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**.

Vaccine	Effectiveness/Efficacy/Immunogenicity
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

Vaccine	Effectiveness/Efficacy/Immunogenicity
Meningococcal quadrivalent conjugate	• Immunogenicity: 80-100% depending on age of recipient • Demonstrated ability to boost antibody response to meningococcal C conjugate vaccine
Meningococcal quadrivalent polysaccharide	• Efficacy for serogroups A and C 85-100% among children ≥ 4 years of age and adults • 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