Vaccine Immunogenicity, Efficacy, and Effectiveness

**Immunogenicity** – the ability of an antigen (i.e., vaccine) to provoke an immune response in an individual.

**Efficacy** – the extent to which a vaccine provides a beneficial result under **ideal conditions**. The efficacy of a new vaccine is measured in phase III clinical trials by giving one group of people a vaccine and comparing the incidence of disease in that group to another group of people who do not receive the vaccine.

**Effectiveness** – the extent to which a vaccine provides a beneficial result under **real-life conditions**.

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<th>Vaccine</th>
<th>Effectiveness/Efficacy/Immunogenicity</th>
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| **Diphtheria – Pertussis – Tetanus** | • Diphtheria: 99% of people immunized with complete primary series develop protective antibody levels (antitoxin titres of > 0.1 IU/mL)  
• Tetanus: close to 100% (virtually all people immunized with full primary series achieve protective antitoxin levels)  
• Acellular Pertussis: estimated efficacy is approximately 85% |
| **Haemophilus influenza type b**  | • Clinical efficacy: 95-100% |
| **Inactivated Polio**            | • Close to 100% of vaccine recipients develop protective antibody levels after 3 doses |
| **Hepatitis B**                  | • Children < 2 years of age: 95% immune response rate  
• Children 5-19 years of age: 99% seroprotection  
• Adults ≥ 20 years of age: immune response declines with age (95% at 20 years of age and 50-70% at ≥ 60 years of age) |
| **Human Papillomavirus (HPV)**   | • Seroconversion rates in adolescents > 99% for all 4 HPV vaccine types (i.e., 6, 11, 16, and 18)  
• 99% efficacy against CIN 2/3 (cervical cancer precancerous lesions) due to HPV types 16 and 18  
• 99% efficacy against genital warts related to HPV types 6 and 11 |
| **Influenza**                    | • Effectiveness depends on age and immunocompetence of recipient and degree of similarity between virus strains included in the vaccine and circulating strains  
• 70-90% efficacy in healthy children and adults  
• Elderly: 56% effective in preventing respiratory illness; 50% effective in preventing hospitalization due to pneumonia; 68% effective in preventing death  
• Facility residents: 30-40% effective against influenza illness; 50-60% effective against hospitalization and pneumonia; and 85-95% effective in preventing death  
• Yearly vaccination is required |
| **MMR**                          | • 85-95% of infants immunized with 1 dose of MMR at 12-15 months of age develop antibodies  
• Close to 100% with 2 doses of MMR |
| **Meningococcal C conjugate**    | • Efficacy > 90%  
• Immunogenic in infants and young children  
• Induces immunologic memory |
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| Meningococcal quadrivalent      | • Immunogenicity: 80-100% depending on age of recipient  
| conjugate                       | • Demonstrated ability to boost antibody response to meningococcal C conjugate vaccine                                                                                      |
| Meningococcal quadrivalent      | • Efficacy for serogroups A and C 85-100% among children ≥ 4 years of age and adults  
| polysaccharide                  | • Vaccine effectiveness of 87-94% has been observed in children ≥ 2 years                                                                                                    |
| Pneumococcal conjugate          | • Protective efficacy of 89-97% observed against invasive disease due to vaccine serotypes  
|                                | • Effective in infants and young children. Induces immunologic memory                                                                                                        |
| Pneumococcal polysaccharide     | • 60-70% effective in preventing invasive disease caused by serotypes in the vaccine (> 80% in healthy young adults and 50-80% in the elderly and individuals with chronic illness) |
| Varicella                       | • Children 12 months to 12 years of age: 98% seroconversion rate at 4-6 weeks post-immunization  
|                                | • Adults and adolescents ≥ 13 years of age given 2 vaccine doses 4-8 weeks apart: 99% seroconversion rates at 4-6 weeks after the second dose  
|                                | • Vaccine effectiveness 70-90% in preventing varicella disease of any severity and 95% protection against severe varicella for at least 7-10 years after immunization |