## Topics

- **Principals of immunization**
- **Vaccines**
- **Immunizations**

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## Principals of immunization

- **Active immunity**
- **Passive immunity**

17-2

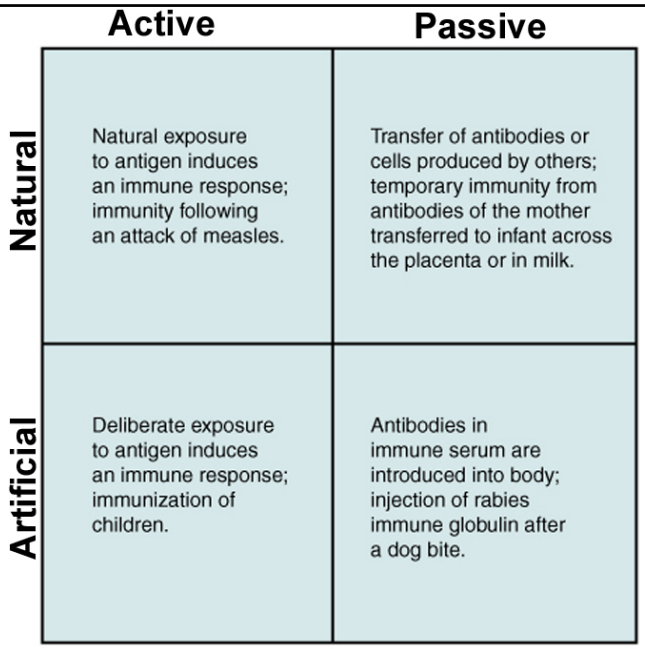


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**Figure 17.1 Active and passive immunity**

*Antitoxin – antibody preparation against a specific toxin*

*Antiserum – a preparation of serum containing protective antibodies*

*Immune serum globulin – passive immune preparation containing IgG (gamma globulin*

- *pooled blood serum from many donors*
- *variety of Abs*
- *given to travelers and immunosuppressed individuals*

*Hyperimmune globulin – sera from donors with high levels of specific Abs*

- *eg anti tetanus, rabies, hepatitis A and hepatitis B*
- *given during disease incubation period to prevent disease development*

*Herd immunity – inability of a pathogen to spread ; no hosts*

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## Vaccines

- **Attenuated** *(weakened form of the disease-causing agent)*
  - *Agent replicates, may cause mild disease*
  - *Mimics wild type strain, controls infection*
  - *Longer antigen exposure than inactivated vaccines*
  - *Can cause disease in immunocompromised people*
  - *eg Sabin polio vaccine*

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## Vaccines

- **Attenuated**
- **Inactivated** *(unable to replicate; retains immunogenicity)*
  - *cannot cause infections or revert to dangerous form*
  - *no amplification of dose in vivo; boosters required*
  - *Inactivated whole agent vaccines – killed microorganisms*
  - *Toxoids – inactivated toxins*
  - *Protein subunit vaccines (and recombinant vaccines)*
    - *contain key protein antigens*
    - *reduced unwanted side effects*
  - *Polysaccharide vaccines – T-independent antigens*
    - *conjugate vaccine – polysaccharide plus protein = T-dependent vaccine*
  - *Adjuvant – enhances immune response to antigens, provide "danger signals"*

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**Table 17.1 Some Important Immunizing Agents for Humans**

| Disease | Type of Vaccine | Persons Who Should Receive the Vaccine |
|---|---|---|
| Anthrax | Acellular | People in occupations that put them at risk of exposure, such as military personnel |
| Diphtheria | Toxoid | Children; adults receive a booster every 10 years |
| *Haemophilus influenzae* type b infections | Polysaccharide-protein conjugate | Children |
| Hepatitis A | Inactivated virus | Children who live in selected regions, people traveling to certain parts of the world |
| Hepatitis B | Protein subunit is produced by genetically engineered *Saccharomyces cereviseae* and purified | Children, adults in high-risk groups such as IV drug abusers, health care workers who might be exposed to infected blood, and contacts of infected people, homosexual men, and people who have multiple sexual partners |
| Influenza | Inactivated virus, usually given by injection in the United States, but as a nasal spray in parts of Europe | Adults over age 50, medical personnel, and people at increased risk for complications; given yearly, as the antigens of the virus change frequently |
| Measles | Attenuated virus | Children, people entering college, adults born after 1956 who have not been immunized, travelers to foreign countries, and HIV-infected people without severe immunosuppression |
| Meningococcal disease | Purified polysaccharide (4 serotypes) | Children and adults with certain conditions that put them at greater risk (for example, those without a spleen or who have certain complement system defects); people traveling to sub-Saharan Africa |

