**Program Name:** Immunization Competencies Education Program  
**Module 4 - The Types of Immunizing Agents and Their Composition**

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**CCCEP:**
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**Sponsor:**
- This module is developed in collaboration with the Canadian Paediatric Society, the Public Health Agency of Canada and Health Canada.
Competency: Applies the knowledge of the components and properties of immunizing agents as needed for safe and effective practice.

Learning Objectives

Upon successful completion of this section the health professional will be able to perform the following:

1. Classify each immunizing agent used in practice as live attenuated, inactivated, or subunit.
2. Demonstrate the ability to describe live attenuated, inactivated, and subunit immunizing agents to an audience with minimal or no science knowledge.
3. Compare the major advantages and disadvantages of live attenuated versus inactivated/subunit immunizing agents.
4. Identify key differences in the immune response to purified polysaccharide versus polysaccharide protein conjugate vaccines.
5. Describe, in general terms, the purpose, action and potential concerns of each of the following components that may be present in a given vaccine product: adjuvant, preservative, additives, glass vial, stopper, and prefilled syringe.
6. Locate and utilize current information resources on the types and content of immunizing agents used in practice.

Test Your Current Knowledge

1. Live attenuated vaccines replicate in the patient’s body
   a. True
   b. False
2. Live attenuated vaccines normally require a multiple dosage regimen
   a. True
   b. False
3. Subunit vaccines produce a similar immune response as live attenuated vaccines
   a. True
   b. False
4. The MMR is contraindicated in patients with an egg allergy
   a. True
   b. False
5. Clinicians have to be very careful with vaccines when a patient is allergic to antibiotics as the risk of allergic reactions is very significant
   a. True
   b. False
6. Combination vaccines contain different antigens to multiple disease conditions
Types of Vaccines

There are several different types of vaccines that are used in Canada. Each type of vaccine simulates the immune system somewhat differently resulting in varying antibody production. Healthcare professionals involved in immunizations should be able to explain the key differences between these different types to the patients they are immunizing and their parents.¹

Live Attenuated Vaccines

This type of vaccines contains whole, living bacteria or viruses that induce immunity by actively replicating within the host.¹ Live vaccines are attenuated which means the vaccine strains are weakened so that the infection is usually not apparent or very mild in contrast to the natural or “wild” infection.

The organism in the vaccine replicates within the person to mimic a natural infection. Following immunization, microorganism particles rapidly disseminate throughout the body and reach their target tissues.²

Frequently Asked Questions Regarding Live Attenuated Vaccines

1. Are you immunizing me with something live that will cause an infection?
   o These vaccines are live and will grow in the body just like if you were to come into contact with the real infection.
   o The major difference is they are weakened so they are unlikely to cause an infection in the person that receives them.

2. Why use a live vaccine over a virus and bacteria that is already dead?
   o Live vaccines offer some advantages over some other vaccines:
      They grow in the body and they are transmitted to other areas of the body so the immune system develops an effective immune reaction to them, just like if you were to come in contact with a natural infection.
      These vaccines lead to high antibody levels and most will only need one dose to lead to long-term immunity.

3. Is there any group that should not receive this type of vaccine?
   o Because these are live vaccines, we usually do not administer them to people who have weakened immune systems, including those receiving chemotherapy or long-term oral steroids or who are HIV positive (except in select cases where the risks of infection outweigh the risks of immunization).
   o These vaccines are not recommended to use during pregnancy.

4. Are there any other special concerns with these vaccines?
These vaccines contain live agents so storage conditions are especially important so that they maintain their full potency.

5. **Which infectious diseases can currently be prevented by live attenuated vaccines?**
   - Live-attenuated vaccines are currently available against measles, mumps, rotavirus, rubella, tuberculosis, yellow fever, varicella, and shingles.
   - For a complete listing of the vaccines types available in Canada see [Appendix 1](#).

**Inactivated Vaccines**

This type of vaccine contains killed bacteria or virus. As a result of the production process there is no risk of uncontrolled replication of the organism in the immunocompromised persons. While these vaccines can induce broad immunity when multiple antigens are present, the immune response might be blunted in persons who are not fully immunocompetent.

**Frequently Asked Questions Regarding Inactivated Vaccines**

1. **If we can administer dead and inactivated vaccines why would we use a live vaccine?**
   - With the absence of microbial replication seen with live attenuated vaccines, the inactivated vaccines tend to have less of an immune response.

