MUNI
MED

VACCINATION

Epidemiology - lectures
MUDr. Bohdana Rezková, Ph.D.

OVERVIEW

- Importance of vaccination
- Composition of vaccine
- Classification of vaccines
- Immune response to vaccines
- Vaccination contraindications
- Side effects of immunization
- Principles of right vaccination
- Vaccination programs

MUNI MED

VACCINATION = ACTIVE IMMUNIZATION

- one of the most beneficial and cost-effective disease prevention measures,
- one of the most important inventions in medicine,
- method that used natural ways of bodies protection,
- key process – arising of immunological memory

→ faster and more powerful immunity response.

TYPES OF QUESTIONS FROM PARENTS

- Is it possible for a vaccinated child to get the disease against which it is vaccinated?
- Is it true that vaccination reduces immunity to other diseases?
- Can vaccines cause autism?
- Wouldn't it be better to postpone some vaccinations until later? Little child can hardly catch jaundice B….
- Isn't it dangerous to vaccinate so many infections at once?
- Why is aluminum used in vaccines? Isn't it dangerous for the baby?

„VACCINATION - THE PROS AND CONS“
(VITALIA.CZ)

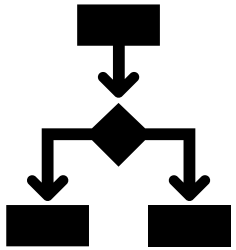
Parents question: *Do you think it is normal to give a small child a vaccine in which there are seven diseases at once? Even with poisonous additives!*

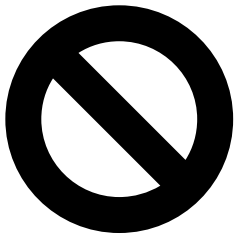
Answer of antivaxxers czech guru: *It's not normal. It's a crime against humanity!*

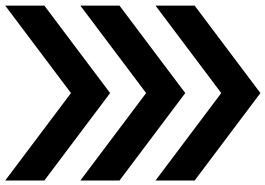
MUDr. Ludmila Elekova

ACTIVE IMMUNIZATION

IMPORTANCE OF VACCINATION







1796 - Edward Jenner showed efficacy of smallpox vaccine

1801 – vaccination commenced in the UK

1802 - vaccination started in the Czech lands

1959 – WHO ACCEPTED PLAN FOR ERADICATION

MAIN STRATEGIES:

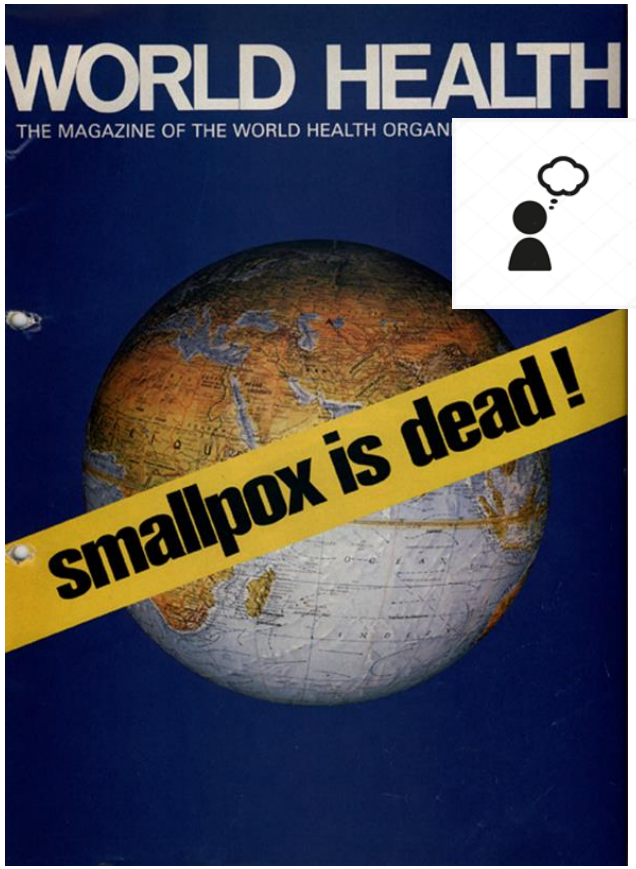
1. mass vaccination: mass vaccination of the population with a target of 80% vaccine coverage in each country,

2. surveillance and anti-epidemic strategies: reporting of variegated disease, regular screening actions, strict isolation of patients, rapid vaccination of all persons in contact with the sick person

→ to interrupt the spread of the disease where vaccination is low.

