Ministry of education and science of Ukraine
V. N. Karazin Kharkiv National University

IMMUNOLOGICAL PROPHYLAXIS OF THE MOST COMMON INFECTIOUS DISEASES IN CHILDREN

Methodical recommendations

Kharkiv – 2019

УДК 616.9-053.2:614.47(072)
М 54

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Approved for publishing by the decision of Scientific and Methodological Council of V. N. Karazin Kharkiv National University (protocol № 5 from 24.04.2019)

Immunological prophylaxis of the most common infectious diseases in children : methodical recommendations / compilers N. O. Panko, L. O. Rakovska. – Kharkiv : V. N. Karazin Kharkiv National University, 2019. – 24 p.

М 54

Methodical recommendations is worked out on the basis of the Program of discipline «Pediatrics with pediatric infectious diseases» for students of higher medical educational institutions of III–IV levels of accreditation, authorized by Ministry of Health of Ukraine. This recommendation is intended for the 6th years English-speaking medical students.

УДК 616.9-053.2:614.47(072)

Навчальне видання

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ІМУНОПРОФІЛАКТИКА НАЦБІЛЬШ ПОШИРЕНИХ ІНФЕКЦІЙНИХ ЗАХВОРЮВАНЬ У ДІТЕЙ

Методичні рекомендації

(Англ. мовою)

Комп'ютерне верстання *В. В. Савінкова*
Макет обкладинки *І. М. Дончик*

Формат 60х84/16. Ум. друк. арк. 1,44. Наклад 50 пр. Зам. № 64/19.

Видавець і виготовлювач
Харківський національний університет імені В. Н. Каразіна,
61022, м. Харків, майдан Свободи, 4.
Свідоцтво суб'єкта видавничої справи ДК № 3367 від 13.01.2009
Видавництво ХНУ імені В. Н. Каразіна
Тел. 705-24-32

CONTENTS

LIST ABBREVIATIONS

DT – diphtheria and tetanus toxoids
DTP – diphtheria toxoid, tetanus toxoid, and pertussis
DTaP – diphtheria and tetanus toxoids and acellular pertussis
HBsAg – hepatitis B surface antigen
Hib – Haemophilus influenzae type b
HPV – human papillomavirus
IIV – inactivated influenza vaccine
IPV – inactivated poliovirus
LAIV – live, attenuated influenza vaccine
MCV4 – quadrivalent meningococcal conjugate vaccine
MMR – measles, mumps, and rubella
MPSV4 – quadrivalent meningococcal polysaccharide vaccine
PCV13 – pneumococcal conjugate vaccine
PPSV23 – pneumococcal polysaccharide vaccine
Td – tetanus and diphtheria toxoids
Tdap – tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis
TIV – trivalent inactivated influenza vaccine
GBS – Guillain-Barré syndrome
MenACWY – Meningococcal group A, C, W-135 and Y conjugate vaccine
MenB – serogroup B Meningococcal Vaccines
RIV3 – recombinant influenza vaccine, Trivalent
SCID – severe combined immunodeficiency disease
HIV – human immunodeficiency virus
wks – weeks

INTRODUCTION

Immunization is the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine. Vaccines stimulate the body's own immune system to protect the person against subsequent infection or disease.

Immunization prevents illness, disability and death from vaccine-preventable diseases including cervical cancer, diphtheria, hepatitis B, measles, mumps, pertussis (whooping cough), pneumonia, polio, rotavirus diarrhoea, rubella and tetanus.

Global vaccination coverage has stalled at 86 %, with no significant changes during the past year.

Uptake of new and underused vaccines is increasing.

Immunization currently averts an estimated 2 to 3 million deaths every year. An additional 1.5 million deaths could be avoided, however, if global vaccination coverage improves.

Corresponding to WHO expert's estimation 19.5 million infants worldwide are still missing out on basic vaccines.

Definition of terms

Immunity: Protection from an infectious disease. If you are immune to a disease, you can be exposed to it without becoming infected.

Vaccine: A product that stimulates a person's immune system to produce immunity to a specific disease, protecting the person from that disease. Vaccines are usually administered through needle injections, but can also be administered by mouth or sprayed into the nose.

Vaccination: The act of introducing a vaccine into the body to produce immunity to a specific disease.

Immunization: A process by which a person becomes protected against a disease through vaccination. This term is often used interchangeably with vaccination or inoculation.

TYPES OF VACCINES

- Live, attenuated vaccines
- Inactivated vaccines
- Subunit vaccines
- Toxoid vaccines
- Conjugate vaccines
- DNA vaccines
- Recombinant vector vaccines

Live, attenuated vaccines

It contains a version of the living microbe that has been weakened in the lab so it can't cause disease. Because a live, attenuated vaccine is the closest thing to a natural infection, these vaccines are good "teachers" of the immune system: They elicit strong cellular and antibody responses and often confer lifelong immunity with only one or two doses.

Despite the advantages of live, attenuated vaccines, there are some downsides. It is the nature of living things to change, or mutate, and the organisms used in live, attenuated vaccines are no different. The remote possibility exists that an attenuated microbe in the vaccine could revert to a virulent form and cause disease. Also, not everyone can safely receive live, attenuated vaccines. For their own protection, people who have damaged or weakened immune systems because they've undergone chemotherapy or have HIV, for example, cannot be given live vaccines.

