VACCINATION
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Outline

- ☐Basics of vaccination.
- ☐General rules in vaccination
- ☐Vaccines in common use (routine childhood vaccines and vaccination)
- ☐Expanding the vaccination schedule
- ☐Recent COVID vaccines
- ☐Vaccination schedules
- ☐Vaccines in use in Jordan

Basics of immunization
IMMUNIZATION SAVES LIVES

- Immunization saves up to 3 million lives annually
- Vaccines are available to protect against the following 26 infectious diseases, with many more in development

Cholera • Dengue • Diphtheria • Hepatitis A • Hepatitis B • Hepatitis E • Haemophilus influenzae type b (Hib) • Human papillomavirus • Influenza • Japanese encephalitis • Malaria • Measles • Meningococcal meningitis • Mumps • Pertussis (whooping cough) • Pneumococcal disease • Poliomyelitis • Rabies • Rotavirus • Rubella • Tetanus • Tick-borne encephalitis • Tuberculosis • Typhoid • Varicella (chickenpox) • Yellow Fever
RECENTLY ADDED COVID vaccines

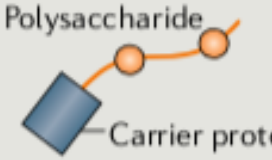
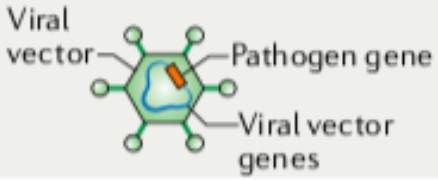
Vaccines are not new! The history

Type of vaccine		Licensed vaccines using this technology	First introduced
Live attenuated (weakened or inactivated)		Measles, mumps, rubella, yellow fever, influenza, oral polio, typhoid, Japanese encephalitis, rotavirus, BCG, varicella zoster	1798 (smallpox)
Killed whole organism		Whole-cell pertussis, polio, influenza, Japanese encephalitis, hepatitis A, rabies	1896 (typhoid)
Toxoid		Diphtheria, tetanus	1923 (diphtheria)

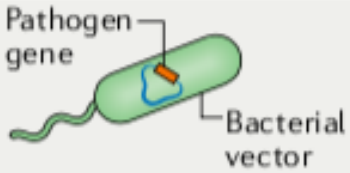
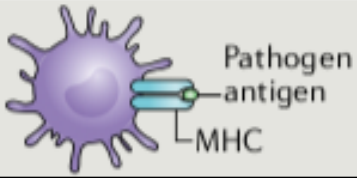
New and old ways of making vaccines

Subunit (purified protein, recombinant protein, polysaccharide, peptide)		Pertussis, influenza, hepatitis B, meningococcal, pneumococcal, typhoid, hepatitis A	1970 (anthrax)
Virus-like particle		Human papillomavirus	1986 (hepatitis B)
Outer membrane vesicle		Group B meningococcal	1987 (group B meningococcal)

Other modes of making vaccines

Protein–polysaccharide conjugate		*Haemophilus influenzae* type B, pneumococcal, meningococcal, typhoid	1987 (*H. influenzae* type b)
Viral vectored		Ebola	2019 (Ebola)
Nucleic acid vaccine		SARS-CoV-2	2020 (SARS-CoV-2)

New ways of making vaccines

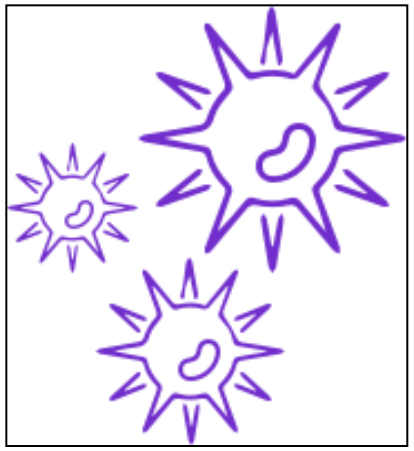
Nucleic acid vaccine		SARS-CoV-2	2020 (SARS-CoV-2)
Bacterial vectored		Experimental	–
Antigen-presenting cell		Experimental	–

