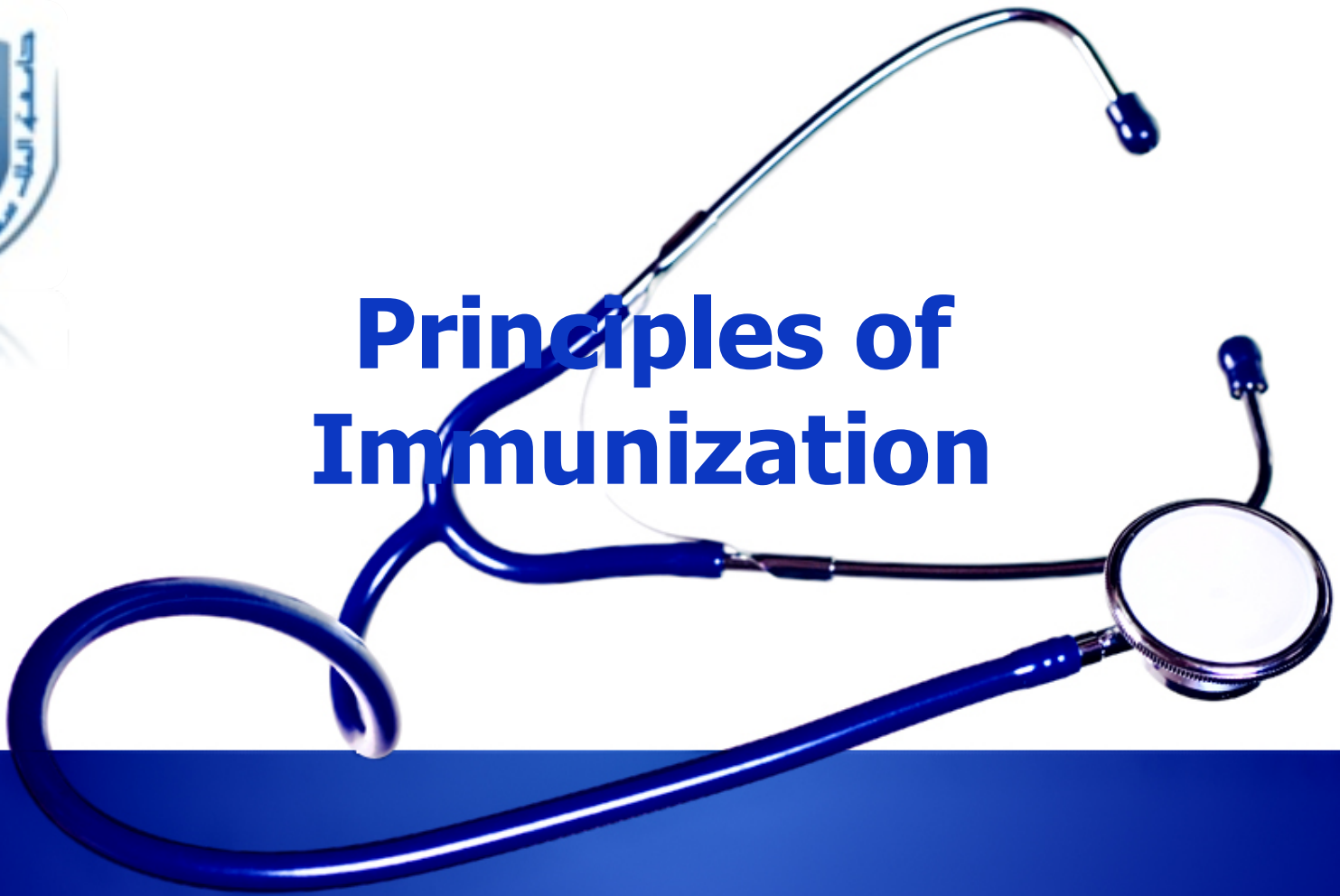




Principles of Immunization



Dr Salwa A. Tayel, & Prof Ashry Gad
KSU Department of Family & Community Medicine
October, 2017

Objectives of the session



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



- Importance of immunization
- 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 CD



