

* What is immunization *

- Immunization is the process of making a person resistant to a disease by stimulating their immune system to recognize and fight specific pathogens, such as virus or bacteria and usually through vaccination.

Goals

* prevent disease, reduce transmission, protect vulnerable people, and achieve herd immunity.

How vaccines work (Basic ideas)

- Vaccines expose the immune system to a safe part or mimic of a pathogen (antigen), training the body to recognize and fight the real pathogen.

*Types of vaccines (Common Categories) *

- Live attenuated: weakened form of the pathogen (e.g., measles, mumps, rubella).
- Inactivated/killed: killed pathogen (e.g., polio Salk, hepatitis A).
- Subunit, toxoid, and conjugate: only parts of the pathogen or inactivated toxins (e.g., HPV, hepatitis B, diphtheria/tetanus/pertussis components).
- mRNA and viral-vector vaccines: deliver genetic instructions or harmless vectors to produce antigen (e.g., some COVID-19 vaccines).
- Vaccines stimulate memory B and T cells for faster, stronger responses upon real exposure.

* Immunization strategies and schedules*

- Routine immunization programs aim to vaccinate children and extend protection to teens and adults.
- Catch-up schedules fill gaps for those who missed vaccines.
- Booster doses may be needed to maintain protection (e.g., tetanus, diphtheria, pertussis; some vaccines for adults or older age groups).
- Herd immunity threshold varies by disease and depends on how transmissible the disease is and the vaccine's effectiveness.

Prevention of vaccine-preventable diseases (VPDs)

- Core elements
- High population vaccination coverage.

- Timely administration according to the recommended schedule.
- Access to vaccines and convenient service delivery (locations, hours, reminders).
- Public education to address hesitancy and misinformation.
- Surveillance for disease and vaccine safety (to monitor effectiveness and adverse events).
- Special populations: pregnant peoples (certain vaccines recommended and contraindications considered), healthcare workers (important for preventing nosocomial transmission), immunocompromised individuals (timing and vaccine choice may differ).

Safety, monitoring, and adverse events

- Adverse events following immunization (AEFI) are monitored to ensure safety.
- Common AEFI are usually mild (pain at injection site, low-grade fever, fatigue).
- Serious AEFI are rare; systems exist to investigate and manage them.
- Contraindications and precautions:
 - Severe allergic reaction (anaphylaxis) to a vaccine component is a contraindication.
 - Acute severe illness with fever may delay vaccination in some guidelines.
 - Pregnancy considerations vary by vaccine type (e.g., some vaccines are recommended, others deferred).
- Storage and handling (the cold chain) are critical to preserves vaccine potency.
- Safe administration practices include correct dose, route, interval between doses, and documentation.

Prevention of immunization errors and maximizing effectiveness

- Ensure accurate records and recall/reminder systems for upcoming doses.
- Verify vaccine lot numbers, expiry dates, and contraindications before administration.
- Maintain proper storage, handling, and preparation procedures.
- Educate patients and caregivers to support informed decisions and timely vaccination.
- Address barriers: access, costs, transportation, misinformation, cultural beliefs.

Common vaccines and diseases (examples)

- Diphtheria, Tetanus, Pertussis (DTaP/Tdap), Polio (IPV/OPV), Measles/Mumps/Rubella (MMR),

Varicella, Hepatitis B, HPV, Influenza, Pneumococcal, Rotavirus, Hepatitis A, Meningococcal.

- New vaccines (as guidelines update): COVID-19 vaccines, RSV vaccines, etc.

Pregnancy and immunization

- Some vaccines are recommended during pregnancy (e.g., Tdap in every pregnancy, influenza if seasonally indicated) to protect both mother and newborn.
- Live vaccines are typically avoided in pregnancy unless specified otherwise.

Global and policy context (brief)

- Vaccination programs are guided by national immunization schedules and WHO guidance.
- Goals include high coverage, equity of access, safety monitoring, and rapid response to outbreaks.
- Global partnerships (e.g., Gavi) help extend access to vaccines in low-resource settings.