Introduction to Community Medicine Course
(31505201)
Unit 4 Epidemiology

Introduction to Epidemiology

Prevention - Principles of Vaccination

By

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MD  MPH  JBCM  PhD
10+13 -11- 2016
إعلان مهم

"الإسعاف الطائر"

الأثنين 14-11-2016
الساعة 13:00
مسرح العلوم
الدعوة عامة

المخاطر الصحية للتعامل مع الحاسوب وطرق الوقاية منها

الأربعاء 16-11-2016
الساعة 13:30
مسرح العلوم
الدعوة عامة
Introduction to unit 4 Epidemiology

• Definition, History of Epidemiology
  Purpose/Use of Epidemiology
• Concepts in the infectious diseases
• Disease Causation
• Measurements of Morbidity and Mortality
• Levels of prevention and vaccination
• Sources of Data and methods of data collection
• Epidemic Investigation and Management
• Epidemiological Surveillance
## Presentation outline

<table>
<thead>
<tr>
<th>Topic</th>
<th>Time</th>
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<tbody>
<tr>
<td>Introduction to Immunology</td>
<td>12:00 to 12:10</td>
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<tr>
<td>Immunity: Active and Passive</td>
<td>12:10 to 12:20</td>
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<tr>
<td>Classification of Vaccines</td>
<td>12:20 to 12:40</td>
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<tr>
<td>General Recommendations on Immunization</td>
<td>12:40 to 12:50</td>
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Immunization averts 2 to 3 million deaths annually; however, an additional 1.5 million deaths could be avoided if global vaccination coverage improves.

Today, an estimated 18.7 million infants – nearly 1 in 5 children – worldwide are still missing routine immunizations for preventable diseases, such as diphtheria, pertussis and tetanus.
CLOSE THE IMMUNIZATION GAP

SIX GOALS OF THE GLOBAL VACCINE ACTION PLAN

IMMUNIZATION AGAINST DIPHTHERIA, TETANUS AND PERTUSSIS

- Target: Immunization coverage with 3 doses of diphtheria, tetanus and pertussis vaccines
  - 90% coverage
  - Gap: 65 countries
  - 18.7 million children unvaccinated

MEASLES MORTALITY REDUCTION

- Target: At least 4 WHO Regions to eliminate measles in 2015
  - Gap: 15%
  - 15% of all children not being immunized with one dose.
  - Only one Region has eliminated measles

RUBELLA ELIMINATION

- Target: Eliminate rubella from at least two WHO regions in 2015
  - Gap: 1/2
  - Half of all children do not receive the rubella vaccine

MATERNAL AND NEONATAL TETANUS ELIMINATION

- Target: Eliminate maternal and neonatal tetanus in 59 priority countries
  - Gap: 21 countries
  - 21 countries have not yet eliminated maternal and neonatal tetanus

POLIO ERADICATION

- Target: A world free of polio
  - Gap: 2 countries
  - Remain polio endemic

USE OF NEW OR UNDERUTILIZED VACCINES

- Target: At least 90 low- and middle-income countries introduce one or more new or underutilized vaccine
  - On TRACK
  - 86 low- and middle-income countries added at least one new or underutilized vaccine
What’s the difference between Vaccination and Immunization

• **Immunization** is the **process of protecting people against harmful infections** **before they** come into contact with them. It does this by using the body’s own natural defense system, the immune response.

• When you are immunized you are given a **vaccine, usually as an injection**, which contains a small dose of:

• **Vaccination** just **means having the injection**. When you are **vaccinated, your body produces** an immune response, just as you would if you were exposed to the infection, but without having the symptoms, and this builds up your resistance to that infection. If you come into contact with that infection in the future, your immune system will respond fast enough to prevent you from developing the disease.
Vaccine Preventable Diseases (VPDs)

- World immunization coverage up from 10% in 1970s to 80% in 1990s, then to 77% in 2004
- Smallpox eradication achieved 1982
- Polio eradication 2005-2010 ???????????????????
- Measles still kills >0.4 million per year, need for a two dose policy (MMR)
- Many new vaccines available and coming
- Costs effectiveness and priorities
- Reinforce success e.g. Sanipeds in former USSR
- Coverage is good; Adapt and expand
Eradication or Control of VPDs

• Since eradication of smallpox, discussion of possibility of eradicating other diseases
• Potential candidate diseases emerged; some were abandoned because of practical difficulties with current technology
• Diseases under discussion for eradication - measles, TB, and some tropical diseases e.g. malaria and dracunculiasis
• Eradication - no further cases of a disease occur anywhere in nature; continued control measures may be unnecessary e.g. smallpox, polio
• Reducing epidemic and endemic VPDs in selected areas or target groups, may achieve local elimination
• Local elimination is where domestic circulation of a virus is interrupted with cases occurring from importation only
• Strong, sustained immunization program, adaptation to changing epidemiologic patterns e.g. age groups
BASIC TERMS IN IMMUNOLOGY OF INFECTIOUS DISEASES

• **Infectious agent**: organism (e.g. virus, rickettsia, bacteria, fungus, protozoa or helminth) capable of producing infection or an infectious disease.