SELECTED VACCINE-PREVENTABLE DISEASES, UNITED STATES

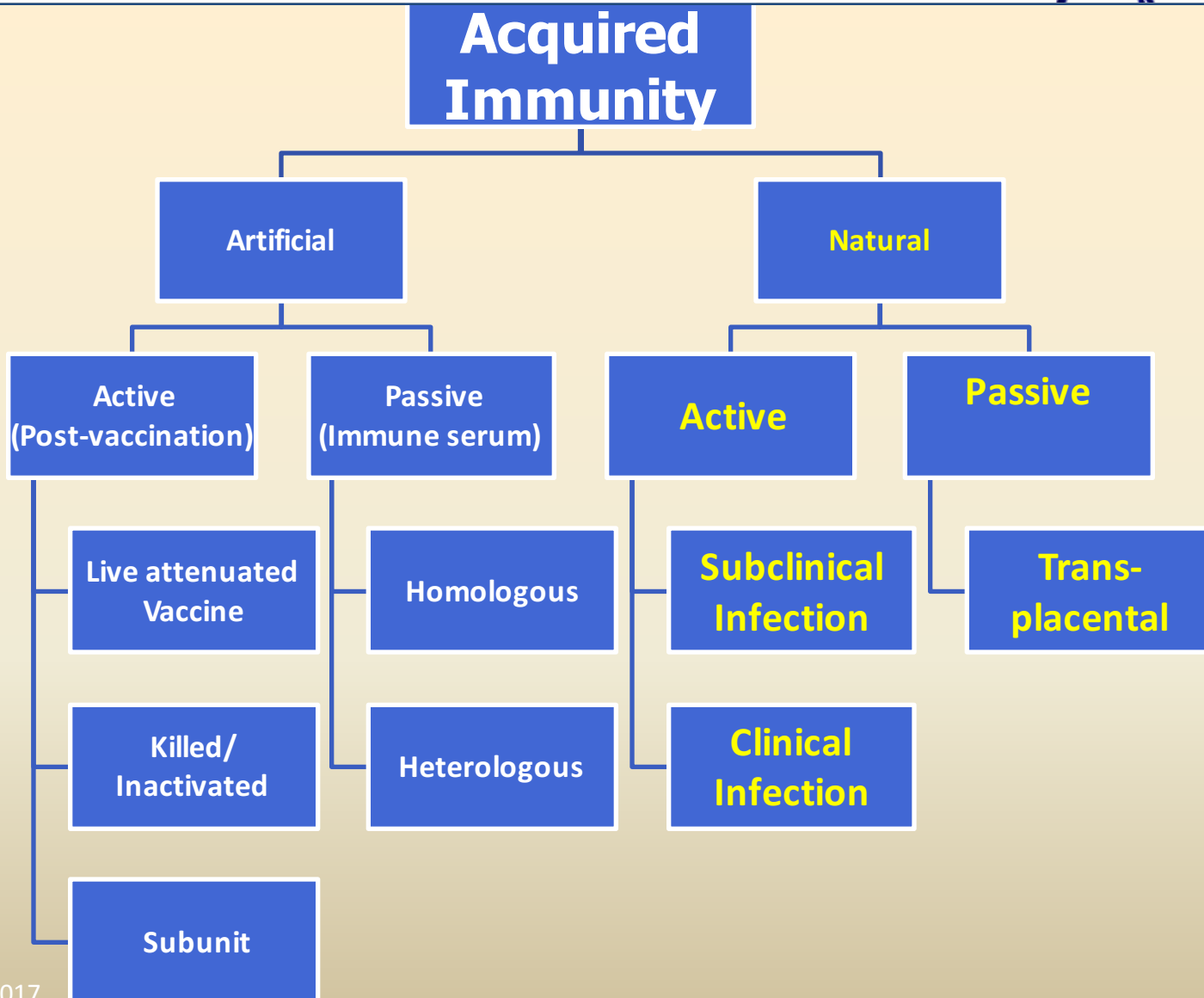
	Cases per Year (Average) Before Vaccines	Cases in 2003	Decrease in Cases per Year
Diphtheria	175,885	1	99.9%
Hib (<5 yrs old)	20,000 (est.)	259	98.8%
Measles	503,282	56	99.9%
Mumps	152,209	231	99.9%
Pertussis	147,271	11,647	92.1%
Polio (paralytic)	16,316	0	100.0%
Rubella	47,745	7	99.9%
Smallpox	48,164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



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”.

