

Review

Evaluation of Whole-Cell and Acellular Pertussis Vaccines in the Context of Long-Term Herd Immunity

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Abstract: After the pertussis vaccine had been introduced in the 1940s and was shown to be very successful in reducing the morbidity and mortality associated with the disease, the possibility of improving both vaccine composition and vaccination schedules has become the subject of continuous interest. As a result, we are witnessing a considerable heterogeneity in pertussis vaccination policies, which remains beyond universal consensus. Many pertussis-related deaths still occur in low- and middle-income countries; however, these deaths are attributable to gaps in vaccination coverage and limited access to healthcare in these countries, rather than to the poor efficacy of the first generation of pertussis vaccine consisting in inactivated and detoxified whole cell pathogen (wP). In many, particularly high-income countries, a switch was made in the 1990s to the use of acellular pertussis (aP) vaccine, to reduce the rate of post-vaccination adverse events and thereby achieve a higher percentage of children vaccinated. However the epidemiological data collected over the past few decades, even in those high-income countries, show an increase in pertussis prevalence and morbidity rates, triggering a wide-ranging debate on the causes of pertussis resurgence and the effectiveness of current pertussis prevention strategies, as well as on the efficacy of available pertussis vaccines and immunization schedules. The current article presents a systematic review of scientific reports on the evaluation of the use of whole-cell and acellular pertussis vaccines, in the context of long-term immunity and vaccines efficacy.

Keywords: pertussis; *Bordetella pertussis*; acellular pertussis vaccine; whole cell pertussis vaccine; DTaP; Tdap; DTwP

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1. Introduction

Pertussis, also known as whooping cough, is a highly contagious respiratory disease mainly caused by gram-negative bacteria named *Bordetella pertussis*. This is a disease that causes uncontrollable violent coughing, most commonly affects infants and young children, and can be fatal, especially in babies less than 1 year of age. However, it is important to note that pertussis can affect people of any age [1]. Several underlying medical conditions, such as asthma and chronic obstructive pulmonary disease, were reported as risk factors for pertussis [2–4]. The best way to prevent pertussis is to get vaccinated. The types of pertussis vaccines and schedules used in the national immunization programs have evolved since the development of the first generation of pertussis vaccine consisting of a suspension of detoxified and heat-killed bacteria (whole-cell pertussis, wP) [5–9]. In the late 1940s, Pearl Kendrick, Grace Eldering, and Loney Gordon developed a combined

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Table of Contents Pertubis Evaluation And Research On Acellular Pertubis Vaccines

1. Understanding the eBook Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - The Rise of Digital Reading Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Advantages of eBooks Over Traditional Books
2. Identifying Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - User-Friendly Interface
4. Exploring eBook Recommendations from Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Personalized Recommendations
 - Pertubis Evaluation And Research On Acellular Pertubis Vaccines User Reviews and Ratings
 - Pertubis Evaluation And Research On Acellular Pertubis Vaccines and Bestseller Lists
5. Accessing Pertubis Evaluation And Research On Acellular Pertubis Vaccines Free and Paid eBooks
 - Pertubis Evaluation And Research On Acellular Pertubis Vaccines Public Domain eBooks
 - Pertubis Evaluation And Research On Acellular Pertubis Vaccines eBook Subscription Services
 - Pertubis Evaluation And Research On Acellular Pertubis Vaccines Budget-Friendly Options
6. Navigating Pertubis Evaluation And Research On Acellular Pertubis Vaccines eBook Formats
 - ePub, PDF, MOBI, and More
 - Pertubis Evaluation And Research On Acellular Pertubis Vaccines Compatibility with Devices
 - Pertubis Evaluation And Research On Acellular Pertubis Vaccines Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Highlighting and Note-Taking Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Interactive Elements Pertubis Evaluation And Research On Acellular Pertubis Vaccines

8. Staying Engaged with Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Pertubis Evaluation And Research On Acellular Pertubis Vaccines
9. Balancing eBooks and Physical Books Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Pertubis Evaluation And Research On Acellular Pertubis Vaccines
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Setting Reading Goals Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Fact-Checking eBook Content of Pertubis Evaluation And Research On Acellular Pertubis Vaccines
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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