• **Infection**: the process of entry, development and multiplication of an infectious agent into the body of a living body (human, animal or plant) resulting in an inapparent or clinically manifest disease.

• **Antigen**: a substance (e.g. protein, polysaccharide) capable of inducing specific response mechanisms in the body. An antigen may be introduced into the body by invasion of an infectious agent, by immunization, inhalation, ingestion or through the skin, wounds or via transplantation.
**BASIC TERMS IN IMMUNOLOGY OF INFECTIOUS DISEASES**

- **Antibody**: a protein molecule formed by the body in response to a foreign substance (an antigen) or acquired by passive transfer. Antibodies bind to the specific antigen that elicits its production, causing the infective agent to be susceptible to immune mechanisms protecting against infectious disease.

- **Immunoglobulins**: antibodies which meet different types of antigenic challenges. They are present in blood or other body fluids, and can cross from a mother to fetus in utero, providing protection during part of the first year of life. There are 5 major classes and various subclasses are based on molecular weight.

- **Antisera or antitoxin**: are materials prepared in animals for use in passive immunization against infection or toxins.
# Defense Mechanisms

1. External defense
2. Internal Defense
3. Immune Defense

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<tr>
<th>Nonspecific defense mechanisms</th>
<th>Specific defense mechanisms (immune system)</th>
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<td><strong>First line of defense</strong></td>
<td><strong>Second line of defense</strong></td>
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<td>• Skin</td>
<td>• Phagocytic white blood cells</td>
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<td>• Mucous membranes</td>
<td>• Antimicrobial proteins</td>
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<td>• Secretions of skin and mucous membranes</td>
<td>• The inflammatory response</td>
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<td>• Lymphocytes</td>
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<td>• Antibodies</td>
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</table>
What is immunity?

• Immunity is the body's ability to fight off harmful micro-organisms –PATHOGENS- that invade it.

• The immune system produces antibodies or cells that can deactivate pathogens.

• Fungi, protozoans, bacteria, and viruses are all potential pathogens.
The Immune System - includes all parts of the body that help in the recognition and destruction of foreign materials.

White blood cells, phagocytes and lymphocytes, bone marrow, lymph nodes, tonsils, thymus, and your spleen are all part of the immune system.
Herd Immunity

- **Herd immunity can be defined as the resistance of a population to the introduction and spread of an infectious agent, based on the immunity of a high proportion of individual members of the population, thereby lessening the likelihood of a person with a disease coming into contact with susceptible.**

- Example - If 90% of the children are vaccinated for measles, the remaining 10% of the children who are not vaccinated might not become infected with measles because most of the children (90%) are vaccinated.

- That means transmission from infected person to other susceptible children will not be easier.
Herd Immunity

• **Factors affecting herd immunity**
  – Environmental Factors: crowded conditions, seasonal variations
  – Strength of Individual’s Immune System
  – Infectiousness of Disease: greater the risk of infection, the higher percentage of people need vaccines to attain herd immunity

• When enough people are vaccinated, *chance of germ infecting the non-immunized population is small*

• Can lead to disappearance of diseases (smallpox)
  – *Vaccination no longer necessary*
Immunity

Specific defenses

Immunity

Active immunity
- Following clinical infection
- Following subclinical infection
- Following vaccination

Passive immunity
- Transfer of maternal Antibodies Through placenta
- Transfer of maternal Antibodies Through milk
- Following administration of Immunoglobulin or antiserum

natural

acquired
Types of Acquired Immunity

- Naturally acquired
  - Active: Infection; contact with pathogen
  - Passive: Antibodies pass from mother to fetus via placenta; or to infant in her milk
- Artificially acquired
  - Active: Vaccine; dead or attenuated pathogens
  - Passive: Injection of immune serum (gamma globulin)
Active immunity

- Resistance developed in response to stimulus by an antigen (infecting agent or vaccine) and is characterized by the production of antibodies by the host.

