TARGET PRELIMS 2023
BOOKLET-3
SCIENCE AND TECHNOLOGY-3
HEALTH, DISEASES

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2. SOME NUTRITION BASED UPDATES

1) ANAEMIA

- **What is Anaemia:**
  - » It is a condition in which number of red blood cells or the hemoglobin concentration within them is lower than normal or there are abnormal red blood cells.
  - » This negatively hampers the ability of blood to carry oxygen to tissues (Note: It is the hemoglobin which attaches to oxygen).
  - » It results into symptoms such as fatigue, weakness, dizziness, shortness of breath etc.

- **Causes:**
  - » **Nutritional Deficiency** - particularly iron deficiency, deficiency of folate (vitamin B-9 is important for RBC formation and for healthy growth and function), vitamin B12 and Vitamin A.
  - » **Haemoglobinopathies** - It is a group of disorders in which there is abnormal production or structure of the hemoglobin molecule. These group of diseases include hemoglobin C disease, hemoglobin S-C disease, Sickle Cell Anemia, and Thalassemia.
  - » **Infectious** diseases which impact blood such as malaria, TB, HIV and parasitic infections may also cause Anaemia.

- **Impact:**
  - » Anaemia compromises immunity and impedes cognitive development.

- **Global Situation:**
  - » As per WHO, around 42% of children under 5 and 40% of pregnant women worldwide are anaemic.

- **Anaemia Situation in India:**
  - » Between 2005 - 2015, the anaemia situation declined marginally in India.
  - » **But, as per the NFHS-5, the incidence of Anaemia** in under-5 **children** (from 58.6 to **67%**), **women** (53.1% to 57%) and **men** (22.7% to 25%) has worsened in all states of India (20%-40% is considered moderate) (when compared to NFHS-4)
    - ▫ **Kerala** (at 39.4%) is the only state at moderate level. Else all other states are in **severe category** (above 40%).

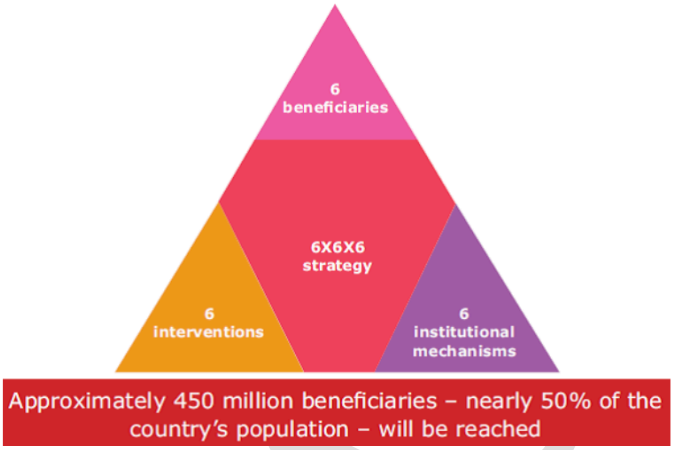
- **Factors which cause high levels of Anaemia?**
  - » Cereal centric diet with less consumption of iron rich food groups like meat, fish, eggs, and Dark Green Leafy Vegetables (DGLF).
  - » Poor water quality and sanitation may also impact the nutrient absorption.
  - » Women's empowerment can impact the kind of food being consumed by them
  - » Delivery of health and nutritional interventions play a significant role in the prevalence of anaemia.

- **India's great anaemia mystery** – class discussion

A) ANAEMIA RELATED INITIATIVES

- ▫ The Anaemia Mukt Bharat - **intensified Iron-plus initiative** was launched in 2018.
- ▫ It aimed to strengthen the existing mechanism and foster newer strategies for tackling Anaemia.

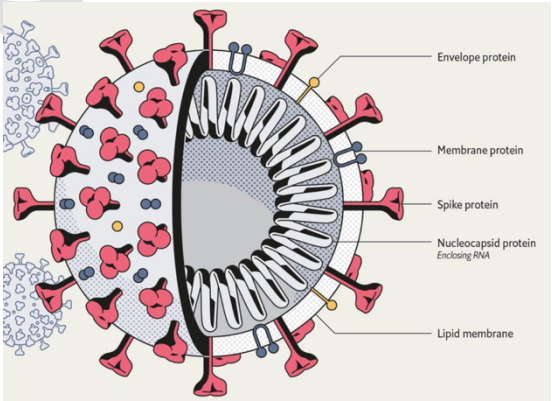
- **Objectives:**
  - » Complying with the targets of POSHAN Abhiyaan and National Nutrition Strategy set by NITI Aayog, the Anaemia Mukt Bharat strategy has been designed **to reduce prevalence of anaemia by 3 percentage points per year among children, adolescents, and women in the reproductive age group (15–49 years**), between the **year 2018 and 2022**



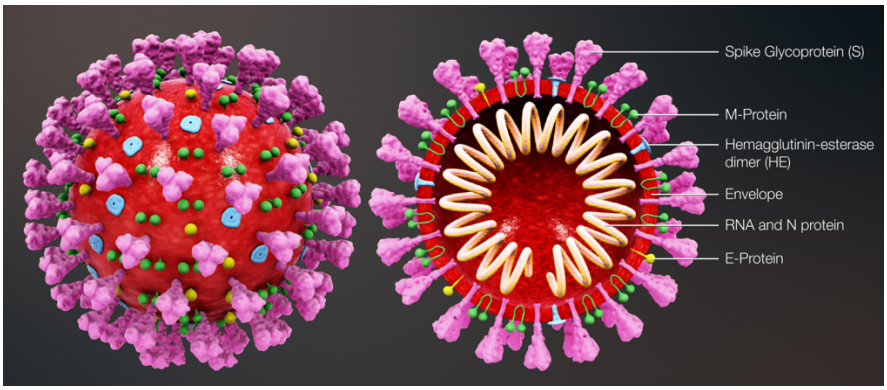
- It focuses on **six target beneficiary group**s, **through six interventions** and **six institutional mechanisms** to achieve the envisaged target under the POSHAN Abhiyan. This is known as **6X6X6 strategy**.
- **Are we on track to achieve the targets:**
  - » No, NFHS-5 has shown an increase in the Anaemia affected population.

3. COVID-19

1) CORONA VIRUSES



- Coronaviruses are a group of viruses in the **subfamily Orthocoronavirinae,** in the **family Coronaviridae.** In humans they are known to cause infection in upper respiratory tract (sinuses, nose and throat) and/or lower respiratory tract (windpipe and lungs).
  - » **Most** of these viruses are harmless, but **some** can cause less severe common cold to more severe diseases such as severe acute respiratory syndrome (SARS), Middle East Respiratory Syndrome (MERS) and COVID-19.
- Coronaviruses were first identified in the 1960s. Almost everyone gets a coronavirus infection at least once in their life, most likely as a young child. The symptoms of most coronavirus are similar - a runny nose, coughing, sore throat and sometimes a fever.
- Many Coronaviruses are **zoonotic** i.e., they are transmitted from animals to humans.
  - » **SARS** coronavirus is believed to be an animal virus from an as-yet-uncertain animal reservoir, perhaps bats, that spread to other animals (civet cats) and first infected humans in the Guangdong province of Southern China in 2002.
  - » The **MERS** coronavirus was passed on from dromedary camels to humans in Saudi-Arabia in 2012.
  - » **SARS-COV-2** also seems to have transmitted from bats to humans (not confirmed yet). Pangolin may have acted as intermediary.
    - Note: SARS-COV-2 is a coronavirus very similar to the one that causes SARS.
- **Structure**



» They are enveloped viruses with a **positive sense single stranded RNA genome** and a nucleocapsid of helical symmetry.
» The genome size of the coronaviruses ranges from approximately 26 to 32 kilo bases, one of the largest among RNA viruses

2) SARS-COV-2: NAMING, STRUCTURE AND PHYSIOLOGY

- SARS-COV-2 is one of the seven known types of known Corona virus, including SARS and MERS.
  » **Naming of the Virus**: The Coronavirus Study Group of the International Committee on Taxonomy of Viruses, which had assessed the novelty of the human pathogen, has named the virus as "**Severe Acute Respiratory Syndrome Coronavirus 2**", or "**SARS-COV-2**".

- It is an **RNA-virus** as it has ribonucleic acid as genetic material, instead of DNA.

- **Structure of the Virus**
  » Like other Coronaviruses, SARS-COV-2 virus particles are **spherical** in shape and have mushroom shaped protein called **spikes** protruding from their surface. These spikes give the virus appearance of a crown or halo around sun. Therefore, it is called CORONA which is the Latin name for crown.
    - The **spike binds and fuses with human cell**s, allowing the virus to gain entry.
    - The spike protein of the novel coronavirus **shares 98% sequence identity** with the spike protein of the bat coronavirus.
    - The spike of the virus has something called a **receptor binding domain** (RBD) which facilitates the virus entry into the target cells by binding with the cellular receptor called **Angiotensin Converting Enzyme 2 (ACE2)**, which serves as the entry point into human cells. SARS corona virus also used the same mechanism for entry into the cells.
      - But unlike SARS the case of SARS Corona, the **spike protein of the novel coronavirus binds to the cell receptor with much higher affinity - 10 to 20-fold higher**.
      - This much higher binding affinity to the cell receptor explains high human to human transmission of the virus compared to SARS coronavirus.
- The virus (or virus particle) is **50-200 nm** in diameter

3) NAMING OF THE DISEASE – CORONA VIRUS DISEASE-19 (COVID-19)

- On Feb 11, 2020, the **WHO officially announced COVID-19** as the name for the disease caused by the n-COV (novel Coronavirus)
  » The name has a **standard format** to be used in any future corona virus disease.

- **Why was it important to name the disease?**

» To prevent the use of other names that can be "inaccurate or stigmatizing".

- Based on WHO's May 2015 guidelines.

4) COVID-19 DISEASE CAUSED BY INFECTION OF SARS-COV-2 (2019 N-COV)

- **Early symptoms** include - Fever, Dry Cough and Fatigue.
- The virus can lead to **pneumonia**, **respiratory failure**, **septic shock**, and **death**.

- **How does SARS-CoV-2 spread?**
  - It mainly spreads from person to person.
    - When a sick person coughs or sneezes, droplets containing virus are released in air, on various surfaces. If you inhale or swallow this virus, the virus gets into your body.

- **Vertical Transmission across Placenta**
  - » A study has found evidence that confirms vertical transmission of SARS-CoV-2 virus from the mother to foetus. The route of infection is **through the womb (in utero)** well before onset of labor and delivery of baby.

- **What is community transmission?**

- **Reproduction Number (Ro)** (pronounced R naught) is used to describe the intensity of an infectious disease outbreak.
  - » Ro is the number of cases, on average, an infected person will cause during their infectious period. The larger this number, more contagious is the disease.
  - » It can be viewed as the product of three numbers (i) the number of days an infected person remains infective (i.e., can infect others), (ii) the number of susceptible persons available to infect and (iii) the chance that a susceptible person gets infected.
  - » Early studies of **COVID-19** in Wuhan estimated the average R0 between 2.2 and 2.7.

5) DIAGNOSIS

- **Basics**
  - » Broadly, there are **two types of tests for Covid-19**.
    - **One type**, which detects the virus itself, includes the RT-PCR test and the antigen test.
    - **The second** is the serological test, which looks for antibodies developed by the body against the virus. This determines if a person has been exposed to the infection and is used for surveillance of infection in a community.

- A **swab test** looks for signs of the virus in your upper respiratory tract. Here a swab is put up your nose to get a sample from the back of your nose and throat. Then this sample is tested in the lab.
  - » Note: this test can only tell you whether you are currently infected by the virus.
  - » The virus can be detected by a **RT-PCR test**.

A) RT-PCR

- The test detects the presence of viral RNA in human samples.
- In this test first the viral RNA is converted into DNA (reverse transcription)
  - » PCR is a process where a few copies of DNA are amplified to produce millions of copies.

» This is done with the help of enzymes, primers, and probes.

B) RAPID TEST (RAPID ANTI-BODY TEST)

6) TREATMENT

There is **no specific treatment** for COVID-19. People who get a mild case need care to ease their **symptoms**, like rest, fluids, and fever control.

A) PAXLOVID: PFIZER'S COVID-19 PILL

- **Why in news?**
  - In Dec 2021, US FDA have issued an emergency use authorization (EUA) for Pfizer's Paxlovid (nirmatrelvir tablets and ritonavir tablets, co packaged for oral use) for treatment of mild to moderate COVID-19 in adults and pediatric patients (12 years and older weighing at least 40 kgs).

- **Details**
  - This is the first treatment of COVID-19 that is in the form of pill and is taken orally.
  - It is not authorized for pre-exposure or post-exposure prevention of COVID-19 or for initiation of treatment in those requiring hospitalization due to **severe or critical COVID-19**.
  - It consists of **nirmatrelvir**, which **inhibits a SARS-CoV-2 protein to stop the virus from replicating**, and **ritonavir**, which slows down nirmatrelvir breakdown to help it remain in body for longer period in higher concentration.
  - **Paxlovid is** administered as **three tablets** (two tablets of nirmatrelvir and one tablet of ritonavir) taken together orally twice daily for five days, for a total of 30 tablets. Paxlovid is not authorized for use for longer than five consecutive days.

B) CONVALESCENT PLAMA THERAPY – DROPED BY ICMR FROM COVID-19 TREATMENT GUIDELINES IN MAY 2021

- **Why in news?**
  - **ICMR drops Plasma therapy from the COVID-19 treatment guidelines** (May 2021)
- **Details**
  - Through a trial by ICMR on 400 patients last year - called the PLACID trial - ICMR has found that there is no significant benefit from the use of plasma.
  - Several other international trials had also found no benefit from the plasma therapy.

- **What is Plasma Therapy?**
- This method seeks to use antibodies in the blood plasma of the recovered patient to fight Coronavirus.

- **Has this method been used in past? Yes,** on several occasions.
  - **For fighting Spanish flu** (1918-20), used in USA.
  - **SARS** - Hong Kong used it to treat SARS patients in 2005.
  - **H1N1** patients were also treated by this method in 2009.
  - In 2014, WHO released guidelines for the treatment of **EBOLA** patients with convalescent whole blood and plasma. . **DRC** and **Guinea** eventually used Convalescent Plasma Therapy for treatment of Ebola.
  - It was also used to treat **MERS** in 2015.

7) CYTOKINE STORMS AND ITS IMPACT ON COVID-19 DEATHS

- **Basics: Understanding how immune system functions:**
  - » An effective immune system response involves **inflammation**, an important and indispensable part of the process. This is visible when, for example, you hurt your knee or ankle — the area of this external injury becomes red and swollen, and the immune system in response deploys white blood cells to the injured area to begin work on repairs. Without such an immune response, injuries would not heal, and infections would become deadly
  - » Inflammation has an important protective function. The release of inflammatory mediators increases the blood flow to the area, which allows larger numbers of immune system cells to be carried to the injured tissue, thereby aiding the repairing process.

- **What are Cytokines and what is their role in immune system?**
  - » Cytokines are small proteins released by many different cells in the body, including those of the immune system where they coordinate the body's response against infection and trigger inflammation.
  - » Cytokines are signalling proteins that are released by cells **at local high concentratio**n.

- **However, sometimes the body's response to infection can go to overdrive**: **Cytokine Storm Syndrome**
  - » In some patients excessive or uncontrolled levels of cytokines are released which then activate more immune cells, resulting into hyperinflammation. Here body's immune system starts attacking its own cells and tissues rather than just fighting off the virus. This can seriously harm or even kill the patient.
  - » Cytokine storms are a common complication in COVID-19, MERS, SARS, and flus. They are also associated with non-infectious diseases such as multiple sclerosis and pancreatitis.
    - For instance, the high fatality rate of 2005 H5N1 influenza, also known as Bird Flu, was linked to an out of control cytokine response.
  - » Cytokine storm can explain why some people have severe reaction to coronavirus while others only experience mild symptoms. They could also be the reason why younger people are less affected, as their immune systems are less developed and so produce lower levels of inflammation driving cytokines.

8) MUCORMYCOSIS OR BLACK FUNGUS

- **Details**
  - » The disease is caused by a group of molds known as **mucoromycetes** present naturally in the environment.
    - It mainly effects **people who are on medication for health problems that reduce their ability to fight environmental pathogens**. It generally doesn't pose a serious threat to individuals with healthy immune system.
  - » **Sinuses or lungs** of the infected person get affected after they inhale fungal spores from the air.
  - » **Symptoms:**
    - Warning signs include pain and redness around the eyes or nose, with fever, headache, coughing, shortness of breath, bloody vomits, and altered mental status.
    - **It should be suspected** when there is:
      *** Sinusitis** — nasal blockade or congestion, nasal discharge (blackish/bloody).
      ***** Local pain on the cheek bone, one-sided facial pain, numbness or swelling.
      ***** Blackish discoloration over bridge of nose/palate.
      ***** Loosening of teeth, jaw involvement.
      ***** Blurred or double vision with pain.
      ***** Thrombosis, necrosis, skin lesion.

