Principles of Immunization

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Original Content | **Titles** | Additional Notes | **Important**

Learning Objectives

By the end of the session the students should be able to;

- Mention the types of acquired immunity
- List important immunizable diseases
- Describe the compulsory childhood vaccination schedule practiced in KSA
- Define the Cold Chain and its importance.

CONCEPTS

- Know Importance of immunization and Types of immunity
- Classes of vaccines
- KSA Compulsory immunization schedule
- Female adult immunization
- Immunization for special occupations
- The Cold Chain

Importance of immunization

- Immunization has helped reduce the impact of Communicable Disease (CD) on health and wellbeing
- Some diseases have been well controlled and other eliminated from some parts of the world because of vaccination
- Stopping vaccination may again lead to epidemics of Communicable disease

Selected Vaccine-Preventable Diseases, United States

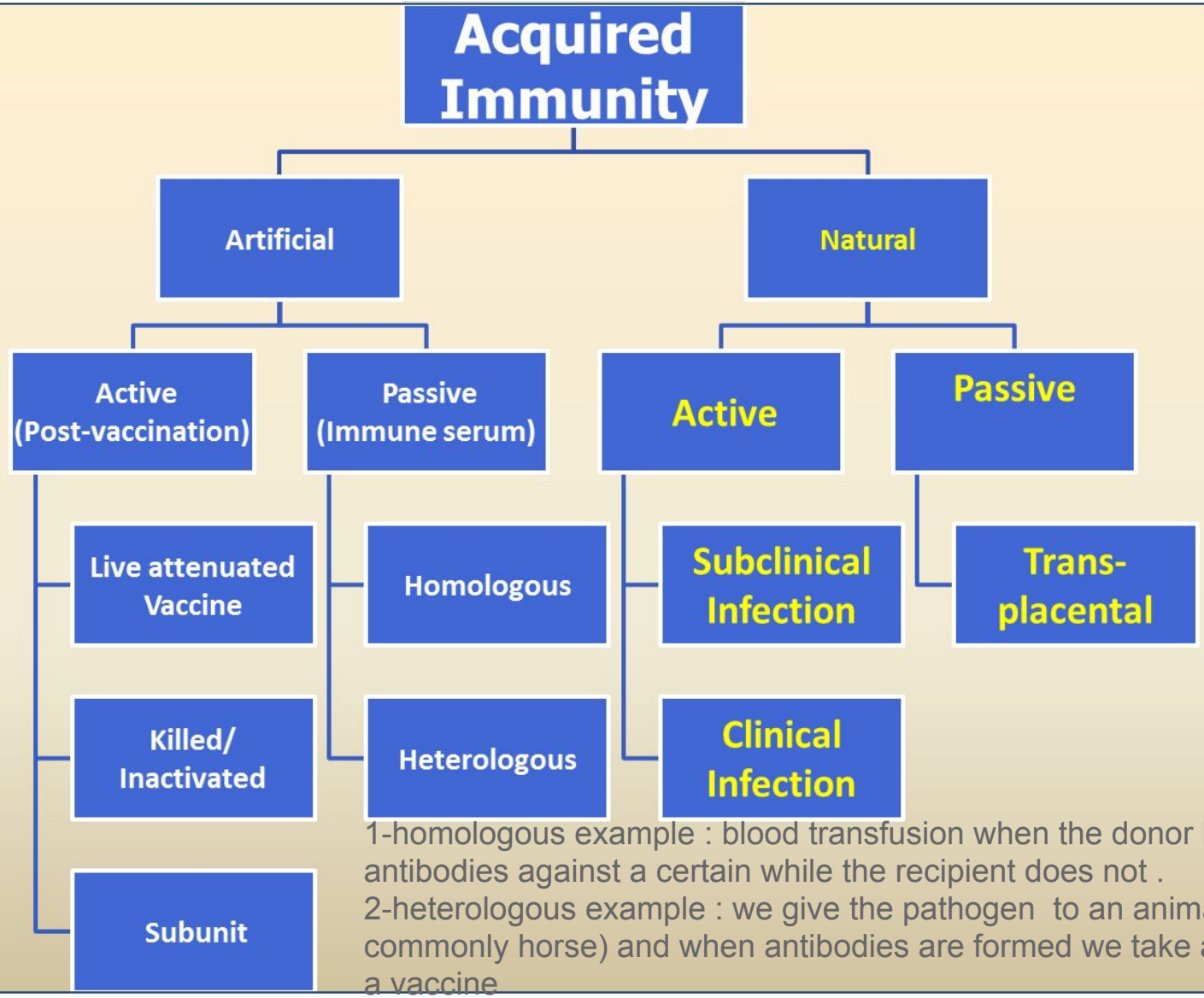
	Cases per Year (Average) Before Vaccines	Cases in 2003	Decrease in Cases per Year
Diphtheria	175,885	1	99.9%
Hib (<5 yrs old)	20,000 (est.)	259	98.8%
Measles	503,282	56	99.9%
Mumps	152,209	231	99.9%
Pertussis	147,271	11,647	92.1%
Polio (paralytic)	16,316	0	100.0%
Rubella	47,745	7	99.9%
Smallpox	48,164	0	100.0%
Tetanus	1,314	20	98.5%