2. **Are there any other main differences with inactivated vaccines compared to live vaccines?**
   - Non-live vaccines activate innate response only at their sites of injection and the site and route of administration is more important than with live vaccines.
   - These injections are normally given in well vascularised muscles and subcutaneous injections are generally less effective due to a reduction in immune response.
   - Inactivated vaccines almost always require multiple doses. The first dose does not produce protective immunity, but “primes” the immune system. A protective immune response develops after the second or third dose.
   - Protection provided by an inactivated vaccine will diminish over time. For this reason some inactivated vaccines may require periodic supplemental doses to increase or “boost” antibody levels.

3. **Which infectious diseases can currently be prevented by inactivated vaccines?**
   - Inactivated vaccines are currently available against hepatitis A, influenza, Japanese encephalitis, poliomyelitis, rabies and tick-born encephalitis.
   - For a complete listing of the vaccines types available in Canada see [Appendix 1](#).

**Subunit Vaccines**

Subunit vaccines contain purified products that usually come from the bacteria or virus that causes the natural infection but may also be synthesized using recombinant technology. The end products include proteins, polysaccharides and protein-polysaccharide conjugates.

**Frequently Asked Questions Regarding Subunit Vaccines**
1. **What are the main differences with subunit vaccines compared to live vaccines and inactivated vaccines?**
   - Subunit vaccines contain only a small portion of a bacteria or virus and therefore are very safe and can be administered to immunocompromised patients.
   - The disadvantage of these products is they do not elicit a high immune response compared to live vaccines and like inactivated vaccines normally require multiple injections and booster doses to achieve and maintain immunity.1

2. **What are combination vaccines?**
   - Both the inactivated vaccine format and the subunit vaccine format facilitate the preparation of a variety of combination products with multiple antigens to different infections.3 For example the combination of diphtheria toxoid, tetanus toxoid, pertussis and *Haemophilus influenzae* type B are included in one injection.
   - This allows for fewer injections and a simpler regimen for patients, parents and healthcare professionals.

3. **What is special about polysaccharide vaccines and polysaccharide-conjugated vaccines?**
   - Polysaccharides are complex sugars that form the outer coats of many bacteria. It is possible to isolate the polysaccharide and administer it to stimulate immunity to the bacterial agent.
   - Although these vaccines are very safe they do not elicit a good immune response. These polysaccharides are not viewed as a large threat from the immune system and activate a T-cell independent immune response (see Module 1 – The Immune System and Vaccines). Polysaccharide vaccines do not induce memory and it was found repeating this vaccine does not increase immune response. On the contrary, repeated doses may actually decrease antibody production, a phenomenon known as “vaccine hyperresponsiveness”.
   - Antibody production with polysaccharide vaccines in young children (<2 years of age) is very poor.4 For this reason some of the polysaccharide vaccines (e.g. Hib, and meningococcal) are conjugated with a protein carrier.4 This allows the body to respond more broadly to the antigen and provides immune memory even in small children.4

4. **Which infectious diseases can currently be prevented by subunit vaccines or a combination of subunit + inactivated vaccines?**
   - Subunit vaccines are currently available against *Haemophilus influenzae*, type B (Hib), hepatitis A, hepatitis B, human papillomavirus, meningococcus; typhoid, and tetanus, diphtheria; and poliomyelitis.
   - Subunit + inactivated vaccines are available as different combination products against many infectious diseases such as diphtheria, tetanus, pertussis, poliomyelitis, HiB, hepatitis A, hepatitis B, cholera, E. Coli enteritis, and typhoid.
   - For a complete listing of vaccine types available in Canada, see Appendix 1
Other Vaccine Components

Adjuvants

Adjuvants are commonly added to subunit vaccines and many inactivated vaccines to enhance the immune response. The incorporation of adjuvants into vaccine formulations is aimed at enhancing, accelerating and prolonging the specific immune response towards the desired vaccine antigens.\(^5\)

Answering Patients' Questions on Adjuvants

1. Why do they add adjuvants to immunizations?
   - Some vaccines do not activate the body’s immune system sufficiently to provide enough protection to last long-term.
   - Adjuvants are compounds that enhance the body’s reaction to the vaccine. These compounds either prolong the vaccine deposit at the site of injection or create more danger signals activating the immune system more extensively.\(^2\)
   - For this reason many immunizations with adjuvants require less frequent dosages and less antigen to induce the same response without adjuvant.