Another limitation is that live, attenuated vaccines usually need to be refrigerated to stay potent. If the vaccine needs to be shipped overseas and stored by healthcare workers in developing countries that lack widespread refrigeration, a live vaccine may not be the best choice.

Live, attenuated vaccines are relatively easy to create for certain viruses. Viruses are simple microbes containing a small number of genes, and scientists can therefore more readily control their characteristics. Viruses often are attenuated through a method of growing generations of them in cells in which they do not reproduce very well. This hostile environment takes the fight out of viruses: As they evolve to adapt to the new environment, they become weaker with respect to their natural host, human beings.

Currently available live attenuated viral vaccines include measles, mumps, rubella, varicella, yellow fever, intranasal influenza and Oral polio vaccine. Live attenuated bacterial vaccines include BCG and oral typhoid vaccine.

Inactivated vaccines

Scientists produce inactivated vaccines by killing the disease-causing microbe with chemicals, heat, or radiation. Such vaccines are more stable and safer than live vaccines. The dead microbes can't mutate back to their disease-causing state.

Inactivated vaccines usually don't require refrigeration, and they can be easily stored and transported in a freeze-dried form, which makes them accessible to people in developing countries.

Most inactivated vaccines, however, stimulate a weaker immune system response than do live vaccines. So it would likely take several additional doses, or booster shots, to maintain a person's immunity. This could be a drawback in areas where people don't have regular access to health care and can't get booster shots on time.

Currently available inactivated vaccines are limited to inactivated whole viral vaccines (parenteral influenza, polio, rabies, and hepatitis A). Whole inactivated bacterial vaccines include pertussis, typhoid, cholera, and plague. “Fractional” vaccines include subunits (hepatitis B, influenza, acellular pertussis), and toxoids (diphtheria, tetanus).

Subunit vaccines

Instead of the entire microbe, subunit vaccines include only the antigens that best stimulate the immune system. In some cases, these vaccines use epitopes – the very specific parts of the antigen that antibodies or T cells recognize and bind to. Because subunit vaccines contain only the essential antigens and not all the other molecules that make up the microbe, the chances of adverse reactions to the vaccine are lower.

Subunit vaccines can contain anywhere from 1 to 20 or more antigens. Of course, identifying which antigens best stimulate the immune system is a tricky, time-consuming process. Once scientists do that, however, they can make subunit vaccines in one of two ways:

1. They can grow the microbe in the laboratory and then use chemicals to break it apart and gather the important antigens.

2. They can manufacture the antigen molecules from the microbe using recombinant DNA technology. Vaccines produced this way are called «recombinant subunit vaccines».

A recombinant subunit vaccine has been made for the hepatitis B virus. Scientists inserted hepatitis B genes that code for important antigens into common baker’s yeast. The yeast then produced the antigens, which the scientists collected and purified for use in the vaccine. Research is continuing on a recombinant subunit vaccine against hepatitis C virus.

Toxoid vaccines

For bacteria that secrete toxins, or harmful chemicals, a toxoid vaccine might be the answer. These vaccines are used when a bacterial toxin is the main cause of illness.

Scientists have found that they can inactivate toxins by treating them with formalin, a solution of formaldehyde and sterilized water. Such «detoxified» toxins, called toxoids, are safe for use in vaccines.

When the immune system receives a vaccine containing a harmless toxoid, it learns how to fight off the natural toxin. The immune system produces antibodies that lock onto and block the toxin.

Vaccines against diphtheria and tetanus are examples of toxoid vaccines.

Conjugate vaccines

If a bacterium possesses an outer coating of sugar molecules called polysaccharides, as many harmful bacteria do, researchers may try making

a conjugate vaccine for it. Polysaccharide coatings disguise a bacterium's antigens so that the immature immune systems of infants and younger children can't recognize or respond to them.

Conjugate vaccines, a special type of subunit vaccine, get around this problem.

When making a conjugate vaccine, scientists link antigens or toxoids from a microbe that an infant's immune system can recognize to the polysaccharides. The linkage helps the immature immune system react to polysaccharide coatings and defend against the disease-causing bacterium.

The vaccine that protects against Haemophilus influenzae type B (Hib) is a conjugate vaccine. Also now available are conjugate vaccines for pneumococcal disease and meningococcal disease.

DNA vaccines

DNA vaccines take immunization to a new technological level. These vaccines dispense with both the whole organism and its parts and get right down to the essentials: the microbe's genetic material. In particular, DNA vaccines use the genes that code for those all-important antigens.

Researchers have found that when the genes for a microbe's antigens are introduced into the body, some cells will take up that DNA. The DNA then instructs those cells to make the antigen molecules. The cells secrete the antigens and display them on their surfaces. In other words, the body's own cells become vaccine-making factories, creating the antigens necessary to stimulate the immune system.

A DNA vaccine against a microbe would evoke a strong antibody response to the free-floating antigen secreted by cells, and the vaccine also would stimulate a strong cellular response against the microbial antigens displayed on cell surfaces. The DNA vaccine couldn't cause the disease because it wouldn't contain the microbe, just copies of a few of its genes. In addition, DNA vaccines are relatively easy and inexpensive to design and produce.

