

Principles of Immunization



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Objectives:

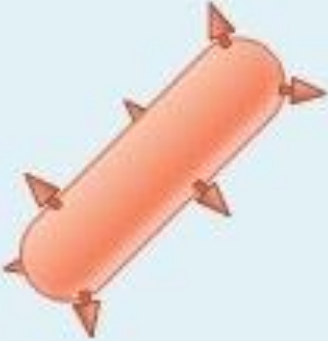


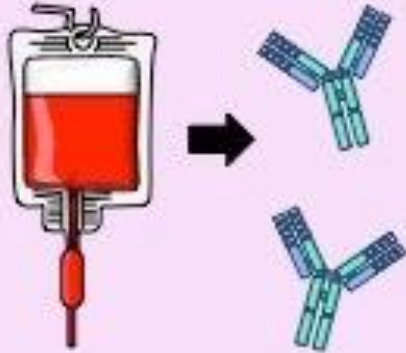


- To understand the types of acquired immunity
- To differentiate between the different types of vaccines used in preventing illness
- To understand the type of vaccine, its mode of delivery, and schedule for important immunizable diseases; TB, Pertussis, Rubella, Diphtheria, Measles, Tetanus, Hepatitis, Meningitis, Rabies, Polio
- To define and understand the cold chain and its importance
- To list the vaccines in the current National compulsory vaccination schedule
- For each disease, briefly describe epidemiology and mode of transmission

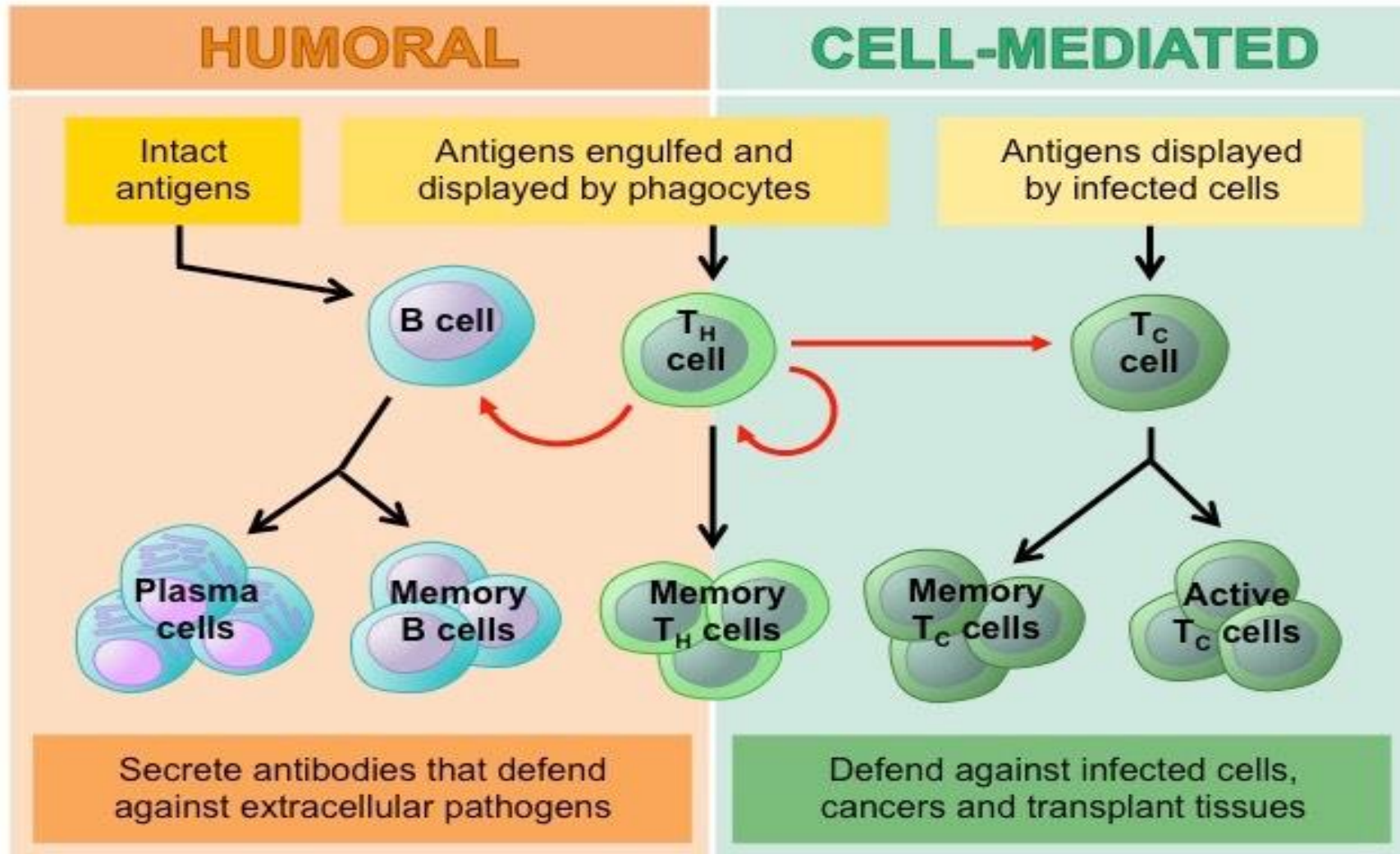
Types of acquired immunity



Types of Immunity

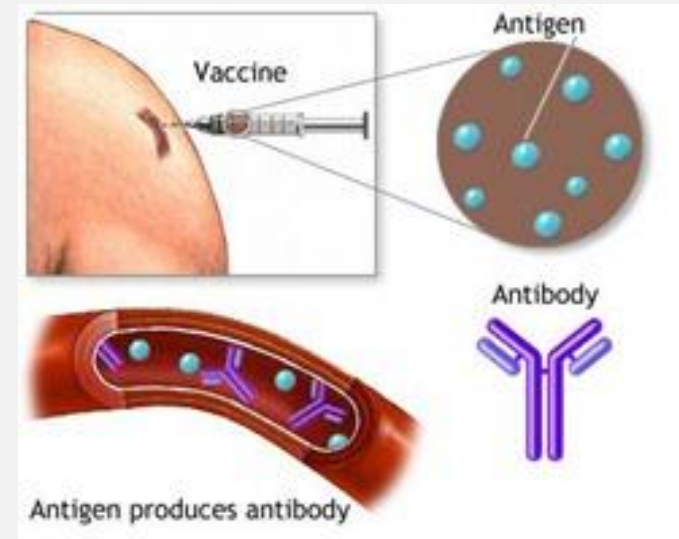
ACTIVE IMMUNITY		PASSIVE IMMUNITY	
Natural	Artificial	Natural	Artificial
 <p>Infection</p>	 <p>Vaccination</p>	 <p>Maternal antibodies</p>	 <p>Monoclonal antibodies</p>

Types of Active Immunity



Advantages of active immunity compared to passive immunity:

- Long-lasting protection
- Severe reactions are rare.
- Higher protective efficacy
- Less expensive.