Passive immunity

- Immunity conferred by an antibody produced in another host. It may be acquired naturally or artificially (through an antibody-containing preparation).
Immunoglobulins

- There are 5 major classes: IgM, IgA, IgG, IgE, IgD. Two types of immunoglobulin preparations are available for passive immunization:
  - Normal human immunoglobulin
  - Specific (hyper-immune) human immunoglobulin

Antisera or antitoxins

These are materials prepared in animals or non-human sources such as horses.
## Immunoglobulin and antiserum

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<tr>
<th>Human normal immunoglobulin</th>
<th>Human specific immunoglobulin</th>
<th>Non human Ig (antisera, antitoxins)</th>
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<td>Hepatitis A</td>
<td>Hepatitis B</td>
<td>Diphtheria</td>
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<td>Measles</td>
<td>Varicella</td>
<td>Tetanus</td>
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<td>Rabies</td>
<td>Diphtheria</td>
<td>Gas gangrene</td>
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<td>Tetanus</td>
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<td>Botulism</td>
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<td>Mumps</td>
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<td>Rabies</td>
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Vaccination

• Vaccination is a **method of giving antigen** 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”.
Goal of Vaccination

• To **generate and sustain** the number of **antigen specific B & T cells** against a particular pathogen / antigen sufficient to provide **protection**.

• Most of the successful vaccines are against small organisms (viruses & bacteria)

• Microorganisms have evolved complex **defense mechanisms** that interfere with the immune response. Some of these are
  – Molecular mimicry
  – Interference with antigen processing
  – Prevention of apoptosis of infected cells
1. Properties of an *ideal vaccine*

1. Give *life-long* immunity
2. Broadly protective against *all variants* of organism
3. Prevent disease *transmission*
4. Rapidly induce immunity
5. Effective in *all* subjects (the old & very young)
2. Properties of an **ideal vaccine**

6. Transmit **maternal protection** to the fetus

7. Require **few immunizations** to induce protection

8. **Not** need to be administered by injection (oral, intranasal, transcutaneous)

9. **Stable, cheap & safe**
Four types of traditional vaccines

- **Killed microorganisms** - these are previously virulent micro-organisms that have been killed with chemicals or heat.
- **Live, attenuated microorganisms** - live micro-organisms that have been cultivated under conditions that disable their virulent properties. They typically provoke more durable immunological responses and are the preferred type for healthy adults.
- **Toxoids** - inactivated toxic compounds from micro-organisms in cases where these toxins (rather than the micro-organism itself) cause illness.
- **Subunit** - A fragment of a microorganism can create an immune response. Example is the subunit vaccine against HBV that is composed of only the surface proteins of the virus which are produced in yeast.
Types of vaccines

1. Live vaccines
2. Attenuated live vaccines
3. Inactivated (killed vaccines)
4. Toxoids
5. Polysaccharide and polypeptide (cellular fraction) vaccines
6. Surface antigen (recombinant) vaccines.
Live vaccines

• Live vaccines are made from *live infectious agents without any amendment*.

• The only live vaccine is “Variola” smallpox vaccine, made of live vaccinia cow-pox virus (not variola virus) which is not pathogenic but antigenic, giving cross immunity for variola.
Live *attenuated* (a*virulent*) vaccines

• Virulent pathogenic organisms are treated to become *attenuated* and avirulent but antigenic. They have lost their capacity to induce full-blown disease but retain their immunogenicity.

• Live attenuated vaccines **should not** be administered to persons with suppressed immune response due to:
  – Leukemia and lymphoma
  – Other malignancies
  – Receiving corticosteroids and anti-metabolic agents
  – Radiation
  – pregnancy
Inactivated (killed) vaccines

• Organisms **are killed or inactivated** by heat or chemicals **but remain antigenic**.

• They are usually **safe but less effective** than live attenuated vaccines.

• The only absolute **contraindication to their administration** is a severe local or general reaction to a previous dose.
Toxoids

• They **are 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 produces in the body as a consequence of **toxoid administration neutralize the toxic moiety produced during infection rather than act upon the organism itself.**

• In general toxoids are **highly efficacious and safe immunizing agents.**
Polysaccharide and polypeptide (cellular fraction) vaccines

• They are prepared from extracted cellular fractions e.g. meningococcal vaccine from the polysaccharide antigen of the cell wall, the pneumococcal vaccine from the polysaccharide contained in the capsule of the organism, and hepatitis B polypeptide vaccine.