So-called naked DNA vaccines consist of DNA that is administered directly into the body. These vaccines can be administered with a needle and syringe or with a needle-less device that uses high-pressure gas to shoot microscopic gold particles coated with DNA directly into cells. Sometimes, the DNA is mixed with molecules that facilitate its uptake by the body's cells. Naked DNA vaccines being tested in humans include those against the viruses that cause influenza and herpes.

Recombinant vector vaccines

Recombinant vector vaccines are experimental vaccines similar to DNA vaccines, but they use an attenuated virus or bacterium to introduce microbial DNA to cells of the body. «Vector» refers to the virus or bacterium used as the carrier.

In nature, viruses latch on to cells and inject their genetic material into them. In the lab, scientists have taken advantage of this process. They have figured out how to take the roomy genomes of certain harmless or attenuated viruses and insert portions of the genetic material from other microbes into them. The carrier viruses then ferry that microbial DNA to cells. Recombinant vector vaccines closely mimic a natural infection and therefore do a good job of stimulating the immune system.

Attenuated bacteria also can be used as vectors. In this case, the inserted genetic material causes the bacteria to display the antigens of other microbes on its surface. In effect, the harmless bacterium mimics a harmful microbe, provoking an immune response.

Researchers are working on both bacterial and viral-based recombinant vector vaccines for HIV, rabies, and measles.

CALENDARS OF PREVENTIVE VACCINATIONS

Calendar of preventive vaccinations includes four sections:

- vaccinations by age,
- vaccination by condition of health,
- immunizations, conducted in endemic and enzootic areas with epidemic indications,
- recommended vaccinations.

General Principles for Vaccine Scheduling

Optimal response to a vaccine depends on multiple factors, including the type of vaccine, age of the recipient, and immune status of the recipient.

Recommendations for the age at which vaccines are administered are influenced by age-specific risks for disease, age-specific risks for complications, age-specific responses to vaccination, and potential interference with the immune response by passively transferred maternal antibodies. Vaccines are recommended for members of the youngest age group at risk for experiencing the disease for which efficacy and safety have been demonstrated.

Certain products, including inactivated vaccines, toxoids, recombinant subunit vaccines, polysaccharide conjugate vaccines, and live vaccines, require ≥ 2 doses to elicit an adequate antibody response. Tetanus and diphtheria toxoids require booster doses to maintain protective antibody concentrations. Unconjugated polysaccharide vaccines do not induce T-cell memory, and additional doses (although they elicit the same or a lower antibody concentration) might increase the level of protection. Conjugation with a protein carrier improves the effectiveness of polysaccharide vaccines by inducing T-lymphocyte-dependent immunologic function. Many vaccines that stimulate both cell-mediated immunity and neutralizing antibodies (e.g.,

live, attenuated virus vaccines) usually can induce prolonged immunity, even if antibody titers decline over time. Subsequent exposure to such viruses usually results in a rapid anamnestic antibody response without viremia.

Approximately 90 % - 95 % of recipients of a single dose of certain live vaccines administered by injection at the recommended age (i.e., measles, rubella, and yellow fever vaccines) develop protective antibodies, generally within 14 days of the dose. For varicella and mumps vaccines, 80 % - 85 % of vaccines are protected after a single dose. However, because a limited proportion (5 % - 15 %) of measles, mumps, and rubella (MMR) or varicella vaccines is fail to respond to 1 dose, a second dose is recommended to provide another opportunity to develop immunity. Of those who do not respond to the first dose of MMR or varicella vaccine, 97 % - 99 % respond to a second dose.

The Recommended Immunization Schedules for Persons Aged 0 Through 18 Years and the Recommended Adult Immunization Schedule are revised annually.

Physicians and other health-care providers should ensure that they are following the most up-to-date schedules.

Recommended immunization schedule
for persons aged 0 through 18 years in Ukraine

Age	Vaccine against diseases					
1 day	Hepatitis B					
3–5 days		BCG				
2 month	Hepatitis B		Diphteria Pertussis Tetanus	Poliomyelitis	Homophilus influenza b	
4 month			Diphteria Pertussis Tetanus	Poliomyelitis	Homophilus influenza b	
6 month	Hepatitis B		Diphteria Pertussis Tetanus	Poliomyelitis		
12 month					Homophilus influenza b	Measles Mumps Rubella
18 month			Diphteria Pertussis Tetanus	Poliomyelitis		
6 years			Diphteria Tetanus	Poliomyelitis		Measles Mumps Rubella
14 years				Poliomyelitis		
16 years			Diphteria Tetanus			
Next every 10 years of life			Diphteria Tetanus			

SUMMARY OF RECOMMENDATIONS FOR CHILD/TEEN IMMUNIZATION (AGE BIRTH THROUGH 18 YEARS) of the Centers for Disease Control and Prevention