2. What are adjuvants made of?
   - The only adjuvants currently used in routine immunization are the aluminum salts (aluminum hydroxide, aluminum phosphate or potassium aluminum sulphate).
   - The pH1N1 vaccine used an adjuvant containing DL-a-tocopherol, squalene and polysorbate 80.

3. Are they safe?
   - Adjuvants have been shown to be safe over decades of use.\(^1\)
   - Some injection site reactions have been seen but most adverse effects are minor.

Preservatives

Preservatives are chemicals added to multi-dose, killed or subunit vaccines to prevent serious secondary infections as a result of bacterial or fungal contamination.\(^1\) The requirement for preservatives in vaccines arose from incidents in the early part of the 20th century when children developed severe and occasionally fatal bacterial infections after administration of vaccines contained in multi-dose vials.\(^6\)

The three preservatives used in current preparations are thimerosal, phenol and 2-phenoxyethanol.\(^1\)
Answering Patients' Questions on Preservatives

1. Why are preservatives added to vaccines, aren't they sterile and safe when they are produced by the manufacturer?
   - Many vaccines in Canada's immunization program are available in multi-dose vials. Although these vials are sterile when manufactured, there is the chance for contamination when the vial is punctured multiple times by the immunization provider.
   - To find one example of this issue, one has to go back quite far. In 1916, 26 individuals developed local abscesses, 68 individuals developed severe systemic infections and four people died after receiving a typhoid vaccine contaminated with *S. aureus*. The vaccine did not contain a preservative.6
   - For this reason preservatives have been required for vaccines contained in multi-dose vials.6
   - For more information on this any other immunization issues please read module 13.

2. I have heard all the vaccines have mercury. Can this cause problems in children?
   - Thimerosal is a preservative that contains mercury and is converted into ethylmercury in the body and is eliminated more quickly than methylmercury.7
   - This preservative has come under intense media and public scrutiny due to allegations of health consequences.6
   - The amount of thimerosal used in a vaccine is 0.01% per dose or 100 parts per million.7
   - There is no scientific evidence that thimerosal has caused brain damage or other neurological problems as a result of vaccination.7 Thimerosal breaks down into ethylmercury which is very different from methylmercury, the kind that is toxic and can cause severe brain damage.7

   | Patient Counselling Tip: |
   | No vaccines made in Canada since March 2001 for routine use in children contain thimerosal. |

Additives

Many vaccines have additives to help for the stability and delivery of the product.6 Additives used include sugars (e.g. sucrose, lactose), amino acids (e.g. glycine, monosodium salt of glutamic acid) and proteins (e.g. gelatin or albumin). These products are added to the vaccine to:

- Prevent immunogens from adhering to the side of the vial.
- Stabilize the vaccine. Additives control acidity (pH) and stabilize immunogens through all the steps of manufacturing process.6

Answering Patients' Questions on Additives

1. Can people catch mad cow disease from different vaccines?
Creutzfeld-Jacob disease (CJD) in humans is caused by a unique infectious agent that also causes encephalopathies in other mammals such as cows (BSE – Bovine Spongiform Encephalopathy) and sheep.\textsuperscript{6}

Vaccines contain several reagents that are derived from cows (e.g. gelatin, glycerol, enzymes, serum, amino acids).\textsuperscript{6}

These bovine-derived agents commonly added to vaccines included in the routine schedule are manufactured from animals considered to be free of BSE.\textsuperscript{1}

The risk of transmitting variant CJD from vaccines containing bovine-derived material is theoretical, estimated to be 1 in 40 billion or less.\textsuperscript{1}

2. An Internet site said vaccines contain human tissues and can transmit diseases to my child, is this true?

- Human albumin is contained in several vaccines.
- Human serum albumin is derived from human blood; there is a theoretical risk that it might contain infectious agents.\textsuperscript{6}
- To date, there have been no documented cases of transmission of infectious agents by human serum albumin used in vaccines.\textsuperscript{1}

3. Does the gelatin added to vaccines dramatically increase the risk of a severe reaction?

- This protein may be the cause of very rare hypersensitivity reactions to gelatin-containing vaccines (approximately 1 event per 2 million doses).
- Some patients with immediate hypersensitivity reactions to gelatin have a history of allergies to gelatin-containing foods.\textsuperscript{6}
- It would be of value to ask about food allergies before vaccination with gelatin-containing vaccines.