* Chest pain, pleural effusion, worsening of respiratory symptoms

- **Treatment:**
  - It is treated with antifungal but in worse case it may require surgery.
    - » The treatment includes infusion of normal saline (IV) before infusion of **amphotericin B** and antifungal therapy, for at least 4-6 weeks.
    - » It is of utmost importance to control diabetes, reduce steroid use and discontinue immunomodulating drugs.

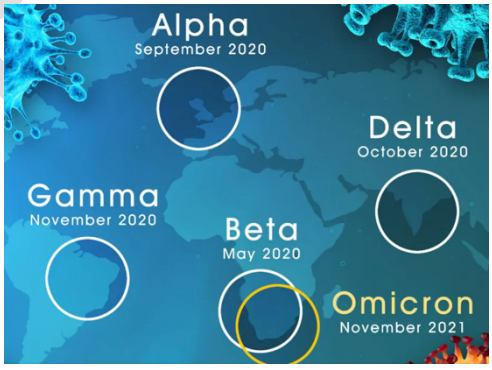
- **Management of COVID-19 patients** with Mucormycosis is a team effort involving microbiologists, internal medicine specialists, intensivist neurologist, ENT specialists, ophthalmologists, dentists, surgeons and others.

- **Life after Mucormycosis:**
  - It can lead to loss of upper jaw and sometimes even the eye.
    - » Once the patient stabilizes, prosthetic replacement of the missing facial structures can commence.

9) VARIANTS OF CONCERN

A) DETAILS OF DELTA VARIANT

- » The original Wuhan variant mutated into the successively more dangerous **Alpha, Beta, Gamma and Delta Variants**.
- » **Note:** All mutations don't mean that they are more harmful.
- » **Variant of Concern:** WHO classifies a variant as Variant of Concern when it is associated with an increase in transmissibility or detrimental change in COVID-19 epidemiology; increase in virulence; or decrease in effectiveness of the public health measure or available diagnostics, vaccines, therapeutics.
- » **So far, WHO has 5 variants of concerns (**Omicron was the fifth one)



- T**he Delta variant, or the B.1.617.2 lineage** was **first discovered in Maharashtra, India, in Oct 2020.**
  - » It has **mutation in its spike protein**, which helps it bind to the ACE2 receptors present on the surface of the cells more firmly, making it more transmissible and capable of evading the body's immunity.

- **Key characteristics of Delta Variants:**
  - » **Delta variant spreads faster** and **reduces protection gained from previous infections or vaccines**
  - » **Doesn't cause more severe illness**
  - » **Vaccines are effective** (a bit less) **on delta** variants. It's just that delta variant is less sensitive to neutralizing antibodies.

- **Why Delta variant spreads faster?**
  - » **Evolution** (Class discussion)

B) DETAILS OF OMICRON VARIANT (VARIANT B.1.1.529)

» Omicron is WHO's fifth variant of concern.
» It was first reported to WHO on 24th Nov 2021 and was classified as a variant of concern by WHO on 26th Nov 2021.
» It spreads much easily than original virus and the Delta variant.
» It generally causes less severe disease than infection with prior variants.
» Symptoms: Similar to previous COVID-19 symptoms.

10) NEW OMICRON SUB-LINEAGE, RECOMBINANTS CAUSE CASES TO SPIKE (OCT 2022)

- **New Omicron Sublineage, recombinants cause cases to Spike** (Oct 2022)
  - Genetic mutations don't necessarily lead to functional advantages. But, when a functional advantage appears, the variant tends to emerge over those without this advantage.

- **Recombination in viruses:**
  - Viruses rarely evolve by exchanging large fragments of the genome called recombination.
  - Recombination events are rare and occur when **two viruses or lineages co-infect a cell. I**t results in viruses that have a mixed genome, each part of the mix derived from the parent genomes which recombined. While most recombination results in a **dysfunctional genome**, in rare occurrences, they can bring together **the best of two viruses** with significant functional advantages resulting in their emergences.

- **Recombinant lineages of SARS-CoV-2:**
  - It has the potential to recombine. So far**, around 50 recombinant lineages of SARS-CoV-2 have been detected** and assigned lineage name.

  - **The PANGO network**, an open and global consortium of researchers, provides a **system for naming** different lineages of SARS-CoV-2.
    - **Recombinant lineage** names start with the letter '**X**', followed by letters that indicate the order of their detection.
      - **XA**: It is a recombinant lineage between B.1.1.7 (Alpha) and B.1.177 lineages of the virus. It was the first recombinant lineage of SARS-CoV-2 and was first detected in the UK in early 2021.
      - **XB** (detected in US)
      - **XC** (detected in Japan) is a recombinant of B.1.1.7 (Alpha) and the AY.29 Sublineage of Delta.

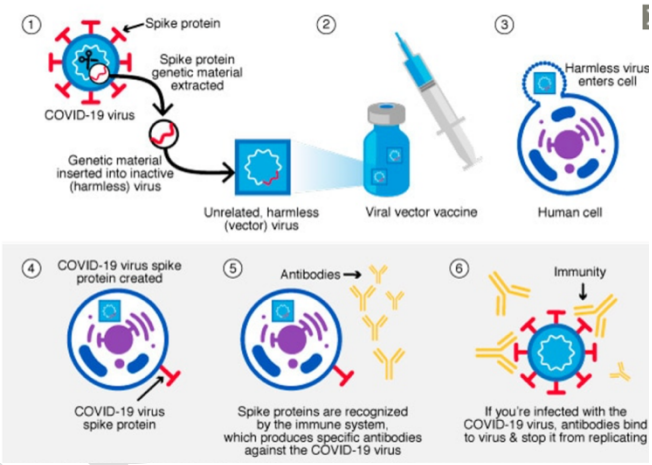
  - It is important to track SARS-COV-2 recombinant lineages as they would lead to the emergence of a lineage that is more harmful to humans (easy transmittability or immunity to vaccines)

  - **XBB Lineage**:
    - It is a recombinant lineage which has been emerging in Asia (as of Oct 2022).
      - It is a **combination of two Omicron sublineages BJ.1 and BA.2.75**.
      - It has been found in multiple countries including **India**. Recently, it has been emerging concurrently with a surge in COVID-19 infections in Singapore.
    - Early data shows that this variant can evade a wide range of monoclonal anti-bodies as well as protection acquired through vaccination. The preliminary data also shows that this lineage may also outcompete previously circulating Omicron sublineages.
    - **Apart from XBB**, other sublineages of Omicron have been emerging across the world.

4. VARIOUS TYPES OF COVID-19 VACCINES

- **Inactivated or weakened Virus Vaccine**: It uses a form of virus that has been inactivated or weakened so it doesn't cause disease but still generates an immune response.
    - **COVAXIN(BBV152) developed** by Bharat Biotech.

- **Viral Vector Vaccine**:
    - It uses a safe virus that can't cause disease but **serves as a platform to produce coronavirus protein**s to generate an immune response.
    - **Adenovirus Route**
        - In this method, the adenoviruses (common cold virus) are weakened so that they don't replicate in humans. They are also modified to make the code for coronavirus spike protein. Spike proteins help the body recognize it and make antibodies against the spike protein. These antibodies will help mount an immune response and prevent the virus from entering the human cells and cause an infection.



        - **Oxford-AstraZeneca** (ChAdOx1 nCoV-19) are using the **Adenovirus route**.
            - **Covishield** used in India is a version of this.
        - **Sputnik V Vaccine** also has gone **Adenovirus route**
            - It uses two different viruses that cause common cold (adenovirus) in humans. The viruses are weakened so they can't replicate in humans and cannot cause disease. They are also modified to make the code for coronavirus spike protein.

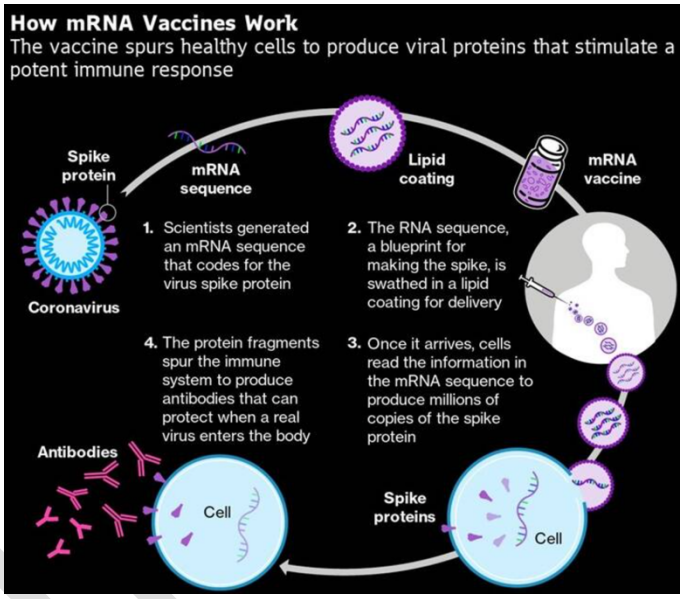
- **Subunit Virus:**
    - Protein subunit vaccines **include only the parts of virus that best stimulate immune system**.
        - **Advantages:**
            - No risk of introducing the disease and is safer and stable than vaccine containing whole pathogens.
            - Suitable for immunocompromised individuals.
            - Well established tech
        - **Disadvantage**
            - Relatively complex to manufacture (compared to other vaccines like RNA vaccines)
            - May require multiple doses.

        - **Covovax** (NVX-CoV2373) is a subunit vaccine developed by Novavax and the Coalition for Epidemic Preparedness Innovation (CEPI).

        - **Corbevax** is a **protein subunit COVID-19** vaccine developed by Texas Children Hospital Centre, Texas and Dynavax technologies, California. It is licensed to Indian pharma company **Biological E. Limited** (BioE) for development and production.
            - It delivers the spike protein to the body directly.
                - **How protein was manufactured?**

- Add gene of spike protein into yeast to produce large amount of proteins. After isolating the virus spike protein from the yeast and adding an adjuvant, which helps trigger an immune response, the vaccine was ready.

- **RNA or DNA Vaccine:**
  - A cutting-edge approach that uses genetically engineered RNA or DNA to generate a protein that safely prompts an immune response.
  - **mRNA Vaccines**
    - mRNA vaccines make use of the **messenger RNA molecules** that tell the body's cells what proteins to build. The mRNA in this case is coded to tell the body's cells to **recreate the spike protein of the coronavirus** SARS-CoV-2. It is the spike protein which appears as spikes on the surface of the coronavirus - that initiates the process of infection. They prompt the immune cells to create antibodies to fight it.



  - **DNA Vaccines**
    - E.g. INO-4800 by Inovio (a US pharma company)
    - the DNA vaccine injects a part of genetic code of the virus (spike protein), which allows cells to produce antigens - a molecule present on the outer surface of the virus. This triggers immune responses

- **Conjugate Vaccine for COVID-19**
  - **Basics of Conjugate Vaccines:**
    - A conjugate vaccine is a type of subunit vaccine which combines a weak antigen with a strong antigen as a carrier so that the immune system has a stronger response to the weak antigen.

  - **Soberana 02**, a conjugate COVID-19 vaccine developed in Cuba, was given emergency use authorization in Cuba and Iran.
    - In Soberana 02, the spike protein is linked to tetanus toxoid, making it a conjugate vaccine.
    - It provides **more effective response**.
      - **How?**
        - For an effective response, not only antibodies but even killer T-cells, or those produced by the immune system and capable of destroying infected cells, must be produced.
        - Spike protein may be able to elicit a strong vaccine response but when combined with tetanus toxoid, such a T-cell response could also be generated which can confer more effective protection:
        - **Note**: Tetanus Toxoid is a very widely used childhood vaccine and therefore one which immune system recognizes.
    - The design and manufacturing allows the vaccine to be stored in regular refrigerator settings of 2-8 degree Celsius.

- **Note:** Soberana 02, is by far (July 2021) the only one among coronavirus vaccine candidates that relies on the conjugate vaccine technology

5. OTHER VIRAL DISEASES

1) MEASLES

- **Why in news?**
  - India has emerged as the measles capital of the world with 9,490 cases in April - Sep (Nov 2022)
  - Centre deploys High Level team to Mumbai to assess and manage outbreak of Measles cases (Nov 2022)

- **Measles** is a highly contagious infectious disease caused by **measles virus**. It is an acute respiratory illness. **Infection** is characterized by a prodrome of fever (as high as 105-degree F) and malaise, cough, coryza, and conjunctivitis - the three "C"s, followed by maculopapular **rash**. The rash spreads from the head to the trunk to the lower extremities. Patients are considered contagious 4 days before and 4 days after the rash appears.
  - It can severely sicken **young children** but is normally kept under check due to large-scale vaccination.

- **About the Virus:**
  - It is a **single stranded, enveloped RNA virus with 1 serotype**.
  - **Humans** are the only natural host of the measles virus.

- **Detection:**
  - RT-PCR
  - Anti-body test

- **Vaccinations:**
  - Measles can be prevented with **Measles-containing vaccine**, which is primarily administered as the combination of measles-mumps-rubella (MMR) vaccine.
  - It can be used for children aged 12 months through 12 years. One dose of MMR vaccine is approximately 93% effective, and two doses are approximately 97% effective.

- **Rise of Cases in 2022:**
  - During the COVID-19 pandemic, measles cases in India dropped to lowest in many years, with 5700 cases in 2021 and 5604 cases in 2020, mainly because airborne viral infection couldn't spread with children staying home.
  - But, in 2022 in the first six months only, India has registered 9,490 cases and appears to be on the verge of topping the 2019 ally of 10,430 cases.
  - **Why?**
    - Disruption of routine vaccination during 2020 and 2021.
    - WHO and UNICEF studies have shown that immunization program - especially those focusing on DPT and measles - have taken a hit in low and mid-income countries, including India, in the past two years.

2) HUMAN IMMUNODEFICIENCY VIRUS (HIV) AND AIDS (ACQUIRED IMMUNODEFICIENCY SYNDROME)

- **Introduction:**

» **About virus:**
  - HIV are two species of Lentivirus (genus) *of Retroviridae* family. The virus first emerged in 1920 in **Kinshasa (then Leopoldville)**, Belgian Congo.

» The **Human Immunodeficiency Virus (HIV) targets the immune system** and weakens people's surveillance and defence systems against infections and some types of cancers.
  - As the virus destroys and **impairs the function of the immune cells**, infected individuals gradually become immunodeficient. Immune function is typically measured by CD4 cell count.
  - The most advanced for of HIV infection is **acquired immunodeficiency syndrome (AIDS),** which can take from 2 to 15 years to develop depending on individual. It is defined by developments of certain cancers, infections, or other severe chemical manifestations.
  - **Note: CD4 cells** are a type of white blood cells that play a major role in protecting your body from infection. They send a signal to activate your body's immune response when they detect "intruders" like the viruses or bacteria.

- **Transmission**
  - » **Exchange of a variety of body fluids - blood, breast milk, semen, and vaginal secretion**
  - » **Note:** Individual can't be infected through ordinary day to day contact such as kissing, hugging, shaking hands, sharing food or water etc.

- **Behaviours or conditions which can put individual on risk:**
  - » Unprotected sex (including anal)
  - » Having other STDs like syphilis, herpes, chlamydia etc.
  - » Use of contaminated needles, syringes etc. while injecting medicines or drugs.
  - » Unsafe blood transfusion and medical procedures
  - » Infected mother to unborn child.

- **Diagnosis**
  - » **Three types of tests:**
    - **Antibody test**: By detecting presence or absence of antibodies to HIV in blood; **most commonly used test**.
    - **RNA** (viral load) test (RT-PCR)
    - **A Combination tests**
      - It detects both antibodies and viral protein called p24 (antibody-antigen test, or HIV Ab-Ag test).
        - P24 forms part of the core of the virus (an antigen of the virus).

C) DRUG RELEASING VAGINAL RING CAP: TO PREVENT HIV AIDS IN WOMEN

- **Intro:**
  - » Girls and women make up more than half of the 38 million people living with HIV-AIDS, as of 2019.
- **Dapivirine Vaginal Ring (DPV-VR),** recommended by the WHO in Jan 2021, can be used for preventing HIV AIDS in women.
- **How does the ring work?**
  - » The ring is made of flexible silicon matrix polymer. The woman inserts it into the vagina, where it, over the course of a month, **releases the antiretroviral drug dapivirine**. It has to be changed after 28 days.
  - » The ring was developed by International Partnership for Microbicides (IPM), a non-profit product development partnership that works to accelerate the development and availability of safe and effective microbicides for women in developing countries.