<table>
<tr><th>Vaccine name and route</th><th>Schedule for routine vaccination and other guidelines</th><th>Schedule for catch-up vaccination and related issues</th><th>Contraindications and precautions (mild illness is not a contraindication)</th></tr>
<tr><td rowspan="2">Hepatitis B (HepB)
Give IM</td><td rowspan="2">Give Hep B dose № 1 within 24 hrs of birth to all medically stable infants weighing > 2000 g and born to HBsAg-negative mothers.
Give dose № 2 at age 1–2 m and the final dose at age 6–18 m (the last dose in the infant series should not be given earlier than age 24 wks). After the birth dose, the series may be completed using 2 doses of single-antigen vaccine (ages 1–2 m, 6–18 m) or with 3 doses of Pediarix (ages 2 m, 4 m, 6 m), which may result in giving a total of 4 doses of Hep B vaccine.
If mother is HBsAg-positive: Give HBIG and Hep B dose № 1 within 12 hrs of birth; complete series by age 6m.
If mother's HBsAg status is unknown: Give Hep B dose № 1 within 12 hrs of birth. If low birth weight (less than 2000 g), also give HBIG within 12 hrs. For infants weighing 2000 g or more whose mother is subsequently found to be HBsAg positive, give the infant HBIG as soon as possible (no later than age 7 d) and follow Hep B immunization schedule for infants born to HBsAg-positive mothers.
Vaccinate all other children and teens who have not completed a series of Hep B vaccine.</td><td>Do not restart series, no matter how long since previous dose. 3 - dose series can be started at any age.
Minimum intervals between doses: 4 wks between № 1 and № 2, 8 wks between № 2 and № 3, and at leas 16 wks between № 1 and № 3 (and give dose № 3 no earlier than age 24 wks).</td><td>Contraindication
Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components, including hypersensitivity to yeast.
Precautions
Moderate or severe acute illness, with or without fever.
For infants who weigh less than 2000 g, see ACIP recommendations at www.cdc.gov/mmwr/PDF/rr/rr5416.pdf</td></tr>
<tr><td colspan="2">Special Dosing of Hep B:
Monovalent vaccine brands are interchangeable.
For people on age 0 through 19 yrs, give 0.5 mL of either Engerix-B or Recombivax HB.
Hepatitis B Alternative dosing, schedule for unvaccinated adolescents aged 11 through 15 yrs: Vaccine Give 2 doses Recombivax HB 1.0 mL (adult formulation) spaced 4–6 m apart.
(Hep B) (Engerix-B is not licensed for a 2-dose schedule.)</td></tr>
</table>

DTaP, DT (Diphtheria, tetanus, acellular pertussis) Give IM	Give to children at ages 2 m, 4 m, 6 m, 15–18 m, and 4–6 yrs. May give dose № 1 as early as age 6 wks. May give № 4 as early as age 12 m if 6 m have elapsed since № 3. Do not give DTaP/DT to children age 7 yrs and older. If possible, use the same DTaP product for all doses.	Dose № 2 and № 3 may be given 4 wks after previous dose. Dose № 4 may be given 6 m after № 3. If dose № 4 is given before 4th birthday, wait at least 6m for № 5 (age 4–6 yrs). If dose № 4 is given after 4th birthday, № 5 is not needed.	**Contraindications** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components, with or without fever. For all pertussis-containing vaccines: Encephalopathy not attributable to an identifiable cause, within 7 d after DTP/DTaP/Tdap.
Td, Tdap (Tetanus, diphtheria, acellular pertussis) Give IM	For children and teens lacking previous Tdap: Give Tdap routinely at age 11–12 yrs and vaccinate older teens on a catch-up basis; then boost every 10 yrs with Td. Make special efforts to give Tdap to children and teens who are 1) in contact with infants younger than age 12 m and, 2) health care workers with direct patient contact. Give Tdap to pregnant adolescents during each pregnancy (preferred during the early part of gestational weeks 27 through 36 wks), regardless of interval since prior Td or Tdap.	DTaP and DT should not be used for children age 7 yrs and older; use Td and Tdap instead. Children as young as age 7 yrs and teens who are unvaccinated or behind schedule яshould complete a primary Td series (3 doses, with an interval of 1–2 m between dose № 1 and № 2, and an interval of 6–12m between dose №2 and №3); substitute Tdap for any dose in the series, preferably as dose № 1. Tdap should be given regardless of interval since previous Td.	**Precautions** Moderate or severe acute illness. History of Arthus reaction following a prior dose of tetanus or diphtheria toxoid-containing vaccine (including MenACWY); defer vaccination until at least 10 yrs have elapsed since the last tetanus toxoid-containing vaccine. Guillain-Barré syndrome (GBS) within 6 wks after previous dose of tetanus toxoid-containing vaccine. For DTaP only: any of these events following a previous dose of DTP/DTaP: 1) temperature of 105° F (40.5° C) or higher within 48 hrs; 2) continuous crying for 3 hrs or more within 48 hrs; 3) collapse or shock-like state within 48 hrs; 4) seizure within 3 d For all pertussis-containing vaccines: progressive or unstable neurologic disorder, uncontrolled seizures, or progressive encephalopathy until a treatment regimen has been established and the condition has stabilized.