- Appendix 1 lists the vaccines in Canada containing gelatin.

Manufacturing Residuals

Residual quantities of reagents that are used to make vaccines may be in the final immunization product. These include:\textsuperscript{1,6}

- **Antibiotics** added to prevent contamination of the bacteria used during the viral cell culture.\textsuperscript{1} Certain vaccines contain residual amounts of these antibiotics and the concern is cross reactivity. The risk of immediate hypersensitivity to the trace amount of antibiotics in the vaccines is very low.\textsuperscript{6}

- **Formaldehyde** is used in the manufacturing of pertussis and inactivated polio vaccines. The agents are killed with formaldehyde.\textsuperscript{7} Both tetanus and diphtheria toxins are inactivated by formaldehyde to make the toxoids used in the vaccine.\textsuperscript{7}

- **Residual proteins** may still be present in the final vaccine products. Some vaccines are grown in chick embryos and with yeast. Although most of these proteins are removed in the manufacturing process there may be some residual protein.\textsuperscript{6}

**Answering Patients' Questions on Manufacturing Residuals**

1. My son is allergic to penicillin can he have vaccines that may have antibiotics?
Antibiotics that are used during vaccine manufacture include neomycin, streptomycin, polymyxin B, chlorotetracycline, gentamycin and amphotericin B. Only neomycin is contained in vaccines in detectable quantities. Immediate-type hypersensitivity reactions to the small quantities of neomycin contained in vaccines has not been clearly documented. Vaccine do not contain the antibiotics that are most likely to cause immediate-type hypersensitivity reactions (e.g. penicillins, cephalosporins, sulfonamides).

2. **Can I give my daughter this immunization as she is allergic to eggs?**
   - Egg allergies occur in approximately 0.5% of the population and in approximately 5% of children with eczema.
   - The influenza virus and yellow fever vaccine are grown in chick embryos and egg proteins are present in the final product.
   - Residual quantities of egg proteins found in the influenza vaccine are sufficient to induce severe and rarely fatal hypersensitivity reactions in children with egg allergies. Allergists have immunized hundreds of egg-allergic children during the last flu epidemic. The reactions were extremely rare. Special precautions may be necessary when your child receives the vaccine, but an egg allergy does not mean it cannot be given safely.
   - The measles and mumps vaccines are also manufactured with chick embryos. The amount of egg protein in the final product is approximately 500 times less than that found in the influenza vaccine. The quantity of egg proteins found in measles- and mumps-containing vaccines is not sufficient to induce immediate-type hypersensitivity reactions, and children with severe egg allergies can receive these vaccines safely.

3. **Why would they add formaldehyde to my child’s vaccines?**
   - Formaldehyde is added to certain bacteria and viruses to inactivate these pathogens and to manufacture inactivated vaccine products.
   - Following this inactivation process, the purification of the vaccine removes almost all formaldehyde.
   - The amount of formaldehyde in a vaccine is several hundred times lower than the amount known to cause harm to humans.

**Potential Patient Concerns on the Delivery of the Vaccine**

The mode of delivery must also be considered by immunization providers. A concern from some patients is some vaccines containing latex.

Some pre-filled syringes may contain latex proteins in the tip cap and/or rubber plunger of the syringe. Similarly, the stoppers of some vaccines supplied in vials may contain latex proteins. It is theoretically possible that latex protein from these tip caps, plungers or vial stoppers may cause allergic reactions when the vaccines are administered to latex-sensitive individuals. There is little evidence that such a risk exists and any such risk would be extremely small. Millions of
doses of vaccines in pre-filled syringes are administered every year and the risk of anaphylaxis due to any allergen following immunization is about one per million vaccine doses. Appendix 1 lists the vaccines in Canada containing latex.

**Key Learning Points**

1. Live attenuated vaccines induce immunity by replicating in the body.
   - They are composed of weakened virus or bacteria.
   - The replication in the body induces a similar immunity to that seen with a “wild” infection.
   - One dose is usually sufficient to induce long-term immunity.
   - They are contraindicated in immunocompromised patients.