• Their efficacy and safety appear to be high.
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.
# Types of vaccines

<table>
<thead>
<tr>
<th>Live vaccines</th>
<th>Live Attenuated vaccines</th>
<th>Killed Inactivated vaccines</th>
<th>Toxoids</th>
<th>Cellular fraction vaccines</th>
<th>Recombinant vaccines</th>
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<tbody>
<tr>
<td>• Small pox variola vaccine</td>
<td>• BCG</td>
<td>• Typhoid</td>
<td>• Typhoid</td>
<td>• Diphtheria</td>
<td>• Meningococcal polysaccharide vaccine</td>
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<td>• Typhoid oral</td>
<td>• Cholera</td>
<td>• Plague</td>
<td>• Tetanus</td>
<td>• Pneumococcal polysaccharide vaccine</td>
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<td>• Hepatitis B vaccine</td>
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Routes of administration

- Deep **subcutaneous** or intramuscular route (most vaccines)
- **Oral route** (sabine vaccine, oral BCG vaccine)
- **Intradermal route** (BCG vaccine)
- **Scarification** (**small pox vaccine**)
- **Intranasal route** (live attenuated influenza vaccine)
Scheme of immunization

• Primary vaccination
  – One dose vaccines (BCG, variola, measles, mumps, rubella, yellow fever)
  – Multiple dose vaccines (polio, DPT, hepatitis B)

• Booster vaccination
  To maintain immunity level after it declines after some time has elapsed (DT, MMR).
Vaccines in use for children worldwide

- Diptheria
- Tetanus
- Pertussis
- Polio (OPV)
- Measles,
- Mumps
- Rubella
- Hemophilus influenza
- Hepatitis b
- BCG

- IPV
- Chickenpox
- Pneumococcus
- Rotavirus
- Hepatitis a
- Influenza vaccine
- Meningococcal vaccine
- HPV vaccine
- Acellular pertussis vaccine
- Zoster vaccine
## National vaccination schedule / Jordan

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<td>على عمر 18 شهرًا يعطى الطفل</td>
<td>جرعة مدعمة من مطعم الثلاثي البكتيري (DPT)</td>
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<td>Information about vaccine</td>
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<td>OPV (Oral Polio Vaccine) (Mandatory)</td>
<td>Poliomyelitis (Polio) that damages nervous system</td>
<td>Given for free in government hospitals on Pulse Im</td>
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<td>Liver infection caused by Hepatitis B Virus</td>
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<td>Weeks 6</td>
<td>DPT (Mandatory)</td>
<td>Diphtheria, Pertussis and Tetanus</td>
<td>The injected area may swell as well as pain and th</td>
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<td>Menangitis that can affect membrane covering the b</td>
<td>The injected site may swell or pain and become sli</td>
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<td>DPT (Mandatory)</td>
<td>Diphtheria, Pertussis and Tetanus</td>
<td>The injected area may swell as well as pain and th</td>
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<td>It is given in the form of injection</td>
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<td>The injected area may swell as well as pain and th</td>
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<td>It is given in the form of injection</td>
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# Vaccination schedule
**preschool - Jordan**

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<th>Age</th>
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<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; contact</td>
<td>BCG</td>
</tr>
<tr>
<td>2 months</td>
<td>DaPT&lt;sub&gt;1&lt;/sub&gt;+HepB&lt;sub&gt;1&lt;/sub&gt;+Hib&lt;sub&gt;1&lt;/sub&gt;+IPV&lt;sub&gt;1&lt;/sub&gt;</td>
</tr>
<tr>
<td>3 months</td>
<td>DaPT&lt;sub&gt;2&lt;/sub&gt;+HepB&lt;sub&gt;2&lt;/sub&gt;+Hib&lt;sub&gt;2&lt;/sub&gt;+IPV&lt;sub&gt;2&lt;/sub&gt;+OPV</td>
</tr>
<tr>
<td>4 months</td>
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</tr>
<tr>
<td>9 months</td>
<td>Measles + OPV</td>
</tr>
<tr>
<td>12 months</td>
<td>MMR&lt;sub&gt;1&lt;/sub&gt;</td>
</tr>
<tr>
<td>18 months</td>
<td>DPT&lt;sub&gt;booster1&lt;/sub&gt; + OPV&lt;sub&gt;booster1&lt;/sub&gt; + MMR&lt;sub&gt;2&lt;/sub&gt;</td>
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</table>
# Vaccination schedule