Rotavirus (RV) Give orally	Rotarix (RV1): Give at ages 2 m, 4 m. RotaTeq (RV5): Give at ages 2 m, 4 m, 6 m. May give dose № 1 as early as age 6 wks. Give final dose no later than age 8 m.	Do not begin series in infants older than age 14 wks 6 d. Intervals between doses may be as short as 4 wks. If prior vaccination included use of different or unknown brand(s), a total of 3 doses should be given.	**Contraindications** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components. If allergy to latex, use RV5. History of intussusceptions. Diagnosis of severe combined immunodeficiency (SCID). **Precautions** Moderate or severe acute illness, with or without fever. Altered immunocompetence other than SCID. Chronic gastro-intestinal disease. For RV1 only, spina bifida or bladder exstrophy.
Varicella (Var) (Chicken-pox) Give Subcut	Give dose № 1 at age 12–15 m. Give dose № 2 at age 4–6 yrs. Dose № 2 of Var or MMRV may be given earlier if at least 3 m since dose № 1. If dose № 2 was given at least 4 wks after dose № 1, it can be accepted as valid. Give a 2nd dose to all older children/teens with history of only 1 dose. MMRV may be used in children age 12 m through 12 yrs.	If younger than age 13 yrs, space dose № 1 and № 2 at least 3 m apart. If age 13 yrs or older, space at least 4 wks apart. May use as postexposure prophylaxis if given within 5 d. If Var and either MMR, and/or yellow fever vaccine are not given on the same day, space them at least 28 d apart. (If yellow fever vaccine, space by 30 d.)	**Contraindications** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components. Pregnancy or possibility of pregnancy within 4 wks. Severe immuno-deficiency (e.g., hematologic and solid tumors; receiving chemotherapy; congenital immunodeficienc; long-term immunosuppressive therapy, or severely symptomatic HIV) Children on high-dose immunosuppressive therapy or who are immunocompromised because of malignancy and primary or acquired immunodeficiency, including HIV/AIDS (al–though vaccination may be considered if CD4+ T-lymphocyte percentages are 15 % or greater in children age 1 through 8 yrs or 200 cells/μL in children age 9 yrs and older) **Precautions** Moderate or severe acute illness, with or without fever. If blood, plasma, and/or immune globulin (IG or VZIG)

			were given in past 11m, see ACIP's General Recommendations on Immunization1 regarding time to wait before vaccinating. Receipt of specific antivirals (i.e., acyclovir, famciclovir, or valacyclovir) 24 hrs before vaccination, if possible; delay resumption of these antiviral drugs for 14 d after vaccination. For MMRV only, personal or family (i.e., sibling or parent) history of seizures. NOTE: For patients with humoral immunodeficiency or leukemia, see ACIP recommendations at www.cdc.gov/mmwr/pdf/rr/rr5604.pdf.
MMR (Measles, mumps, rubella) Give Subcut	Give dose № 1 at age 12–15 m. Give MMR at age 6–11 m if traveling internationally; revaccinate with 2 doses of MMR at age 12–15 m and at least 4 wks later. The dose given at younger than 12 m does not count toward the 2-dose series. Give dose № 2 at age 4–6 yrs. Dose № 2 may be given earlier if at least 4 wks since dose № 1. For MMRV: dose № 2 may be given earlier if at least 3 m since dose № 1. Give a 2nd dose to all older children and teens with history of only 1 dose. MMRV may be used in children age 12 m through 12 yrs (see note above). NOTE: For the first dose of MMR and varicella given at age 12–47 m, either MMR and Var or MMRV may be used. Unless the parent or caregiver expresses a preference for MMRV,	If MMR and either Var, and/or yellow fever vaccine are not given on the same day, space them at least 28 d apart. (If yellow fever vaccine, space by 30 d.) When using MMR for both doses, minimum interval is 4 wks. When using MMRV for both doses, minimum interval is 3 m. May use as postexposure measles prophylaxis if given within 3 d.	**Contraindications** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components. Pregnancy or possibility of pregnancy within 4 wks. Severe immuno-deficiency (e.g., hematologic and solid tumors; receiving chemotherapy; congenital immunodeficiency; long-term immunosuppressive therapy, or severely symptomatic HIV). NOTE: HIV infection is NOT a contraindication to MMR for children who are not severely immuno-compromised (see ACIP recommendations at www.cdc.gov/mmwr/pdf/rr/rr6204.pdf). Vaccination is recommended if indicated for 1) children age 12 m through 5 yrs whose CD4+ T-lymphocyte percentage has been greater than 15% for at least 6m or 2) for children age 6 yrs

	CDC recommends that MMR and Var be used for the first doses in this age group.		and older whose CD4+ T-lymphocyte counts have been 200 cells/μL or greater for at least 6m. **Precautions** Moderate or severe acute illness, with or without fever. If blood, plasma, or immune globulin given in past 11 m, see ACIP's General Recommendations on Immunization1 regarding time to wait before vaccinating. History of thrombocytopenia or thrombocytopenic purpura. For MMRV only, personal or family (i.e., sibling or parent) history of seizures. Need for tuberculin skin testing (TST). If TST needed, give TST before or on same day as MMR, or give TST 4 wks following MMR.
Pneumococcal conjugate (PCV13) Give IM	Give at ages 2 m, 4 m, 6 m, 12–15 m (booster dose). Dose № 1 may be given as early as age 6 wks. For age 24 through 59 m and healthy: if unvaccinated or any incomplete schedule of 3 doses of PCV 13 was received previously, give 1 supplemental dose of PCV13 at least 8 wks after the most recent dose. For high-risk** children ages 2 through 5 yrs give 2 doses at least 8 wks apart if they previously received an incomplete schedule of fewer than 3 doses; give 1 dose at least 8 wks after the most recent dose if they previously received 3 doses. For high-risk** children all recommended PCV13 doses should be given prior to PPSV vaccination.	When children are behind on PCV13 schedule, minimum interval for doses given to children younger than age 12 m is 4 wks; for doses given at 12 m and older, it is 8 wks. <u>For age 7 through 11 m:</u> if history of 0 doses, give 2 doses of PCV13, 4 wks apart, with a 3rd dose at age 12–15 m; if history of 1 or 2 doses, give 1 dose of PCV13 with a 2nd dose at age 12–15 m at least 8 wks later. <u>For age 12 through 23 m:</u> if unvaccinated or history of 1 dose before age 12 m, give 2 do-	**Contraindication** Previous severe allergic reaction (e.g., anaphylaxis) to a PCV vaccine, to any of its components, or to any diphtheria toxoid-containing vaccine. **Precaution** Moderate or severe acute illness, with or without fever.