Herd immunity (Community immunity)

- When vaccination of a portion of population (or herd) provides protection to unprotected individuals.
 - Higher number of immune individuals, the lower likelihood that a susceptible person will come in contact with an infectious agent.
- Provides an immunological barrier to the spread of disease in the human herd.
- On-going immunization programme will keep the herd immunity at a very high level.

A collection of medical supplies including several glass vials with white labels and teal caps, and a syringe with a pink plunger. The items are arranged on a light-colored surface. A dark green rounded rectangle is overlaid on the left side of the image, containing the word "Vaccines" in white text.

Vaccines

Types of Used Vaccines



Live, attenuated vaccines

- Contain a version of the **living** virus or bacteria that has been weakened
- It does not cause serious disease in people with healthy immune systems.

Contraindication

- Immunocompromised persons (leukaemia, lymphoma or cancer)
- Persons with immune deficiency disease.
- Pregnancy

Types of Used Vaccines

Examples:

▪ Viral

- Measles, mumps, rubella,
- Zoster,
- Varicella
- Yellow fever,
- Rotavirus
- Influenza
- Oral polio

• bacterial

- Bacille Calmette-Guérin (BCG)
- Oral typhoid vaccine.



Types of Used Vaccines



Inactivated vaccines

- Produced by growing the bacterium or virus in culture media, then **inactivating** it with heat and/ or chemicals (usually formalin).
- Not alive and **cannot replicate**.
- Cannot cause disease from infection, even in an immunodeficient person.
- Always require **multiple doses**.
 - In general, the first dose **“primes”** the immune system.
 - A protective immune response develops after the second or third dose (boosters).

Types of Used Vaccines



Contraindication:

- Sever local or general reaction to a previous dose.

Example:

- Polio, Hepatitis A, Rabies
- Pertussis, Typhoid, Cholera, Plague

Types of Used Vaccines



Polysaccharide Vaccines

- Type of **inactivated subunit vaccine** composed of long chains of **sugar molecules**
- Pure polysaccharide vaccines are available for three diseases: pneumococcal disease, meningococcal disease, and Salmonella Typhi.
- The immune response to a pure polysaccharide vaccine is typically T-cell independent, which means that these vaccines are able to stimulate B cells without the assistance of T-helper cells.
- Conjugated polysaccharide (polysaccharide is chemically combined with a protein molecule). Example: **Haemophilus influenzae type b (Hib)**

Types of Used Vaccines



Recombinant Vaccines

- Vaccine antigens may also be produced by genetic engineering technology.
- Four genetically engineered vaccines are currently available.
 - Hepatitis B
 - human papillomavirus (HPV)
 - Live typhoid vaccine (Ty21a)
 - Live attenuated influenza

Combinations Vaccines



- If **more than one** kind of immunizing agent is included in the vaccine it is called a mixed or combined vaccine.

The aims of combined vaccines are to

- Simplify administration
 - Reduce costs
 - Minimize the number of contacts of the patient with the health system,
 - Reducing the storage cost
- Usually **does not increase** the risk of adverse reactions

Combinations Vaccines



Examples

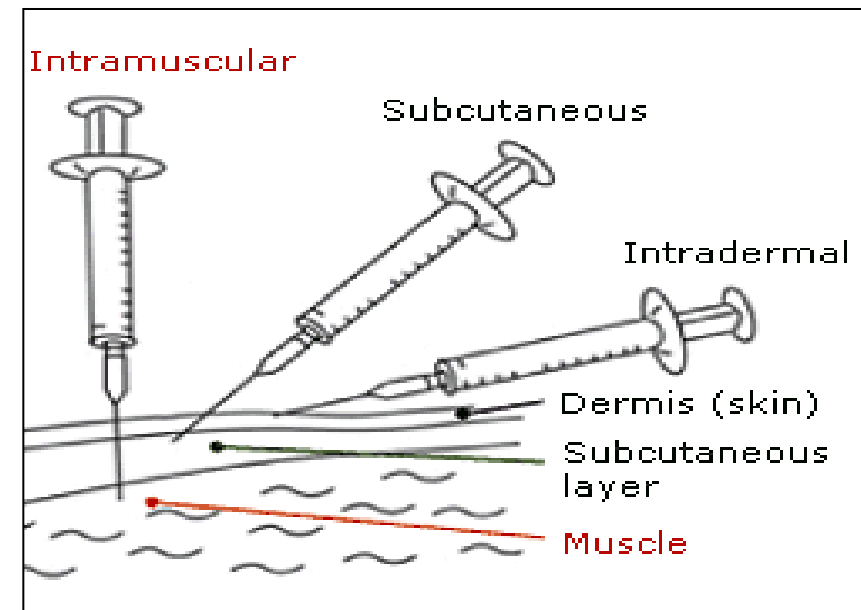
- DPT (Diphtheria-pertussis-tetanus)
- MMR (Measles, mumps and rubella)
- DPTP (DPT plus inactivated polio)
- DPT-Hep B-Hib (Diphtheria, pertussis, tetanus, hepatitis B and haemophilus influenza type B).