**preschool - Jordan**

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccine</th>
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</thead>
<tbody>
<tr>
<td>1st contact</td>
<td>BCG</td>
</tr>
<tr>
<td>2 months</td>
<td>DaPT1 IPV1+Hib+1HepB1</td>
</tr>
<tr>
<td>3 months</td>
<td>DaPT2 IPV2+Hib2+HepB2+OPV</td>
</tr>
<tr>
<td>4 months</td>
<td>DaPT3 IPV3+Hib3+HepB3+OPV</td>
</tr>
<tr>
<td>9 months</td>
<td>Measles + OPV</td>
</tr>
<tr>
<td>12 months</td>
<td>MMR1</td>
</tr>
<tr>
<td>18 months</td>
<td>DPT_{booster1} + OPV_{booster1} + MMR2</td>
</tr>
</tbody>
</table>
Periods of maintained immunity due to vaccines

- **Short period (months):** cholera vaccine
- **Two years:** TAB vaccine
- **Three to five years:** DPT vaccine
- **Five or more years:** BCG vaccine
- **Ten years:** yellow fever vaccine

- **Solid immunity:** measles, mumps, and rubella vaccines.
Levels of effectiveness

• Absolutely protective (100%): yellow fever vaccine
• Almost absolutely protective (99%): Variola, measles, mumps, rubella vaccines, and diphtheria and tetanus toxoids.
• Highly protective (80-95%): polio, BCG, Hepatitis B, and pertussis vaccines.
• Moderately protective (40-60%) TAB, cholera vaccine, and influenza killed vaccine.
The Cold Chain

• The "cold chain" is a system of storage and transport of vaccines at low temperature from the manufacturer to the actual vaccination site.

• The cold chain system is necessary because vaccine failure may occur due to failure to store and transport under strict temperature controls.
What is Cold chain?

- Cold Chain is a system of storing and transporting vaccine at the recommended temperature range from the point of manufacture to point of use.
COLD CHAIN

• All Vaccines tend to lose potency on exposure to heat above $+80^\circ$ C

• Some Vaccines lose potency when exposed to freezing temperatures

• The damage is irreversible
COLD CHAIN EQUIPMENTS

- WALK IN COOLERS & FREEZERS
- ICE LINED REFRIGERATORS
- DEEP FREEZERS
- VACCINE CARRIERS
- DAY CARRIERS
- COLD BOXES
- DOMESTIC REFRIGERATORS-IN DELHI
The Cold Chain Equipment

Cold chain equipment consists of the following:

(a) **Walk in cold rooms**: They are located at regional level, meant to store vaccines up to 3 months and serve districts.

(b) **Deep freezers (300 ltr)** and Ice lined Refrigerators: supplied to all districts and the WIC locations to store vaccines. Deep freezers are used for making ice packs and to store OPV and measles vaccines.

(c) **Small deep freezers** and ILR (140 ltr) : One set is provided to PHCs, and Family Planning Centers
• (d) **Cold boxes**: Cold boxes are supplied to all peripheral centers. These are used mainly for transportation of the vaccines.

• (e) **Vaccine carriers**: Vaccine carriers are used to carry small quantities of vaccines (16-20 vials) for the out of reach sessions. 4 fully frozen ice packs are used for lining the sides, and vials of DPT, DT, TT and diluents should not be placed in direct contact with frozen ice packs. The carriers should be closed tightly.

• (f) **Ice packs**: The ice packs contain water and no salt should be added to it.
• Among the vaccines, polio is the most sensitive to heat, requiring storage at minus 20 degree C.
• Vaccines which must be stored in the freezer compartment are: polio and measles.
• Vaccines which must be stored in the COLD PART but never allowed to freeze are: typhoid, DPT, tetanus toxoid, DT, BCG and diluents.
VACCINE VIAL MONITOR

1 = good: Utilize
2 = good: Utilize

The central square is lighter than the surrounding circle

3 = bad: Don’t Utilize
4 = bad: Don’t Utilize

The central square is equal to, or darker than the surrounding circle
These are **not** contraindications to Routine Immunization

- Minor illnesses such as upper respiratory infections or diarrhoea, mild fever (< 38.5°C)
- Allergy, asthma
- Prematurity, underweight newborn child
- Malnutrition
- Child being breastfed
- *Family history of convulsions*
- Treatment with antibiotics
- Dermatoses, eczema or localized skin infection
- Chronic diseases of the heart, lung, kidney and liver
- Stable neurological conditions, such as cerebral palsy and Down's syndrome
- History of jaundice after birth
HAZARDS OF IMMUNIZATION