- **How effective is the ring?**
  - » A study done in Africa found that infection in the dapivirine group was lower by 27% than in the placebo group.
- **Is the ring safe?**
  - » As per a study published in Lancet in 2019, no treatment related and no product related and no safety concerns were identified.

- **Dapivirine** is an antiretroviral drug - medicine to treat infection by retroviruses, particularly HIV. They work to suppress the viral activity'

D) NEW HIV STRAIN

- **Why in news?**
  - » A new, highly virulent strain of HIV has been discovered in the Netherlands. (Jan 2022)

- **Details**
  - » Its origin has been traced as far back as to the 1990s using genetic sequence analysis.
    - This is the main group of HIV-1 that triggered the HIV pandemic worldwide in 1981.
    - The strain's high virulence is calculated based on viral load and CD4 counts.
    - **The BEEHIVE** project is an ongoing study funded by the European Research Council that looks at what causes a more severe impact on a person infected with HIV.

  - » Note1: Like COVID-19, HIV is also an RNA virus and therefore it is in its nature to mutate.

  - » Note2: HIV has already been recorded as **one of the most rapidly mutating viruses**. According to a report in Nature, the virus genes vary from one person to another who has tested positive for it. At times, it differs within one individual.

E) HIV VACCINATION: HUMAN TRIAL

- **Moderna**, a USA based biotechnology company has indicated tha**t it would soon begin human trials f**or a vaccine for HIV (Aug 2021)
  - » It will use the **same mRNA platform** that it has used in its COVID-19 vaccine.

- **How is the vaccine expected to work**?
  - » The vaccine will stimulate B-cells of the immune system. B cells are a class of WBCs that produce antibodies which can bind to invading bacteria and viruses.
  - » B-Cells will help in generation of **broadly neutralizing antibodies** (bnAbs), which are specialized blood proteins that attach to the surface protein of HIV and disable them by accessing key but hard to reach regions on the virus.
    - Over the last decade, there have been advances in identifying new bnAbs from HIV-infected individuals that were seen to target very specific sites in the outer envelope of the HIV.
    - The techniques for producing **immunogens** (or parts of a virus or bacteria that elicit an antibody response from the immune system) have also improved.
      - **Note:** In case of **a coronavirus**, spike protein is the immunogen.
    - **One such immunogen** which has been designed in the lab is **eOD-GT8 60mer**, developed by the International AIDS Vaccine Initiative (IAVI) and its partners.
  - » **Phase-1 Trial:** Scientists tested weather this approach would stimulate the human immune system to initiate the generation of bnAbs, and the results were promising. The target response was detected in 97% of the participants.

» **The Moderna trial** is designed to investigate a way to effectively deliver the eOD-GT8 60mer immunogen using the m-RNA technology that will direct the cells to make the BnAbs which will illicit immune response against HIV. The vaccine is **formally being called mRNA-1644**.
    - Note: the vaccine development also involves funding from the Bill & Melinda Gates Foundation.

3) POLIO

- **Basics:**
    - » Polio is a highly infectious disease caused by a virus. It invades the nervous system and can cause total paralysis in a matter of hours.
    - » **Transmission:** The virus is transmitted by person to person and spread mainly through **faecal-oral routes,** or less frequently by, a common vehicle (e.g., contaminated water or food) and multiplies in the intestine.
    - » **Symptoms:** Initial symptoms are fever, fatigue, headache, vomiting, stiffness in the neck and pain in the limbs.
    - » **Affect:** 1 in 200 infections leads to irreversible paralysis (usually in legs). Among those paralyzed, 5% to 10% die when their breathing muscles become immobilized.
    - » **People most at risk**
        - Polio mainly affects children under five years of age
    - » **Prevention and Cure**
        - There is no cure
        - It can only be prevented. **Polio vaccine** given multiple times can protect a child for life.

- **Three Different strains of Polio Virus**
    - » 3 strains of poliovirus (type 1, type 2, and type 3).
    - » Wild polio virus **type 2 was eradicated in 1999**.
    - » Wild Polio virus **type 3 was eradicated in 2019**.
        - WPV3 is the **second strain of the polio virus to be wiped out**, following the certification of the eradication of WPV2 in 2015.
        - The **last case of WPV3** was detected in Northern Nigeria in 2012.

F) TWO TYPES OF VACCINES: OPV AND IPV

- **Oral Polio Vaccine (OPV)** is taken orally as drops. It has served as the main preventive measure against polio and is easily administered not requiring very trained health workers. Further, the cost per dose of OPV is much less than IPV. It also leads to passive immunization.
    - **Other Advantages**
        - **Passive immunization**
    - **Limitations**
        - Virus may mutate and turn virulent Or;
        - Virus may multiply in intestine and spread through excreta and over the period mutate to become virulent.

- **Inactivated Polio Vaccine** (IPV) is given through an injection by a trained health worker.
    - It is not a "live" vaccine (i.e. it is inactivated) and thus carries no risk of vaccine associated paralysis.

- In countries still using OPV, IPV hasn't replaced OPV but is used to strengthen a child's immune system and protect them from polio.

G) ISSUE OF VACCINE DERIVED POLIO VIRUS

- **How vaccines may lead to infection**
  - Oral Polio Vaccine (OPV) contains an attenuated vaccine-virus. This weak form of the virus is used to activate an immune response in the body, which protects the child when challenged by WPV.
  - But when child is immunized with OPV, the virus replicates in the intestine and during this time the virus is excreted.

- **WHO recommendations**
  - » Use of OPV must eventually be stopped (starting with OPV containing Type-2 poliovirus) worldwide and at least one dose of IPV must be introduced, to protect against Type-2 Polio virus and to boost population immunity.
  - » **Why??**
    - Since, wild Polio virus of type 2 was eradicated in 1999, the risk of paralytic disease due to OPV type 2 now outweighs its benefits.
    - A single dose of IPV before OPV protects against VAPP (Vaccine Associated Paralytic Poliomyelitis).

- **IPV is very safe** vaccines in humans, whether used alone or in combination vaccines.
  - » No serious adverse events have been reported, only minor side effects.
  - » It **doesn't cause VAPP or cVDPV**

- **Situation in India**
  - » India was declared Polio free in 2014, 3 years after the last case of Polio in 2011. But we still see cases of **vaccine derived Polio**.
  - » Further, there have been cases of **Non-Polio Acute Flaccid Paralysis (NPAFP)** which are associated with OPV.
    - NPFAP is defined as a sudden onset of paralysis or weakness in any part of the body of a child less than 15 years of age.
    - All AFP cases in last six years (2012-2018) have been due to non-polio causes. But, NPAFP has shown high correlation with number of pulse polio round conducted.
    - According to a recent paper (Aug 2018) by NCBI, since India has been polio free for six years, we can reduce the cases of NPAFP by further reducing polio rounds.

4) EBOLA VIRUS DISEASE (EVD)

- **Why in news?**
  - » Uganda declares end of Ebola disease outbreak: WHO (Jan 2023)
    - The outbreak had started in Sep 2022 and led to 55 deaths. The country was thus able to end the outbreak in less than 4 months. This was the country's 1st Ebola outbreak in the last decade and fight overall.

- **Introduction**:
  - » The Ebola virus causes an acute, serious illness which is often fatal if untreated.

    - » Ebola Virus Disease first appeared in 1976 in two simultaneous outbreaks, one in Nzara, Sudan, and the other in Yambuku, Democratic Republic of Congo. The later occurred in a village near the Ebola River, from which the disease takes its name.
    - » **2014-2016 outbreak:** This outbreak in Wet Africa was the largest and most complex Ebola outbreak since the discovery of virus. It had mostly impacted **Guinea, Sierra Leone and Liberia**.

- **Virus**: The virus family **Filoviridae** includes the **Ebolavirus genus**. This Ebolavirus Genus has 5 identified species so far: Zaire, Bundibugyo, Sudan, Reston and Tai Forest. The first three Zaire Ebola virus, Bundibugyo Ebolavirus, and Sudan Ebolavirus have been associated with large outbreaks in Africa. 2014 outbreak has been caused by Zaire Ebolavirus.

- **Transmission**
    - **Introduction in Human:** It is believed that **fruit bats** of the Pteropodidae family are **natural Ebola virus host**s.
    - **Human to Human:** Via **direct contact** (through broken skin or mucous membranes) with the **blood, secretions, organs or other fluids** of infected people, and with surface and materials (e.g., bedding clothing) contaminated with these fluids.

- **Symptoms of EVD**
    - First symptoms are sudden onset of **fever fatigue, muscle pain, headache and sore throat**.
    - This is followed by vomiting, diarrhea, rash, symptoms of impaired kidney and liver functions, and in some cases both internal and external bleeding.

- **Diagnosis**
    - **Difficult to distinguish EVD from other infectious diseases** such as malaria, Typhoid fever and meningitis.
    - **Confirmation tests**: Electron Microscopy, ELISA, RT-PCR etc.

- **Treatment and Vaccine**
    - Supportive care rehydration with oral or intravenous fluids - and **treatment of specific symptoms**, improves survival.
    - There is as yet **no proven treatment available** for EVD
    - However, a range of potential treatments including blood products, immune therapies and drug therapies are currently being evaluated
    - **Vaccines** has been developed and is being used in DRC.
        - Vaccine rVSV-ZEBOV (tradename "Ervebo") was approved by US FDA in Dec 2019.
    - **Monocolonal Anti-Bodies** have also been found effective in treatment: WHO

- **Prevention and Control**
    - Good outbreak control relies on applying a **package of interventions**, namely case management, surveillance and contact tracing, a good laboratory service, safe burials and social mobilization.

5) MARBURG VIRUS DISEASE

- **Why in news?**
    - Two cases of Marburg virus disease reported in Ghana (July 2022)
        - » These are the only two cases of the disease in the world

- **Details**

- MVD is a highly virulent disease that can cause hemorrhagic fever, with fatality rates varying between 24-88% (average 50%). Though caused by different viruses, the EVD and MVD are clinically similar.
- **Virus**
  - Marburg Virus is the causative agent of MVD.
    - The virus belongs to Filoviridae family (filovirus)
    - Note: Ebolavirus genus also belongs to the Filoviridae family.

- **Symptoms**
  - Incubation Period: 2 to 21 days
  - High Fever, severe headache, severe malaise, Muscle aches and pains are a common feature.
  - Severe water diarrhea, abdominal pain and cramping, nausea and vomiting can begin on the third day. The appearance of patients at this phase has been described as showing **"ghost like" drawn features**, deep set eyes, expressionless faces, and extreme lethargy.
  - In **fatal cases**, death occurs most often between 8 and 9 days after symptom onset, usually preceded by severe blood loss and shock.

- **History**
  - Two large outbreaks had occurred simultaneously in Marburg and Frankfurt in Germany, and Belgrade, Serbia in 1967. This led to initial recognition of the disease. The outbreak was associated with laboratory work associated with African Green monkeys imported from Uganda.
  - Subsequently, cases have been reported from Angola, the DRC, Kenya, South Africa and Uganda. In July 2022, the cases were reported in Ghana for the first time.

- **Transmission**
  - **Rousettus aegyptiacus bats** are considered the **natural host** for Marburg virus.
    - Initially, human MVD infection results from prolonged exposure to mines or caves inhabited by Rousettus bat colonies.
  - **Human to Human Transmission:**
    - This may happen through **direct contact** (through broken skin or mucous membrane) with the blood, secretions, organs or other bodily fluids of infected people and with surfaces and materials (e.g., bedding, clothing) contaminated with these fluids.
    - Health care workers are frequently infected. Burial ceremonies involving direct contact with the body.

- **Diagnosis –** Cell culture isolation; electron microscopy; RT-PCR; ELISA etc.

- **Treatment:** No licensed treatment yet to neutralize the virus.
  - But, a range of blood products, immune therapies, and drug therapies are currently under development.
  - Further, supportive care - rehydration and oral intravenous fluids - and treatment of specific symptoms, improve survival.

- **Vaccine:** Not yet.

6) RABIES

- **Why in news?**
  - Stray dog bites leading to rabies deaths despite vaccination in Kerala have raised several eyebrows, with questions on the efficacy of shots and whether proper protocol is being followed while treating bites (Sep 2022)

- In 2022, so far 14 deaths have taken place after dog bite. Of these five had taken the rabies vaccine.
- **Concerns:**
  - Has the virus changed such that the vaccine is no longer effective. Or are dog bites not being treated efficiently, following the appropriate protocol.

- The state government has set up an expert committee to look into the five deaths of those vaccinated.

- **About Rabies:**
  - » It is a vaccine preventable viral disease which occur in more than 150 countries in the world.
    - **Dogs** are the main source of human rabies deaths, contributing to 99% of all rabies transmission to humans.
      - It is spread when infected animal bites or scratches a human or other animal. Saliva from an infected animal can also transmit rabies if the Saliva comes into contact with the eyes, mouth, or nose.
    - **Interrupting transmission** is feasible through vaccination of dogs and prevention of dog bites.
    - **Immediate, thorough wound washing with soap and water** after contact with a suspected rabid animal is crucial and can save lives.
    - **Rabies is virtually 100% fatal** once the clinical symptoms appear. And it is also **100% vaccine preventable**.
  - » **WHO** is also leading a collective "**United Against Rabies"** to drive progress towards "Zero Human Deaths from dog mediated rabies by 2030".
  - » **World Rabies Day** is held on 28th September.

  - » **About the Virus:**
    - It is caused by **lyssaviruses**, including the rabies virus and Australian bat lyssavirus.
    - The virus infects the central nervous system. If a person doesn't receive the appropriate medical care after potential rabies exposure, the virus can cause disease in the brain, ultimately resulting in death.

- **Situation of Rabies in India**
  - As per WHO India is endemic to rabies and suffers approx. 36% of the world's human rabies deaths, transmitted by dogs.

- **Key Highlights about Efforts in India:**
  - The ministers have urged all the States to make **Rabies a notifiable Disease**.
  - They launched 'Joint Inter-Ministerial Declaration Support Statement' for elimination of Dog Mediated Rabies from India by 2030 through One Health Approach.
  - IEC campaign should be launched to help people understand the difference between vaccine and medicines for rabies.
  - On the occasion of the World Rabies Day (28th Sep), the MoH&FW and the Minister of Fisheries, Animal Husbandry and Dairying unveiled the N**ational Action Plan for Dog mediated Rabies Elimination by 2030 (NAPRE).**
    - Its approach for elimination of rabies is based on recommendations of several international agencies WHO and the Global Alliance of Rabies Control (GARC).
    - It was **prepared on the basis of 5 major pillars**- political will, intersectoral planning, sustained funding, community planning, coordination & review, and operational research.

7) HUMAN PAPILLOMA VIRUS (HPV)

- **What is HPV**?
  - » HPV is a group of 150 related viruses.
  - » **Cancer Causing:** Some HPV can lead to cancer, especially cervical cancer.
  - » There are more than 40 HPV that can infect genital areas of males and females.

- **How do people get HPV?**
  - » Transmitted through **intimate skin to skin contact** which can happen during vaginal, anal or oral sex with someone who has virus. **Most common sexually transmitted disease**. HPV is so common that nearly all sexually active men and women get it at some point in their lives. HPV can be passed even if the infected person has no signs or symptoms.

- **Does HPV Cause Health Problem?**
  - » In **most cases**, HPV goes away on its own and doesn't cause any health problems. But when HPV doesn't go away, it can cause health problems like genital warts and cancer.
    - **Genital Warts** usually appear as a small bump or group of bumps in the genital area.
    - **Cancer**: HPV can cause cervical cancer and other cancers including cancer of vulva, vagina, penis and anus. It can also cause cancer in the back of the throat, including the base of tongue and tonsils. The types of viruses that cause genital warts are not the same as types of HPV that cause cancers.

- **How can I avoid HPV and the health problems it can cause?**
  - » **Get Vaccinated:**
  - » **Get screened for cervical cancer:** Routine scanning for women aged between 21 to 65 years old can prevent cervical cancer.

  - » **For Sexually Active people**
    - Use latex condoms the right way every time you use them. This can lower your chances of getting HPV. But HPV can infect areas that are not covered by condoms - so condoms may not give full protection against getting HPV
    - Be in mutually monogamous relationship i.e., have sex only with someone who only has sex with you.

- **Can I be treated for HPV or health problems caused by HPV?**
  - » **No treatment for virus itself**, but **there are treatments for health problems associated** with it
    - **Genital warts** can be treated by physician, if left untreated, it will go away, stay the same or increase or decrease in number and size
    - **Cervical Cancers** can be treated. Women who go for routine Pap tests and follow up as needed can identify problems before cancer develops. Prevention is always better than treatment.
    - **Other HPV-related Cancer** are also more treatable when diagnosed and treated early.

8) CERVICAL CANCER

- **Why in news?**
  - » Nine out of 10 women who die of cervical cancer live in low and middle-income countries, according to WHO.