	PCV13 is not routinely given to healthy children age 5 yrs and older. ** High-risk - for both PCV13 and PPSV23, those with sickle cell disease; anatomic or functional asplenia; chronic cardiac, pulmonary, or renal disease; diabetes; cerebrospinal fluid leaks; HIV infection; immunosuppression; diseases associated with immunosuppressive and/or radiation therapy; solid organ transplantation; or who have or will have a cochlear implant. For PPSPV23 only in children ages 6–18 yrs, alcoholism and/or chronic liver disease.	ses of PCV13 8 wks apart; if history of 1 dose at or after age 12 m or 2 or 3 doses before age 12 m, give 1 dose of PCV13 at least 8 wks after most recent dose. <u>For age 2 through 5 yrs and at high risk*:</u> If unvaccinated or any incomplete schedule of 1 or 2 doses, give 2 doses of PCV13, 1 at least 8wks after the most recent dose and another dose at least 8 wks later; if any incomplete series of 3 doses, give 1 supplemental dose of PCV13 at least 8 wks after the most recent dose. <u>For children ages 6 through 18yrs with functional, anatomic asplenia</u> (including sickle cell disease), HIV infection or immunocompromising condition, cochlear implant, or CSF leak, give 1 dose of PCV13 if no previous history of PCV13.	
Pneumococcal Polysaccharide (PPSV) Give IM or Subcut	••Give 1 dose at least 8wks after final dose of PCV13 to high-risk** children age 2yrs and older. ••For children who have sickle cell disease, functional or anatomic asplenia, HIV infection, or other immunocompromising condition, give a 2nd dose of PPSV 5 yrs after previous PPSV. (See ACIP pneumococcal recommendations at <u>www.cdc.gov/mmwr/pdf/rr/rr5911.pdf</u>.)		**Contraindication** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components. **Precaution** Moderate or severe acute illness, with or without fever.
Human Papillomavirus (HPV) (4vHPV or 9vHPV, Gardasil 9) Give IM	Give a 2-dose series of either HPV4 or HPV9 to girls and boys at age 11–12 yrs on a 0,6–12 m schedule. (May give as early as age 9 yrs.) Give a 3-dose series of 4vHPV or 9vHPV to girls and boys age 15 yrs or older or who are immunocompromised on a 0, 1–2, 6 m schedule. (May give as early as age 9 yrs.)	With the exception of immunocom-promised persons, or persons with autoimmune disease, a 2-dose schedule may be followed for all persons initiating the HPV vaccine series before age 15 yrs. A 3-dose schedule must be followed for all persons initiating	**Contraindication** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components. **Precautions** Moderate or severe acute illness, with or without fever. Pregnancy.

	Give a 3-dose series of either 4vHPV or 9vHPV to all older girls/women (through age 26 yrs) and boys/men (through age 21 yrs) who were not previously vaccinated.	the series at age 15 yrs or older, as well as for immuno-compromised persons or persons with autoimmune disease ages 9 through 26 yrs. Minimum intervals between doses: 2-dose schedule: 5 m; 3-dose schedule: 4 wks between № 1 and № 2; 12 wks between № 2 and № 3 and 5 m between № 1 and № 3.	
Hepatitis A (HepA) Give IM	Give 2 doses spaced 6–18 m apart to all children at age 1 yr (12–23 m). Vaccinate all previously unvaccinated children and adolescents age 2 yrs and older who – Want to be protected from HAV infection and lack a specific risk factor. – Live in areas where vaccination programs target older children. – Travel anywhere except U.S., W. Europe, N. Zealand, Australia, Canada, or Japan. – Have chronic liver disease, clotting factor disorder, or are adolescent males who have sex with other males. – Use illicit drugs (injectable or non-injectable). – Anticipate close personal contact with an international adoptee from a country of high or intermediate endemicity during the first 60 d following the adoptee's arrival in the U.S.	Minimum interval between doses is 6 m. Children who are not fully vaccinated by age 2 yrs can be vaccinated at a subsequent visit. Administer 2 doses at least 6 m apart to previously un-vaccinated persons who live in areas where vaccination programs target older children, or who are at increased risk for infection. Give 1 dose as post exposure prophylaxis to incompletely vaccinated children and teens age 12 m and older who have recently (during the past 2 wks) been exposed to hepatitis A virus.	**Contraindication** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components. **Precautions** Moderate or severe acute illness, with or without fever.
Inactivated polio (IPV) Give Subcut or IM	Give to children at ages 2 m, 4 m, 6–18 m, 4–6 yrs. May give dose № 1 as early as age 6 wks. Not routinely recommended for U.S. residents age	The final dose should be given on or after the 4th birthday and at least 6m from the previous dose.	**Contraindication** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components.