MASS CAMPAIGN AND VACCINATION

DECLARATION OF ERADICATION



IMPACTS OF VACCINATION

DIRECT EFFECT

resulted from immune response of organisms to vaccine

→ creation of individual immunity

↓

- prevents the disease or its severe course

INDIRECT EFFECT

impact on disease transmission in the population

→ creation of herd immunity

↓

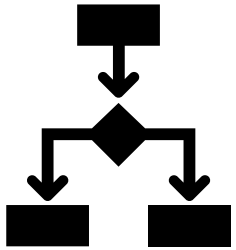
- stops the spread of infections in the population
- helps protect unvaccinated person

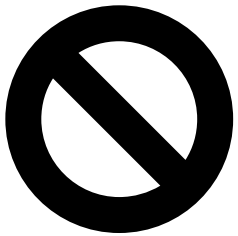
HERD IMMUNITY

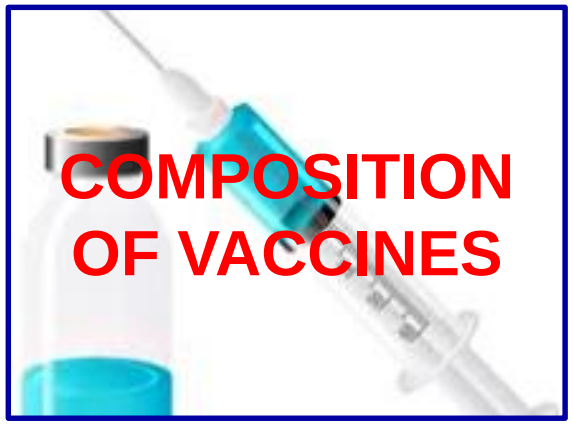
- *percentage of immune people in the population needed to prevent the spread of the agent.*