- **Details:**
  - » The low- and middle-income countries have low rate of vaccination against the HPV, which causes the cancer.

- Most HPV vaccination consignments go to wealthier nations, driving a gap in access similar to the inequitable distribution of vaccines against the COVID-19.
- Vaccines haven't been introduced in 80 countries and these countries record 2/3rd the incidences of cervical cancer.
- Globally, just 13% of girls between nine and fourteen years were vaccinated against HPV in 2020. This was a reduction from 15% girls in 2019.

- **4th HPV Vaccine:**
  - » In Oct 2021, WHO has given approval to **Ceolin**, manufactured by Xiamen Innovax Biotech Co Ltd to bridge the gap.

H) CERVAVAC: FIRST MADE IN INDIA CERVICAL CANCER VACCINE IN OFFING (SEP 2022)

- **Why in news?**
  - Union Minister Jitendra Singh announced the development of India's first indigenously developed vaccine for the prevention of cervical cancer (Sep 2022)

- **Details**
  - **Cervavac** has been developed by Serum Institute of India Private Limited and is an outcome of partnership of DBT and BIRAC with the Bill and Melinda Gates Foundation.
    - It is a quadrivalent Human Papilloma Virus (qHPV) vaccine meaning that it is effective against at least four variants of cancer causing HPV.
    - **Note:** Almost all cervical cancer cases are linked to certain strains of Human papillomavirus (HPV), a common virus hat is transmitted through sexual contact.
  - Department of Biotechnology and its Public Sector Undertaking, Biotechnology Industry Research Assistance Council (BIRAC) has completed all the stages scientific research on the quadrivalent Human Papilloma Virus (qHPV) vaccine in the making for the past decade.
    - Drug Controller General of India gave market authorization approval in July 2022.
  - **Science behind Cervavac:**
    - This vaccine introduces **VLP** (virus like particles) to stimulate an immune response from the body resulting in production of anti-bodies.
  - Vaccine would be launched once an adequate quantum of doses is manufactured and ready for distribution.
  - It will be administered with a two dose schedule for girls in the age group of 9-14 and a three-dose schedule for girls and women in the age group of 15-26.

- **Why this vaccine was a priority for India?**
  - Cervical cancer ranks as the 2nd most prevalent cancer in India and accounts for nearly one-fourth of the world's cancer deaths despite being largely preventable.
  - Current estimates indicate that every year approximately 125,000 women are diagnosed with cervical cancer. Over 75K die from the disease in India.
  - **Foreign brands were also very expensive**: Until now, the HPV vaccines available in India were produced by foreign manufacturers at an approx. cost of Rs 2,000 to Rs 3,500 per dose. Cervavac is likely to be **significantly cheaper**, slated to cost approx. Rs 200 to 400.
  - **Other vaccines available in India:**
    - **Two vaccines** (which are globally licensed) are available in India.
      i. **Gardasil** (a quadrivalent vaccine marketed by Merck)
      ii. **Cervarix** (a bivalent vaccine, marketed by Glaxo Smith Kline)
    - Both these vaccines are produced from recombinant DNA technology that produces non-infectious **VLPs** (virus like particles) comprising of HPV L1 protein.

- These vaccines, though available for over a decade - are unaffordable for the vast majority of Indians.

9) DENGUE

- **Dengue fever,** also known as break bone fever, is a **mosquito borne tropical disease** caused by the dengue virus.
  - » **Dengue Virus (DENV)** in one of the five serotypes is the cause of Dengue fever. It is a mosquito borne single positive stranded RNA virus of the family **Flaviviridae; genus Flavivirus**.
  - » Dengue can affect anyone but tends to be more severe in people with compromised immune systems.
  - » **Dengue hemorrhagic Fever (DHF)** is a specific syndrome that tends to affect children under 10 years of age. It causes abdominal pain, hemorrhage (bleeding), and circulatory collapse (shock).
- **Possible to get dengue multiple times**
- **Symptoms**
  - » Severe joint and muscle pain, swollen lymph nodes, headache, fever, exhaustion, and rash. The presence of fever, rash, and headache (**the dengue "triad**") is characteristics of dengue fever.
- **Geographical Regions**
  - » Prevalent throughout the tropics and subtropics.
- **Transmission**
  - » The virus is contracted from the bite of a **striped Aedes aegypti** mosquito that has previously bitten an infected person. The virus is not contagious and cannot spread from person to person directly. There must be person to mosquito to another person pathway.
- **Treatment**
  - » **Symptomatic treatment)**
- **Prevention**
- **Vaccine:**
  - » Since there are around 5 serotypes of dengue virus known, vaccine making is difficult. It's because different vaccine is needed against each serotype.
  - » A vaccine against dengue, **DENGVAXIA**, from Sanofi Pasteur is approved in several countries and shows efficacies ranging from 42% to 78% against four serotypes of the virus.
  - » In **India**, Zydus Cadilla has been developing a DNA vaccine against dengue

10) ZIKA FEVER / ZIKA DISEASE

- **About Zika Virus**
  - » Zika virus (ZIKV) is a member of the Flaviviridae virus family and the Flavivirus genus, transmitted by daytime active Aedes mosquitoes, such as A. aegypti, A. Africanus, A. furcifer etc. Virus can also get transferred during sexual contacts, across the placenta (affecting unborn child). A mother already infected with Zika virus near the time of delivery can pass on virus to the newborn around the time of birth but this is rare.
  - » Zika virus is related to dengue, yellow fever, Japanese Encephalitis, and West Nile virus. The illness it causes is similar to mild form of dengue fever, is treated by rest, and cannot yet be prevented by drugs or vaccine.

- **Earliest discovery**
  - » Virus was first isolated in 1947 from a rhesus macaque monkey that had been placed in a cage in the Zika Forest of Uganda, near Lake Victoria, by the scientists of yellow fever research institute.

- **Spread among Humans:**

» For the first 60 years after detection, only **14 human cases** has been reported from Tropical Africa and Asia (including India in 1952-53).
» The **first ever outbreak (185 cases) of Zika** virus was reported in 2007 in the **island of Yap (**a federated state in **Micronesia**) in the **Pacific**.
» In 2015 to Mexico, Central America, the Caribbean, and South Africa, where the Zika outbreak has reached pandemic levels.
  ▪ The outbreak was associated with higher incidences of microcephaly as well as GB syndrome.

- **Symptoms and treatment**
  » Common symptoms include mild headaches, **maculopapular rash**, fever, joint pains etc.
    ▪ Thus far, Zika fever has been a relatively mild disease of limited scope, with only one in five persons developing symptoms, with no fatalities, but is true potential as a viral agent is unknown.
  » As of 2022, **no WHO approved vaccine or preventing drug is available**. Symptoms can be treated, with rest, fluids, and paracetamol, while aspirin and other non-steroidal anti-inflammatory drugs should be used only when dengue has been ruled out to reduce the risk of bleeding.

- **Zika's link with Microcephaly and GB Syndrome**
  » **Microcephaly** is a condition where a baby has a head size much smaller than other babies of the same age and sex. According to WHO this condition may be caused in newborn by mother to child Zika virus transmission.
  » **GBS (Guillain-Barre Syndrome)** is a rapid onset of muscle weakness as a result of damage to the peripheral nervous system. In a French Polynesian epidemic, 73 cases of GBS and other neurological conditions occurred in a population of 270,000, which may be complications of Zika virus.

11) JAPANESE ENCEPHALITIS

- It's a viral fever that affects the brain and is considered **extremely dangerous for children**, and it also has a high "mortality and morbidity rate".

- **About JE Virus**
  » Japanese Encephalitis virus (JEV) is a flavivirus belonging to same genus as dengue, yellow fever and west Nile viruses.
  » It is the main cause of viral encephalitis in many countries of Asia with an estimated 68,000 clinical cases every year.

- **Symptoms** of JE includes sudden onset of fever, vomiting, headache, neck stiffness, and seizures.

- **Transmissions**
  » The virus is maintained in a **cycle between mosquitoes and vertebrate hosts, primary pigs, and wading birds**. Humans are incidental or dead-end hosts because they don't develop high enough concentration of JE virus in their bloodstream to infect feeding mosquitoes.
    ▪ **So It is not transmitted from human to human**
  » JE virus transmission often occurs in primarily rural agricultural areas, often associated with rice production and flooding irrigation.
  » **Transmitted by** the bite of **Culex tritaeniorhynchus, and Culex vishnui mosquitoes.**

- **Management Control and Prevention**
  » **Vaccination**: Safe and effective JE vaccines are **available** to prevent disease. WHO recommends having strong JE prevention and control system.
    ▪ In the **mission Indradhanush** - JE vaccination was included in May 2016.

» **Controlling mosquitoes**
» **Pigs act as a carrier** for the virus - so it is also important to control mosquito population around the pig domestication areas
  - Animal husbandry department plays an important role here.

- **Treatment**
  » No specific treatments have been found to benefit patients with JE, but hospitalization for supportive care and close observation is generally required. Treatment is symptomatic.
    - Rest, fluids, and use of pain relievers and medication to reduce fever may relieve symptoms

12) ACUTE ENCEPHALITIS SYNDROME (AES)

- **What is AES?**
  » AES is a c**omplex syndrome that affects central nervous system**, mostly in children and young adults. It starts with fever, then hampers neurological functions causing mental disorientation, seizure, confusion, delirium, coma etc.
  » **Causes**:
    - It may be caused by **virus, bacteria, fungi, and a range of agents**. Japanese Encephalitis (JE) is the most common cause of AES in India. But the syndrome is also caused by scrub typhus, dengue, mumps, measles, even Nipah or Zika virus.

- **Relation between Hypoglycemia, children, and AES**
  » Some researchers have claimed that there is an increasing correlation between death due to AES and hypoglycaemia. So, **AES may affect undernourished children more**.

- **Any relation between Litchi and AES**
  » **More research** needs to be done in this aspect.
    - Some toxin/virus/bacteria found in Litchi **may** be responsible for AES.
    - Unripe fruit contains **toxins** hypoglycin A and methylenecycloprophyglycine (MCPG) which cause vomiting if ingested in large quantities
  » **Note:** AES is called "Chamki Bukhar" in Bihar

- **Prevention**
  » **Preventing Mosquito bite** -> keeping surrounding clean to prevent mosquito breeding, wearing full sleeve clothes etc.
  » **Drink plenty of water** and **ensuring proper nutrition** flushes out toxins which may be causing AES from the body.
  » **Properly washing fruits** before consuming them properly.

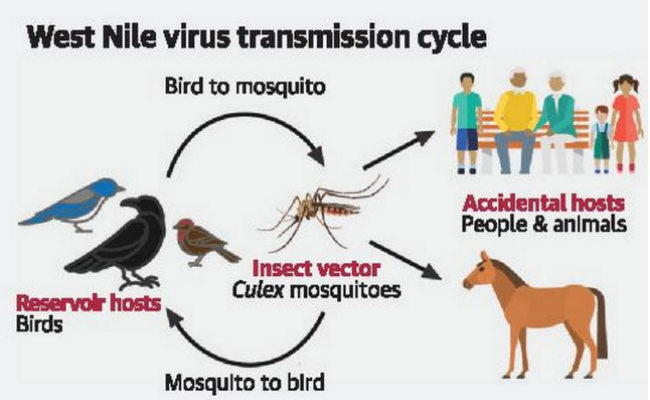
13) WEST NILE VIRUS

- **About the Virus**
  » It is a member of flavivirus genus and Flaviviridae family.
  » It was **first isolated** in a woman in the West Nile District of Uganda in 1937. It was also identified in birds (including crows) starting 1953 and have also been found to be pathogenic for them (birds).
  » The WNV Is commonly found in Africa, Europe, the Middle east, North America and West Asia.

- **Human Infection** is most often the result of bites from infected mosquitoes. Mosquitoes get infected by feeding on infected birds, which circulate the virus in their blood for a few days. It may also be transmitted through

contact with other infected animals, their bloods or other tissues. There are also reports about few transmissions through organ transplant, blood transfusion, mother to child etc.

- **Symptoms**
  - » **Asymptomatic** (80% of the cases)
  - » **West Nile Fever** (in 20% of infections) -> Fever, headache, tiredness, body aches, nausea, vomiting, skin rash etc.
  - » **Severe West Nile Disease** (also called neuro-invasive disease, west Nile encephalitis or meningitis, or West Nile Poliomyelitis) (less than 1% cases) -> Headache, severe fever, neck stiffness, stupor, coma, tremors, convulsions, and paralysis. People who are above 50 and under immuno-suppressants are under high risk



- **Vector and Animal Hosts**
  - » WNV is maintained in nature in a **mosquito bird mosquito transmission cycle**. Mosquitoes of the **genus Culex** are considered vectors of WNV, in particular **Cx. Pipiens**.
  - » **Birds are reservoir hosts** in Europe, Africa, Asia and Middle east. But in America, the WNV is highly pathogenic for birds.
  - » **Horses like humans are dead-end hosts** i.e. they get infected but don't spread the virus.

14) CHIKUNGUNYA

- **Basics about Chikungunya:**
  - » **Virus:** Chikungunya is a viral disease caused by an **RNA virus** that belongs to the **aphavirus genus** of the Togaviridae family.
  - » **Vector:** The virus is transmitted to humans through the bites of infected female mosquitoes, most commonly, **Aedes Aegypti and Aedes Albopictus**.
  - » **Symptoms:** Fever, severe joint pain, muscle pain, nausea, fatigue and rash.
  - » **Shares clinical signs with dengue** - They can be misdiagnosed with dengue.
  - » **Diagnosis**: **RT-PCR** (testing serum or plasma for detection of virus or viral nucleic acid)>
  - » **Treatment**: No cure available, treatment is mostly symptomatic.
  - » **People at risk**: People living in the proximity of mosquito breeding sites.
  - » **Prevention and Control -> Prevent Mosquitoes and Mosquito bites**
  - » **Less dangerous than dengue** -> rarely leads to fatalities. However, it does affect patients severely, leaving them with pain in the joints and swelling.

- **India and Chikungunya:**
  - » A team from ICMR - National Institute of Virology, Pune have concluded that India has become an endemic reservoir for the virus with persistent global transmission from the country.

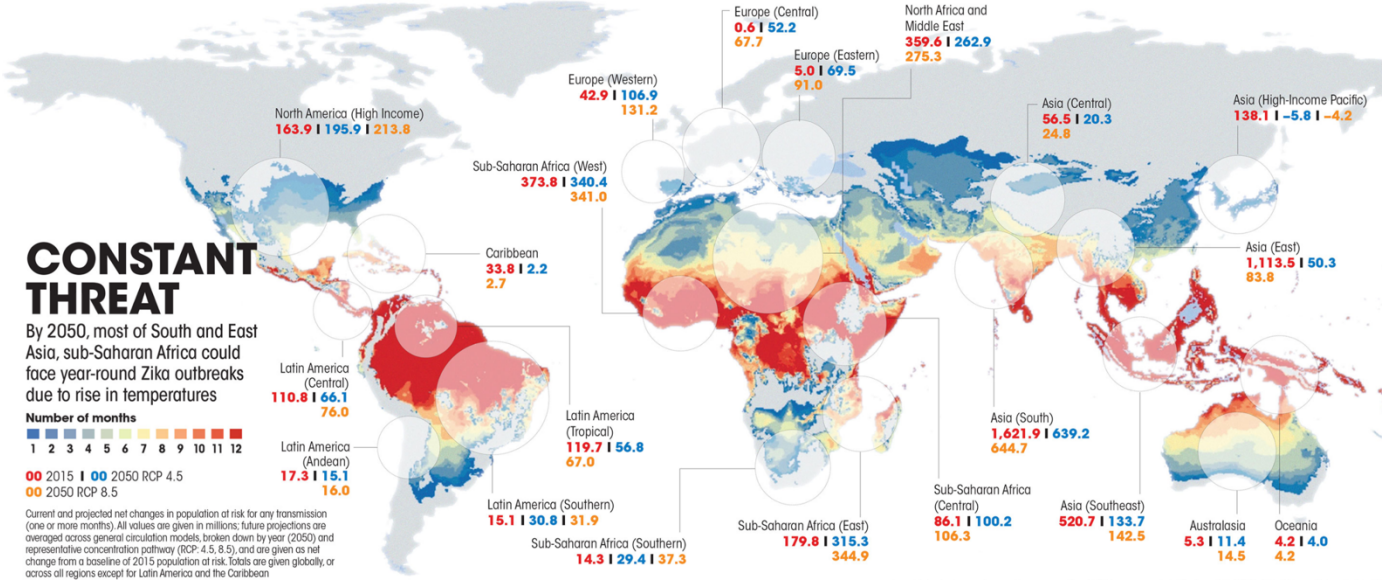
- **Vaccine Efforts:**
  - » **BBV87:**
    - o A multi-country Phase-II/III clinical trial of a vaccine led by the **International Vaccine Institute (IVI)** in partnership with Bharat Biotech International Ltd (BBIL) began in **Costa Rica** in Aug 2021.