Vaccination NOT vaccines (by themselves) SAVE LIVES AND KEEPS PEOPLE HEALTHY

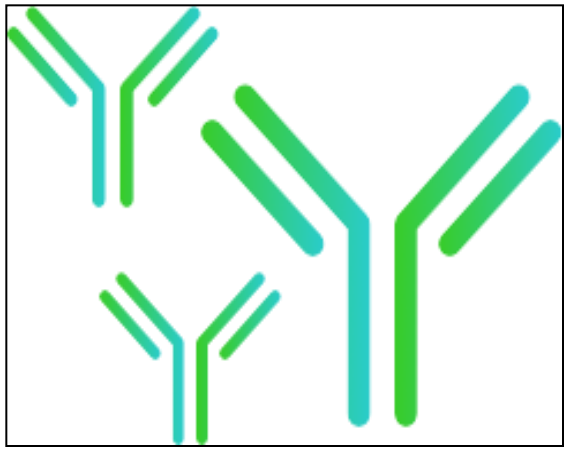
- Immunization saves up to 3 million lives annually
- Vaccines are available to protect against the following 26 infectious diseases, with many more in development
- The challenge is to make sure that all members of society have access to needed vaccines

Cholera • Dengue • Diphtheria • Hepatitis A • Hepatitis B • Hepatitis E • Haemophilus influenzae type b (Hib) • Human papillomavirus • Influenza • Japanese encephalitis • Malaria • Measles • Meningococcal meningitis • Mumps • Pertussis (whooping cough) • Pneumococcal disease • Poliomyelitis • Rabies • Rotavirus • Rubella • Tetanus • Tick-borne encephalitis • Tuberculosis • Typhoid • Varicella (chickenpox) • Yellow Fever

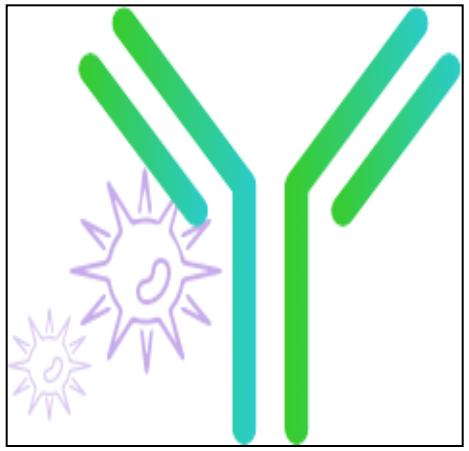
HOW VACCINES WORK



The body is exposed to a weakened or dead pathogen



The body's immune cells make antibodies to attack the pathogen



If the body is exposed to the pathogen again, the body will be prepared with antibodies

However vaccines by themselves do not prevent disease, vaccination should be strengthened to deliver vaccines

- Vaccination prevents disease
- The wider the coverage the greater the protection
- Vaccination should be viewed as a human right and all those who need vaccines should be provided vaccines
- Prioritization is acceptable in case of limited supply only if the health condition warrants this
- Vaccines and vaccine adoption in a country is based on availability for all who need it

General rules for vaccination

- Vaccination is a **process** and all steps have to be taken care of and delivered appropriately. The vaccine and the host have to be appropriately matched for vaccine dose and schedule
- These include host related issues including, age, sex, health status, previous number of doses, health status
- The antigen should be well kept at all steps before delivery including in transportation and in controlled temperature before administration in order to assure that this is effective

General rules in delivering vaccines to a host

- Minimum age at vaccination for the vaccine
- Minimum interval between vaccine doses
- Appropriate Dosing of vaccines, adult versus children content and amount of antigen
- Vaccination in special situations such as mass vaccination
- Vaccination of special hosts
- Planning for vaccination is different
- However routine scheduled vaccines are most important

Types of immunity against an infectious disease agent

Active Immunity = Antigen

Passive Immunity = Antibody

Types of antigens

- Live attenuated organisms
  - Viral
  - Bacterial
- Inactivated
  - Whole organisms
    - Viral
    - bacterial
  - Fractional
    - Protein
    - Polysaccharides
    - Conjugate polysacharide vaccines
    - New types of vaccines, mRNA, mDNA,

Viral Vaccines

- Live attenuated
  - OPV
  - MMR
  - Chickenpox*
  - Live attenuated influenza vaccine*
  - Rotavirus vaccines*
- Inactivated
  - IPV
  - Hepatitis a vaccine*
  - Influenza vaccine*
- Component
  - Hepatitis b vaccine
  - Subunit influenza vaccines
  - HPV vaccines*