	18 yrs and older (except certain travelers). For information on polio vaccination for international travelers, see wwwnc.cdc.gov/travel/diseases.	If dose № 3 is given after 4th birthday, dose № 4 is not needed if dose № 3 is given at least 6 m after dose № 2.	**Precautions** Moderate or severe acute illness, with or without fever. Pregnancy.
Influenza Inactivated influenza* vaccine (IIV) Give IM * includes Recombinant influenza vaccine (RIV3) for teens ages 18 yrs and older	Vaccinate all children and teens age 6 m and older. For children age 6 m through 8 yrs, give 2 doses of age-appropriate vaccine, spaced 4 wks apart, who 1) are first-time vaccinees, or 2) have received only one lifetime dose previous to this current season (season runs July to June) For IIV in children age 6–35 m give either Fluzone 0.25 mL dose or FluLaval 0.5 mL dose. For IIV in children age 3 yrs and older give 0.5 mL dose of any age-appropriate influenza vaccine. For teens age 18 yrs and older, intradermal vaccine (Fluzone Intradermal) may be used.		**Contraindications** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine, to any of its components, including egg protein. **NOTE:** People age 18 yrs and older with egg allergy of any severity can receive any influenza vaccine, including the recombinant influenza vaccine (RIV3) (Flublok). RIV3 does not contain any egg protein. **Precautions** Moderate or severe acute illness, with or without fever. History of Guillain-Barré syndrome (GBS) within 6wks of a previous influenza vaccination. Previous severe reaction to eggs involving symptoms other than hives. These people may receive any age-appropriate influenza vaccine. The vaccine should be administered in a medical setting (e.g., a health department or physician office) and should be supervised by a healthcare provider who is able to recognize and manage severe allergic conditions. For children/teens who have experience only hives with exposure to eggs, give any age-appropriate influenza vaccine.

Hib (Haemophilus influenzae type b) Give IM	ActHib (PRP-T), Menhibrix, Hiberix, or Pentacel give at age 2 m, 4 m, 6 m, 12–15 m (booster dose). PedvaxHIB (containing PRP-OMP) give at age 2 m, 4 m, 12–15 m (booster dose). Dose № 1 of Hib vaccine should not be given earlier than age 6 wks. Give final dose (booster dose) no earlier than age 12 m and a minimum of 8 wks after the previous dose. Hib vaccines are interchangeable; however, if different brands of Hib vaccines are administered for dose № 1 and dose № 2, a total of 3 doses are necessary to complete the primary series in infants, followed by a booster after age 12 m. For vaccination of children 12 through 59 m who are immuno-compromised (immunoglobulin deficiency, complement component deficiency, HIV infection, receipt of chemotherapy or radiation therapy for cancer) or asplenic: if previously received no doses or only 1 dose before age 12 m, give 2 additional doses at least 8 wks apart; if previously received 2 or more doses before age 12 m, give 1 additional dose. Hib is not routinely given to healthy children age 5 yrs and older. 1 dose of Hib vaccine should be administered to children age 5 yrs and older who have anatomic or functional asplenia	All Hib vaccines: If dose № 1 was given at 12–14 m, give booster in 8 wks. Give only 1 dose to unvaccinated children ages 15–59 m. ActHib: Dose № 2 and № 3 may be given 4 wks after previous dose. If dose № 1 was given at age 7–11 m, only 3 doses are needed; № 2 is given at least 4 wks after № 1, then final dose at age 12–15 m (wait at least 8 wks after dose № 2). PedvaxHIB: Dose № 2 may be given 4 wks after № 1. Recipients of hematopoietic stem cell transplant should receive 3 doses of Hib vaccine at least 4 wks apart beginning 6–12 m after transplant, regardless of Hib vaccination history.	**Contraindications** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components. Age younger than 6 wks. **Precaution** Moderate or severe acute illness, with or without fever.

	(including sickle cell disease) and who have not received a primary series and booster dose or at least 1 dose of Hib vaccine after age 14 m. 1 dose of Hib vaccine should be administered to unvaccinated persons 5 through 18 yrs of age with HIV infection.		
Meningo-coccal conjugate, quadriva-lent (MenACWY) Menactra and Menveo Give IM MenHibrix (contains Hib vaccine) Give IM Meningo-coccal Polysaccha-ride (MPSV4) Menomune Give Subcut	Give a 2-dose series of MenACWY with dose #1 at age 11–12 yrs and dose № 2 at age 16 yrs. If unvaccinated at 11–12 yrs, give dose № 1 at age 13 through 15 yrs. Give dose № 2 at 16 through 18 yrs with a minimum interval of at least 8 wks between doses. If unvaccinated at 11 through 15 yrs, give dose № 1 at 16 through 18 yrs. For college students, give 1 (initial) dose to unvaccinated first-year students age 19 through 21 yrs who live in a residence hall; give dose № 2 if most recent dose given when younger than age 16 yrs. Give MenHibrix or Menveo to children age 2–18 m with persistent complement component deficiency, HIV infection, or anatomic/functional asplenia; give at ages 2, 4, 6, 12–15 m. For unvaccinated or partially vaccinated children age 7–23 m with persistent complement component deficiency: 1) if age 7–23 m and using Menveo, give a 2-dose series at least 3 m apart with dose № 2 given after age 12 m or,	If previously vaccinated and risk of Meningococcal disease persists, revaccinate with MenACWY in 3 yrs (if previous dose given when younger than age 7 yrs) or in 5 yrs (if previous dose given at age 7 yrs or older). Then, give additional booster doses every 5 yrs if risk continues. Minimum ages for MCV: 6 wks MenHibrix; 2 m Menveo; 9 m Menactra. See ACIP schedule footnotes for additional information on catch-up vaccination of high-risk persons and for MenHibrix. If using Menactra in a high-risk child, it should be given before or at the same visit as DTaP is administered.	**Contraindication** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components. **Precaution** Moderate or severe acute illness, with or without fever.