Route of administration of Vaccines

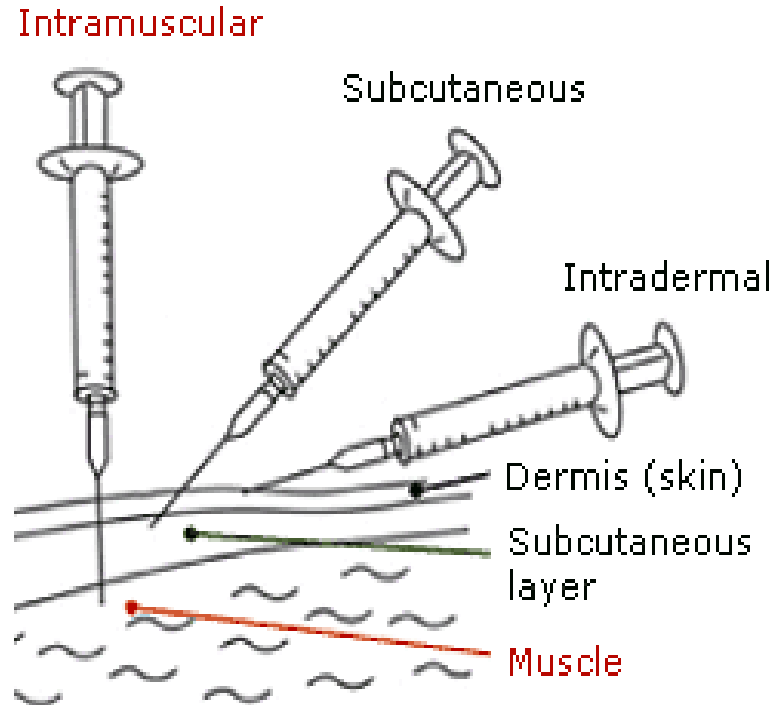


Routes of Administering Vaccines

- **The route of administration** is the path by which a vaccine is brought into contact with the body.
- This is a critical factor for success of the immunization.
 - Intramuscular route
 - Subcutaneous route
 - Intradermal route
 - Oral route



Routes of Administating Vaccines



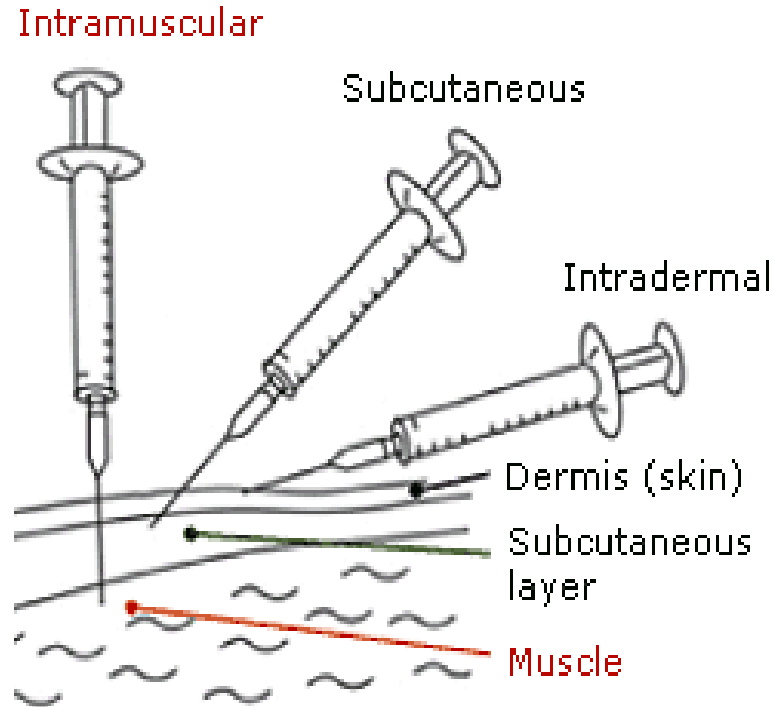
Intramuscular (IM) injection

- Administers the vaccine into the muscle mass.
- Vaccines containing adjuvants should be injected IM to reduce adverse local effects.

Subcutaneous (SC) injection

- Administers the vaccine into the subcutaneous layer above the muscle and below the skin.

Routes of Administating Vaccines



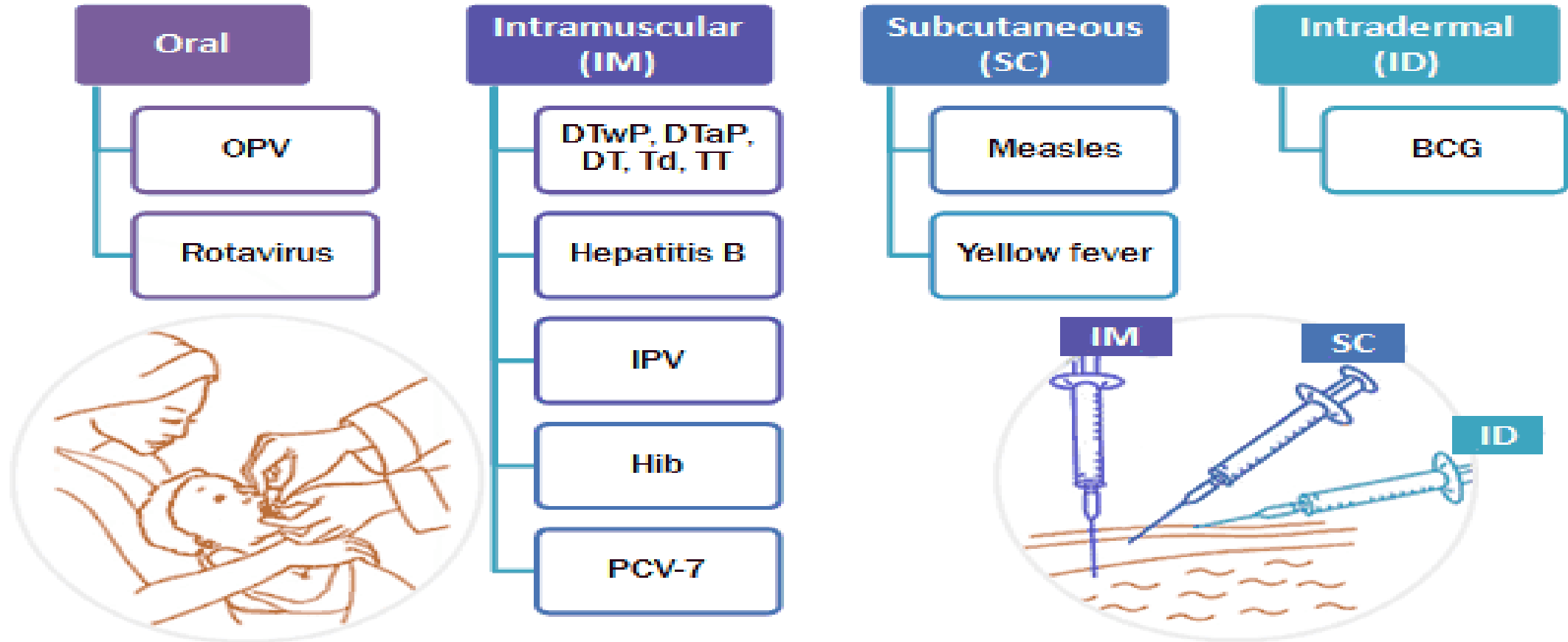
Intradermal (ID) injection

- Administers the vaccine in the topmost layer of the skin.
- BCG is the only vaccine with this route of administration.
- Intradermal injection of BCG vaccine reduces the risk of neurovascular injury.