Live viral and bacterial vaccines

- BCG
- OPV
- MMR
- Rotavirus
- Chickenpox
- Intranasal influenza vaccine
- Oral typhoid vaccine

Killed or fractional vaccines

- IPV
- Hepatitis a vaccine
- DTP
- Injectable influenza vaccine
- DTaP
- HB
- HIB

☐Pneumo

☐Meningo

☐HPV

Modern vaccines using new technology

- mRNA
- mDNA
- Viral Vector Vaccines
- Protein subunit
- These types of vaccines were Recently used for COVID 19

VACCINES PROTECT THE COMMUNITY

COMMUNITY IMMUNITY

When a sufficient proportion of a population is immune to an infectious disease to make its spread from person to person unlikely.

COVERAGE THRESHOLD

The minimum percentage of individuals immune to a disease needed to prevent an outbreak.

These may differ according to disease, however as a general rule the more uptake of vaccines the greater is the protection

Only 6 countries in the EU/EEA achieved the 95% coverage threshold needed to prevent measles outbreaks in 2017

Vaccines in use for children

Vaccines in use in Jordan

- Diptheria
- Tetanus
- Pertussis
- Polio both IPV and OPV
- Measles,
- Mumps
- Rubella
- Hemophilus influenza b
- Hepatitis b
- Hepatitis a
- BCG
- Rotavirus vaccine

Recently introduced Vaccines some not yet adopted in Jordan

- Chickenpox
- Pneumococcal vaccine
- VZV vaccine (zoster)
- Influenza vaccine
- Acellular pertussis vaccine for adolescents and adults
- Meningococcal vaccine
- HPV vaccine

Vaccination schedule Jordan 2008 upgrade is needed

Age	Vaccine
1st contact	BCG
2 months2	DTaP + $HepB_1$ +Hib_1 + IPV
3 months	DTaP+$HepB_2$+Hib_2+ IPV,OPV
4 months	DTaP+$HepB_3$+Hib_3 + OPV
9 months	Measles + OPV
18 Months	MMR +DTP **booster1**+OPV **booster1**
1st & 10th class	**Td (OPV for 1st class)**

Vaccination to school age children

- 1st elementary class

  Td +OPV booster2

  Validation MMR

- 10th class Td Second dose of MMR
- Recent additions to be added such as HAV and COVID 19

Diphtheria, Corynebacterium diphtheriae

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Greek *diphtheria* (leather hide)

Gram positive rod, a human pathogen that is transmitted by droplets, both asymptomatic and symptomatic individuals may transmit infection

There are four biotypes mitis, intermedius, belfanti, and gravis). All biotypes of *C **diphtheriae*** may be either toxigenic or nontoxigenic.

Diphtheria is caused by toxigenic strains of Corynebacterium diphtheriae

Diphtheria pathogenesis

- Toxigenic strains produce exotoxin. This is phage induced and is the cause of the serious complications of the infection
- The toxin inhibits protein synthesis in all cells, including myocardial, renal, and peripheral nerve cells
- Since the disease is toxin mediated the vaccine is made up of the in activated toxin only, this is diphtheria toxoid

Diphtheria vaccine

- Formalin-inactivated diphtheria toxin
- Protein antigen
- Must administer by deep IM
- Do not freeze
- Efficacy Approximately 95%
- Duration Approximately 10 years
- Amount of antigen higher in children
- Should be administered with tetanus toxoid as DTP. DTaP, DT, Td, or Tdap

DTP, DTaP, DT, and Td

	Diphtheria	Tetanus
DTP,DTaP, DT	7-8 Lf units	5-12.5 Lf units
Td, Tdap (adult)	2-2.5 Lf units	5 Lf units

(D) Designated the formula used for children which has more antigen given to children <7 yrs.
(d) Designated formulation with lesser toxin found in Tdap which is used for older individuals

10-18 years (Boostrix)
11-64 years (Adacel)

Diphtheria and Tetanus Toxoids
Adverse Reactions

- Local reactions (erythema, induration)
- Exaggerated local reactions (Arthus-type)
- Fever and systemic symptoms not common
- Severe systemic reactions rare

Number of admissions of cases of paralytic disease to the Jordan University Hospital each month from January 1978- December 1980.