2. Inactivated vaccines are manufactured by killing viruses or bacteria.
   - These products do not replicated in the body and are therefore safe to used in immunocompromised patients.
   - They tend to cause less of a immune response compared to live vaccines.
   - Most of these vaccines will require multiple injections to induce sufficient immune response.
   - Protection provided by an inactivated vaccine will diminish over time and boosters are normally required to maintain sufficient protection.

3. Subunit vaccines contain a purified product from a bacteria or virus.
   - They are very safe and can be administered to immunocompromised patients.
   - They can be formulated into preparations containing multiple antigens to different vaccine-preventable infections.
   - This can decrease the number of needles required to immunize a patient.
   - Polysaccharide vaccines induce a very small response in the immune system. Conjugating a polysaccharide with a carrier protein dramatically increases the immune response.

4. Adjuvants are commonly added to increase the immune response to an inactivated or subunit vaccine.
   - The most common adjuvants are aluminum-based.
   - They prolong the vaccine deposit at the site of injection or create more signals activating the immune system more extensively.
   - Adjuvants have been shown to be safe over decades of use.

5. Preservatives are commonly added to multi-dose vaccines.
   - This reduces the risk of contamination of the vial through multiple punctures.
   - Thimerosal is not included in any routine immunizations currently used for children. There is no scientific evidence that it causes any ill effect to the immunized patient.
6. Some immunizations contain additives derived from bovine and human sources. These products have been shown to be safe and the risk of problems such as an allergic reaction to gelatin is very rare.

7. The residual amount of antibiotic in vaccines is very small and unlikely to be a concern for most patients.

8. Anaphylactic egg allergy can be a concern with the influenza (as above) and yellow fever virus but are not a concern with the measles and mumps vaccine.

9. Clinicians should be aware that some injection stoppers contain trace amount of latex proteins and this may be a concern in someone who is highly allergic.

Discussion Forum:

1. Do you have any tips or counselling pearls that you use from your clinical practice when discussing the differences between the different types of immunizations (live-attenuated, inactivated, subunit) and the differences between the immunization schedule?

2. Vaccine adjuvants and preservatives are a major concern for some patients. What are your most frequently asked question(s) and how you respond to them?

3. Most serious reactions to vaccines are very rare. What are the most common serious adverse reactions concerns that you are asked about in your clinical practice?

Post Test

Mrs. Chen approaches you to discuss varicella immunization of her son Ritchie with the vaccine Varivax III®. She mentions that she has heard that this immunization contains human tissue and she is concerned about administering this vaccine to her child. She has also heard that requires multiple immunizations are required to allow protection. Why should Ritchie be injected multiple times for a harmless disease. She was told the product has toxic doses of aluminum and she is worried about it causing multiple diseases and complications.

1. What type of vaccine is Varivax III®?
   a. Live-attenuated
   b. Inactivated
   c. Subunit

2. When discussing the dosing regimen with Mrs. Chen which of the following is the MOST appropriate statement to use:
   a. Don’t worry Mrs. Chen, although we have to inject Ritchie multiple times it is a subcutaneous injection and it does not hurt as much
   b. Mrs. Chen, one injection should be enough to protect Ritchie for a long-time. A booster dose might be needed in the future, if surveillance finds evidence of waning immunity
   c. Mrs. Chen, we can give a priming dose today and we can hold off for the booster for a whole 6 months
   d. Mrs. Chen, your concerns are right. Why don’t we skip this vaccine and focus on the others
3. When discussing the concern about human tissue with Mrs. Chen which of the following statements is the MOST appropriate to use?
   a. Don’t worry Mrs. Chen none of our vaccines have any remnants of human tissue
   b. Don’t worry Mrs. Chen you can trust me this product is safe
   c. Mrs. Chen, I understand your concerns regarding the human tissue. I can ensure you there has not been a single case of disease transmission due to vaccination
   d. Mrs. Chen, if you don’t want to give the vaccine to Ritchie, so be it

4. What would be the MOST appropriate response to Mrs. Chen’s concern about aluminum?
   a. Don’t worry Mrs. Chen, I know aluminum can be toxic but it is not in this vaccine
   b. Mrs. Chen, a small amount of aluminum is added to certain vaccines to boost the immune response. Varivax III® does not contain it, but the aluminum in other vaccines is very safe
   c. Mrs. Chen, they add aluminum to the Varivax III® to ensure that Ritchie is protected long-term
   d. Mrs. Chen, your concerns are ridiculous. This product is safe.