## Table 17.1 - Vaccines

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**Table 17.1 Some Important Immunizing Agents for Humans**

| Disease | Type of Vaccine | Persons Who Should Receive the Vaccine |
|---|---|---|
| Mumps | Attenuated virus | Same as measles |
| Pertussis (whooping cough) | Acellular vaccine given together with diphtheria and tetanus toxoids (DTaP) | Children |
| Pneumococcal infection | Two forms—purified polysaccharide (PPV) and polysaccharide-protein conjugate (PCV) | Children should receive PCV; adults over 65, people with certain chronic infections, and others in high-risk groups should receive PPV |
| Rabies | Inactivated virus grown in human or rhesus monkey cells | People exposed to the virus, people at high risk for exposure, such as veterinarians and other animal handlers |
| Rubella (German measles) | Attenuated virus | Children, adults (particularly women) who are susceptible, health care workers who are at high risk of exposure |
| Tetanus | Toxoid | Children; adults receive a booster every 10 years |
| Tuberculosis | Attenuated BCG strain of tuberculosis bacteria | Used only in special circumstances in the United States; widely used in other countries |
| Typhoid fever | Two forms—attenuated bacteria (taken orally) and purified polysaccharide | People traveling to certain parts of the world |
| Varicella-zoster (chickenpox) | Attenuated virus | Children; may also be given to susceptible adults |
| Yellow fever | Attenuated virus | Travelers to affected areas |

## Table 17.2 - Vaccines

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## Immunizations

- **Paralytic poliomyelitis**
- **Effectiveness of immunizations**
- **Recommended immunizations**
- **Future immunizations**

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## Paralytic poliomyelitis

- **1950 – Salk vaccine (inactivated virus)**
- **1960 – Sabin vaccine (attenuated virus)**
- **Salk vaccine is safe *(but virus can replicate and spread)***
- **Sabin vaccine provides herd immunity**
  - ***given orally, induces mucosal immunity***
  - ***can cause vaccine-related polio in some individuals***

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**Table 17.3 The Effectiveness of Universal Immunization in the United States**

| Disease | Cases per Year Before Immunization | Decrease After Immunization |
|---|---|---|
| Smallpox | 48,164 (1900–1904) | 100% |
| Diphtheria | 175,885 (1920–1922) | Nearly 100% |
| Pertussis (whooping cough) | 147,271 (1922–1925) | 95.7% |
| Tetanus | 1,314 (1922–1926) | 97.4% |
| Paralytic poliomyelitis | 16,316 (1951–1954) | 100% |
| Measles | 503,282 (1958–1962) | Nearly 100% |
| Mumps | 152,209 (1968) | 99.6% |
| Rubella (congenital syndrome) | 823 (estimated) | 99.4% |
| *Haemophilus influenzae* type b infections | 20,000 (estimated) | 99.7% |

## Table 17.3 - Effectiveness of immunizations

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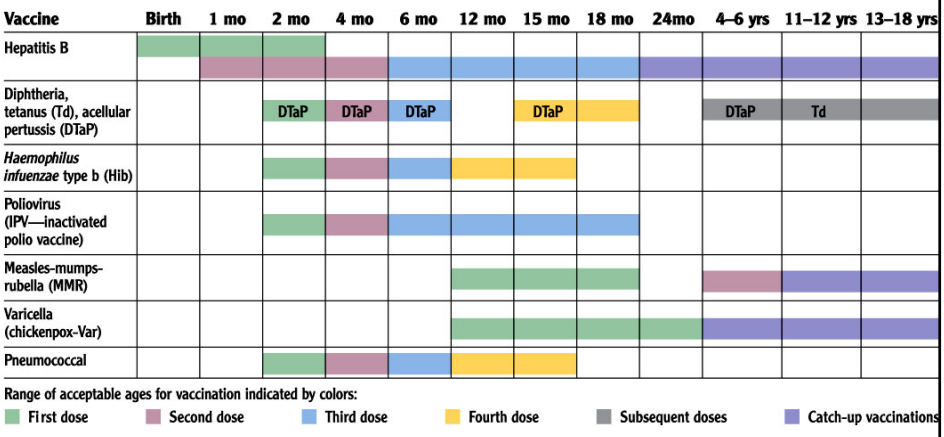
**Table 17.4 Recommended Childhood Immunization Schedule in the United States (2002)**




## Table 17.4 - Recommended immunizations

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**Table 17.5 Some Diseases for Which New or Improved Vaccines Are Sought**

| Disease | Estimated impact |
|---|---|
| HIV/AIDS | 40 million infected worldwide, with approximately 14,000 new infections daily |
| Malaria | 300–500 million cases/yr and up to 3 million deaths/yr worldwide |
| Influenza | 30–50 million cases/yr worldwide; 10,000–40,000 deaths/yr in the United States |
| Strep throat | 20 million cases/yr in the United States |
| Genital herpes | 45 million infected and 500,000 new infections/yr in the United States |
| Hepatitis C | 170 million infected worldwide |
| Cancer | 1 in 3 in the United States may get cancer, resulting in 560,000 deaths/yr |

# Table 17.5 - Future immunizations

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