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Perspective

Infants Influenza Vaccine Viruses: Seasonal Vaccine Development Insights

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ABOUT THE STUDY

Influenza, commonly known as the flu, is a highly contagious respiratory illness that causes substantial morbidity and mortality worldwide each year. Vaccination plays a pivotal role in preventing and controlling influenza outbreaks, with seasonal vaccines being the cornerstone of influenza prevention efforts. This commentary explores the process of developing influenza vaccine viruses and the important considerations involved in the development of seasonal vaccines.

Understanding influenza virus variation

Influenza viruses are renowned for their ability to rapidly evolve through two mechanisms: antigenic drift and antigenic shift. Antigenic drift refers to small genetic changes that accumulate over time in the viral surface proteins, Hemagglutinin (HA) and Neuraminidase (NA), allowing the virus to evade immunity acquired from previous infections or vaccinations. Antigenic shift, on the other hand, occurs when there is a major reassortment of genetic material between different influenza virus strains, resulting in the emergence of a novel virus subtype with pandemic potential.

Selecting vaccine viruses

Each year, the World Health Organization (WHO) convenes experts to determine the composition of the influenza vaccine for the upcoming influenza season. This process involves surveillance of circulating influenza strains, analysis of their antigenic characteristics, and prediction of the strains likely to predominate in the following season. Based on this information, WHO recommends the inclusion of specific influenza strains in the seasonal vaccine.

The recommended strains are usually representative of the three main influenza virus types: Influenza A (H1N1), Influenza A (H3N2), and Influenza B. The selected strains are propagated in eggs or cell cultures to produce the viral antigens required for vaccine production. It is crucial to ensure that the chosen vaccine viruses closely match the circulating strains to maximize vaccine effectiveness.

Egg-based vaccine production

Historically, the majority of influenza vaccines have been produced using egg-based methods. In this process, selected vaccine viruses are injected into fertilized chicken eggs, where they replicate and produce viral proteins. The virus-containing fluid is then harvested, purified, and used as the basis for vaccine formulation.

However, egg-based production methods have limitations. Some influenza strains do not grow well in eggs, and the process is time-consuming, requiring several months to produce sufficient vaccine quantities. Additionally, rare cases of egg allergies have raised concerns regarding the safety of egg-based vaccines for certain individuals. These challenges have prompted the exploration of alternative production technologies.

Cell-based and recombinant vaccine production

In recent years, cell-based and recombinant technologies have gained prominence in influenza vaccine production. Cell-based vaccines involve the propagation of vaccine viruses in animal cell cultures, typically using mammalian cells. This method offers several advantages, including shorter production timelines and the ability to grow a broader range of influenza strains, including those that do not thrive in eggs.

Recombinant vaccines, on the other hand, are produced using genetically engineered systems. In this approach, the HA protein genes from the selected influenza strains are inserted into other viruses or bacteria, such as baculoviruses or yeast. These genetically modified organisms then produce large quantities of the HA protein, which is used as the antigen for vaccine formulation.

Both cell-based and recombinant technologies offer increased flexibility and scalability compared to traditional egg-based methods. They also provide the opportunity for rapid response

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to emerging influenza strains, as the production processes can be initiated more swiftly. Moreover, these technologies reduce the risk of potential egg-related allergies, making them suitable for individuals with egg allergies.

CONCLUSION

The development of seasonal influenza vaccines relies on the careful selection of vaccine viruses that closely match the circulating strains. This process involves ongoing surveillance, antigenic analysis, and expert recommendations. While egg-based vaccine production has been the historical norm, alternative technologies such as cell-based and recombinant methods offer advantages in terms of efficiency, scalability, and potential safety considerations.

Continued research and development in influenza vaccine production are crucial to address the challenges posed by viral evolution and to enhance vaccine effectiveness. The use of novel technologies, coupled with robust surveillance and rapid response capabilities, can contribute to the development of more effective and accessible seasonal vaccines, ultimately reducing the burden of influenza-related illness and mortality worldwide.