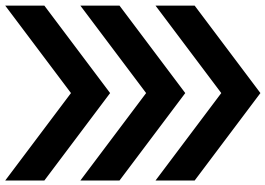
ACTIVE IMMUNIZATION

IMPORTANCE OF VACCINATION

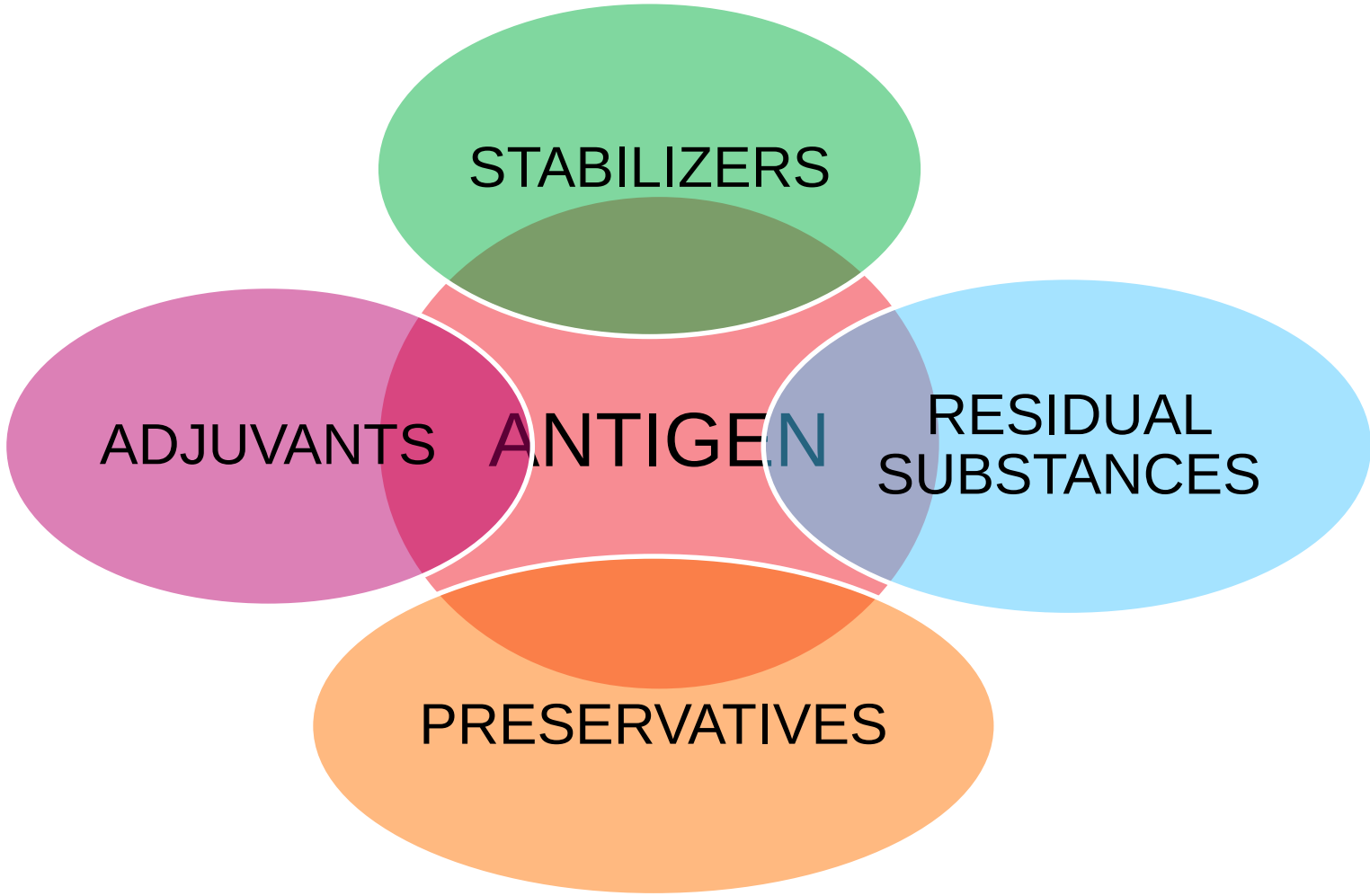








VACCINE INGREDIENTS



ANTIGEN

- any substance inducing a desired immune response in a vaccinated person.

ADJUVANTS

- added to some vaccines to enhance the immune response,
- benefit for people with compromised immune systems, the elderly, and the very young,

  ➡ use of less antigen (in short supply or costly),
  reducing or eliminating the need for booster vaccinations

➢ aluminum-containing adjuvants

➢ others: AS04, MF59, AS01B, …

RESIDUAL SUBSTANCES - ANTIBIOTICS

- only in some vaccines,
- used to help prevent bacterial contamination during manufacturing ➡ small amounts of antibiotics may be present in some vaccines (e.g. neomycin, polymyxin B, streptomycin, gentamicin),
- antibiotics most likely to cause severe allergic reactions (e.g., penicillins, cephalosporins and sulfa drugs) are not used in vaccine production!

STABILIZERS

- help protect the vaccine from adverse conditions (e.g. temperature).
- various substances - e.g.:

➢sugars such as sucrose and lactose,

➢amino acids such as glycine or the monosodium salt of glutamic acid

➢proteins such as human serum albumin or gelatin.

PRESERVATIVES

- to prevent the growth of bacteria or fungi that may be introduced into the vaccine during its use (e.g. repeated puncture of a multi-dose vaccine vial with a needle).

ACTIVE IMMUNIZATION

IMPORTANCE OF VACCINATION

TYPES OF VACCINES

1. Live-attenuated vaccines → Whole-Pathogen Vaccines
2. Inactivated vaccines → Whole-Pathogen Vaccines
3. Subunit, recombinant, polysaccharide, and conjugated vaccines → Subunit Vaccines
4. Toxoid vaccines → Nucleic Acid Vaccines

SUBUNIT VACCINES

- include only the components, or antigens, that best stimulate the immune system,
- antigens alone are not sufficient to induce adequate long-term immunity → + adjuvants,
- are safer and easier to produce.

