



One Minute Revision Guides

Vaccines: A guide for medical students

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Vaccines

Objectives

- Understand the role vaccines have in promoting individual and public health
- Know the different types of vaccines and be able to list some examples
- Be aware of the current UK immunization schedule for children and other high risk groups that require vaccines.

Definition

“Vaccines are antigenic preparations of a pathogen that are administered to a host to either prevent or reduce the severity of a disease in an individual”

In the context of public health terms we usually think of vaccines are being as a classic example of **primary prevention** (Table 1)

| Type of Prevention | Definition | Example |
|--------------------|---|--|
| Primary | Designed to prevent occurrence of a disease | Vaccines |
| Secondary | Designed to catch an early stage of disease | Mammography and breast cancer |
| Tertiary | Designed to minimize the harmful effects of a diagnosed disease | The use of aspirin in patient with ischaemic heart disease |

Table 1 The different types of prevention in public health.

Vaccination can also protect non immunized individuals - known as **herd immunity**

“Herd immunity is when a non immunized individual is protected from the disease because there is less exposure to the pathogen in a population. This is because a high proportion of the population is immunized.”

Mechanism of Action

Most vaccines work by inducing **active immunity**. This is where the host immune system produces an antibody response to a known antigen. **Passive immunity** refers to when antibodies are acquired externally (e.g. by maternal-fetal transfer or by immunisation) Vaccines are constructed using different methods. It is not surprising that a vaccine that most resembles the real organism is more likely to induce a better response. Table 2 lists a number of different vaccines and how they are made.

It is important to know the list of **live vaccines** as there are specific groups of people that should not receive these vaccines without prior consideration. These include:

- pregnant women
- immunocompromised patients (on high dose steroids, post chemotherapy, HIV etc)

| Type of vaccine | Description | Example |
|------------------------------|--|---|
| Live attenuated | A weak strain of live pathogen is selected Alternatively the pathogen is "weakened" either by heat or chemical treatment. | BCG, measles, mumps, rubella, oral polio, yellow fever |
| Whole killed organism | The whole organism is killed | Rabies, pertussis, typhoid, influenza |
| Fragment | An antigenic fragment of the organism is used. | Diphtheria, tetanus, meningococcus, pneumococcus, haemophilus |
| Other: | Various methods- recombinant technology, use of adjuvant to enhance immune response. | Hepatitis B, cholera |

Table 2 The different types of vaccines

Special cases of vaccine administration

There are a couple of high risk groups who have special vaccination requirements. You should be aware of these.

a) Patients undergoing splenectomy¹

The spleen is involved in the removal of capsulated organisms. If they have not received the necessary vaccines, these patients should have vaccines against the following organisms **at least two weeks before** their splenectomy.

- Haemophilus Influenza (B,C)
- Meningococcus C
- Pneumococcus
- Influenza

In addition remember that these patients should be on lifelong penicillin or erythromycin (if penicillin allergic) after their splenectomy. Each local area is likely to have guidelines.

b) Influenza Vaccine²

This is a vaccine given on a yearly basis and it is designed based on the strains most likely to cause flu that winter. It is given to groups with such a degree of co-morbidity that they are likely to get a bronchitis or pneumonia from the flu. Some of the high risk groups include:

- Over 65 years of age
- Chronic lung disease, heart disease or renal disease
- Diabetes Mellitus
- Immunocompromised or asplenic patients
- Health professionals in contact with influenza.

The UK Immunization Schedule

In the UK children are put through an immunization schedule for a group of diseases considered serious enough to be an individual and public health burden. Usually a series of immunizations are needed to achieve the appropriate immunity. It is important that vaccinations do not start too early as newborn babies often have maternal antibodies (transferred via the placenta) that confer some immunity, hence neutralizing the vaccine. Also note that live vaccines are usually given at least one month apart.

| Age | Vaccines given for diseases: |
|------------------|---|
| 2 months | Diphtheria, Tetanus and Pertussis, Polio and Haemophilus Influenza B Pneumococcal infection |
| 3 months | Diphtheria, Tetanus and Pertussis, Polio and Haemophilus Influenza B Meningitis C |
| 4 months | Diphtheria, Tetanus and Pertussis, Polio and Haemophilus Influenza B Pneumococcal infection Meningitis C |
| 12 months | Haemophilus Influenza B Meningitis C |
| 13 months | Measles mumps and rubella Pneumococcal infection |
| 3 years 4 months | Diphtheria, Tetanus and Pertussis Polio and Haemophilus Influenza B Measles mumps and rubella |
| 12-13 years | Human Papilloma vaccine virus (for cervical cancer) |
| 13-18 years | Diphtheria, Tetanus and Polio |

Table 3 The UK immunization schedule³

References:

1. *Guidelines for the prevention and treatment of infections in patients with an absent or dysfunctional spleen.* British Society of Haematology.
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About the Author

Reuben Arasaratnam is a currently a Foundation Year 2 Doctor working in the United Kingdom, with a Masters in Public Health. He is helping to write a series of guides for MedicalEducator. Medical Educator would like to thank him for his contribution.