5. Which of the following vaccines can be administered to a patient with a severe egg allergy?
   a. YF-VAX®
   b. Fluviral®
   c. Vaxigrip®
   d. None of the above

6. When a patient approaches you with concerns about vaccines containing mercury, which of the following is the MOST appropriate response?
   a. Mercury is toxic and they have removed it from all immunizations used routinely in children
   b. They have never put any mercury based products in vaccines
   c. Mercury-containing products have been removed from most products, there has never been a link suggesting it causes complications
   d. Mercury is used in almost every vaccination; it is a safe preservative.

7. What is the main reason for conjugating a polysaccharide vaccine?
   a. It increases the safety of the product
   b. It increase the immune response to the product
   c. It allows for all the antigens to be administered in one dose
   d. It allows for the polysaccharide products to be safely administered to the elderly

8. Your patient J. Cardone has a severe latex allergy. Which of the following products could be a potential concern?
   a. Menomune® A/C/Y/W-135
   b. Dukoral®
   c. Engerix B®
   d. Fluviral®

References:


## Appendix 1 – Vaccine Types and Contents Commonly Used in Canada

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Route</th>
<th>Vaccine type</th>
<th>Vaccine type</th>
<th>Adj</th>
<th>Pres</th>
<th>Potential allergens (egg, antibiotic, gelatine, latex, thimerosal)</th>
<th>Other Material</th>
</tr>
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<tbody>
<tr>
<td>Act-HIB®</td>
<td>IM</td>
<td>Subunit</td>
<td>Hib</td>
<td></td>
<td></td>
<td>Conjugate</td>
<td></td>
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<tr>
<td>Adacel *</td>
<td>IM</td>
<td>Subunit</td>
<td>T, D, aP</td>
<td>Proteins</td>
<td>Alu m PE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avaxim *</td>
<td>IM</td>
<td>Subunit</td>
<td>HA</td>
<td>Killed Virus</td>
<td>Alu m PE</td>
<td>Neomycin</td>
<td>Formaldehyde</td>
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<tr>
<td>Avaxim Pediatric*</td>
<td>IM</td>
<td>Subunit</td>
<td>HA</td>
<td>Killed Virus</td>
<td>Alu m PE</td>
<td>Neomycin</td>
<td>Formaldehyde</td>
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<tr>
<td>BCG Vaccine (Freeze Dried)</td>
<td>Intra-dermal</td>
<td>Live attenuated</td>
<td>BCG</td>
<td>Live Bacteria</td>
<td>Polysorbate 80</td>
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<tr>
<td>DT Polio Adsorbed</td>
<td>IM</td>
<td>Subunit + inactivated</td>
<td>D, T, IPV</td>
<td>Proteins + killed virus</td>
<td>Alu m PE</td>
<td>Polymyxin B, Neomycin</td>
<td>Formaldehyde</td>
</tr>
<tr>
<td>Dukoral *</td>
<td>Oral</td>
<td>Subunit + inactivated</td>
<td>Chol-Ecoli-O</td>
<td>Proteins + killed bacteria</td>
<td>Alu m PE</td>
<td>Polymyxin B, Neomycin</td>
<td>Saccharin</td>
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<td>Engerix *</td>
<td>IM</td>
<td>Subunit</td>
<td>HB</td>
<td>Recombinant protein</td>
<td>Alu m PE</td>
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<td>Inf</td>
<td>Killed virus</td>
<td>TM</td>
<td>Egg proteins</td>
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<tr>
<td>FSME – Immun</td>
<td>IM</td>
<td>Inactivated</td>
<td>TBE</td>
<td>Inactivated whole virus</td>
<td>Alu m</td>
<td>Neomycin, gentamycin, egg, protamine sulphate, chick protein</td>
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<td>Gardasil*</td>
<td>IM</td>
<td>Subunit</td>
<td>HPV</td>
<td>Recombinant protein</td>
<td>Alu m</td>
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<td>HA</td>
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<td>Alu m PE</td>
<td>Neomycin, Latex in stopper of prefilled syringes</td>
<td>Formaldehydle, polysorbate 80</td>
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<td>Imovax Polio</td>
<td>SC</td>
<td>Inactivated</td>
<td>IPV</td>
<td>Killed virus</td>
<td>PE</td>
<td>Polymyxin B, neomycin, streptomycin</td>
<td>Bovine serum, formaldehyde</td>
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<td>Rab</td>
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<td></td>
<td>Neomycin</td>
<td>Human albumin</td>
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<tr>
<td>IPV</td>
<td>SC</td>
<td>Inactivated</td>
<td>IPV</td>
<td>Killed Virus</td>
<td>PE</td>
<td>Polymyxin B, neomycin</td>
<td>Bovine serum, formaldehyde , polysorbate 80</td>
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<td>Infanrix * hexa</td>
<td>IM</td>
<td>Subunit + inactivated</td>
<td>D, T, aP, HB, IPV, + Hib</td>
<td>Proteins + killed viruses + conjugate</td>
<td>Alu m</td>
<td>Polymyxin B, neomycin</td>
<td>Yeast protein, formaldehyde , lactose,</td>
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</table>