- The vaccine is called **BBV87.** It is an **inactivated whole virion vaccine** based on a strain derived from an East, Central and South African genotype.

- **Vaccine: No**
- **Treatment:** Symptomatic
- **Prevention**
  - **Active animal health surveillance system** to detect new cases in birds and horses. (Vaccine for horses)
  - **Mosquito control**

15) MOSQUITOES ARE EMERGING AS BIG ISSUE

- **Details**
  - » ***Aedes Aegypti*** is native to sub-Saharan Africa, and in its native environment it lives in tree holes and small pools of water and bites non-human primates. These mosquitoes may have first moved to nearby human settlements during droughts when the tree holes dried up. During **trans-Atlantic slave trade**, the mosquitoes moved out of Africa. The first case of Yellow fever reported outside Africa in Yucatan, Central America in 1648.
  - » ***Aedes albopictus*** is native to tropical SE Asia, where it was originally a forest species that fed on wild animals. During 1980s it spread to islands in the Indian and Pacific Oceans and then during the 1980s extended its range across temperate regions in Europe, Africa and the Americas.
  - » A modelling study published in ***Nature Communications*** on May 1, 2020, shows that the **world became about 1.5% more suitable per decade** for the development of ***A aegypti*** during 1950-2000.
  - » **Another study showed that by 2050, 49% of the World's population** will live in places where *A aegypti and A albopictus* are present if greenhouse gas emissions continue at the current rates.



- **Climate change is increasing vector population:**
  - » Mosquitoes are now able to breed throughout the year.
  - » Breeding behaviours of mosquitoes have also changed over the years. Now, they can lay eggs in dirty waters too. There is evidence that Aedes mosquitoes can breed in brackish water too.
  - » Artificial lights have increased the feeding period of Aedes mosquitoes.

- **Other factors**
  - » *Aedes aegypti* has also developed resistance to common insecticide permethrin.

16) WORLD MOSQUITOE PROGRAM (WMP)

- **Intro**
  - » WMP is a not-for profit initiative that works to protect the global community from mosquito-borne diseases such as Zika, Dengue, Chikungunya.
  - » Pioneered by Australian researchers, the WMP **uses safe and natural bacteria called Wolbachia** to reduce the ability of mosquitoes to transmit these viruses.
  - » WMP was first launched in Australia in 2011 and has expanded rapidly since then.

- **About Wolbachia**
  - » Wolbachia is a natural bacteria present in upto 60% of insect species, including some mosquitoes. It is one of the most common parasitic microbes and is possibly the most common reproductive parasite in the biosphere.
  - » However, they are naturally not found in Aedes aegypti mosquito, the primary species responsible for transmitting human viruses such as Zika, Dengue, Chikungunya, and yellow fever.

- **WMP** research has shown that when introduced in Aedes aegypti mosquito, **Wolbachia can help reduce the transmission** of these virus in people. When introduced into this mosquito's cells, this parasite competes successfully against other parasites such as the viruses that cause dengue, chikungunya, yellow fever, Zika etc. Thus, it can be used to fight life-threatening diseases.
- **How is it introduced:**
  - » Aedes mosquitoes, infected with Wolbachia in lab, are released in localities where the disease is prevalent. These lab infected mosquitoes quickly spread the bacterium to native Aedes mosquitoes. Various studies have shown that eventually the dengue cases start to decline in this region.
    - In a study in Djakarta, the number of cases saw a decline of 77% in the number of cases and a decline of 86% in hospitalizations due to dengue.
  - » Video link: World Mosquito Program - Our Wolbachia method

17) KYASANUR FOREST DISEASE (KFD) / MONKEY FEVER

- **Why in news?**
  - » A case of KFD has been reported from the Panavally area in Wayanad district (Feb 2022)

- **Introduction**
  - » KFD is caused by KFDV, a member of virus family **Flaviviridae**. It was first identified in 1957 when it was isolated from a sick monkey in Kyasanur Forest in Karnataka state India.
  - » Since then, about 400-500 cases are reported every year from the state.
- **Reservoirs for Virus**
  - » **Hard Ticks** (Hemaphysalis spinigera) are the reservoir of the KFD virus and once infected, remain so for life.
  - » **Monkeys, shrews**, and **Rodents** are common hosts for KFDV after being bitten by an infected tick.
- **KFDV can cause epizootics** with high fatality in primates.
- **Transmission**
  - » Infected tick bite or contact with an infected animal (monkey, shrew etc). No person-to-person transmission has been known so far.

» Transmission from other infected animals like goats, cows etc is extremely rare.

- **Symptoms**
  - » Chills, fever, headache, muscle pain, low platelet, low RBCs and WBCS.
- **Treatment**
  - » No specific treatment -> hospitalization and support therapy like hydration and usual precautions is important.
- **Vaccine**: Yes
  - » Used in endemic areas of India.
- **Distribution**
  - » Historically limited to western and central district of Kar, India. However, some samples have also been found from Tamil Nadu and Kerala.

18) INFLUENZA

A) SWINE FLU

- **Swine Flu** is a respiratory disease caused by **influenza A viruses** that infects respiratory tract of pigs and result in barking cough, decreased appetite, nasal secretion, and restless behavior; the virus **can be transmitted to human.**

- **The first case** of influenza A H1N1 was reported in Mexico in **April 2009**. Since then, this infection has affected almost all the countries of the world.
  - » **The Virus**
    - Investigators decided to name it **H1N1** flu since it was mainly found infecting people and **exhibits two main surface antigens, H1 (hemagglutinin type 1**) **and N1 (neuraminidase type 1**). The eight RNA strands from novel H1N1 flu have one strand derived from human flu strains, two from avian (bird) strains, and 5 from swine strains.
    - Most common virus causing swine flu is H1N1 but the flu virus can sometimes also come from other subtypes such as **H1N2, H3N1, and H3N2**. Since 2017, H3N2 is becoming a dominant strain.
    - In general, all of the influenza A viruses have a structure similar to the H1N1 virus; each type has a somewhat different H or N structure.
  - » **Cross Species infections** (swine to humans, humans to swine) etc. have **mostly remained local and haven't caused national or worldwide infections** in either pig or humans.
  - » **Transmission**
    - Most common way for humans to catch swine flu is through **contact with an infected pig (**not through properly cooked pork)
    - Swine flu is transmitted from **person to person** by inhalation or ingestion of droplets containing virus from people sneezing or coughing**.**
  - **Symptoms**
    - **Similar to most influenza infections**: - fever, cough, nasal secretion, fatigue and headache.
  - **Prevention and cure**
    - **Vaccination** is the best way to prevent or reduce the chances of becoming infected with influenza virus
    - Two antiviral agents, **zanamivir (Relenza)** and **oseltamivir (Tamiflu),** have been reported to help prevent or reduce the effects of swine flu if taken within 48 hours of the onset of symptoms.

B) AVIAN INFLUENZA/ BIRD FLU

- **Intro**
  - » Bird flu (Avian Influenza) is caused by influenza A viruses, which have 18H subtypes and 11N subtypes.
    - Only viruses of the **H5 and H7 subtypes** are known to cause the highly pathogenic form of the bird diseases.
      - Most avian influenza virus don't infect humans; however, some such as A(H5N1) and A(H7N9), have caused serious infections in people.
    - Recently, China reported that **H10N3** has also infected humans.

- **There are several subtypes of Avian Influenza**
  - » **H5N1** is the most common virus causing bird flu, or avian influenza. It is largely restricted to birds, and often fatal **(high pathogenicity)** to them, it can cross over to other animals, as well as human.
    - According to WHO, the H5N1 was first discovered in humans in 1997 and has killed almost 60% of those infected. Though, it is not known to transmit easily among humans, the risk remains.
    - Since Jan 2021, **H5N8 and H5N1** strain have been reported in India in birds.
  - » **A-H7N9**: It was reported in China in 2013. An outbreak of H7N9 strain killed around 300 people in 2016 and 2017.

- **H10N3** (one human infection reported in China) is a rare strain of virus that normally infects poultry. The virus has low pathogenesis among birds, implying that the virus didn't spread easily among poultry and was likely to be restricted to limited populations.

- **Typical Symptoms of an avian influenza:**
  - » Mild Upper Respiratory Tract Infection (fever, sore throat), red eyes, etc.
  - » Early sputum production and rapid progression to severe pneumonia, sepsis with shock, acute respiratory distress syndrome, and even death.

19) AFRICAN SWINE FEVER (ASF)

- **Why in news?**
  - » In Manipur, ASF was reported for the first time in Dec 2020 and there have been no cases since then. But the state is still not sure how the disease broke out there. Illegal imports of pigs might have been the reason. (July 2021, DTE)

- **About African Swine Fever:**
  - » African Swine fever (ASF) is a contagious viral disease affecting both domestic and wild pigs. It spreads rapidly through contact with infected animals or contact with contaminated pens, trucks, clothing, feed etc.
  - » The disease was first reported in Kenya in 1921.
  - » **Vaccine**: No. Unlike classical swine fever, there is no vaccine for ASF yet. Culling is the only means to curb an outbreak.
  - » **Does it affect humans**: No, ASF only affects domestic and wild pigs.

20) CRIMEAN CONGO HEMORRHAGIC FEVER (CCHF)

- **Why in news?**
  - » **Asian-West African strain of Congo fever** in humans found in Gujarat (Sep 2021)
    - Of the 34 cases recorded in 2019 in Gujarat - a majority of it from Bhavnagar and Surendranagar, 17 died, pegging the case fatality rate at 50%, which is higher than the WHO defined CFR of upto 40%.

- **Introduction**
  - » CCHF is a widespread disease caused by a tick-borne virus (**Nairovirus**) of the Bunyaviridae family. The CCHF virus causes severe viral hemorrhagic fever outbreaks, with a case **fatality rate of 10-40%**.
  - » **Transmission**: The virus is primarily **transmitted to people from ticks and livestock animals**. **Humans to human transmission** can occur resulting from close contact with the blood, secretions, organs, or other bodily fluids of infected persons.
  - » CCHF is endemic in Africa, the Balkans, the Middle east, and Asia, in countries south of 50th parallel north.
  - » **Vaccination -** No vaccination available yet for people or animals.

- **Asian-West African variant** of CCHF in humans was recorded for the first time in India in a recent study of 34 cases in Gujarat reported in 2019.
  - » Genomic sequence reported from Indian samples so far belonged to Asian lineages.

21) NIPAH

- **Why in news**?
  - » After a gap of over 3 years, a case of Zoonotic Nipah virus infection was reported in Kozhikode district of Kerala, with the death of a 12-year-old boy from Pazhoor, near Chathmangalam, at a private hospital (Sep 2021)
    - Kerala government has confirmed that the boy got infected by eating fruits bitten by flying foxes.

- **Introduction**
  - » According to WHO Nipah Virus (NiV) infection is a **newly emerging zoonosis** (a disease that can be transmitted from animals to humans) that can infect both humans and animals.
    - It is classified as a **"highly pathogenic paramyxovirus"** and handling it requires the highest grade of facilities called **BS-4**.
  - » The natural host of the virus are **fruit bats** of the Pteropodidae family, Pteropus genus. Humans are generally infected by fruit bat or pigs. Human to human transmission is also known including in the hospital setting.

- **First identification**
  - » First identified during the outbreak of disease that took place in **Kampung Sungai Nipah**, Malaysia in 1998. In this case pigs were intermediate hosts. Since, then there have been several outbreaks even without intermediate hosts.
  - » In India it was first detected in Siliguri in 2001 and Nadia in 2007. This was a spillover of the outbreak in Bangladesh.
  - » Later in 2018, 19 and again in 2021 it appeared in Kerala.

- **Symptoms** of NiV can be **neurological, respiratory, and pulmonary**. They include:
  i. **Inflammation of the brain**
  ii. Confusion, disorientation, and even persistent drowsiness
  iii. Headache, fever, nausea, and dizziness (flu like symptoms)

- **Fatality:** Around **40-70% depending on the local capability** for epidemiological surveillance and clinical management.

- **Prevention** (Avoid date palm sap; Avoid close contact with NiV Patient; avoid direct contact with pigs/bats in endemic area)

- **Treatment / Vaccine**
  - **Intensive Support care (no treatment or vaccine is available)**
  - According to NCDC (National Centre for Disease Control), **Ribavirin,** an antiviral, may have a role in reducing mortality among patients with encephalitis caused by NIPAH virus disease

A) WHY ZOONOTIC DISEASES ARE INFECTING HUMANS MORE AND MORE

- **Introduction**
  - According to WHO, more than 300 zoonotic diseases have been observed over the past 70 years. It constitutes about 60% of all human diseases and 75% of all the Emerging Infectious diseases. The last decade has been worst and have caught the humans unprepared. Some recent examples are that of Ebola, Zika, Nipah, Kyasanur Forest disease etc.

- **Why increase in zoonotic diseases?**
  - **Dramatic increase in population and mobility ->** Environmental changes, Deforestation etc. -> increase human contact with pathogens.
  - **Increased demand for animal protein**
    - Livestock production is moving closer to towns in the form of poultry farms etc.
  - **Rise in intense and unsustainable farming**
  - **Increased use and exploitation of wildlife**
  - **Unsustainable utilization of natural resources**
  - **Many Indian villages are located within or around forests**
    - Thus, significant number of people interact with forests in their day-to-day lives
  - **Global Warming**
    - Increases the population of insects like ticks that harbour and transfer the virus
  - **Poor Preparation in terms of infra and human resource**
    - Zoonotic diseases become more problematic in countries where health infrastructure is poor (e.g. Ebola in Africa, Zika in South America, Nipah in Asia etc.)
  - **Lack of awareness** especially in rural areas also

22) HEPATITIS

- **About Hepatitis**
  - Hepatitis refers to **inflammatory condition of liver**. It's commonly caused by **viral infections**, but there can be **other causes too** (e.g., auto-immune hepatitis that occurs as a secondary result of medication, drugs, toxins etc.)

- **5 Types of Viral Hepatitis**
  - Hepatitis A, B, C, D, and E.

- A different virus is responsible for each of these types.

» **Hepatitis A** by Hepatitis A Virus (HAV)
  - Transmitted by consuming food or water contaminated by faeces from a person infected with hepatitis A.
» **Hepatitis B** (HBV) is transmitted through contact with infectious body fluids, such as **blood, vaginal secretion, semen** etc.
» **Hepatitis C** (HCV) is transmitted through direct contact with infected blood fluids typically through injection drug use and sexual contact.
  - Injecting drug use is a major contributor to the number of people newly infected with Hepatitis C globally.

» **Hepatitis D** (HDV), also called Delta Hepatitis is transmitted through direct contact with infected blood.
» **Hepatitis E** (HEV), is mostly found in areas with poor sanitation and typically results from injecting fecal matter that contaminates the water supply.

- **Hepatitis B and C** are responsible for more than 96% of cases.
  » Vaccine for Hepatitis B is available
  » Vaccine for Hepatitis C is not available

- **National Viral Hepatitis Control Program** (launched in July 2018)
  » By MoH&FW
  » It is aimed at **eliminating the deadly condition by 2030**.
  » It has been launched in collaboration with WHO.
  » Under the program, government will be providing **free drugs and diagnosis** for Hepatitis **B and C**.
  » **Key strategies under the program include** - Preventive and promotive intervention through awareness generation; safe injection practices; sanitation and hygiene; safe drinking water; infection control and immunization; collaboration and coordination among different ministries; access to testing and management; building capacities at district, state, and national levels.

- **World Hepatitis Day - 28th July**
  » Aims at raising awareness of hepatitis (A,B,C,D,E) and encourage prevention, diagnosis and treatment.
  » World Hepatitis Day is one of the 8 global public health campaigns marked by WHO, along with World Health Day (7th April), World Blood Donor Day (14th June), World Immunization Week (last week of April), World Tuberculosis Day (24th March), World No tobacco day (31st May), World Malaria Day (25th April), and World Aids Day (1st December)

23) LASSA FEVER

- **Why in news?**
  » The Lassa fever has claimed 3 lives in UK, and the country's health officials have said that it has "Pandemic Potential". (Feb 2022)

- **About Lassa Fever**
  » Lassa fever is an animal borne (zoonotic), viral hemorrhagic fever caused by **Lassa Virus** (a member of **arenavirus family** of viruses). It causes **damages to organs and ruptures of blood vessels**.
  » The illness was first discovered in 1969 and is named after a **town in Nigeria** where the first case occurred.
  » It is common in **West Africa**. An estimated 1,00,000 to 3,00,000 infections of Lassa fever occur annually, with approximate 5,000 deaths.