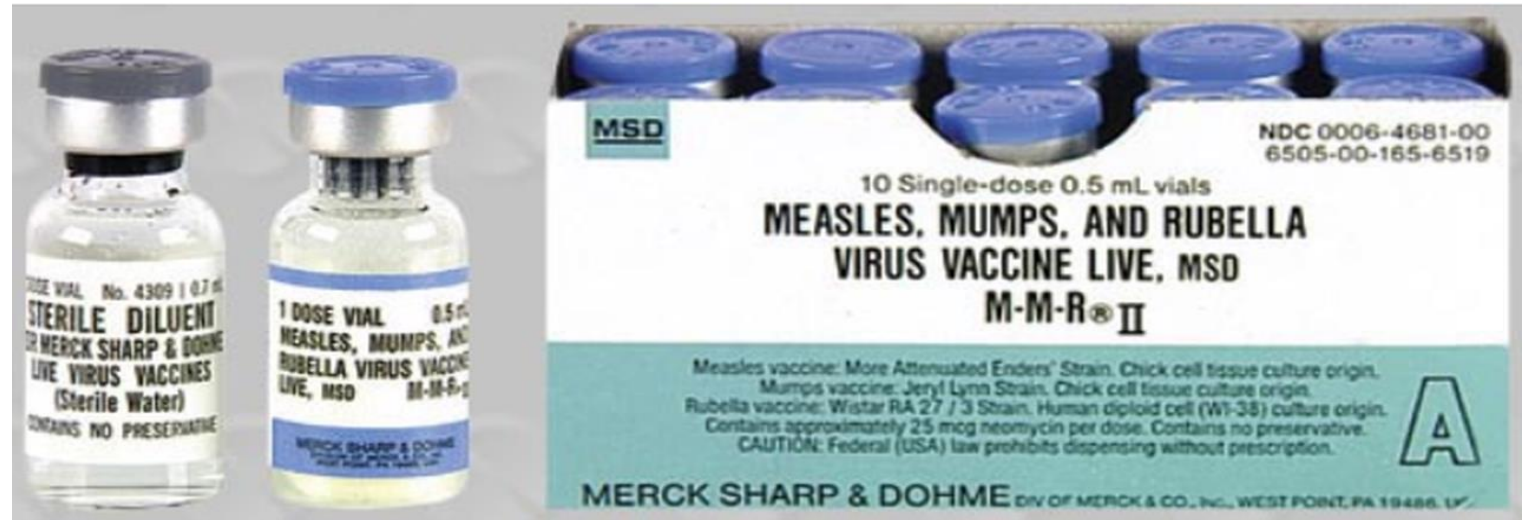
Oral administration

- Oral administration of vaccine makes immunization easier by eliminating the need for a needle and syringe.

Routes of Administering Vaccines



Different types of vaccine vials



Single-Dose Vials

- A single-dose vial (SDV) contains one dose and should be used one time for one patient.
- SDVs do not contain preservatives to help prevent microorganism growth.

Different types of vaccine vials



Multidose Vials

- A multidose vial (MDV) contains more than one dose of vaccine.
- MDVs typically contain a preservative to help prevent the growth of microorganisms, they can be entered or punctured more than once.
- Only the number of doses indicated in the manufacturer's package insert should be withdrawn from the vial.
- After the maximum number of doses have been withdrawn, the vial should be discarded, even if there is residual vaccine or the expiration date has not been reached.

Different types of vaccine vials



Manufacturer-Filled Syringes

- A manufacturer-filled syringe (MFS) is prepared and sealed under sterile conditions by the manufacturer.
- Activate an MFS (i.e., remove the syringe cap or attach the needle) only when ready to use.
- An MFS does not contain a preservative to help prevent the growth of microorganisms.
- Once the sterile seal has been broken, the vaccine should be used or discarded by the end of the workday.

Immunization Schedules



Immunization Schedules

- Each country determines its own immunization schedule and chooses vaccine presentations.
- Health workers should always refer to their national schedules and vaccine handling instructions when providing immunization services.

Vaccination	Birth	1 month	2 months	4 months	6 months	12 months	18 months	24 months	4 to 6 years
HepB <small>(protects against hepatitis B)</small>	1st	2nd				3rd			
DTaP <small>(protects against diphtheria, tetanus, pertussis)</small>			1st	2nd	3rd		4th		5th
Hib <small>(protects against haemophilus influenzae type B; may be 3 or 4 doses)</small>			1st	2nd	3rd	4th			
IPV <small>(protects against polio)</small>			1st	2nd	3rd				4th
RV <small>(protects against rotavirus; may be 2 or 3 doses)</small>			1st	2nd	3rd				
PCV13 <small>(protects against pneumococcal disease)</small>			1st	2nd	3rd	4th			
Flu <small>(protects against influenza)</small>					1 or 2 doses each year				
MMR <small>(protects against measles, mumps, rubella; if traveling outside the U.S., your baby can get the first dose at 6 months)</small>						1st			2nd
Varicella <small>(protects against varicella, also called chickenpox)</small>						1st			2nd
HepA <small>(protects against hepatitis A)</small>						1st and 2nd <small>6 to 18 months apart</small>			

National Immunization Schedule



الاسم: _____

تاريخ الميلاد: / / هـ الموافق / /

رقم السجل العائلي / رقم السجل الطبي: _____

تطعيمهم أمانتك
لخدمة التنبيه بمواعيد تطعيمات الأطفال تفضل بزيارتنا على

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وزارة الصحة Ministry of Health

مديرية الشؤون الصحية بمنطقة: Health Affairs Directorate of (Region):

بمحافظة: Governorate:

بيانات الطفل Child Info

مركز صحي / مستشفى: Health Center / Hospital:

الاسم: Name:

تاريخ الميلاد / هـ الموافق / / Date of Birth:

رقم السجل العائلي / رقم السجل الطبي: Family / Medical File No.:

رقم السجل المدني للطفل (إن وجد) / رقم الإقامة: Child ID / Iqama Number:

رقم القيد بسجل التطعيم: No. In Immunization Registry:

العنوان كاملاً: Full Address:

هاتف المنزل: Tel. Home:

رقم الحوال: Mobile:

تطعيمات أخرى Other Vaccine

التطعيم Vaccine	التاريخ Date	الختم Stamp	الاسم والتوقيع Name & Signature

رسالة

عزيزي الأب، عزيزتي الأم.....