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<table>
<thead>
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<th>Vaccines</th>
<th>Route</th>
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<th>Protein Type</th>
<th>Aluminate</th>
<th>Additional Ingredients</th>
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<td>Inf</td>
<td>Killed virus</td>
<td>Polysorbate 20 &amp; 80, bovine serum albumin</td>
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<tr>
<td>JE-VAX®</td>
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<td>JE</td>
<td>Killed virus</td>
<td>TM Gelatin</td>
<td>Mouse serum, protein, formaldehyde</td>
</tr>
<tr>
<td>Meningitec®</td>
<td>IM</td>
<td>Men</td>
<td>Conjugate</td>
<td>Lactose</td>
<td></td>
</tr>
<tr>
<td>Menomune A/C®</td>
<td>SC</td>
<td>Men</td>
<td>Polysaccharide</td>
<td>Lactose</td>
<td></td>
</tr>
<tr>
<td>Menomune A/C/Y/W-135</td>
<td>SC</td>
<td>Men</td>
<td>Polysaccharide</td>
<td>Thimerosal in trace amounts in multidose vials, latex in stopper</td>
<td></td>
</tr>
<tr>
<td>Menjugate®</td>
<td>IM</td>
<td>Men</td>
<td>Conjugate</td>
<td>Bovine serum, glutamate, residual components of chick embryo cell cultures</td>
<td></td>
</tr>
<tr>
<td>M-M-R® II</td>
<td>SC</td>
<td>M, M, R</td>
<td>Live Virus</td>
<td>Polysaccharide</td>
<td></td>
</tr>
<tr>
<td>Neisvac-C®</td>
<td>IM</td>
<td>Men</td>
<td>Conjugate</td>
<td>Bovine serum, formaldehyde</td>
<td></td>
</tr>
<tr>
<td>Pediacel®</td>
<td>IM</td>
<td>D, T, aP, IPV, Hib</td>
<td>Protein, killed virus + conjugate</td>
<td>Neomycin, polymyxin B, streptomycin</td>
<td></td>
</tr>
<tr>
<td>Pneumo 23®</td>
<td>IM/SC</td>
<td>Pneu</td>
<td>Polysaccharide</td>
<td>Latex in stopper</td>
<td></td>
</tr>
<tr>
<td>Pneumovax 23®</td>
<td>IM/SC</td>
<td>Pneu</td>
<td>Polysaccharide</td>
<td>Lactose</td>
<td></td>
</tr>
<tr>
<td>Prevnar®</td>
<td>IM</td>
<td>Pneu</td>
<td>Conjugate</td>
<td>Bovine albumin, formaldehyde</td>
<td></td>
</tr>
<tr>
<td>Priorix®</td>
<td>SC</td>
<td>M, M, R</td>
<td>Live virus</td>
<td>Polymyxin B, Neomycin,</td>
<td>Lactose</td>
</tr>
<tr>
<td>Priorix-Tetra®</td>
<td>SC</td>
<td>M, M, R, Var</td>
<td>Live virus</td>
<td>Lactose</td>
<td></td>
</tr>
<tr>
<td>Quadracel®</td>
<td>IM</td>
<td>D, T, aP, IPV</td>
<td>Protein + killed virus</td>
<td>Bovine albumin, formaldehyde</td>
<td></td>
</tr>
<tr>
<td>RabAvert®</td>
<td>IM</td>
<td>Rab</td>
<td>Killed Virus</td>
<td>Human albumin, ovalbumin, bovine serum</td>
<td></td>
</tr>
<tr>
<td><strong>Recombivax</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>IM</td>
<td>Subunit</td>
<td>HB</td>
<td>Recombinant Protein</td>
<td>Alum</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----</td>
<td>---------</td>
<td>--------</td>
<td>---------------------</td>
<td>------</td>
</tr>
<tr>
<td><strong>Td Adsorbed</strong></td>
<td>IM</td>
<td>Subunit</td>
<td>T, D</td>
<td>Protein</td>
<td>Alum</td>
</tr>
<tr>
<td><strong>Td Polio Adsorbed</strong></td>
<td>IM</td>
<td>Subunit</td>
<td>T, D, IPV</td>
<td>Protein + killed virus</td>