Antigens & Antibodies



- **Antigen:** A live or inactivated 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/ pre-formed 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 immune deficient
- Lasts 2-3 months

Immunotherapy/ pre-formed Ab



- Specific immune globulin-** prepared from convalescent patients in a hyperimmune state
- Contains high titer of specific Ab
 - 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



– Live attenuated

- Viral
- Bacterial

– Inactivated

- *Whole*
 - Virus
 - Bacterial
- *Fractional*
 - protein-based
 - » toxoid
 - » subunit
 - polysaccharide-based
 - » pure
 - » conjugate

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

*except those administered orally

Examples of Live Attenuated Vaccines



- **Viral** e.g. measles, mumps, rubella, yellow fever, influenza, oral polio
- **Bacterial** BCG, oral typhoid

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



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

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

Surface antigen (recombinant) vaccines



- 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.



Vaccines & Immunizations

[Vaccines Home](#) > [Vaccines & Preventable Diseases](#) > List of Vaccine-Preventable Diseases

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:
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	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

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
- **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, fire fighters) 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 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

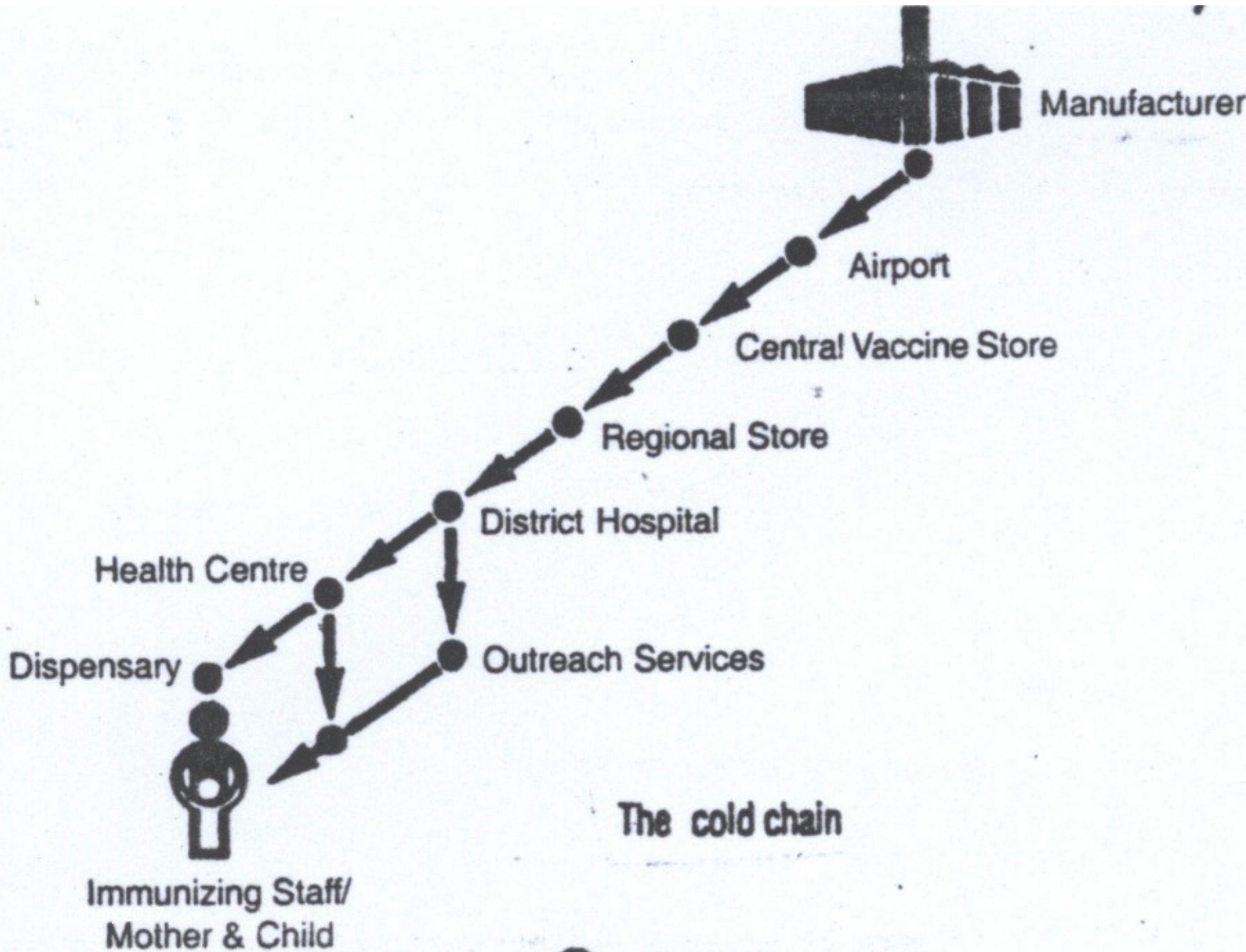


All vaccines are thermo-sensitive and need to be properly stored and distributed within **an efficient cold chain system**

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.