Sources

CDC. Impact of vaccines universally recommended for children — United States, 1900-1998. *MMWR* 8(12):243-8

CDC. Notice to Readers: Final 2003 Reports of Notifiable Diseases. *MMWR* 2004;53(30):687

Acquired immunity



1-homologous example : blood transfusion when the donor has antibodies against a certain while the recipient does not .
2-heterologous example : we give the pathogen to an animal (most commonly horse) and when antibodies are formed we take and use it as a vaccine

Vaccination

- **Vaccination** is a method of giving antigens to stimulate the immune response through ***active immunization***
- A **vaccine** is an immuno-biological substance designed to produce specific protection against a given disease.
- **A vaccine is "antigenic" but not "pathogenic".**

- **Antigen:** A live or inactivated (killed) substance (e.g., protein, polysaccharide) capable of producing an immune response

- **Antibody:** Protein molecules (immunoglobulin) produced by B lymphocytes to help eliminate an antigen

Immunotherapy/ preformed Ab

Immune serum globulin – (gamma-globulin) contains immunoglobulin extracted from the pooled blood of human donors

- Treatment of choice for preventing measles, hepatitis A and replacing Ab in the immunodeficient
- Lasts 2-3 months

Specific immune globulin- prepared from convalescent patients in a hyperimmune state

- Contains high titer of specific Ab
- Prevents Pertussis, Tetanus, Chickenpox, Hepatitis B
- Sera produced in horses are available for Diphtheria, Botulism, Spider and Snake bites
- Act immediately and can protect patients for whom no other useful medication exists

Classification of types of Vaccines

1-Inactivated

A-Whole : Virus or Bacterial

B-Fractional

-protein-based

» toxoid (toxin from bacteria)

» Subunit

– Polysaccharide-based (part of the capsule)

» pure

» conjugate

2-Live attenuated

– Viral

– Bacterial

Live Attenuated Vaccines

- Attenuated (weakened) form of the "wild" virus or bacterium
- Must replicate to be effective
- Immune response similar to natural infection
- Usually effective with one dose*
- Severe reactions are possible
- Interference from circulating antibodies are possible
- Fragile – must be stored and handled carefully

  Ihas to be kept alive because if it dies there will be no benefit and the vaccine will be rendered useless

*except those administered orally

التطعيم الفموي حاسبين حسابهم ان راح يتعرض لإنزيم المعدة ،يعني اذا ماموته الحفظ الجيد في الثلاجة راح يموته حمض المعدة ،فيصنعونه بشكل مايموت في كل الحالتين، خلقة حامي نفسه .

Inactivated Vaccines

- Cannot replicate
- Less interference from circulating antibody than live vaccines
- Generally require 3-5 doses
- Immune response mostly humoral
- Antibody titer diminishes with time

Examples of Inactivated Vaccines and Live Attenuated Vaccines

1-inactivated

- Viral: Inactivated polio vaccine (IPV), Hepatitis A, Influenza, Rabies
- Bacterial: Pertussis, Typhoid, Cholera, Plague
- Subunit :Hepatitis B
- Toxoid: Tetanus, Diphtheria

Influenza+typhoid has two types could be live attenuated or inactivated

2-live attenuated

- Viral :e.g. measles, mumps, rubella, yellow fever, influenza, oral polio
- Bacteria: BCG (for TB), oral typhoid

Cellular fraction (Polysaccharide) vaccines

- They are prepared from extracted cellular fractions e.g. N. meningitidis (A,C,Y,W-135); meningococcal vaccine from the polysaccharide antigen of the cell wall

- S. Pneumoniae; pneumococcal vaccine from the polysaccharide contained in the capsule of the organism

- Their efficacy and safety appear to be high.

Conjugate vaccine

- Haemophilus influenzae B (Hib) vaccine; gives long-term protection from Haemophilus influenzae type B the leading cause of meningitis in children under 5 years.