- polysaccharid vaccines
- conjugated vaccines
- toxoids
- recombinant vaccines

SUBUNIT VACCINES II

TOXOID VACCINES

- chemically inactivated toxins (toxoids),
- elicit immune responses against disease-causing proteins, or toxins, secreted by the bacteria,
- against bacterial illnesses, such as diphtheria and tetanus.

RECOMBINANT VACCINES

- recombinant DNA technology,
- genetic code for the viral protein has been inserted into other cells which then produce it,
- against hepatitis B, Men B, HPV

NUCLEIC ACID VACCINES

- use introduction of genetic materials encoding one or more antigens of pathogen into the body cells, they then produce the antigen
- ➡ stimulation of broad long-term immune responses,
- relative ease of large-scale vaccine manufacture,
- excellent vaccine stability,
- recently licensed for human use.

KINDS OF VACCINES

1. SIMPLE X COMBINED – against one or more infections (e.g. MMR, hexavaccine,…)
2. MONOVALENT X POLY (…) VALENT – against one or more serotypes of one pathogen (e.g. tetravalent vaccine against meningococcus A,C,W,Y)

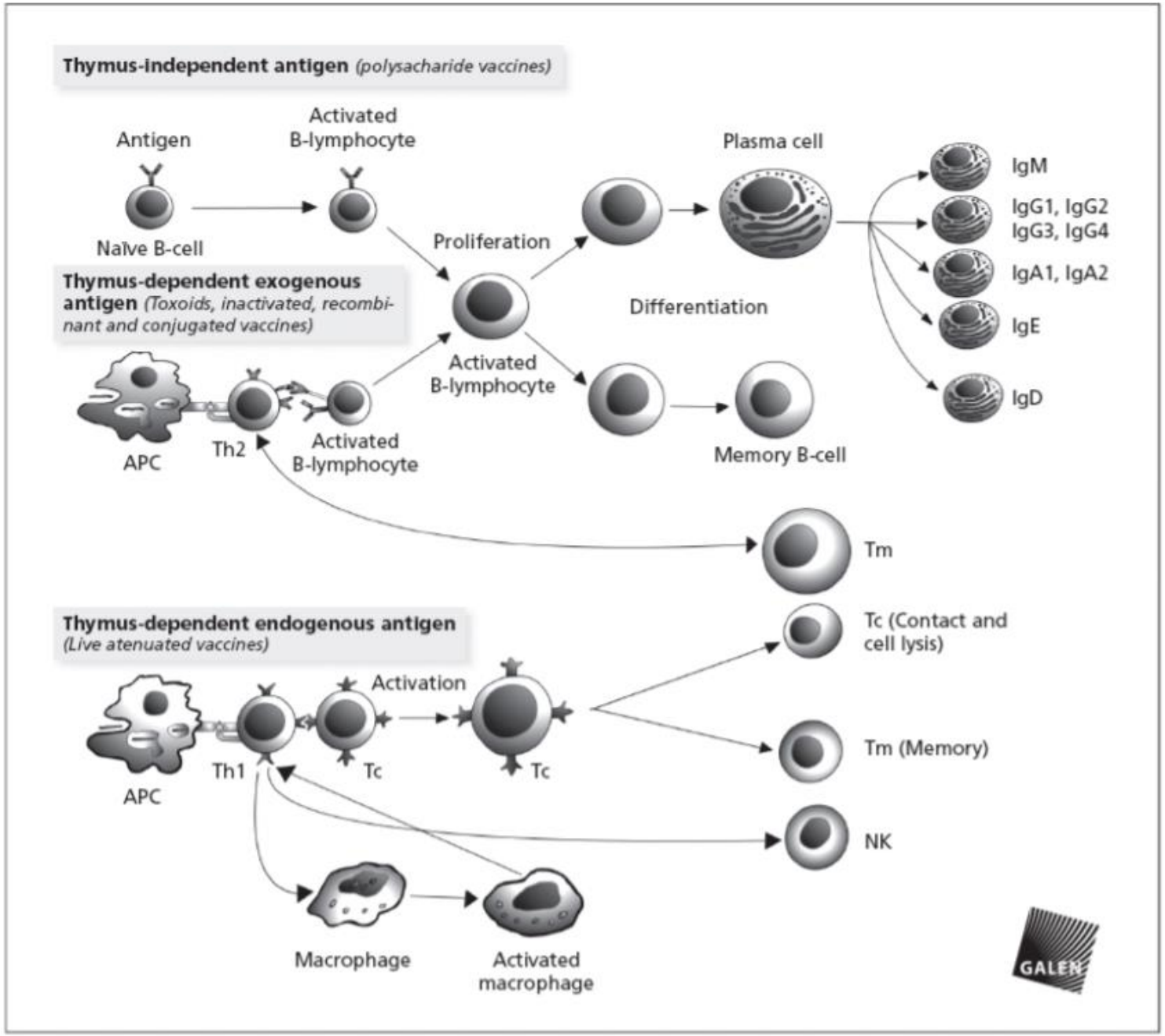
ACTIVE IMMUNIZATION

IMPORTANCE OF VACCINATION

IMMUNE RESPONSE TO VACCINATION

3 ways of interaction between vaccine antigens and immune system

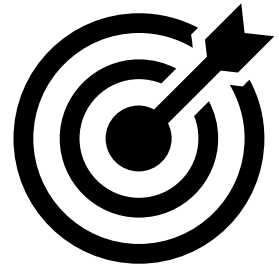
Source: J. Beran :Physiology of immune response to vaccination. Available at: https://www.vakcinace.eu/prednasky-stud .



ACTIVE IMMUNIZATION

IMPORTANCE OF VACCINATION

