Vaccines and immunization: Harnessing immunity to prevent infections.

Taylor wein*

Department of Immunology Manchester University Medical School, UK

Introduction

Vaccines and immunization have revolutionized public health by preventing the spread of infectious diseases and saving millions of lives worldwide. Vaccines stimulate the immune system to recognize and respond to specific pathogens, providing immunity without causing the associated risks and complications of natural infection. This essay explores the importance of vaccines and immunization, their historical significance, the mechanisms of action, types of vaccines, and their impact on global health [1].

Historical significance

The concept of immunization dates back centuries, with early practices of variolation in ancient China and India to protect against smallpox. However, the development of modern vaccines began in the late 18th century. Edward Jenner's discovery of smallpox vaccination in 1796 marked a turning point, followed by breakthroughs in vaccine development against diseases such as polio, measles, diphtheria, pertussis, tetanus, and influenza [2]. These advancements have led to the successful eradication or significant reduction of once-devastating diseases.

Mechanisms of action

Vaccines work by stimulating the immune system to recognize and respond to specific pathogens. They typically contain weakened or inactivated forms of the target pathogen, its components, or molecules that mimic the pathogen. The immune response triggered by vaccines involves both the innate and adaptive immune systems.

Innate immune response: Vaccines activate innate immune cells, such as dendritic cells, macrophages, and natural killer cells, which recognize and engulf the vaccine components. This initiates an inflammatory response, releasing cytokines and chemokines that recruit other immune cells to the site of vaccination.

Adaptive immune response: Vaccines induce a specific adaptive immune response, primarily mediated by B cells and T cells. B cells produce antibodies that recognize and neutralize the target pathogen, preventing its entry into host cells. T cells, specifically helper T cells and cytotoxic T cells, are activated to recognize and eliminate infected cells.

Types of vaccines

Vaccines can be categorized into different types based on their composition and mode of action. The main types of vaccines include:

Live attenuated vaccines: These vaccines contain weakened forms of the live pathogen, which can still replicate but cause minimal or no disease symptoms. Examples include the Measles, Mumps, and Rubella (MMR) vaccine and the Oral Polio Vaccine (OPV).

Inactivated vaccines: Inactivated vaccines consist of killed or inactivated forms of the pathogen. They cannot replicate, but they can still stimulate an immune response. Examples include the Inactivated Polio Vaccine (IPV) and the hepatitis A vaccine.

Subunit, recombinant, and conjugate vaccines: These vaccines contain specific components of the pathogen, such as proteins or polysaccharides, to stimulate an immune response. Subunit vaccines, like the hepatitis B vaccine, use purified antigens. Recombinant vaccines, such as the Human Papillomavirus (HPV) vaccine, use genetically engineered proteins. Conjugate vaccines, like the Haemophilus influenzae type B (Hib) vaccine, attach the pathogen component to a carrier protein to enhance the immune response [3].

Viral vector vaccines: Viral vector vaccines use a harmless virus, such as an adenovirus or a modified vaccinia virus, to deliver specific genes from the target pathogen. These genes produce the pathogen's antigens, triggering an immune response [4,5].

Conclusion

Vaccines and immunization have been pivotal in protecting individuals and communities, saving lives, and improving public health. Ongoing research, education, and vaccination efforts are vital to sustain these achievements and tackle future health threats effectively.

References

1. Eyigün CP, Yilmaz S, Gül C, et al. A comparative trial of two surface subunit recombinant hepatitis B vaccines vs a surface and PreS subunit vaccine for immunization of healthy adults. J Viral Hepat. 19;5(4):265-9.
2. Dinleyici EC, Borrow R, Safadi MA, et al. Vaccines and routine immunization strategies during the COVID-19 pandemic. Hum Vaccines Immunother. 2021;17(2):400-7.
3. Pettigrew ZJ, Kim M, Becker-Dreps S. Vaccines and Immunization. InChronic Illness Care: Principles Practice. 2023.

***Correspondence to:** Taylor wein. Department of Immunology Manchester University Medical School, UK, E-mail: wein@manchester.ac.uk

***Received:** 04-Jul-2023, Manuscript No. AACIR-23-104163; **Editor assigned:** 07-Jul-2023, Pre QC No. AACIR-23-104163(PQ); **Reviewed:** 21-Jul-2023, QC No. AACIR-23-104163; **Revised:** 23-Jul-2023, Manuscript No. AACIR-23-104163(R); **Published:** 27-Jul-2023, DOI: 10.35841/aacir-6.3.149*

***Citation:** Wein T. Vaccines and immunization: Harnessing immunity to prevent infections. J Clin Immunol. 2023;6(3):149*

4. Pelletier AN, Sanchez G, Watson M, et al. A prevaccination validated network that drives the breadth of the protective neutralizing antibody response following Dengue Vaccine TV003 immunization. Medrxiv. 2021:2021-09.

5. Delany I, Rappuoli R, De Gregorio E. Vaccines for the 21st century. EMBO Mol Med. 2014;6(6):708-20.

Citation: *Wein T. Vaccines and immunization: Harnessing immunity to prevent infections. J Clin Immunol. 2023;6(3):149*