A **conjugate vaccine** is created by covalently attaching a poor antigen to a strong antigen thereby eliciting a stronger immunological response to the poor antigen. Most commonly, the poor antigen is a polysaccharide that is attached to strong protein antigen. However peptide/protein and protein/protein conjugates have also been developed

Surface antigen (recombinant) vaccines

مُصنّع

- It is prepared by cloning HBsAg gene in yeast cells where it is expressed. HBsAg produced is then used for vaccine preparations
- Their efficacy and safety also appear to be high.

Toxoid Vaccines

- Prepared by detoxifying the exotoxins of some bacteria rendering them ***antigenic but not pathogenic.***
- Adjuvant (e.g. alum precipitation) is used to increase the potency of vaccine.
- The antibodies produced in the body neutralize the toxic part produced during infection rather than act upon the organism itself.
- In general toxoids are highly ***efficacious and safe*** immunizing agents.

Vaccine-Related Topics

- Immunization Schedules
- Recommendations and Guidelines
- Vaccines & Preventable Diseases
  - Vaccine Shortages & Delays
  - Potential New Vaccines
  - FAQ about Vaccines & Diseases they Prevent
- Basics and Common Questions
- Vaccination Records
- Vaccine Safety and Adverse Events
- For Travelers
- For Specific Groups of People
- Campaign Materials

Additional Resources

- Publications
- News and Media Resources
- Calendars and Events

Vaccines & Preventable Diseases:

List of Vaccine-Preventable Diseases

The following links will lead you to the main page that describes both the disease and the vaccine(s). Vaccines are available for all of the following vaccine-preventable diseases (unless otherwise noted):

- Anthrax
- Cervical Cancer (Human Papillomavirus)
- Diphtheria
- Hepatitis A
- Hepatitis B
- *Haemophilus influenzae* type b (Hib)
- Human Papillomavirus (HPV)
- Influenza (Flu)
- Japanese encephalitis (JE)
- Lyme disease
  Lyme disease vaccine no longer available in the United States.
- Measles
- Meningococcal

Childhood Immunization Schedule in KSA - 2013

Age:	Vaccines: IMPORTANT
At birth	BCG / Hepatitis B
2 Months	IPV /DTaP / Hepatitis B/ Hib/Pneumococcal Conjugate (PCV)/Rota
4 Months	IPV /DTaP / Hepatitis B/ Hib/Pneumococcal Conjugate (PCV)/Rota
6 Months	OPV/IPV /DTaP/ Hepatitis B/ Hib/Pneumococcal Conjugate (PCV)
9 Months	Measles / Meningococcal Conjugate quadrivalent (MCV4)
12 Months	OPV/ MMR/ Pneumococcal Conjugate (PCV)/Meningococcal Conjugate quadrivalent (MCV4)
18 Months	OPV/DTaP/Hib/ MMR/ Varicella/ Hepatitis A
24 Months	Hepatitis A
First class Primary School age	OPV/ DTaP(Td) / MMR/Varicella

Doses & Routes of administration

Vaccine	Dose (not important) Almost all 05 ml except for BCG	Route
BCG	0.05 ml	ID or SC (left arm)
DPT	0.5 ml	IM (right or left side of thigh)
Hepatitis **B** (HBV)	0.5 ml	IM
Haemophilus Influenza **b** (Hib)	0.5 ml	IM
MMR	0.5 ml	SC
OPV. Rota	2 drops	Oral

The doctor said that we need to know it

-_-

BCG =Bacillus Calmette – Guerin vaccine (tuberculosis).
DPT = Diphtheria, pertussis and tetanus vaccine.
MMR = Live measles, mumps and rubella viruses in a combined vaccine.
OPV = Oral Poliovirus vaccines containing attenuated poliovirus types 1,2 and 3
Intradermal = ID Subcutaneous= SC Intramuscular= IM

Factors influencing recommendations concerning the age of vaccination

- Age-specific risks of diseases
- Age-specific risks of complications
- Ability of persons of a given age to respond to the vaccine(s)
- Potential interference with the immune response by passively transferred maternal antibody (e.g., measles vaccine)

Active immunization for adult females

- MMR vaccine is given in adolescence before or after marriage, but **not during pregnancy** and has to be before 3 months of conception

is an immunization vaccine against measles, mumps, and rubella (German measles). It is a mixture of live attenuated viruses of the three diseases, administered via injection

- Tetanus toxoid in pregnancy to prevent tetanus neonatorum in the newborn. In the first pregnancy on the third month and after 1 month. The third dose in the second pregnancy, and the fourth on the third pregnancy with a maximum of 5 doses.
- If 10 years elapse, and then pregnancy occurs, the doses are given from the start
- *Live attenuated vaccines should not be given during pregnancy*.