<td>Alum</td>
</tr>
<tr>
<td><strong>Tetanus Toxoid Adsorbed</strong></td>
<td>IM</td>
<td>Subunit</td>
<td>T</td>
<td>Protein</td>
<td>Alum</td>
</tr>
<tr>
<td><strong>Twinrix</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>IM</td>
<td>Subunit</td>
<td>HB, HA</td>
<td>Recombinant protein + killed virus</td>
<td>PE</td>
</tr>
<tr>
<td><strong>Twinrix Jr</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>IM</td>
<td>Subunit</td>
<td>HB, HA</td>
<td>Recombinant protein + killed virus</td>
<td>PE</td>
</tr>
<tr>
<td><strong>Typherix</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>IM</td>
<td>Subunit</td>
<td>Typh-I</td>
<td>Polysaccharide</td>
<td>P</td>
</tr>
<tr>
<td><strong>Typhim Vi</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>IM</td>
<td>Subunit</td>
<td>Typh-I</td>
<td>Polysaccharide</td>
<td>P</td>
</tr>
<tr>
<td><strong>Vaqta</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>IM</td>
<td>Inactivated</td>
<td>HA</td>
<td>Killed Virus</td>
<td>Alum</td>
</tr>
<tr>
<td><strong>Varilrix</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>SC</td>
<td>Live</td>
<td>Var</td>
<td>Live virus</td>
<td></td>
</tr>
<tr>
<td><strong>Varivax III</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>SC</td>
<td>Live</td>
<td>Var</td>
<td>Live virus</td>
<td></td>
</tr>
<tr>
<td><strong>Vaxigrip</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>IM</td>
<td>Inactivated</td>
<td>Inf</td>
<td>Killed virus</td>
<td></td>
</tr>
<tr>
<td><strong>Vivaxim</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>IM</td>
<td>Subunit</td>
<td>Typh-I + HA</td>
<td>Polysaccharide + killed virus</td>
<td>Alum</td>
</tr>
<tr>
<td><strong>YF-Vax</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>SC</td>
<td>Live</td>
<td>YF</td>
<td>Live virus</td>
<td></td>
</tr>
<tr>
<td><strong>Zostavax</strong>&lt;sup&gt;®&lt;/sup&gt;</td>
<td>SC</td>
<td>Live</td>
<td>Zost</td>
<td>Live virus</td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviations:**
- **Route:** IM – intramuscular, SC – subcutaneous
- **Immunogen:**
• **DTaP-IPV-Hib**: Diphtheria toxoid, tetanus toxoid, acellular pertussis, inactivated poliomyelitis virus, *Haemophilus influenza* type b

• **Tdap**: Tetanus toxoid, diphtheria toxoid, acellular pertussis

• **Men**: Meningococcus

• **Pneu**: Pneumococcus

• **HB**: Hepatitis B

• **Chol-Ecol-O**: Cholera, E. coli

• **IPV**: Inactivated poliomyelitis virus

• **Inf**: influenza

• **HA**: Hepatitis A

• **HPV**: Human papillomavirus

• **Rab**: Rabies

• **JE**: Japanese encephalitis

• **Typh-I**: Typhoid-Infection

• **TBE**: Tickborne encephalitis

• **MMR**: Measles, mumps, rubella

• **Var**: Varicella

• **YF**: Yellow fever

• **BCG**: Bacille Calmette-Guérin (tuberculosis)

**Adjuvant:**

- Alum – aluminum containing adjuvant

**Preservative:**

- **P**: Phenol
- **PE**: 2 phenoxy ethanol
- **TM**: thimerosal

**+ products:** - in which the immunogens of two different vials or chambers are combined, the contents of the second vial or chamber are noted as + (immunogen)