SIDE EFFECTS OF VACCINATION



IMMUNE RESPONSE TO VACCINATION

SIDE EFFECTS OF VACCINES

- Any vaccine can cause side effects.
- All side effects are monitored by national institution systems.

➢ Expected x unexpected
➢ Local x general
➢ From the view of severity:

1. Physiological side effects
2. Severe side effects (physiological or neurological)
3. Allergic side effects

COMMON PHYSIOLOCIGAL SIDE EFFECTS

- Usually mild,
- associated with the activation of immune responses in the body,
- usually resolves spontaneously within 1-3 days:

- local reaction (redness and/or swelling around injection site),
- mild temperature or fever,
- irritability, decreased appetite, sleepiness,
- vomiting and diarrhoea,
- fainting.

NEUROLOGICAL SIDE EFFECTS

- except febrile seizures (1 : 15 000) they are very rare! (1 : 10 mill.),
- genetic predisposition in connection with the type of immune reaction is presumed:

➢ febrile seizures

➢ Guillain-Barré Syndrome

➢ encephalitis

➢ encephalomyelitis, etc.

ANAPHYLACTIC REACTION

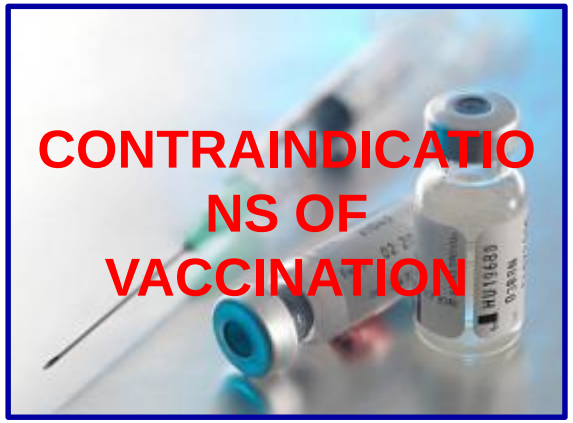
- usually occur within minutes of parenteral administration,
- most common signs and symptoms are cutaneous (e.g. urticaria, angioedema, flushing, pruritus). However, 10 to 20% of patients have no skin findings.
- rapid progression of symptoms
- first and most important therapy - epinephrine,
- providers should have a plan in place to contact emergency medical services.