• No immune response is entirely free from the risk of adverse reactions or remote squeal. The adverse reactions that may occur may be grouped under the following heads:

1. Reactions inherent to inoculation
2. Reactions due to faulty techniques
3. Reactions due to hypersensitivity
4. Neurological involvement
5. Provocative reactions
6. Others
1. Reactions inherent to inoculation:

• These may be local general reactions.
• The local reactions may be pain, swelling, redness, tenderness and development of a small nodule or sterile abscess at the site of injection.
• The general reactions may be fever, malaise, headache and other constitutional symptoms. Most killed bacterial vaccines (e.g., typhoid) cause some local and general reactions.
• Diphtheria and tetanus toxoids and live polio vaccine cause little reaction.
2. **Reactions due to faulty techniques:**

Faulty techniques may relate to:

- **faulty production of vaccine** (e.g. inadequate inactivation of the microbe, inadequate detoxication),
- **too much vaccine given in one dose**,  
- improper immunization **site or route**,  
- vaccine reconstituted **with incorrect diluents**,  
- wrong amount of diluent used,  
- drug substituted for vaccine or diluent,  
- vaccine prepared incorrectly for use (e.g., an adsorbed vaccine not shaken properly before use),  
- **vaccine or diluent contaminated**,  
- vaccine stored incorrectly,  
- contraindications ignored (e.g. a child who experienced a severe reaction after a previous dose of DPT vaccine is immunized with the same vaccine),  
- reconstituted vaccine of one session of immunization used again at the subsequent session.
3. Reactions due to hypersensitivity

- Administration of antisera (e.g., ATS) may occasionally give rise to anaphylactic shock and serum sickness.
- Many viral vaccines contain traces of various antibiotics used in their preparation and some individuals may be sensitive to the antibiotic which it contains.
- Anaphylactic shock is a rare but dangerous complication of injection of antiserum. There is bronchospasm, dyspnoea, pallor, hypotension and collapse.
- The symptoms may appear within a few minutes of injection or may be delayed up to 2 hours. Some viral vaccines prepared from embryonated eggs (e.g., influenza) may bring about generalized anaphylactic reactions.
- Serum sickness is characterized by symptoms such as fever, rash, oedema and joint pains occurring 7 -12 days of injection of antiserum.
4. Neurological involvement:

- Neuritic manifestations may be seen after the administration of serum or vaccine. The well-known examples are the postvaccinial encephalitis and encephalopathy following administration of anti-rabies and smallpox vaccines.
- GuillainBarre syndrome in association with the swine influenza vaccine is another example.
5. Provocative reactions

• Occasionally following immunization there may occur a disease totally unconnected with the immunizing agent (e.g., provocative polio after DPT or DT administration against diphtheria).

• The mechanism seems to be that the individual is harboring the infectious agent and the administration of the vaccine shortens the incubation period and produces the disease or what may have been otherwise only a latent infection is converted into a clinical attack.
6. Others:

- These may *comprise damage to the fetus* (e.g., *with rubella vaccination*); displacement in the age-distribution of a disease (e.g., a potential problem in mass vaccination against measles, rubella and mumps).
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<th>عدد الجرع لكل أثر</th>
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<th>الرأي الجانبي</th>
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PRECAUTIONS TO BE TAKEN

• Before administration of the antiserum or antitoxin, it is necessary to **test for sensitivity reaction**. This can be done in 2 ways:

  (a) instilling a drop of the preparation into the **conjunctival sac**. A sensitized person will develop pricking of the conjunctiva.

  (b) a more reliable way of testing is by **intradermal injection of 0.2 ml of antiserum diluted 1 : 10 with saline**. A sensitized patient will develop a wheal and flare within 10 minutes at the site of injection. It should be borne in mind that these tests are not infallible.
• **Adrenaline (1: 1000 solution) should** be kept ready when giving foreign serum. In the event of anaphylaxis, for an adult, 0.5 ml of adrenaline solution should be injected intramuscularly immediately, followed by 0.5 ml every 20 minutes if the systolic blood pressure is below 100 mm of mercury.

• An injection of antihistaminic drug should also be given, e.g., 10-20 mg of chlorpheniramine maleate by the intramuscular route, to minimise the after-effects such as urticaria or oedema. The patient should be observed for 30 minutes after any serum injection.
• The risk of adverse reactions can be reduced by proper sterilization of syringes and needles, by proper selection of the subject and the product, and if due care is exercised in carrying out the procedure. Measles and BCG vaccines should be reconstituted only with the diluent supplied by the manufacturer.