- الهدف من التطعيمات الواردة في هذه الشهادة:
 - حماية الأطفال بالمملكة وفئات المجتمع من الأمراض المستهدفة بالتحصين.
 - الحفاظ على خلق المملكة من شلل الأطفال.
 - الحفاظ على خلق المملكة من الكزاز الوليدي.
 - إزالة أمراض الحصبة، الحصبة الألمانية، النكاف.
 - خفض معدلات باقي الأمراض المستهدفة بالتحصين.
- التزامكم بإحضار أطفالكم لأخذ التطعيم سواء بالجرعات الأساسية أو المنشطة هو وقاية لهم بإذن الله من العديد من الأمراض و مضاعفاتها الخطيرة.
- حرصكم على التعاون مع فرق وزارة الصحة و مراكزها الصحية أثناء حملات التطعيم هو الأساس للوصول إلى أهدافنا الوقائية المتمثلة في وطن خال من الأمراض المستهدفة من التحصين.

National Immunization Schedule

National Immunization Schedule

جدول التطعيمات الوطني

Next Visit Date	تاريخ الزيارة التالية	Stamp	الختم	Name & Signature	الاسم والتوقيع	Date	التاريخ	Vaccine	التطعيم	الزيارة Visit
								• BCG • Hepatitis B	• درن • التهاب كبدي (ب)	عند الولادة At Birth
								• IPV • DTaP • Hepatitis B • Hib • Pneumococcal Conjugate (PCV)* • Rota**	• شلل أطفال معطل • الثلاثي البكتيري • التهاب الكبد (ب) • المستدمية النزلية • البكتيريا العقدية الرئوية* • فيروس الروتا**	عمر شهرين 2 Months
								• IPV • DTaP • Hepatitis B • Hib • Pneumococcal Conjugate (PCV)* • Rota**	• شلل أطفال معطل • الثلاثي البكتيري • التهاب الكبد (ب) • المستدمية النزلية • البكتيريا العقدية الرئوية* • فيروس الروتا**	عمر 4 شهور 4 Months
								• OPV • IPV • DTaP • Hepatitis B • Hib • Pneumococcal Conjugate (PCV)*	• شلل الأطفال الفموي • شلل أطفال معطل • الثلاثي البكتيري • التهاب الكبد (ب) • المستدمية النزلية • البكتيريا العقدية الرئوية*	عمر 6 اشهر 6 Months
								• Measles • Meningococcal Conjugate quadrivalent (MCV4)	• الحصبة المفرد • الحمى التشنجية الرباعي المقترن	عمر 9 اشهر 9 Months
								• OPV • MMR • Pneumococcal Conjugate (PCV)* • Meningococcal Conjugate quadrivalent (MCV4)	• شلل الأطفال الفموي • الثلاثي الفيروسي • البكتيريا العقدية الرئوية* • الحمى التشنجية الرباعي المقترن	عمر 12 شهر 12 Months
								• OPV • DTaP • Hib • MMR • Vericella • Hepatitis A	• شلل الأطفال الفموي • الثلاثي البكتيري • المستدمية النزلية • الثلاثي الفيروسي • الجدري المائي • التهاب الكبد (أ)	عمر 18 شهر 18 Months
								• Hepatitis A	• التهاب الكبد (أ)	عمر 24 شهر 24 Months
								• OPV • DTaP(Td)*** • MMR • Varecella	• شلل الأطفال الفموي • الثلاثي البكتيري (الثلاثي البكتيري)*** • الثلاثي الفيروسي • الجدري المائي	عند دخول الصف الأول الإبتدائي School Entry

* Pneumococcal Conjugate (PCV13).

** Monovalent Rota Vaccine.

*** (Td) Starts from 7 Years of Age.

• لقاح البكتيريا العقدية الرئوية (PCV13).

** لقاح الروتا الأمامي.

*** يعطى الثلاثي البكتيري ابتداءً من 7 سنوات.

National Immunization Schedule

<ul style="list-style-type: none"> • BCG • Hepatitis B 	<ul style="list-style-type: none"> • حرن • التهاب كبدى (ب) 	عند الولادة At Birth
<ul style="list-style-type: none"> • IPV • DTaP • Hepatitis B • Hib • Pneumococcal Conjugate (PCV)* • Rota** 	<ul style="list-style-type: none"> • شلل أطفال معطل • الثلاثي البكتيري • التهاب الكبدى (ب) • المستدمية النزلية • البكتيريا العقدية الرئوية* • فيروس الروتا** 	عمر شهرين 2 Months
<ul style="list-style-type: none"> • IPV • DTaP • Hepatitis B • Hib • Pneumococcal Conjugate (PCV)* • Rota** 	<ul style="list-style-type: none"> • شلل أطفال معطل • الثلاثي البكتيري • التهاب الكبدى (ب) • المستدمية النزلية • البكتيريا العقدية الرئوية* • فيروس الروتا** 	عمر ٤ شهور 4 Months
<ul style="list-style-type: none"> • OPV • IPV • DTaP • Hepatitis B • Hib • Pneumococcal Conjugate (PCV)* 	<ul style="list-style-type: none"> • شلل الأطفال الفموي • شلل أطفال معطل • الثلاثي البكتيري • التهاب الكبدى (ب) • المستدمية النزلية • البكتيريا العقدية الرئوية* 	عمر ٦ اشهر 6 Months
<ul style="list-style-type: none"> • Measles • Meningococcal Conjugate quadrivalent (MCV4) 	<ul style="list-style-type: none"> • الحصبة المفرد • الحمى الشوكية الرباعي المقترن 	عمر ٩ أشهر 9 Months
<ul style="list-style-type: none"> • OPV • MMR • Pneumococcal Conjugate (PCV)* • Meningococcal Conjugate quadrivalent (MCV4) 	<ul style="list-style-type: none"> • شلل الأطفال الفموي • الثلاثي الفيروسي • البكتيريا العقدية الرئوية* • الحمى الشوكية الرباعي المقترن 	عمر ١٢ شهر 12 Months
<ul style="list-style-type: none"> • OPV • DTaP • Hib • MMR • Varicella • Hepatitis A 	<ul style="list-style-type: none"> • شلل الأطفال الفموي • الثلاثي البكتيري • المستدمية النزلية • الثلاثي الفيروسي • الجدري المائي • التهاب الكبدى (أ) 	عمر ١٨ شهر 18 Months
<ul style="list-style-type: none"> • Hepatitis A 	<ul style="list-style-type: none"> • التهاب الكبدى (أ) 	عمر ٢٤ شهر 24 Months
<ul style="list-style-type: none"> • OPV • DTaP(Td)*** • MMR • Varicella 	<ul style="list-style-type: none"> • شلل الأطفال الفموي • الثلاثي البكتيري (الثنائي البكتيري)*** • الثلاثي الفيروسي • الجدري المائي 	عند دخول الصف الأول الإبتدائي School Entry