» **Reservoir (host)** of Lassa virus is a rodent known as the "**multimammate rat**". Once infected, this rodent is able to excrete virus in urine for an extended time period, maybe for the rest of the life.
» **Transmission to humans**
  - Household items **infected with rodent urine or fecal material**.
  - **Human to human transmission** is also possible through direct contact with blood, urine fecal material or other bodily secretion.
» The fever may be **fatal** and death may occur within 14 days of the onset of fatal case.
» **Symptoms:**
  - 80% people who become infected with Lassa virus have no symptoms.
  - **Fever, chest pain, nausea etc.**
  - **Deafness** may occur in 25% of the patients who survive the disease. Hearing can return partially in half of the cases.

- **Vaccines: No**
- **Treatment:** Anti-viral drugs like **ribavirin** have been found to be effective.

24) NOROVIRUS

- **Norovirus:**
  » Norovirus is thought to be the **most common cause of acute gastroenteritis** (diarrhea and vomiting illness) around the world. It spreads easily through food and drink and can have a big impact on people's health.
  » Noroviruses also are **sometimes called food poisoning** because they can be transmitted through contaminated food. They aren't always the result of food contamination.

  » **Transmission of Norovirus:**
    - Having direct contact with an infected person.
    - Consuming contaminated food or water or touching contaminated surface.

  » **Symptoms:** Diarrhea, Vomiting, Nausea, and Stomach Pain.

  » **Prevention:**
    - **General Hygiene:** Regular hand wash; rinse fruits and vegetables etc.

  » **Treatment**: Not available - generally goes away on its own within 1 to 3 days.

6. NON- VIRAL DISEASES

1) MALARIA

- **Causes:** Malaria is caused by a parasite called **Plasmodium vivax,** which is transmitted via the bites of infected mosquitoes. In the human body, the parasite multiply in liver, and then infect the red blood cells.
  » **Mosquitoes** inject **sporozoite (Spore-like) stage** of the parasite into the skin when they bite, and the sporozoites travel to the liver.

- **Symptoms** include fever, headache, and vomiting, and usually appear between 10-15 days after the mosquito bite.

» If not treated, malaria can quickly become life threatening by disrupting the blood supply to various organs.

- **Key Interventions** to control malaria include
  - » Prompt and effective treatment with **artemisinin-based combination therapies**
  - » **Reducing Mosquitoes** and Mosquito bites (**female Anopheles Mosquito** (e.g., A. gambiae, A. culicifacies, A. fluviatilis etc.)

A) DEVELOPMENT OF DRUG RESISTANCE:

- » A study from Uganda have found that Plasmodium falciparum (the parasite causing malaria) has developed resistance to the primary drug used to treat the disease i.e., Artemisinin and artemisinin-based combinations.
- » The study has found that in 20% of the blood samples (between 2015 and 2019), the parasite has shown genetic mutations.
- » Resistance was earlier shown in Asia, but experts are more worried about the development of resistance in Africa as it has 90% of the world's Malaria cases.

B) VACCINATION:

RTS,S

The WHO is **recommending widespread use** of the **RTS,S/AS01(RTS,S) malaria vaccin**e (Commercial name: **Mosquirix**) among children in **sub-Saharan Africa** and in other regions with moderate to high ***P. falciparum*** malaria transmission. (Oct 2021)

- The recommendation is based on results from an ongoing pilot program in Ghana, Kenya, and Malawi that has reached 8 lakh children since 2019.
- The vaccination has shown a efficiency of over 50% in the first year, but dropping as time progresses.

- **RTS,S** has been developed by PATH Malaria Vaccine Initiative (MVI) and GlaxoSmithKline (GSK) with support from Bill and Melinda Gates foundation.
  - » It is a **recombinant vaccine**. It consists of the P.*falciparum circumsporozoite* protein (CSP) from the pre-erythrocytic stage (i.e. the CSP is secreted at the sporozoite stage of this plasmodium). The CSP antigen causes the production of antibodies capable of preventing the invasion of hepatocytes and additionally elicits a cellular response enabling the destruction of infected hepatocytes.
  - » **Note:** Mosquito bites transfer the CSP and **sporozites** into the human bloodstream, and the CSP nudges the parasite towards the liver, where it enters liver cells, matures and proliferates. The release of **mature merozites** marks the onset of the symptoms of malaria

R21 MALARIA VACCINE

- Researchers from the University of Oxford and their partners have reported findings from a Phase-IIb trial candidate malaria vaccine, **R21/Matrix-M**, which demonstrated **high-level efficacy of 77% over 12 months follow-up**. (April 2021)
  - This is the first Malaria vaccine to reach the WHO's Malaria Vaccine Tech roadmap of a vaccine with at least 75% efficacy.
- R21 is a modified form of a vaccine called RTS,S or Mosquirix that has already been deployed in an ongoing study in hundreds of thousands of Children in Malawi, Kenya and Ghana. RTS,S is about 56% effective over one year and 36% effective over four years.

- R21 is designed to be both more potent and cheaper to produce than Mosquirix. The trial of R21 was done in Nanora, Burkina Faso.
    - **Note1:** R21 and Mosquirix both target the malaria parasite in the sporozoite phase of its life cycle - the phase in which it enters the human body from its mosquitoe host. The vaccines include a protein (Circumsporozoite Protein (CSP)) secreted by the parasite at that stage, in the hope of stimulating an antibody response against it. R21 includes a higher concentration of these proteins.
    - **Note2:** Each of the vaccine is administered with a chemical called an adjuvant, which boosts immune responses to the inoculation. But the Adjuvant used with R21 is easier to make than that used with Mosquirix, raising hopes that it cold be cheaper as well.

- **Why slow Progress in Malaria vaccine?**
    - One issue is that of **low investment** as the disease mostly affects low- and middle-income countries.
    - Another issue is that the **malaria parasite (*Plasmodium spp.)*** itself, which has a complex life cycle and the ability to mutate key proteins, generating fresh strains.

2) IMPORTANT INTERNATIONAL INITIATIVES RELATED TO MALARIA

A) E-2025 INITIATIVE

- Under this initiative WHO has identified 25 countries, including 3 from Africa, with the **potential to eradicate malaria by 2025**.
    - » The WHO will provide specialized support and technical guidance to these countries under the initiative.

- The initiative is built on the foundation of the E-2020 initiative. The **countries were identified by WHO across four key criterias**:

    1. The generation of government endorsed elimination plan
    2. Meeting a defined threshold of Malaria case reductions in recent years
    3. A designated government agency for Malaria elimination and the capacity to confirm 100% of suspected malaria cases in a laboratory
    4. Selected by the Malaria Elimination Oversight Committee

- **Countries selected for the E-2025 initiative:**

Automatically Nominated	**Newly Added**
1- Mexico 2- Costa Rica 3- Ecuador 4- Suriname 5- Belize 6- Cabo Verde 7- Saudi Arabia 8- Islamic Republic of Iran	1- Panama 2- Vanuatu 3- Honduras

9- Nepal 10- Bhutan 11- Republic of Korea 12- Malaysia 13- Comoros 14- Bostwana 15- Eswatini 16- South Africa 17- Timor-Leste	4- Thailand 5- Guatemala 6- Dominican Republic 7- Sao Tome And Principe 8- Democratic People's Republic of Korea

I) CHINA CERTIFIED MALARIA FREE AFTER 70 YEARS OF FLIGHT: WHO (JUNE 2021)

- **Background:** China reported 30 million cases of the infectious disease annually in the 1940s but has now gone four consecutive years without an indigenous case.
- **What is the requirement for applying for WHO's Malaria free status?**
  - » At least 3 consecutive years of zero indigenous cases. The country must also present rigorous evidence - and demonstrate the capacity to prevent transmission re-emergence.
- **China** has become the **40th territory to be certified Malaria free**. The other recent countries to get Malaria free status include - El Salvador (2021), Algeria and Argentina (2019), and Paraguay and Uzbekistan (2018).
  - » China is also the first country in WHO's Western Pacific region to be awarded a malaria-free certification in more than three decades. The only others with certified status are Australia (1981), Singapore (1982) and Brunei (1987).
- **How was China able to achieve this?**
  - » In 1967, China launched a scientific program to find new malaria treatments, which led to the discovery in the 1970s of artemisinin - the core compound of artemisinin - based combination therapies (ACTs), which are the most effective anti-malarial drugs available.
  - » In 1980s, China was among the first countries to test the use of insecticide-treated nets to prevent Malaria and millions of nets were distributed later.

C) WORLD MALARIA REPORT, 2021 (RELEASED IN DEC 2021)

- Published by WHO
- **Key Highlights**
  - » **Global efforts to tackle malaria suffered** due to the novel coronavirus disease (COVID-19) in 2020.
  - » If immediate steps are not taken, the world is in danger of seeing an immediate resurgence of the disease, particularly in Africa.
  - » **Total Deaths**: 6,27,000 (12% higher than 2019), an increase in 12% over 2019. (68% of the increase were linked to disruptions in the provision of malaria prevention, diagnosis and treatment during the COVID-19 pandemic).
  - » **Total Cases**: 241 million malaria cases in 2020 (an increase from 227 million in 2019)
  - » The **WHO African Region**, with an estimated 228 million malaria cases in 2020, accounted for about **95% of cases**.
    - **Six countries** (Nigeria (27%), the DRC (12%), Uganda (5%), Mozambique (4%), Angola (3.4%) and Burkina Faso (3.4%) - accounted for about 55% of all cases globally.
  - » **In South-East Asia Region,** India accounted for 83% of cases. SriLanka was declared malaria free in 2016 and would remain so.

- The good news is that India contributed to the largest drop in cases in the WHO's South East Asia region.

» **Crucial milestones of the WHO Global Technical Strategy for Malaria 2016-2030** have been missed in 2020.

- The 2030 targets will not be met without immediate attention.

D) GLOBAL TECHNICAL STRATEGY FOR MALARIA 2016-2030: WHO

- Aimed at dramatically lowering the global malaria burden over the 15-year period.

E) MALARIA SITUATION IN INDIA

- As per the World Malaria report, India contributed 1.7% of malaria cases and 1.2% of the global deaths.

F) MAJOR NATIONAL INITIATIVES

- **National Framework for Malaria Elimination** (2016-2030)
  - Released by MoH&FW and aims to make India Malaria free by 2030.

3) KALA AZAR (VISCERAL LEISHMANIASIS, BLACK FEVER, AND DUMDUM FEVER)

- **Why in news?**
  - » India's Kala Azar cases declined 98.7% since 2007: Health ministry (Jan 2023)
    - Around 99.8% blocks in India have achieved elimination status.
  - » For the first time in 8 years, Jharkhand reported a death due to Kala Azar in the state, even as the total cases continue to decline (Feb 2022)

- **As per WHO**, there are three main forms of Leishmaniases of which Kala-azar is the most serious form.

- **Basics of Kala Azar (Black Fever)**
  - **Parasite:** Protozoan parasite called '**leishmania donovani**'. (Genus: Leishmania)
  - **Vector:** female Sand fly.
    - » The parasite is spread to humans by bites from infected female sand flies.
  - **Second largest parasite killer** in the world (after malaria)
  - It is one of the most neglected Tropical Diseases (NTD).
  - The parasite migrates to the internal organs such as liver, spleen (hence visceral), and bone marrow, and, if **left untreated, will almost always result in the death** of the host.
  - **Other factors:**
    - » The disease affects some of the poorest people in the world and is linked to malnutrition, population displacement, poor housing, a weak immune system and a lack of financial resources.
    - » It is also linked to environmental changes such as deforestation etc.
  - **Symptoms**: Irregular fever, weight loss, anaemia, and swelling of the spleen and liver.
  - **Only infects humans** (no other animal known to harbour the infection in Asia), and **humans are considered the only reservoir of the parasite**.
  - **Treatment:** Anti-leishmanial medicines are available for treatment. Vector control is another aspect.

- **Cases of Visceral Leishmaniasis or Kala Azar in India (Jan 2023)**
    - **Kala Azar** cases in India fell to 834 in 2022 from 44,533 in 2007 - a 98.7% decline: Union health Ministry.
        - As many as 632 endemic blocks (99.8%) spread across Bihar, Uttar Pradesh, Jharkhand and West Bengal have received elimination status (less than one case per 10,000).
        - **Only 1 block** (Littipara) of Pakur district, Jharkhand is in the endemic category (1.23 cases / 10,000 population)
        - Currently, more than 90% of the Kala Azar cases are contributed by Bihar and Jharkhand.
            - UP (2019) and West Bengal (2017) have achieved their elimination targets at block levels.
        - As per the Union Health Ministry, India is committed to eliminating Kala-Azar or Black Fever from the country by 2023.
    - India contributes to 11.5% of total cases reported globally.
    - 89% of the cases were reported from eight countries - Brazil, Eritrea, Ethiopia, India, Kenya, Somalia, South Sudan and Sudan.

- **National Kala Azar Elimination Program (NKEP)**
    - Though the initial 2015 deadline has been missed, the numbers have been brought down significantly.
    - **Key steps taken:**
        - **Expansion of vector control interventions**:
            - In endemic villages that have reported cases of Kala Azar over the past 3 years, 2 rounds of indoor residual spraying are being applied.
            - Since sandflies have developed resistance to DDT, the NVBDCP introduced a synthetic pyrethroid for indoor residual spraying in 2015.
    - **Note:**
        - Since 2003, National Vector Borne Disease Control Programme (NVBDCP) is in charge of coordinating with endemic states to eliminate disease.
            - NVBDCP now funds consultants at state and district level and Kala-Azar Technical Supervisors (KTS) at the State's blocks (or clusters of village panchayats) to conduct surveillance.

- **International efforts to control Kala Azar**
    - An initiative was launched by **WHO** to eliminate VL as a public health problem from SE **Asia region by 2020.** The deadline has now been extended to 2023.

POST KALA-AZAR DERMAL LEISHMANIASIS (PKDL)

» It is a complication of Kala-Azar, in which the disease-causing protozoan invades the patient's skin cells. These cases act as reservoirs of the pathogens.

» **PKDL treatment is a bigger problem**
    - **Diagnostic is difficult**
        - PKDL cannot be diagnosed by the trademark rapid diagnostic kits. So, a skin snip examination is required. But not all PHCs are equipped with such tools.

» **Longer dose and greater quantity of drugs**
    - PKDL requires a longer dose and greater quantity of drugs then primary Kala Azar.

» **Why treating PKDL is important?**
    - It is not life threatening but can act as a source for Kala Azar infection to others.

A) OTHER TWO FORM OF LEISHMANIASIS

CUTANEOUS LEISHMANIASIS (CL)

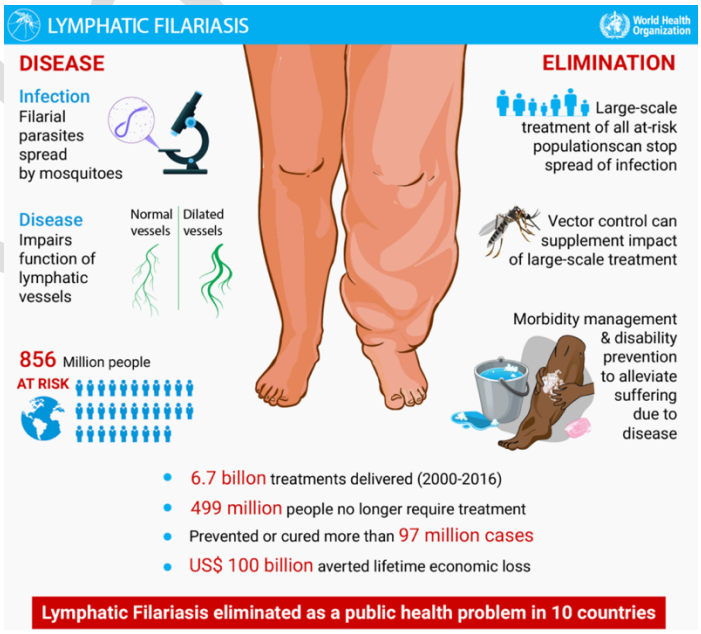
- It is the most common form of leishmaniasis.
- It is caused by 15 different species of the protozoan parasite *Leishmania*, transmitted by infected female sandflies.
- They are not life threatening, but can cause skin lesions, mainly ulcers, on exposed parts of the body, leaving life-long scars and serious disability or stigma.
    - About 95% of CL cases occur in the Americas, the Mediterranean basin, the Middle East and Central Asia.

MUCOCUTANEOUS LEISHMANIASIS

It leads to partial or destruction of mucous membranes of the nose, mouth, and throat. More than 90% of the cases come from Bolivia, Brazil, Peru, and Ethiopia.