• Reconstituted vaccine should be discarded at the end of each immunization session and NEVER retained for use in subsequent sessions. In the refrigerator of the immunization centre, no other drug and substances should be stored beside vaccines.

• **Training** of immunization worker and their close supervision to ensure that proper procedures are being followed are essential to prevent complications and deaths following immunization.
Vaccination Coverage

• Vaccination coverage is the percent of at risk or susceptible individuals, or population who have been fully immunized against particular diseases by vaccines or toxoids.

• To be significantly effective in prevention of disease on mass or community level at least a satisfactory proportion (75% or more) of the at risk population must be immunized.
Vaccine Coverage

No. persons immunized in specified age group

= \frac{\text{No. persons immunized in specified age group}}{\text{No. persons in the age group during that year}} \times 100
Vaccination Coverage Jordan, 2002-2012
### WHO UNICEF estimates time series for Jordan

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</table>
Ways of achieving satisfactory immunization coverage

• Efficient immunization service; urban and rural

• Health awareness and cooperation of the public

• Periodic mass immunization campaigns, to cover those who missed regular immunizations

• Outreach programs in rural and nomad areas, and home visits
Application of active immunization

• Infants and children expanded immunization program (schedule)
• Active immunization for adult females
• Vaccination for special occupations
• Vaccination for special life styles
• Vaccination for special environmental situations
• Vaccinations for special health status persons
• Vaccinations in travel
• Vaccines against bioterrorism
Compulsory (obligatory) vaccination for infants, and booster vaccination for children (Expanded immunization program)

• See local schedule of vaccination

• Note (children failing to complete childhood vaccination schedule)
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
• Vets and animal handlers: rabies, plague and anthrax
• Sewage workers: DT, hepatitis A, polio, TAB
• Food handlers: TAB
• Military troops and camp dwellers: pneumococcal, meningococcal, influenza, BCG (for non reactors), tetanus
Vaccination for special life styles and special environmental situations

- **Homosexually active males**, Heterosexual with promiscus sexual partner specially who has STDs, and Injecting drug users
- Inmates of long term correctional institutes, residents of institutions for the developmentally disabled, and household contacts of HBV carriers or patients

All should receive hepatitis B vaccine
Vaccinations for special health status persons

• Immuno-compromised persons (Leukemia, lymphoma, HIV, malignancy...)
• Hemodialysis and transplantation

*Should receive the following vaccines according to their situation:*

- HBV, Influenza, Pneumococcal vaccines
Vaccinations in travel

• Varies according to the country of arrival and departure.
  – Primary vaccine series
  – Continuation of booster doses
  – Specific vaccine according to the country traveled to:
    • TAB, YF, cholera, meningiococcal, pneuomococcal, HIB, influenza, rabies, plague, Japanese encephalitis.
    • Haj for instance necessitates meningococcal vaccination from all over, and YF from places like south Africa, and cholera from places like India.
Vaccines against bioterrorism

• Anthrax
• Small pox
• plague
New approaches

- Schistosomiasis
- Cancer
- HIV/AIDS
- Malaria
IMMUNISATION/VACCINE RECORDS CAN INCLUDE:

• Photocopies of Vaccine Record Card
• Vaccine documentation on the cards must include:
  • the date of the vaccine and the signature/stamp of the provider (Registered Nurse/Doctor who gave the vaccine); or,
  • the signature of a Registered Nurse/Doctor who has sighted the original records having signed the card with wording indicating they have sighted the original documentation
• Batch numbers are requested if possible. While batch numbers may not be available for vaccines given in past years, batch numbers for vaccines given in recent years should be able to be retrieved and documented
• **Batch numbers are required as they identify the vaccine given.**
• Hepatitis B serology results to include numerical result as per policy requirement
<table>
<thead>
<tr>
<th>ملاحظات</th>
<th>تاريخ اخذ الجرعات</th>
<th>اسم المطعم</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>الجرعة المدعقة</td>
<td>BCG</td>
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<tr>
<td></td>
<td>الجرعة الرابعة</td>
<td>IPV</td>
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<td>الجرعة الثالثة</td>
<td>OPV</td>
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<td>الجرعة الثانية</td>
<td>DPT</td>
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<tr>
<td></td>
<td></td>
<td>DPT IPV + Hib</td>
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<tr>
<td></td>
<td></td>
<td>DPT HBV + Hib</td>
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<td>HSV</td>
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<td>Hib</td>
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<td>Measles</td>
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<td></td>
<td>MMR</td>
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<td></td>
<td>Others</td>
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</tbody>
</table>