Vaccines (1)

Disease	Vaccine	Dose / Rout of administration	Timing	Side effects
Tuberculosis	Bacille Calmette-Guérin (BCG)	0.05 ml Intradermal	At or as soon as possible after birth	Severe: generalized disease or infections such as osteomyelitis (bone infection); abscess; regional lymphadenitis (lymph node inflammation) Mild: injection site reactions
Hepatitis B	(HepB) Pentavalent → with Diphtheria, tetanus, pertussis, and Haemophilus influenzae type b Quadrivalent → DTP+HepB	0.5 ml Intramuscularly	At birth 2, 4, 6 months	Severe: rare anaphylaxis Mild: injection site reactions (pain, redness, swelling); headache; fever

Vaccines (2)

Disease	Vaccine	Dose / Rout of administration	Timing	Side effects
Diphtheria	<p>(DT/ dT) with tetanus (DTP) with tetanus and pertussis Pentavalent → with tetanus, pertussis, hepatitis B and Haemophilus influenzae type b</p>	0.5 ml Intramuscularly	2, 4, 6, 18 months and 4-6 years	<p>Severe adverse events due to diphtheria toxoid alone have not been reported Mild: injection site reactions, fever</p>
Pertussis	<p>(DTP) with tetanus and diphtheria Pentavalent → with tetanus, diphtheria, hepatitis B and Haemophilus influenzae type b</p>	0.5 ml Intramuscularly	2, 4, 6, 18 months and 4-6 years	<p>Severe: rare anaphylaxis, hypotonic–hyporesponsive episodes (loss of muscle tone and responsiveness/consciousness); febrile seizures; prolonged crying Mild: injection site reactions (pain, redness, swelling); fever and agitation</p>

Vaccines (3)

Disease	Vaccine	Dose / Rout of administration	Timing	Side effects
Tetanus	TT (DT/ dT) with diphtheria (DTP) with diphtheria and pertussis Pentavalent → with diphtheria, pertussis, hepatitis B and Haemophilus influenzae type b	0.5 ml Intramuscularly	2, 4, 6, 18 months and 4-6 years	Severe: rare anaphylaxis, brachial neuritis Mild: injection site reactions and fever
Haemophilus influenzae type b (Hib)	Hib Pentavalent → with diphtheria, tetanus, pertussis and hepatitis B	0.5 ml Intramuscularly	2, 4, 6, 18 months	Severe: none reported to date Mild: injection site reactions, fever
Measles	Measles only (M) (MR) → with rubella (MM, MMR) → with mumps/ rubella (MMRV) → with varicella	0.5 ml Subcutaneous	9, 12, 18 months and 4-6 years	Severe: thrombocytopenia, anaphylaxis, encephalitis Mild: fever, rash 5–12 days following administration

Vaccines (4)

Disease	Vaccine	Dose / Rout of administration	Timing	Side effects
Mumps	(MMR)	0.5 ml Subcutaneous	12, 18 months and 4-6 years	Serious: aseptic meningitis (with some strains); orchitis (inflammation of the testicles); sensorineural deafness; acute myositis Mild: injection site reactions; parotid swelling
Rubella	(MR) → with Measles (MMR) → with mumps/ measles	0.5 ml Subcutaneous	12, 18 months and 4-6 years	Mild: injection site reactions
Meningococcal disease	Meningococcal quadrivalent conjugate [A,C,W135,Y-D]	0.5 ml Intramuscular	9 and 12 Months	Severe: rare anaphylaxis • Mild: injection site reaction, fever

Vaccines (5)

Disease	Vaccine	Dose / Rout of administration	Timing	Side effects
Pneumococcal disease	PCVs	0.5 ml Intramuscular	2, 4, 6 and 12 months	Severe: none known Mild: injection site reactions and fever
Poliomyelitis	OPV IPV	OPV → 2 drops orally IPV → 0.5 ml intramuscularly	2, 4, 6, 12, 18 months and 4-6 years	OPV – Rare vaccine-associated paralytic polio (VAPP) IPV – No known serious reactions; mild injection site reactions do occur
Rotavirus gastroenteritis	RV → Monovalent RV, Rotarix	1.5 ml of liquid Oral	2 and 4 months	Severe: intussusception Mild: irritability, runny nose, ear infection, diarrhoea, vomiting

Vaccine Safety and Efficacy



As an immunization provider, you play a key role in helping to ensure the safety and efficacy of vaccines through proper:

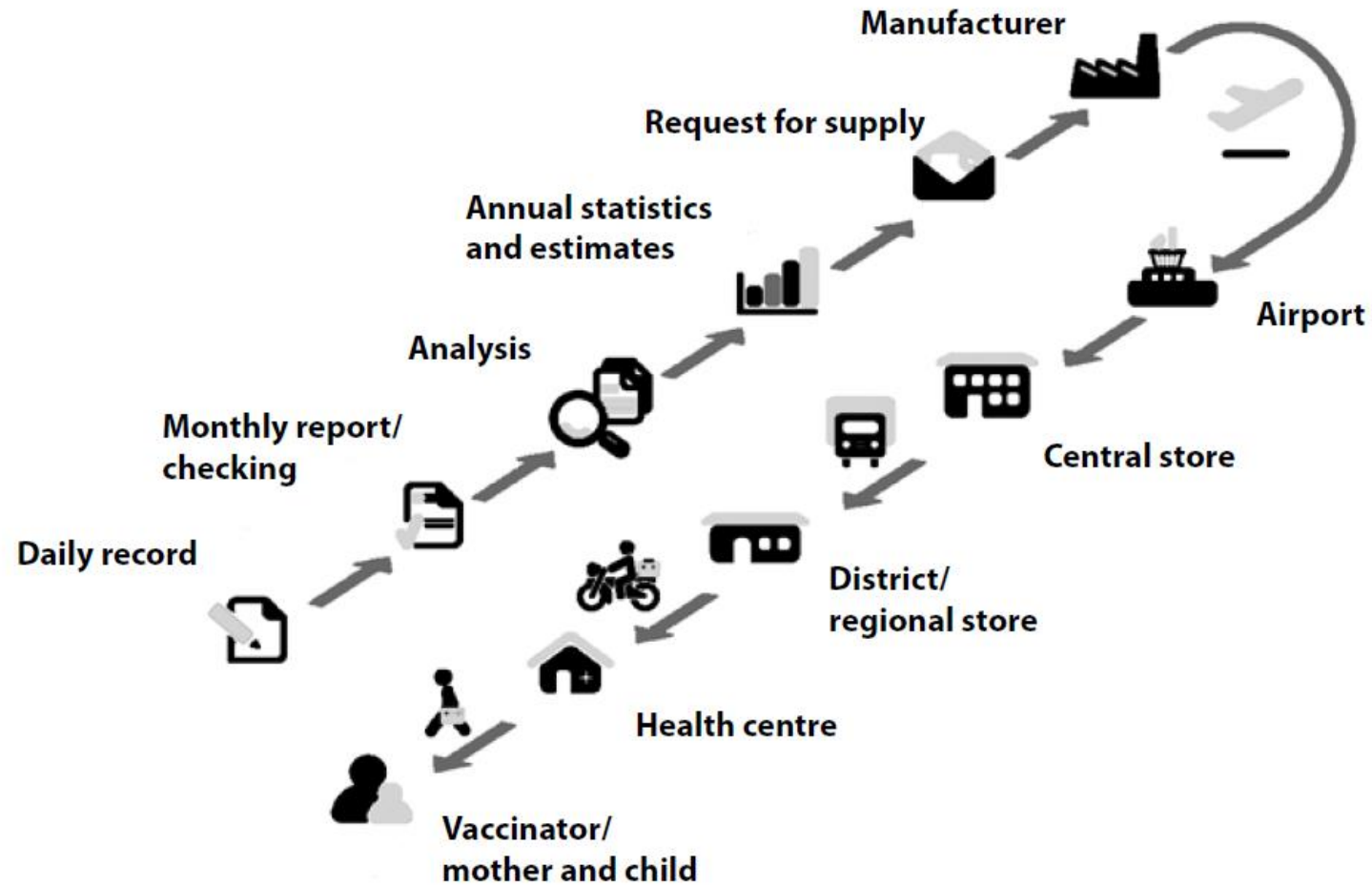
- Vaccine storage and handling
- Vaccine administration
- Timing and spacing of vaccine doses
- Observation of precautions and contraindications
- Management of vaccine side effects
- Reporting of suspected side effects
- Communication about vaccine benefits and risks

Why proper
vaccine storage and
handling are
important?



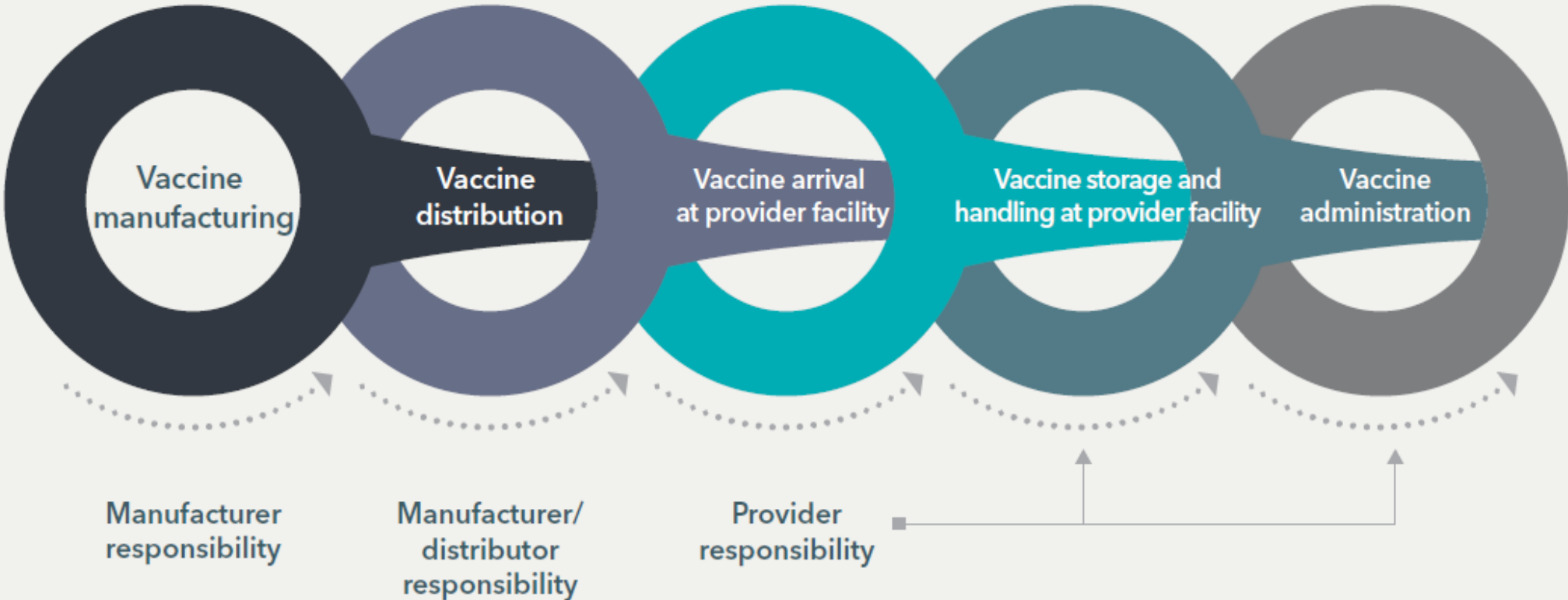
Proper storage and handling begin with an effective
vaccine cold chain

Figure 2.1 The cold chain



Source: PATH/WHO

Cold Chain Flowchart



Cold Chain

- A **temperature-controlled supply** chain that includes all vaccine-related equipment and procedures.
- It begins with the cold storage unit at the manufacturing plant, extends to the transport and delivery of the vaccine and correct storage at the provider facility, and ends with administration of the vaccine to the patient.

Cold Chain

- Vaccines are **sensitive biological products**. Some vaccines are sensitive to freezing, some to heat and others to light. If not maintained, **vaccine potency** may be lost, resulting in a useless vaccine supply.
- Potency is reduced every time a vaccine is exposed to an improper condition. (This includes overexposure to heat, cold, or light at any step in the cold chain). Once lost, potency cannot be restored.

Cold Chain

- Vaccines that are as **sensitive to light** as they are to heat include BCG, measles, measles-rubella, measles-mumps-rubella and rubella.
- These vaccines are often supplied **in dark glass vials** that give them some protection from light damage; but they should be kept in their secondary packaging for as long as possible to protect them during storage and transportation.

Vaccine Storage

Figure 2.4 Freeze sensitive vaccines

DO NOT FREEZE THESE VACCINES!!!

