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Perspective

# Effectiveness of Anti-Viral Vaccine on Viral Diseases

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## DESCRIPTION

Vaccination is the most effective way to prevent and treat viral infections. Smallpox eradication and significant progress toward polio eradication are clear examples of the enormous impact of antiviral vaccines. However, viral infections continue to be a major public health concern and a leading cause of death. The majority of antiviral vaccines introduced over the last century were developed empirically. These empirically developed vaccines have helped to control diseases such as poliomyelitis, measles, mumps, and rubella. There is, however, a growing list of viral pathogens for which effective vaccines have yet to be developed.

Recent technological advances may provide us with new platforms for developing vaccines against emerging and re-emerging viral pathogens. The most effective antiviral vaccines all have one thing in common: they were designed to mimic our natural immune response to the pathogen. A single case of measles provides survivors with lifelong immunity. As a result, we needed to elicit a similar immune response. While developing a broadly protective vaccine against such pathogens has been a monumental task, it is not impossible, and similar missions, such as anti-HBV and anti-HPV vaccines, have been successfully completed. Despite the importance of vaccines in combating viral pathogens, effective vaccines for many infectious diseases remain unavailable. Understanding of genomics, structural biology, and innate or adaptive immunity has broadened the toolkits available for vaccine development today.

However, unexpected outbreaks and the need for population-level immunization remain significant challenges in today's vaccine designs. From previous experiences there are well-established vaccine development protocols in place to guide vaccine development pipelines for emerging viral diseases. Based on advances in materials science and engineering technologies, factors ranging from essential features of safety, efficacy, manufacturing, and distribution to administration approaches are taken into account. Virus-based vaccines, including weakened and inactivated strains, continue to be the most widely used. The vaccine's effective prevention of the polio epidemic in the twentieth century was a watershed moment in medical history. Another medical application of viruses is based on their specificity and ability to kill the cells that they infect. Oncolytic viruses are viruses that have been genetically modified to attack and kill cancer cells. H101, a genetically modified adenovirus, has been used. The results have been promising, with the combination of chemotherapy and viral therapy producing a higher short-term response rate than chemotherapy alone.

The inactivated polio vaccine (IPV) and oral polio vaccine were used in this vaccination regimen (OPV). The IPV was created by formalin-inactivating lab-cultured polioviruses. The OPV was a live but weakened poliovirus. Weakened viruses are highly immunogenic and are frequently created by deleting viral genes. Nevertheless, mutations could cause virulence reversion, as has been observed for vaccine-derived polioviruses that have been responsible for recent polio outbreaks. This is a barrier to polio eradication and, more importantly, a source of concern for weakened virus-based vaccines in general. To avoid this problem, additional genetic manipulation strategies are required. Modifying the 5′ translated region, 2C coding region, and 3D polymerase region, for example, resulted in a genetically stable OPV strain with limited viral adaptability and a lower likelihood to regain virulence. Inactivated virus vaccines, on the other hand, are generally free of virulence reversion. They also do not rely on extensive genetic manipulations, but the inactivation process may cause viral immunogens to lose their antigenicity.

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