- BCG: الباركن
- IPV: علاج الأطفال المولود
- OPV: علاج الأطفال النموذجي
- DPT: الثلاثي البكير
- DPT IPV + Hib: التمهيد البكير المصنوع
- DPT HBV + Hib: التمهيد البكير المصنوع
- HSV: انتفاخ الكبد النامي
- Hib: انتفاخ الكبد النامي
- Measles: الخبيثة
- MMR: الثلاثي الفيروس
- Others: الأخرى

التملئ علاج عينة السمن المتبقي
لا يتم التحري عن الأمراض الوراثية
Vaccination Record Card
for Health Care Workers/Students

Surname

Given names

Address

Postcode

Date of Birth

Important Notice

- The purpose of this card is to provide a vaccination record for health care workers and students who are required to comply with NSW Health occupational assessment, screening and vaccination policies (as amended from time to time).

- Each dose of vaccine should be recorded on the card and signed at the time of administration. Where possible, batch numbers should be recorded or batch stickers affixed, and/or official certification from the vaccination provider should be provided, to enable an assessor to verify that an appropriate vaccine has been administered by a vaccination provider.

- Serological results should be recorded on the card as numerical values or positive/negative, as appropriate. Copies of relevant previous vaccination records (for example, childhood vaccinations) and copies of relevant pathology reports should be attached to the card, if available.
Expanded Program on Immunization

- is a World Health Organization program with the goal to make vaccines available to all children.

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccines</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Birth</td>
<td>OPV, BCG</td>
</tr>
<tr>
<td>6 Weeks</td>
<td>OPV, Pentavalent, PCV</td>
</tr>
<tr>
<td>10 Weeks</td>
<td>OPV, Pentavalent, PCV</td>
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<tr>
<td>14 Weeks</td>
<td>OPV, Pentavalent, PCV</td>
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<tr>
<td>9 Months</td>
<td>Measles</td>
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<tr>
<td>12 Months</td>
<td>Hepatitis A, Chicken pox</td>
</tr>
<tr>
<td>15 Months</td>
<td>PCV</td>
</tr>
<tr>
<td>18 Months</td>
<td>OPV + Hepatitis A</td>
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<tr>
<td>&gt; 2 Years</td>
<td>Typhoid</td>
</tr>
<tr>
<td>4-5 Years</td>
<td>OPV + Chicken Pox + DPT</td>
</tr>
<tr>
<td>10 Years</td>
<td>TT (Tetanus Toxoid)</td>
</tr>
</tbody>
</table>
Vaccine surveillance and testing

“monitoring vaccine effectiveness”

Through:

• Randomized field trials
• Retrospective cohort studies
• Case-control studies
• Incidence density measures
Randomized field trials

– The standard way to measure the effectiveness of a new vaccine introduced.

– In this type of trial, susceptible persons are randomized into two groups and are then given the vaccine or the placebo.

– The vaccinated and the unvaccinated are followed through the high risk season of the year.
Randomized field trials (cont.)

• The attack rate (AR) is then determined in each group:
  \[ AR = \frac{\text{Number of persons ill}}{\text{Number of persons exposed to the disease}} \]

• next the vaccine effectiveness (VE) is calculated:
  \[ VE = \frac{\text{AR (unvaccinated)} - \text{AR (vaccinated)}}{\text{AR (unvaccinated)}} \times 100 \]
Retrospective cohort studies

• The antigenic variability of influenza virus necessitates frequent (often yearly) changes in the constituents of the vaccine to keep them up date with the new strains. Retrospective cohort studies are thus done to evaluate the protective efficacy of the vaccines.
Case-control studies

• Done because randomized control trials are very costly.

\[
VE = \frac{AR \text{ (vaccinated)}}{AR \text{ (unvaccinated)}} = (1- RR) \text{ or } (1- OR)
\]
Incidence density measures

• They are used to determine the optimal timing for administration of a new vaccine and the duration of the immunity produced. It has the following formula:

\[
\text{ID} = \frac{\text{Number of new cases of a disease}}{\text{Person-time of exposure (days, weeks, months, years..)}}
\]
Summary and Conclusion

- Vaccination is cornerstone of PH
- Children and other groups
- Rapidly developing field
- First priority in public health after safe water and food
- National programs must be revised annually
Vaccination Is Not Immunization

Why doctors don't vaccinate their own kids
THANK YOU