- Cholera
 - DTaP-hepatitis B-Hib-IPV (hexavalent)
 - DTwP or DTwP-hepatitis B-Hib (pentavalent)
 - Hepatitis B (Hep B)
 - Hib (liquid)
 - Human papillomavirus (HPV)
 - Inactivated poliovirus (IPV)
 - Influenza
 - Pneumococcal
 - Rotavirus (liquid and freeze-dried)
 - Tetanus, DT, Td
-

Purpose of the vaccine “cold chain”

To maintain **product quality** from the time of manufacture until the point of administration by ensuring that vaccines are stored and transported within WHO-recommended temperature ranges.

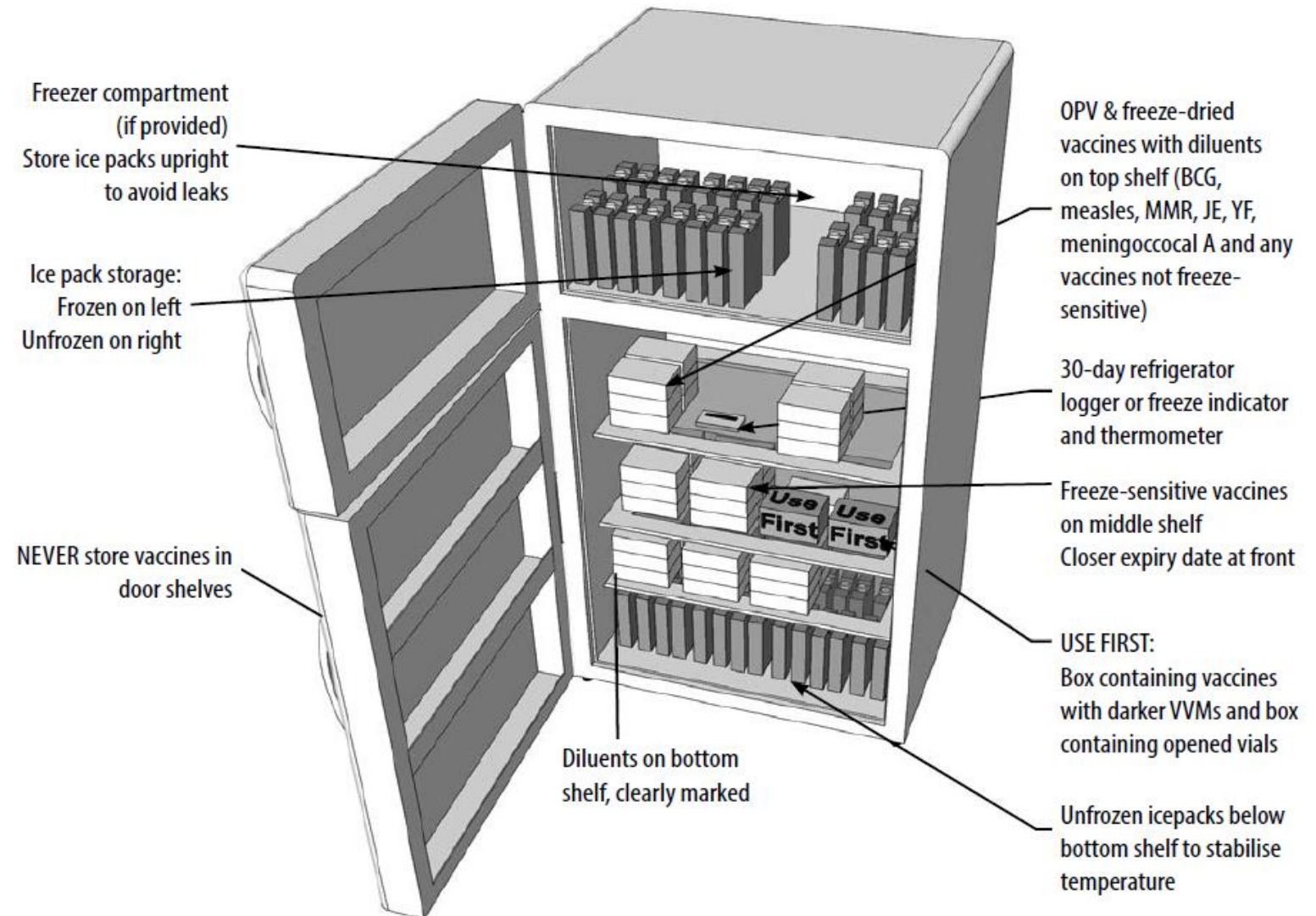
Vaccine Storage

- Carefully select and use the proper **vaccine storage units** to store vaccines.
- Rotate vaccine stock so the oldest vaccines are used first.
- Store vaccines in their original packaging with lids closed until ready for administration.
- Have a properly **calibrated thermometer** or temperature recording device inside each storage compartment.
- Check and record storage unit minimum and maximum temperatures at the start of each workday.

Refrigerator and Freezer Recommendations

- There are several types of vaccine storage units available.
- Purpose-built units are specifically designed to store vaccines.

Figure 2.19 Vaccine and diluent arrangement in a front-opening domestic, gas or kerosene vaccine refrigerator



Refrigerator and Freezer Recommendations

- Place water bottles on the top shelf and floor and in the door racks.
- Putting water bottles in the unit can help maintain stable temperatures caused by frequently opening and closing unit doors or a power failure.



Refrigerator and Freezer Recommendations



Vaccine Storage Units: Refrigerator and Freezer Recommendations

- Every vaccine storage unit must have a Temperature monitoring devices (TMD).
- An accurate temperature history that reflects actual vaccine temperatures is critical for protecting your vaccines
- There are several types of (TMD)

Figure 2.12 30-day electronic temperature loggers



FridgeTag2™ with USB



LogTag® temperature recorder

Vaccine Organizing and Storing

To confirm vaccines are stored correctly and to minimize the risk of administration errors, implement the following practices:

- Store each type of vaccine or diluent in its original packaging and in a separate container.
- Position vaccines and diluents **two to three inches** from the unit walls, ceiling, floor, and door.
- Whenever possible, store diluent with the corresponding refrigerated vaccine. Never store diluent in a freezer.

Vaccine Organizing and Storing

- Avoid placing or storing any items other than vaccines, diluents, and water bottles inside storage units.
 - If other medications and biological products must be stored in the same unit as vaccines, they must be clearly marked and stored in separate containers or bins from vaccines.
 - Potentially contaminated items (e.g., blood, urine, stool) should be properly contained and stored below vaccines due to risk of contamination from drips or leaks.
- Arrange vaccines and diluents in rows and allow space between them to promote air circulation.



THANK YOU