

PREVENTIVE VACCINATIONS

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Abstract

Preventive vaccinations are one of the most effective measures for preventing infectious diseases and protecting public health. Immunization contributes to the development of individual and population-level immunity, reduces the incidence of vaccine-preventable diseases, and helps prevent severe complications and mortality. This article examines the importance of preventive vaccinations, their role in protecting children and adults, and the significance of vaccination programs in maintaining public health.

Keywords: Preventive vaccinations, immunization, vaccines, infectious diseases, public health, disease prevention, vaccine coverage, childhood immunization, vaccination schedule, immunity.

Introduction

Preventive vaccination is one of the most important components of modern public health and primary disease prevention. Vaccination involves the administration of vaccines to stimulate the immune system and develop protection against specific infectious diseases before exposure occurs. Unlike treatment, which is generally provided after a disease or health problem has developed, preventive vaccination aims to reduce the probability of infection, severe disease, complications, disability, and death in advance. The importance of immunization is demonstrated by its historical and contemporary effects on population health. According to the World Health Organization (WHO), global immunization efforts between 1974 and 2024 are estimated to have saved at least 154 million lives, including approximately 101 million infants. The same analysis identified measles vaccination as having the largest contribution among the vaccines studied, accounting for approximately 60% of the estimated lives saved through immunization.

MAIN PART

The public-health value of preventive vaccination extends beyond the protection of an individual. When a sufficiently large proportion of a population is immunized, transmission of particular infectious agents can be reduced, thereby providing indirect protection to people who cannot be vaccinated for specific medical or age-related reasons. This population-level effect is particularly important for highly contagious diseases such as measles. WHO and UNICEF reported that in 2023 approximately 83% of children worldwide received a first dose of measles-containing vaccine through routine immunization, while approximately 74% received the second dose. These levels remained below the approximately 95% coverage with two doses generally required to prevent sustained measles transmission and outbreaks.





The historical eradication of smallpox provides one of the clearest practical examples of the potential of vaccination. UNICEF notes that smallpox, which caused enormous mortality and disability during the twentieth century, was eradicated through coordinated international vaccination and surveillance efforts. This achievement demonstrated that sustained vaccination programmes, combined with epidemiological surveillance and international cooperation, can fundamentally change the global burden of an infectious disease.

Routine childhood immunization represents another important practical application of preventive vaccination.

Routine childhood immunization represents another important practical application of preventive vaccination. Children are particularly vulnerable to a number of infectious diseases during the first years of life because their immune systems are still developing. National immunization programmes therefore establish vaccination schedules according to age and recommended intervals. For example, the U.S. Centers for Disease Control and Prevention (CDC) schedule updated on 2 July 2025 includes vaccines protecting children against hepatitis B, rotavirus, diphtheria, tetanus, pertussis, Haemophilus influenzae type b, pneumococcal disease, poliomyelitis, measles, mumps, rubella, varicella, hepatitis A and other vaccine-preventable diseases. The schedule also provides catch-up recommendations for children who did not receive vaccines at the recommended age.

The concept of catch-up vaccination is particularly important in real-world healthcare. A child may miss a scheduled dose because of illness, migration, limited access to healthcare, administrative problems, or interruption of health services. In such circumstances, healthcare providers should assess the child's documented vaccination history and use the appropriate catch-up schedule rather than simply considering the child permanently unprotected. The CDC's 2025 guidance specifically instructs healthcare professionals to determine the appropriate vaccine according to age, calculate the recommended interval for catch-up vaccination, consider medical indications, and review contraindications and precautions.

The subsequent recovery has been gradual rather than uniform. WHO and UNICEF reported that in 2024 approximately 89% of infants globally, representing about 115 million children, received at least one dose of a DTP-containing vaccine, while approximately 85%, or about 109 million children, completed the three-dose series. Nevertheless, nearly 20 million infants missed at least one DTP-containing dose, including an estimated 14.3 million children who received no routine vaccination at all. These children are commonly described as "zero-dose" children.

The problem of zero-dose children illustrates an important principle of preventive vaccination: vaccine effectiveness at the population level depends on accessibility as well as scientific development. A vaccine can be highly effective but cannot protect a child who never receives it. Consequently, modern immunization strategies increasingly focus on reaching populations living in remote areas, low-resource communities, conflict-affected settings, and other locations where healthcare access is limited. The WHO's Immunization Agenda 2030 emphasizes both high coverage and equity, with the objective of ensuring that people receive vaccination regardless of geographical location, socioeconomic circumstances, age, or other barriers.

Uzbekistan provides a particularly relevant practical example of the importance of preventive vaccination. According to UNICEF's regional report, the Government of Uzbekistan introduced the human papillomavirus (HPV) vaccine into the national immunization calendar in 2015 and began





implementation in 2019. Coverage among eligible girls reportedly reached 98.6% during the initial implementation phase. When the second-dose programme was implemented in June 2020 during the COVID-19 pandemic and associated restrictions, reported coverage reached 97.8%. This example demonstrates how a national immunization programme can introduce a vaccine targeting a specific cancer-related infection and maintain high coverage even during a major disruption to health services.

The Uzbekistan HPV programme also demonstrates the importance of communication between healthcare institutions and communities. UNICEF reported that vaccine confidence was a significant challenge during implementation because rumours circulated linking HPV vaccination with infertility. In response, the Ministry of Health and its partners used multiple communication channels and developed messages for parents and religious leaders, while also engaging influential community figures. The case demonstrates that preventive vaccination is not exclusively a biomedical intervention; it also requires effective health communication, public education, community engagement, and trust in healthcare institutions.

Measles offers an especially clear example of what can happen when vaccination coverage is insufficient. WHO and CDC estimated approximately 10.3 million measles cases globally in 2023, representing a 20% increase compared with 2022. More than 22 million children missed their first measles vaccine dose in 2023, and global first-dose coverage was approximately 83%. Since measles is highly contagious, relatively small reductions in population immunity can create conditions for outbreaks. Thus, maintaining high vaccination coverage is not simply a matter of individual protection; it is also an essential element of outbreak prevention.

Preventive vaccination also applies beyond childhood. Adolescents and adults may require vaccines or booster doses according to age, occupation, medical circumstances, travel, pregnancy, or exposure risks. For example, HPV vaccination is used as a preventive strategy against infections associated with several cancers, while tetanus-containing vaccines may require subsequent doses because protection can decline over time. Influenza vaccination is another example of life-course immunization because vaccination is repeated periodically and is particularly relevant for groups at increased risk of severe influenza complications. The CDC's 2025 schedule includes recommendations covering children, adolescents and adults and therefore reflects the broader principle that immunization is not limited to infancy.

CONCLUSION

In conclusion, preventive vaccination remains a fundamental instrument for protecting individual and population health. Evidence accumulated over decades demonstrates its contribution to preventing infectious diseases, reducing severe illness and mortality, and controlling outbreaks. The estimated 154 million lives saved by global immunization efforts from 1974 to 2024 provide a powerful historical measure of its public-health impact. At the same time, the continued existence of millions of zero-dose children and recurring outbreaks of vaccine-preventable diseases demonstrates that the benefits of vaccination cannot be considered permanent or automatic.





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