4) FILARIASIS

- **Basics:**
    - It is a parasitic disease caused by infection with r**oundworm**s of the **Filarioidea** type.
    - **Lymphatic Filariasis** impairs the lymphatic system and can lead to the **abnormal enlargement of the body parts,** causing pain, severe disability, and social stigma. It is also known as **elephantiasis** and is a Neglected Tropical Disease.
- **Vectors: Mosquitoes** are infected with micro-filariae (immature larvae) when biting an infected host. This larva matures in the mosquitoe and when the mosquitoes bite people, people are infected with mature parasite larvae. The larvae then migrate into lymphatic vessels where they develop into adult worms.
    - It may be transmitted by different types of mosquitoes including the **Culex Mosquito**.



- The disease is prevalent in more than 50 countries.

5) NEUROCYSTICERCOSIS

- **Details**
    - Neurocysticercosis (NCC) is caused when a human consumes meat from (or is indirectly in contact with) - a **pig** infected with **tapeworm**.
        - The eggs of tapeworms invade muscles of the human body to make cysts. Sometimes these cysts get into human brains, triggering epileptic seizures, headaches, difficulty with balance and excess fluid around the brain.

» A study published in the ***Nature journal*** in 2021 reported higher prevalence (42.2%) of NCC among patients with active epilepsy in the tea gardens of Assam. These findings were in sync with the older findings that NCC was one of the leading causes of seizures in developing countries, particularly in areas without proper sanitation and where pig rearing was widespread.

» **Why pig rearing is common among Assam Tea Garden workers?**
  - Supplementation of meagre income by tea garden workers.
  - Unhygienic condition in which pigs are raised
  - Pork is a staple food in NE India. It accounts for 68.75% of pork consumed in India.

» **How the disease spreads?**
  - The **life cycle of a pork tapeworm (*taenia solium)*** takes it from pigs to humans and vice-versa.
    - Tapeworm eggs are spread through food, water, or surfaces contaminated with faeces.
      - Humans swallow the eggs when they eat contaminated food or put contaminated fingers in their mouth.
      - Consumption of infected, undercooked pork which are infected with taenia metacestodes (the larval stage of tapeworm) that develop into adult tapeworm in their intestines (taeniasis).
      - Adult tapeworm are released in person's stool. During open defecation, the eggs can get lodged in nails and end up in humans. Those hands can contaminate food that others ate. So, a person who has never eaten a pork may also get infected.

  - **Note:** Those with NCC can't spread the disease to other. People with taeniasis (tapeworm infection in the intestine) may spread tapeworm eggs to other people if they don't practice good hygiene.
    - On reaching brain, the infection turns NCC causing seizures.

6) TUBERCULOSIS

- **Introduction**
  » TB is an infectious **bacterial disease** caused by bacillus Mycobacterium tuberculosis, which most commonly affects the lungs (pulmonary TB) but can affect other sites as well (extra pulmonary TB)

- **Symptoms:**
  » Healthy people -> often no symptoms (immune system wall off the bacteria)
  » **Symptoms** of **active TB of the lung** include coughing (sometimes with sputum or blood), chest pains, weakness, weight loss, fever, night sweats etc.

- **Diagnosis**
  » **Sputum Smear Microscopy** - used since more than 100 years
  » **Rapid Molecular Test** - developed recently - uses polymerase chain reaction (**PCR**)
  » **Culture Methods** - needs developed laboratory capacity.

- **Treatment**
  » The effective drug treatments were **first developed in the 1940s**.
    - The most effective first-line anti-TB drug, **rifampicin,** became available in the 1960s.

- The currently recommended treatment for new cases of drug-susceptible TB is a **six month regimen of four first line drugs**: **rifampicin, isoniazid, ethambutol and pyrazinamide.** Treatment success rates of 85% or more for new cases are regularly reported to WHO by its member states.

» Additionally**, social determinants** of TB such as under-nutrition, overcrowding and poor ventilation in slums and **clinical risk factors** such as diabetes mellitus, smoking etc. should be addressed simultaneously.

- Treatment for **Multi drug resistant TB (MDR-TB),** defined as **resistance to isoniazid, rifampicin** (the two most powerful anti TB drugs) is longer, and requires more expensive and more toxic drugs. For most patients with MDR-TB, the current regimens recommended by WHO last 20 months, and treatment success rates are much lower.

- **Vaccine**
  - » Not yet (BCG is not effective in tropical countries)

- **Steps Taken**
  i. **For Detection**
     - **National Policy of Mandatory Reporting** of detected cases since 2012
     - Launch of **Nikshay Platform** - a nation wide web-based and case-based reporting system that facilitates reporting of detected cases by care providers in public and private hospitals.

  ii. **National Strategic Plan for Tuberculosis Elimination (2017-2025)**
     - **Goal**
       - » Achieving rapid decline in the burden of TB, morbidity and mortality while working towards elimination of TB by 2025
     - **100% case finding by 2020**
     - **Elimination of TB 2025** (< 1 per 1,00,000 population)

- **Updated MDR-TB Recommendations from WHO** (Aug 2018)
  - **Replace all injectable with oral regime** for MDR-TB patients
    - Injectables have been found to be less effective
  - **Prioritize newer drugs** like **Bedaquiline** in the fully oral regime.
    - Data has shown that newer drugs show greater success in treatment and lower mortality rate.

- **24 March: World Tuberculosis Day**

- **New Vaccines and Medicines**
  i. New BCG based TB vaccine, VPM1002 has shown promise in animal and small-scale human trials. It is to be supplied by Pune based Serum Institute of India.
  ii. **Bedaquiline** - a new drug for drug resistant TB - launched by Union Health Ministry on 24th March 2016 (Worth TB Day)

G) WHO'S GLOBAL TB REPORT

7) LEPROSY

- **Introduction**
  - » Leprosy, also known as Hansen's disease, is a chronic infectious disease caused by ***Mycobacterium leprae***. It is one of the oldest diseases known to humans and despite advances in all spheres of medical science, continues to be a public health challenge in India.
  - » The disease mainly affects the skin, the peripheral nerves, mucosal surfaces of the upper respiratory tract and the eyes. The deadening of hands and feet leaves patients prone to kinds of disabling injuries that have become stigmatizing symbol of leprosy.
  - » Leprosy is known to occur at **all ages** ranging from early infancy to very old age. Leprosy is a leading cause of permanent physical disability.
  - » It is included under the list of Neglected Tropical Diseases of WHO.
  - » India, Indonesia and Brazil constitute around 81% of the cases with India contributing to more than 50% of the cases.
- **Transmission**
  - » The exact mechanism of transmission of leprosy is not known.
  - » Till recently, most widely held belief was that the disease was transmitted by **contact** between cases of leprosy and healthy persons.
  - » More recently, possibility of transmission by **respiratory route** is gaining ground. There are other possibilities like transmission through insects which can't be ruled out.
- **Treatment**
  - » Leprosy is **curable** with combination of drugs known as **multidrug therapy (MDT)**, as the treatment of leprosy with only one anti leprosy drug will result in development of drug resistance to that drug.
  - » Treatment, before nerve damage occurs, is the most effective way of preventing disability due to leprosy.

- **Leprosy Situation in India**
  - India, currently accounts for 60% of the total new leprosy cases in the world. Though, technically, WHO declared India leprosy free in 2005(<1 case per 10,000 population), the disease is still widespread in the region where poverty and stigma have kept patients hidden and untreated.
    - **Bihar, Jharkhand, Odisha, West Bengal, Madhya Pradesh, Chhattisgarh, Odisha and Maharashtra** account for 76% of the new leprosy cases.
  - Further, another worrying trend is that Leprosy is **impacting the marginalized population** more. For e.g. an analysis by ORF indicates that Adivasis account for 18.8% of India's new cases and this percentage has been increasing over the last decade.

- **Steps taken by India towards eradicating Leprosy:**
  - **a. National Leprosy Eradication Program (NLEP)**, running since 1983 - a centrally sponsered health scheme of MoH&FW, GoI.
    - NLEP is aimed at eradicating the disease from the country. India was able to eliminate leprosy (bring the number of cases to less than 1 per 10,000 population) by 2005, but complete eradication has not taken place yet.
  - **b. Sparsh Leprosy Awareness Campaign (SLAC)** under NLEP was launched in 2017
  - **c. Personal Laws (Amendment) Act, 2019** is aimed at removing leprosy as a ground for divorce in India family laws.
    - The act amends five acts - The Divorce Act, 1869, the Dissolution of Muslim Marriage Act, 1939, the Special Marriage Act, 1954, the Hindu Marriage Act, 1955, and the Hindu Adoption and Maintenance Act, 1956 - on provisions related to marriage, divorce, and separation of Hindu and Muslim couples.

8) STREP A

- **Why in news?**
    - A rare invasive form of a usually mild and common bacterial infection has killed several children in the UK in recent weeks (Dec 2022)

- **Details**
    - **Group A streptococcus bacteria**, also known as Strep A, is highly contagious and is commonly carried by many of us in our nose and throats and on our skin without resulting in serious illness.
    - Though most cases are not life threatening, it can develop into an infection known as **invasive Group A strep (iGAS**), which can be fatal, with the risk greatest among children and elderly. **iGAS** is rare, but it can be life-threatening. It occurs when **bacteria goes deeper into the body**, infecting the lungs, muscles and bloodstream.

- **Symptoms of Strep A:**
    - Symptoms are often flu like and mainly include a sore throat sometimes called "strep throat". It is a mild infection but can be vary painful. It can also lead to illnesses such as tonsillitis, scarlet fever and cellulitis. Most people with strep A recover without any complication.

- **iGAS**: A more invasive iGAS infection can get into a person's bloodstream and deep tissue, causing more severe illnesses such as blood infections, endocarditis (an infection of the heart's inner lining), meningitis, urinary tract infection, and **streptococcal toxic shock syndrome**, which cause low blood pressure and injury to organs such as the kidneys, liver and lungs.

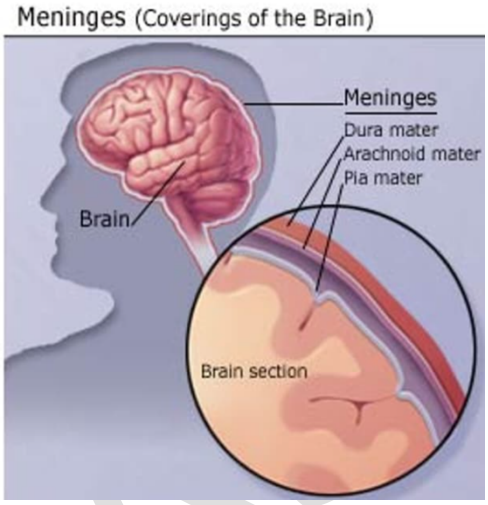
- **How is Strep A transmitted?**
    - Person to person contact through coughing, kissing, sneezing, and touching someone with an infection or a carrier.
    - **Invasive streptococcal infections** are more likely to be picked up by people with existing health conditions "that reduce immunity to infections"

- **Why are Children badly impacted?**
    - Rates of **iGAS** is highest at extreme ages - in children and the elderly.
        - Children are more likely to be exposed at crowded places like schools. Further, children tend to have less developed immunity.
        - COVID-19 lockdown have also led to less exposure to these infections -> leading to less immunity in general population
- **Treatment:** Yes (course of anti-biotics)
- **Vaccines**: No
- **Why more cases in 2022 in UK?**
    - A new variant of bacteria?
    - Natural fluctuation in disease patterns post the pandemic

9) MENINGITIS (BOTH VIRAL AND BACTERIAL REASONS)

- **Why in news?**

» Who releases new roadmap to defeat meningitis (Sep 2021)



- **What is Meningitis?**
  - » It is inflammation of the meninges (three membranes that cover the brain and spinal cord). It occurs when fluid surrounding the meninges becomes infected.

- **Causes:** Viral and bacterial infections; Cancer; chemical irritation; fungi; and drug allergies.
  - » **Bacterial Meningitis**: It is an extremely serious illness. It can be caused by several bacterias including *Streptococcus pneumoniae (pneumococcus), Neisseria meningitidis* (meningococcus) etc.
    - **Meningococcal meningitis** (caused by the Neisseria meningitidis bacteria),is associated with high fatality rate. It primarily affects small children (though can infect everyone) and can cause severe brain damage if left untreated. It holds the potential to cause large epidemics as it has the potential to transfer from person to person through respiratory droplets.
      - This is vaccine preventable.
    - *Haemophilus influenzae type b* (Hib) was a common cause of meningitis in babies and young children until the Hib vaccine became available for infants.
  - » **Viral Meningitis** is more common but generally less serious than bacterial meningitis.
  - » **Fungal Meningitis** is very rare. Generally, people with weak immune system are vulnerable to it.
  - » **Parasitic and Amoebic meningitis** are also rare.
  - » **Noninfectious meningitis** is caused by diseases like cancer or in case of injury due to accident, surgery or reactions to medications.

- **Contagious?**
  - » Some viral and bacterial meningitis are contagious. They can be transmitted by coughing, sneezing, or close contact.

- **Symptoms:** In the beginning the viral and bacterial meningitis have similar symptoms. However, bacterial meningitis symptoms are usually more severe. These symptoms also vary depending on your age.

- **Regions most affected**: Meningitis epidemics have occurred in the last decade in all regions of the world. But it is most common in the '**Meningitis Belt**', which spans 26 countries across sub-Saharan Africa.

- **Vaccines**:
  - » Several vaccines protect against meningitis, including meningococcal, Haemophilus Influenza type b and Pneumococcal vaccines.

- **"The Global Roadmap to Defeat Meningitis by 2030" by WHO** (Sep 2021)
  - » It aims to eliminate the epidemic of bacterial meningitis - the deadliest form of the disease - and to reduce deaths by 70 percent and halve the number of cases.
  - » Focus on urgently expanding access to existing tools like vaccines, spearheading new research to prevent, detect, and treat the various causes of the disease and improving the rehabilitation for the affected.

7. NEGLECTED TROPICAL DISEASES (NTDS)

- **WHO Definition:**
  - » NTDs are a diverse group of **tropical diseases that prevail in tropical and sub-tropical conditions in 149 countries** - affect more than 1 billion people and cost developing economies billions of dollars every year.
  - » The **17 diseases targeted by WHO s**hare a common stronghold on those populations left furthest behind by development.
  - » The World Health Organization (WHO) has established a list of 17 "official" neglected tropical diseases (NTDs): Buruli ulcer, Chagas disease, cysticercosis, dengue, dracunculiasis, echinococcosis, endemic treponematoses, foodborne trematode infections, human African trypanosomiasis, leishmaniasis, leprosy, lymphatic filariasis, onchocerciasis, rabies, schistosomiasis, soil-transmitted helminthiases, and trachoma
  - » These diseases generally receive less funding for research and treatment than malaise like TB, HIV-AIDS and Malaria.

- **Worst Affected**
  - » People living in poverty, without adequate sanitation, and in close contact with infectious vectors and domestic animals and livestock are those worst affected.

- **WHO's new roadmap for 2021-2030 calls for three strategic shifts to end NTDs:**
  - » From measuring process to measuring impact.
  - » From disease-specific planning and programming to collaborative work across sectors.
  - » From externally driven agendas reliant to programmes that are country-owned and country-financed

- **London Declaration**
  - » Signed in 2012, it was a major milestone in the movement to recognize the global burden of these diseases.
  - » Partners committed themselves to achieving the targets for 10 out of 17 diseases in the WHO's roadmap for implementation

» Delegates at the 74th World Health Assembly unanimously adopted a **proposal by the UAE** to declare **Jan 30** as '**World NTD Day**' (May 2021)

8. NON-COMMUNICABLE DISEASES

1) HYPERTENSION (HIGH BLOOD PRESSURE)

- **Details**
  - » **Blood pressure** is a measure of how much the blood moving through your arteries pushes against the vessel walls.
  - » **High Blood Pressure (**Hypertension) is a serious medical condition that significantly **increase the risks of heart, brain, kidney and other diseases**.
  - » As per WHO, around 1.28 billion adults aged 30-79 years worldwide have hypertension, most (two-thirds) living in low- and middle-income countries.

- **Study published in Lancet in Aug 2021:**
  - » 82% of the total number of hypertension patients in the world - lived in low-and middle-income countries in 2019.
  - » **Treatment and control rates** in Nepal, Indonesia, and several countries in sub-Saharan Africa and Oceania were particularly low.

» **Treatment rates among women** were less than 25% and below 20% for men.

2) DIABETES AND INSULIN

- **Why in news?**
  - » Type 1 diabetes is a leading cause of diabetes deaths in those below 25, easily preventable: Study (Feb 2022)

A) WHAT IS DIABETES?