	2) if age 9–23 m and using Menactra, give a 2-dose series at least 3m apart. Give either brand of MenACWY to unvaccinated children age 24 m and older with persistent complement component deficiency or anatomic or functional asplenia; give 2 doses, 2 m apart. If Menactra is given, it must be separated by 4 wks from the final dose of PCV13. Give age-appropriate series of meningococcal conjugate vaccine (brand must be licensed for age of child) to 1) children age 2 m and older at risk during a community outbreak attributable to a vaccine serogroup and 2) children age 2 m and older travelling to or living in countries with hyperendemic or epidemic meningococcal disease. Prior receipt of MenHibrix is not sufficient for children traveling to the meningitis belt or the Hajj.		
Meningococcal serogroup B (MenB) Bexsero and Trumenba Give IM	Teens age 16 through 18 yrs may be vaccinated routinely as a Category B recommendation (provider-patient discussion). Give 2 doses of either MenB vaccine: Bexsero, spaced 1m apart; Trumenba, spaced 6m apart. MenB brands are not interchangeable. For children age 10 yrs and older with persistent complement component deficiencies, functional or anatomic asplenia, including sickle cell disease, or who are at risk during a community outbreak of serotype B, give either 2 doses of Bexsero, 1 m apart, or 3 doses of Trumenba on a 0, 1–2, and 6 m schedule. MenB brands are not interchangeable. MenB vaccine may be given concomitantly with MCV4 vaccine.		**Contraindication** Previous severe allergic reaction (e.g., anaphylaxis) to this vaccine or to any of its components. **Precaution** Moderate or severe acute illness, with or without fever.

THE LIST OF QUESTIONS
OF THE TOPICS TO BE LEARNED

The list of theoretical questions to the topic to be learned

1. Recommended schedule of vaccination for children.
2. Vaccinations by age, by condition of health, immunizations, conducted in endemic and enzootic areas with epidemic indications recommended vaccinations children.
3. Indication and contraindication for vaccination.
4. Types of vaccines.
5. Prevention of hepatitis B.
6. Prevention of Difteria, tetanus and pertussis.
7. Prevention of Varicella, rotavirus.
8. Prevention of Meningococcal infection.
9. Prevention of Pneumococcal infection.

The list of practical knowledge

1. Physical examination child before vaccination;
2. Identifying the different contraindicated pathological conditions in children before vaccination;
3. Providing vaccinations by age, by condition of health, immunizations, conducted in endemic and enzootic areas with epidemic indications recommended vaccinations children.

The tests of self-control and self-correction of initial level

1. Which of the following vaccines would be contraindicated in a 4 year old boy receiving immunosuppressive therapy for autoimmune hepatitis?

a. Hepatitis A vaccine.
b. Hepatitis B vaccine.
c. Acellular pertussis vaccine.
d. Inactivated polio vaccine.
e. Varicella vaccine.

2. Which vaccine should NOT be given to an 8 year old girl who has not been immunized previously?

a. Hepatitis B vaccine.
b. Tetanus vaccine.
c. Acellular pertussis vaccine.
d. Inactivated polio vaccine.
e. Measles vaccine.

3. Inactivated vaccines may be given to an HIV-positive individual:
a. If the CD8+ count is < 200 cells/μl.
b. If the CD4+ count is > 200 cells/μl.
c. If the CD22+ count is < 200 cells/μl.
d. If the CD4+ count is < 400 cells/μl.
e. If the CD4+ and CD8+ counts are < 200 cells/μl.

4. Indicate whether the follow are examples of passive immunity:
a. Diphtheria-Tetanus toxoid.
b. MMR.
c. Influenza vaccine.
d. Botulism antitoxin.
e. Oral polio vaccine.

5. What is according to Schedule for routine PCV13 vaccination?
a. Give at ages 4 m, 6 m, 12–15 m.
b. Give at ages 1 d, 1 m, 4 m, 12–15 m.
c. Give at ages 2 m, 4 m, 6 m, 12–15 m (booster dose).
d. Give 2 doses spaced 6–18 m apart to all children at age 1 yr (12–23 m).
e. Give to children at ages 2 m, 4 m, 6 – 18 m, 4 – 6 yrs.

Standards of answers to tasks: 1 – e, 2 – c, 3 – b, 4 – d, 5 – c.

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