ACTIVE IMMUNIZATION

IMPORTANCE OF VACCINATION

SIDE EFFECTS OF VACCINATION

IMMUNE RESPONSE TO VACCINATION



GENERAL CONTRAINDICATIONS

- Conditions in a recipient that increases the risk for a serious adverse reaction.
- Persons who administer vaccines should screen patients for contraindications!

1. Severe allergic reaction (e.g. anaphylaxis) after a previous dose or to a vaccine component.
2. Severe reaction after previous dose with alteration of general condition.

CONRAINDICATIONS FOR LIVE VACCINES

- Pregnant women
- General contraindications
- Diagnosed immunodeficiency
- Treatment by Corticosteroids (0,5 mg/kg/2 weeks)
- Specific biological treatment
- Selected haemato-oncological or haematological diagnosis
- 3 months after transfusion or passive immunization

PRECAUTIONS

- Condition in a recipient that might increase the risk of a serious adverse reaction.
- In general, vaccinations should be deferred when a precaution is present.
- Vaccination might be indicated in the presence of a precaution if the benefit of protection from the vaccine outweighs the risk for an adverse reaction.

1. Moderate or severe acute illness with or without fever.
2. Other specific precautions at various vaccines.

ACTIVE IMMUNIZATION

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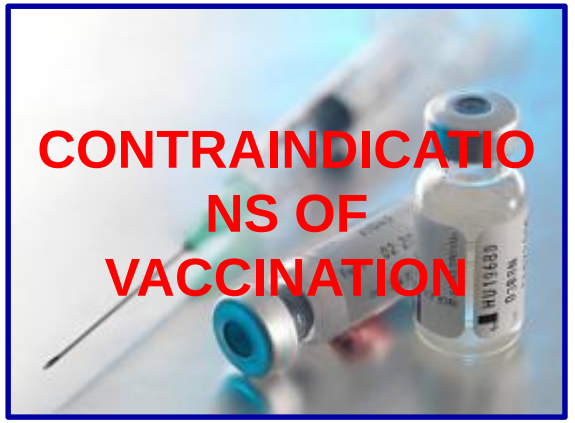
SIDE EFFECTS OF VACCINATION

IMMUNE RESPONSE TO VACCINATION



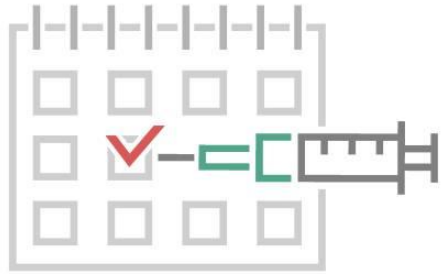
ROUTES OF ADMINISTRATION OF THE VACCINE(S)

- Each vaccine has a recommended administration route and site.

1. Oral route: administered by mouth (e.g.vac. against rotavirosis)
2. Subcutaneous route: injected into the area just beneath the skin into the fatty, connective tissue
3. Intramuscular route: injected into muscle tissue
4. Intradermal route: injected into layers of the skin
5. Intranasal route: administered into the nose (live vac. against flu)

VACCINATION SCHEME

- basic (conventional) scheme - number of doses needed for adequate and prolonged protection, varies from vaccine to vaccine,
  x abbreviated scheme (e.g. for travellers)
- booster dose - for some vaccines, later in life to maintain protection.