Examples of Cold Chain Instruments



Cold Box



Vaccine carrier



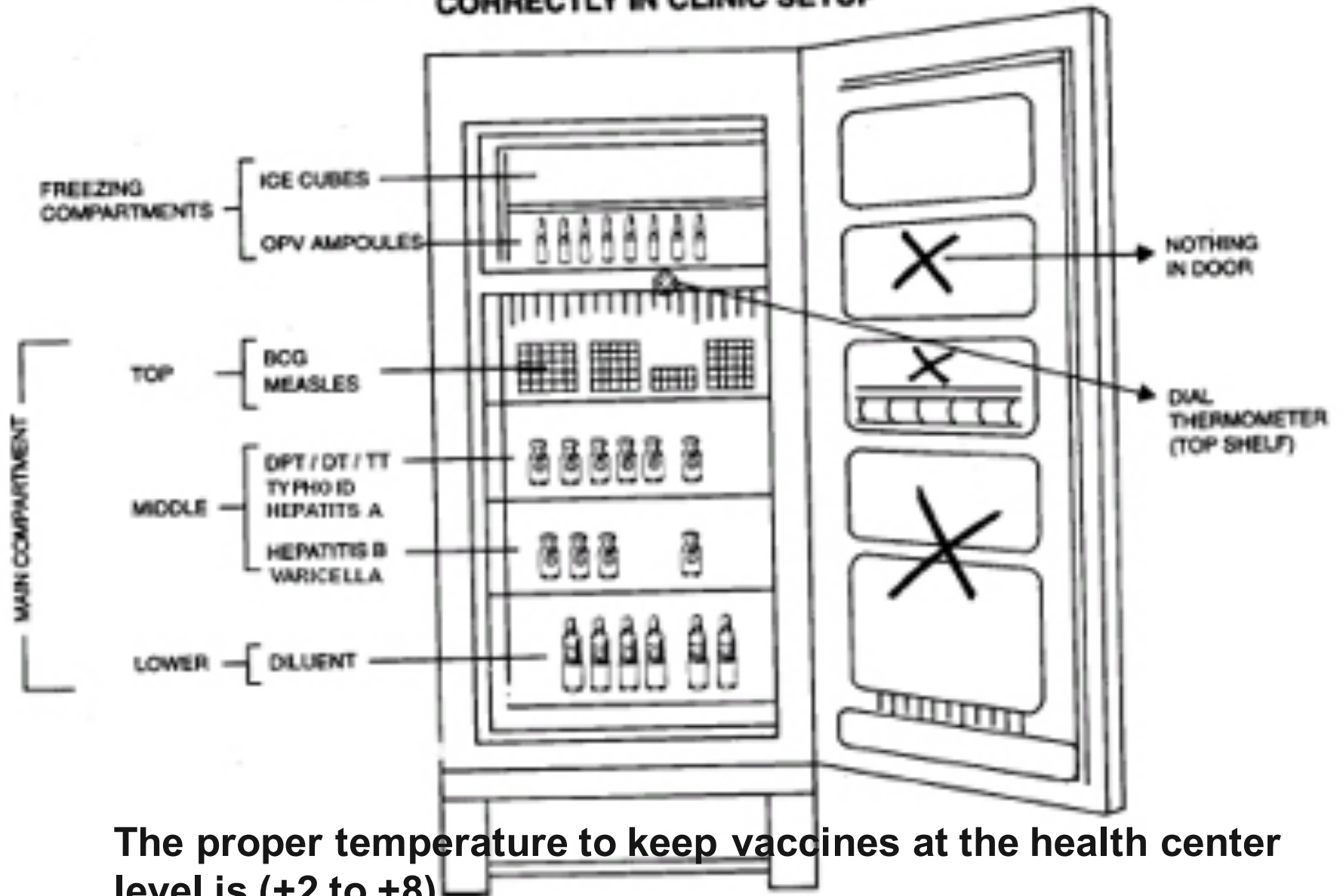
Ice Packs



Guidelines for Maintaining and Managing the Vaccine Cold Chain

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5242a6.htm#tab1>

REFRIGERATOR SHOWING VACCINES STORED CORRECTLY IN CLINIC SETUP



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

Heat Sensitivity of vaccines



- 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

Most sensitive



Least sensitive

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



Thank you