given below based on the CDC and European guidelines[3,5-6].

Table 1: Adult Immunization schedule

Sr. No.	Name of the vaccine	Dose
A	**Age Group 19 to 25 years**	
1	TDap (Tetanus, Diphtheria, acellular pertussis)	One dose followed by TD booster every Ten Years
2	HPV Vaccine	
	Girls 9 to 14 years	Two doses 0….6 months
	Girls >14 years	Three doses 0…..1 month…6 months
	Males up to 26 years	Three doses 0…..1 month….6 months
B	**Age Group 27 to 49 years**	
All of the above, if not immunized earlier, plus the Influenza vaccine annually.		
C	**Age group above 50 years**	
1	Tdap	One dose, Td booster every ten years
2	Varicella	2 doses, 4-6 weeks interval
3	Influenza	Tetraflu quadrivalent, 0.5 ml Intramuscular (IM) annually
4	Pneumonia	Pneumovax 23, 0.5 ml IM/Subcutaneous (SC) one dose. May be repeated after 5 years
5	Herpes Zoster	Shingrix (non-live, recombinant) 0….2 months

All healthcare providers need to be protected against prevalent infections. Pregnancy is a special group as one has to consider the mother, the fetus, and the pregnancy outcome. Every clinician, i.e., family physician, internist, and obstetrician should offer preconception counseling to newly married couples. The couple needs to be physically, mentally, and psychologically prepared for parenthood. If indicated, they should be vaccinated before conception.

During pregnancy, live attenuated viral vaccines are **contraindicated**. Measles, Mumps, and Rubella (MMR) vaccine, Varicella, Yellow fever, and Bacillus Calmette-Guerin (BCG) are NOT to be given. Hepatitis A Virus (HAV) and Hepatitis B Virus (HBV) vaccines should be included in preconception management.

Vaccines against swine flu and COVID-19 can be given during pregnancy, depending on local prevalence. Tdap should be given between 27 and 36 weeks, which will also protect the newborn. Advancing technology has helped in the speedy development of newer vaccines. Traditionally, the antibody response is stimulated by using either an antigen, an inactivated virus, or an attenuated virus. Using recombinant technology, an antigen can be produced. These are injected into the body to stimulate immune response. In contrast, Messenger Ribonucleic Acid (mRNA) vaccines introduce a short-lived synthetically created fragment of the RNA sequence of a virus into the individual being vaccinated. mRNA vaccines have the production advantage that they can be designed swiftly. Moderna designed their mRNA-1273 vaccine for COVID-19 in two days. They can also be manufactured faster, more cheaply, and in a more standardized fashion, which can improve responsiveness to serious outbreaks. mRNA vaccines are not constructed from an active pathogen; they are non-infectious.The efficiency of various mRNA vaccines is 90 to 95 percent. The advent of Artificial Intelligence will be a boon to drug discoveries, simulations, and accelerated medical research. Lastly, one must consider vaccine hesitancy in the population. Adult immunization is a new concept. Not only the community but even the medical fraternity is not fully aware and equipped. Huge efforts are necessary to improve the success of this program. Education, Advocacy, and counseling are the pillars of success!

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Alaka Deshpande 0009-0007-9990-1747

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