CDC RECOMMENDED INTERVALS BETWEEN ADMINISTRATIONS OF DIFFERENT TYPES OF VACCINES

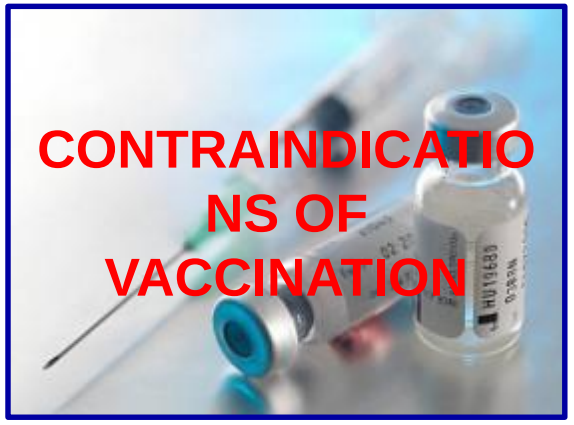
COMBINATIONS OF ANTIGENS	RECOMMENDED MINIMUM INTERVAL
≥ 2 INACTIVATED	NO INTERVAL, COULD BE AMINISTERED ANYTIME
INACTIVATED AND LIVE	NO INTERVAL, COULD BE ADMINISTERED ANYTIME
≥ 2 LIVE - ADMINISTRED PARENTERALLY	4 WEEKS, IF NOT ADMINISTERED ON SAME DAY
AFTER BCG PRIMOVACCINATION	8 WEEKS OR AFTER THE LESION HEALED

ACTIVE IMMUNIZATION

IMPORTANCE OF VACCINATION

SIDE EFFECTS OF VACCINATION

IMMUNE RESPONSE TO VACCINATION



IMMUNIZATION PROGRAMS

IMMUNIZATION PROGRAMS

- All countries have a national immunization programme to protect the population against vaccine-preventable diseases based on the Expanded Programme on Immunization (EPI) from WHO.

https://vaccine-schedule.ecdc.europa.eu/

VACCINATION PREVETABLE DISEASES
RUTINE VACCINATION

BCG
Measles
Rubella
Mumps
Pertusiss
Tetanus
Diphteria
Influenza
TBE

Meningococcal diseases
Pneumococcal diseases
Rotavirus
Poliomyelitis
Hepatitis A
Hepatitis B
HiB
Varicella – Zoster
HPV

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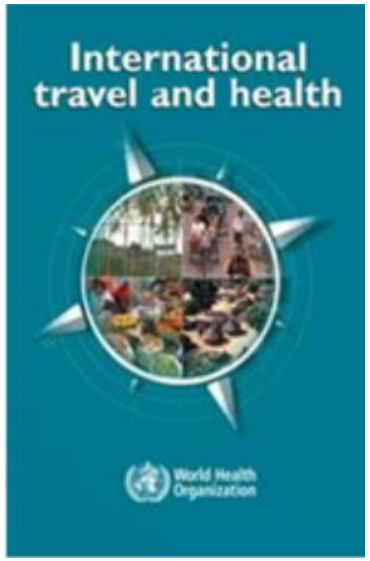
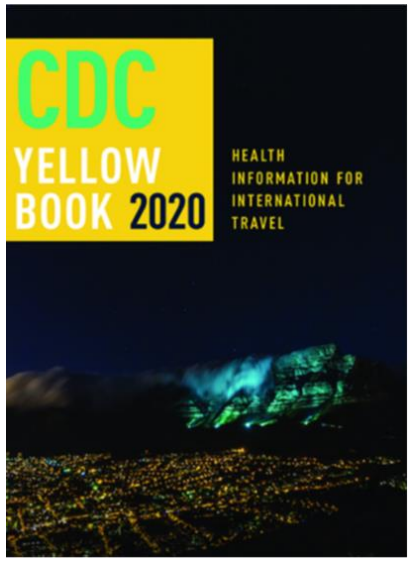
VACCINATION FOR TRAVELLRERS

RECOMMENDATIONS FOR TRAVELLERS

- international travel can pose various risks to health,
- consultation - at least 4–8 weeks before the journey – at the travel medicine clinic or medical practitioner.





VACCINES FOR TRAVELLERS (WHO)

SELECTIVE USE FOR TRAVELLERS

Cholera
Hepatitis A
Japanese encephalitis
Meningococcal disease
Rabies
Tick-borne encephalitis
Typhoid fever
Yellow fever

REQUIRED VACCINATION

Yellow fever (Country list)

Meningococcal disease and polio (required by Saudi Arabia for pilgrims, updates are available on www.who.int/wer)

TAKE AWAY MESSAGE…

Vaccines are safe and effective.

Any vaccine can cause side effects.

Serious side effects from vaccines are extremely rare.

Getting vaccinated is much safer than getting the diseases vaccines prevent.