Vaccination for special occupations

- Health care workers: hepatitis B, influenza, MMR, polio
- Public safety personnel (police, firefighters) and staff of institutions for the developmentally disabled: hepatitis B, influenza
- Veterinarians and animal handlers: rabies, plague and anthrax
- Sewage workers: DT, hepatitis A, polio, TAB (Typhoid vaccine)
- Food handlers: TAB vaccine
- Military troops and camp dwellers: pneumococcal, meningococcal, influenza, BCG (for non reactors), tetanus

Invalid (false) Contraindications to Vaccination

- Mild illness
- Mild/moderate local reaction or fever following prior dose
- Antibiotic therapy
- Disease exposure or convalescence
- Pregnancy in the household
- Premature birth
- Breast feeding
- Allergies to products not in vaccine
- Family history not related to immuno-suppression

Vaccine potency

All vaccines are thermo-sensitive and need to be properly stored and distributed within **an efficient cold chain system**

Examples of Cold Chain Instruments

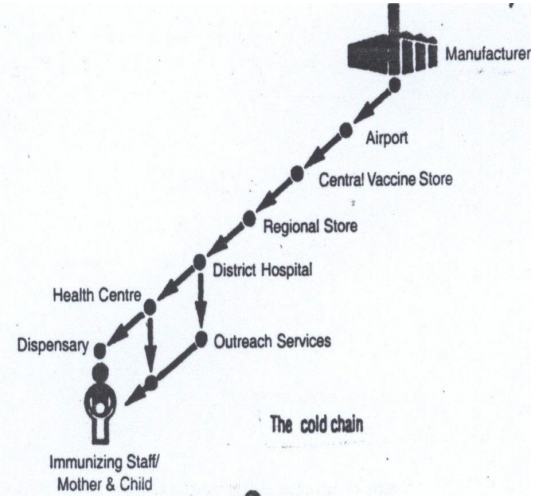
This instrument is portable
If you want to take the vaccine at home for example

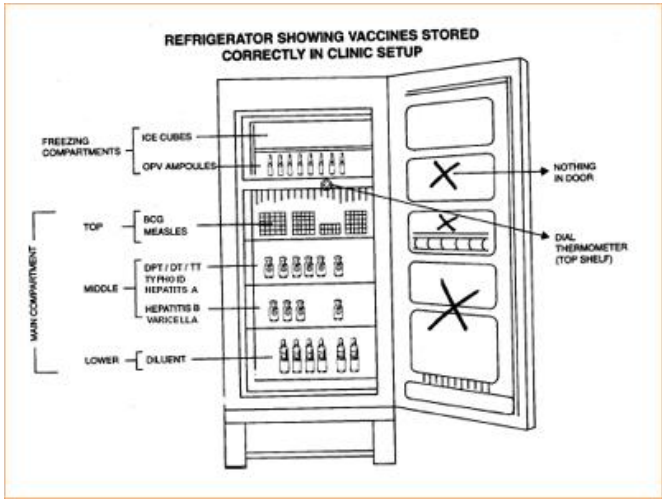
The cold chain system

- Refers to the system (personnel, equipment & procedure) used for keeping and distributing vaccines in good condition.
- When implemented properly, can help overcome the challenge of the delivery of quality vaccines.
- Can enhance the on-going quality, safety and efficacy of an immunization programme.

The proper temperature to keep vaccines at the health center level is (+2 to +8)

- They put water in the fridge in case of power cuts





Heat Sensitivity of vaccines

Most sensitive

- Live oral polio vaccine (OPV)
- BCG (Lyophilized) *
- Measles, MMR (Lyophilized) *
- Rubella and Mumps (Lyophilized)
- Adsorbed Diphtheria-Pertussis-Tetanus vaccine (DPT)
- Adsorbed Diphtheria-Tetanus vaccine (DT, Td)
- Tetanus Toxoid (TT)
- Hepatitis A
- Hepatitis B

Least sensitive

-Oral vaccine

* Note: These vaccines become much more heat sensitive after they have been reconstituted with diluents.

q1/a method of giving antigens to stimulate the immune response through *active immunization*
A-cold chain system
B-vaccination
C-antigen
D-antibody

q2/Which of the following vaccines is the most sensetive to heat?
A-HEB B
B-HEB A
C-polio
D-BCG

Q3/ The type of vaccine that‘s usually weakened +effective from first dose ?
A-live attenuated
B-toxoid
C-conjugate
D-inactivated

Q1=B
Q2=C
Q3=A