- » A medical condition when person's blood sugar level is too high.
- » It is classified in **two types**:
  - i. **Type 1 diabetes:** This type of diabetes appears in childhood where **body can't make insulin or make insufficient Insulin, a** hormone that regulates blood sugar level. It helps glucose get into cell. This condition occurs because body's immune system attacks the cells in the pancreas that make insulin.
  - ii. **Type 2 diabetes:** The **body doesn't make enough insulin** or when **cells are not responding to insulin**. This type of diabetes is associated with **obesity** and can lead to blindness, strokes, heart disease and even death.

B) TYPE 1 DIABETES LEADING CAUSE OF DIABETES DEATHS IN THOSE BELOW 25, EASILY PREVENTABLE: STUDY PUBLISHED IN LANCET (FEB 2022)

- » **Type 1** diabetes in those below 25 years accounted for at least **73.7% of the overall 16,300 diabetes deaths** in this age group in 2019. This is despite fatalities from this condition being largely curable.

- » The **death rate** varied based on the Socio-demographic index (SDI) of a country.
  - Countries on the higher end of the SDI spectrum recorded 0.13 deaths per 100,000 people
  - Countries on the low middle SDI spectrum recorded 0.6 deaths per 100,000 people.
  - Countries on low SDI spectrum recorded a 0.71 per 100,000 population death rate.
    - Myanmar (1.93/1,00,000 population), Papua New Guinea (1.78 per 100,000 population) and Haiti (1.57 per 100,000 population) had the highest age-standardized death rates for diabetes.

C) INSULIN

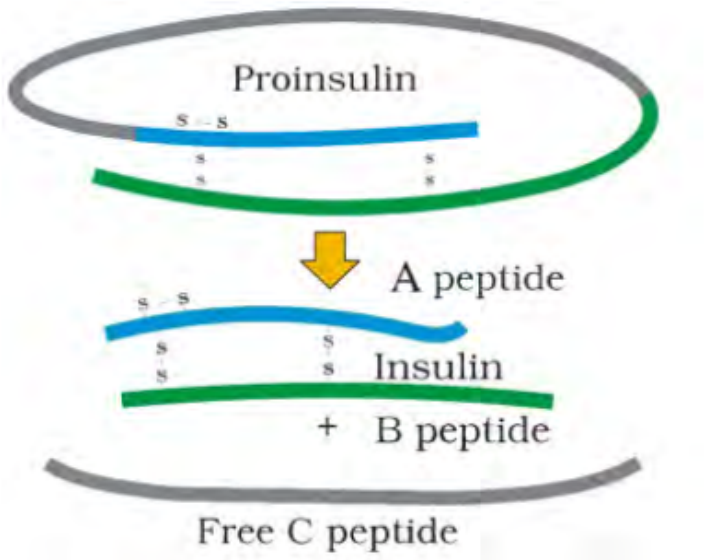
- » **Why in news?**
  - » 100 years of Insulin. In Jan 1922, 14-year-old Leonard Thompson became the first type-1 diabetes patient to receive a shot of insulin. (Jan 2022)

- **Details**

» Insulin is a peptide hormone produced by pancreas. Inside the pancreas, the hormone insulin is made in **the beta cells**, which are part of islets of Langerhans. With each meal, beta cells release insulin to help the body use or store the blood sugar it gets from the food.

» In the beta cells, insulin is first created as a big molecule called "**proinsulin**". Proinsulin is broken into two pieces: Insulin and C-Peptides.

» **Note:** Insulin cannot be taken as pill as it would be broken down during digestion just like the protein in food. It must be injected into the fat under your skin for it to get into your blood.



- **Discovery of Insulin:**
  - » Insulin was discovered in 1921 by **Sir Frederick G Banting,** Charles H Best, and JJR Macleod at the University of Toronto in 1921 - after which it was purified by James B Collip for safer testing on humans. It was the **greatest medical breakthrough of the 20th century** and remains the go-to treatment for type-1 diabetes globally today.
    - **Note:** Back in the 19th century, those suffering from type-1 diabetes were rarely expected to live longer than a year or two after detection. This happens because type-1 diabetes is an autoimmune disease where the body destroys the cluster of cells in the pancreas
  - » In **Jan 2022**, Leonard Thompson was administered first dose. **Banting and Macleod** went on to win the **Nobel prize in Physiology** or Medicine in Oct 25, 1923.
  - » **Important Video:** 100 years of insulin use: How it was discovered and where we stand today

- **Situation today:**
  - » Globally, 15/1 lakh people suffer from type-1 diabetes. The international diabetes federation have estimated that 451 million adult suffered from diabetes worldwide in 2017. This would increase to 693 million by 2026 if not effective prevention methods are adopted.

D) BENEFITS OF REDUCING SALT INTAKE (DEC 2022)

- **Why in news?**
  - A recent study published in the Journal of American College of Cardiology showed a **higher incidence of heart attacks, heart failures, and strokes with higher frequency of adding salt to one's food** (Dec 2022)
- **Details:**
  - This was a large study where over **1.76 lakh participants** from the UK Biobank were followed up for an average of **11.8 years**. Nearly 7,000 attacks and over 2,000 strokes were documented during the period.

- **Key Highlights:**
  - Adding less salt to food -> Fewer heart attacks and strokes.
    - This was found to be true even in participants who were following DASH diet (Dietary Approaches to Stop Hypertension).
    - **DASH** is the best recommended diet to prevent cardiovascular events. It involves eating fruits, vegetables, lean meat, poultry, nuts, whole grains, and reducing intake of saturated fats, cholesterol, and sugar.

- WHO recommends only 5 gm of salt per day.

- **Other key things to know:**
  - **Sodium** intake from processed and restaurant food contributes to high rates of high blood pressure, heart attack, and stroke. Reducing sodium intake could prevent thousands of deaths annually.
  - **How does salt raise blood pressure ->** Class discussion

9. RARE GENETIC DISEASES

- **Why in news?**
  - Rare disease patients yet to receive financial help promised by Centre, flags MP Varun Gandhi (Jan 2023)

- **Introduction**
  - A rare disease is a **health condition of low prevalence that affects a small number of people** compared with other prevalent diseases in general population.
    - They generally include **genetic diseases**, rare cancers, infectious tropical diseases, degenerative diseases etc.
  - The **most common rare diseases recorded in India** are Haemophilia, Thalassemia, sickle cell anaemia, primary immuno-deficiency in children, auto-immune diseases, Lysosomal storage disorders such as Pompe disease, Hirschsprung disease, Gacher's disease, Cystic fibrosis etc. These diseases may be impacting around 70 million people from India, 50% of which are children.

- **Why special focus is needed for Rare diseases / Need of a separate policy on Rare Diseases**
  - **High cost of treatment** or no treatment> not affordable for most of the citizens -> health insurance generally excludes rare diseases.
    - Available are primarily expensive because pharma companies are not interested in R&D as the number of patients for each disease is very less (**Orphan Drugs)**
    - **As per WHO**, only 5% of the identified rare diseases have treatment.
  - **Difficult to diagnose**.
  - **Early screening** generally doesn't happen because of lack of awareness among primary care physicians, lack of adequate screening and diagnostic facilities etc. There are very few medical professionals who can deal with these diseases

10) NATIONAL POLICY FOR RARE DISEASES, 2021

- MoH&FW came up with the policy in March 2021.

- It aims to **lower the high cost of treatment** for rare diseases with **increased focus on indigenous research** with the help of a **National Consortium** to be set up by Department of Health Research, MoH&FW as convenor.

- It envisages creation of a national hospital based registry of rare diseases so that adequate data is available for definition of rare diseases and for R&D.

- It focuses on **early screening and prevention** through primary and secondary healthcare infrastructure such as H&W Centres and District Early Intervention Centres (DEICs) and through counselling of high risk parents.
  - Screening will also be supported by NIDAN Kendras set up by the DBT.

- The policy aims to strengthen **tertiary health care facilities for prevention and treatment of rare diseases** through designating 8 health facilities as **Centre of Excellence** and these CoEs will also be provided **one-time financial support of upto Rs 5 crores for upgradation of diagnostic facilities**.

- **Provision for financial support:** The policy was amended in May 2022. It now provides a financial assistance of upto Rs 50 lakh for treatment of rare diseases of all categories.
    - In the original policy, a financial support of upto Rs 20 Lakhs was provided under the Umbrella Scheme of Rashtriya Arogya Nidhi for treatment of those rare diseases that require a one time treatment (disease listed under Group 1 in the rare diseases policy)

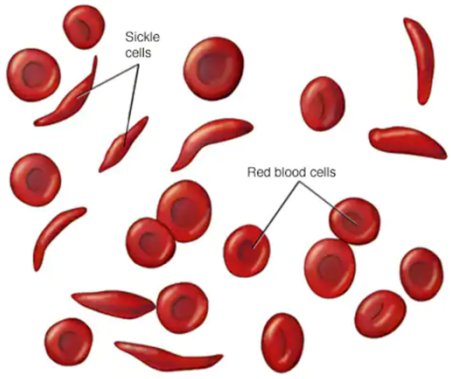
- The policy also envisages a **crowd funding mechanism** in which corporates and individuals will be encouraged to extend financial support through a robust IT platform for treatment of rare diseases.
    - Funds so collected will be utilized by CoEs for treatment of **all three categories of rare diseases a**s first charge and then the balance financial research could also be used for research.

- **Performance of the policy** (Critical Analysis) (Jan 2023)
    - LS MP Varun Gandhi have written to Union Health Minister and have said that more than 4,00 identified patients of rare diseases - mostly children - are yet to receive the Rs 50 lakh financial assistance for treatment guaranteed by the Union Government under the National Policy for Rare diseases, 2021.
        - More than 10 children who were awaiting treatment have already lost their lives.
    - The 10 CoEs constituted under the policy are yet to seek financial assistance (crowdfunding) for patients with rare diseases.

11) SOME RARE GENETIC DISEASES IN MORE DETAILS

A) SICKLE CELL ANAEMIA

- It is one of a group of inherited disorders known as Sickle Cell Diseases. It affects shape of the red blood cells which carry oxygen to all parts of the body.
- RBCs are usually round and flexible so that they move easily through the blood vessels. But, in sickle cell Anaemia, some of the RBCs are shaped like sickle and also become rigid and sticky. This slows or blocks blood flow.
- **Treatment:**
    - No cure yet
    - Some Gene Therapy products are in the advanced stage of human trials in USA.
- **Symptoms**: Anaemia -> fatigue; Episodes of extreme pain called pain crises; Swelling of hands and feet; delayed growth and puberty; Vision problems etc.



B) THALASSEMIA:

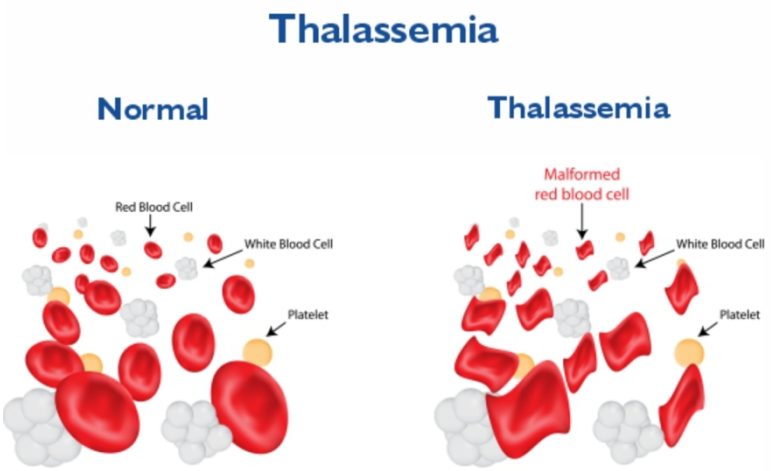
- Thalassemia is an inherited blood disorder in which the body makes an **abnormal form of hemoglobin**.

- If both of your parents are carriers of thalassemia, you have a greater chance of inheriting a more serious form of disease.

    - The disorder results in excessive destruction of RBCs, which leads to anemia.

- **Treatment Option**
  - Blood Transfusion
  - Bone Marrow transplantation
  - Medication and supplements
  - Possible surgery to remove spleen or gallbladder

- **Situation in India**
  - India is the **thalassemia capital of the world with 40 million carriers** (highest in the world) and over 1,00,000 patients (Majors) under blood transfusion every month. It is the most common genetic blood disorder that is prevalent in India.
  - People suffering form the disease are unknowingly transferring on this genetic disorder to their children.
    - Around 10,000 births of Thalassemia major is taking place every year.



  - Most of the thalassemia treatment takes place in private sector with out of pocket expenses.
  - The 2021 policy and associated benefits haven't been operationalized yet.

- **World Thalassemia Day**
  - It is observed on May 8 every year to commemorate Thalassemia victims and to encourage those who struggle to live with the disease.
    - The day was created by Thalassemia International Federation (TIF) in 1994.
  - **Theme for 2022**: '**Be Aware.Share.Care: Working with the global community as one to improve thalassemia knowledge.**"

C) HUNTER SYNDROME OR MPS-II

- It is a very rare inherited, genetic disorder caused by a missing or malfunctioning **enzyme** iduronate 2-sulfatase. This enzyme's job is to break down certain molecules (large sugar molecules called glycosaminoglycans), and without enough of this enzyme, the molecule build up in harmful amounts.
- The build up of massive amounts of these harmful substances eventually causes permanent , progressive damage affecting appearance, mental development, organ function and physical disabilities.
- The condition is one type of a group of **inherited metabolic disorders** called **mucopolysaccharidoses (MPSs)**. Hunter syndrome is also known as MPS II.
- **Cure:** There is no cure for hunter syndrome. Treatment involves managing symptoms and complications.
- **It mainly affects males**.
  - It is caused by a defective X chromosome. For females, even if one X chromosome is defective, the other may provide the correct gene. But, males have only one X chromosome and hence the defective X chromosome would lead to Hunter Syndrome.

D) HAEMOPHILIA A AND HAEMOPHILIA B (ALREADY DISCUSSED WITH BIOTECHNOLOGY)

10. OTHER DISEASES

1) DEMENTIA

- **Details**
  - » **What is dementia?**
    - It is the loss of cognitive functioning - thinking, remembering, and reasoning - to such an extent that it interferes with a person's daily life and activities.
    - Dementia is more common as people grow older (about 1/3rd of all the people aged 85 or older may have some form of dementia) but it is **not a normal part of aging**. Many people live in 90s and beyond without any sign of dementia.
    - There are **different forms of dementia** including **Alzheimer's disease**.

- **Cause:**
  - Dementia is caused when once-healthy neurons, or nerve cells, in the brain stop working, lose connections with other brain cells, and die. While everyone loses some neurons as they age, people with dementia experience far greater loss.
  - **Cause:**
    - The causes of Alzheimer's and related dementias can vary, depending on the type of brain changes that may be taking place.
    - Research has found that some changes in the brain are linked to certain forms of dementia, in most cases, the underlying causes are unknown.
    - Rare genetic mutations may cause dementia in a relatively small number of people.

- **Prevention???**
  - **No proven prevention**
  - In general, leading a healthy lifestyle may help reduce the risk factors that have been associated with these diseases.

- **Key highlight of the Lancet Report** (Jan 2022)
  - The number of dementia cases in India is expected to almost double by 2050. It will increase from 3.8 million in 2019 to 11.4 million by 2050.
  - India's neighborhood (Bangladesh, Bhutan, Pakistan and Nepal) are also likely to show an increase of more than 200%.
  - **Reasons: Population growth and population ageing**.

- **WHO Report** (Sep 2021)
  - Around 25% countries across the world have a national plan to support people with dementia.
    - Half of these countries are in Europe and rest are scattered all across the world.
  - The provisions for community based services and access to medication, hygiene products, assistive technologies and household adjustments are higher in high income countries than in low and middle income countries.

11. ANTI-MICROBIAL RESISTANCE

- **Why in news?**
  - » Antibiotic resistance is now the leading cause of deaths (at least 1.27 million in a year) across the globe: An analysis by researchers from the Global Research on Anti-microbial Resistance (GRAM) Project and study published in LANCET (Jan 2022)
    - The tolls is higher than that for HIV/AIDS or malaria.
    - The study calculated the disease burden on the basis of **two criteria**:
      - **i. Deaths attributable to AMR** (based on the alternative scenario in which all drug-resistant infections were replaced by drug-susceptible infections)

ii. **Deaths associated with AMR** (based on alternative scenario in which all drug resistant infections were replaced by no infection)

» **World Anti-Microbial Awareness Week 2021** (18 - 24 Nov 2021)
  - It is aimed at increasing awareness of global anti-microbial resistance (AMR) and to encourage best practices among the general public, health workers and policy makers to avoid the further emergence and spread of drug-resistant infections (Nov 2021)
    - **Theme for 2021:** "Spread Awareness, Stop Resistance"

- **Introduction:**
  » Antibiotic resistance occurs when an antibiotic has lost its ability to effectively control or kill bacterial growth; in other words, the bacteria become "resistant" and continue to multiply in the presence of therapeutic levels of antibiotic.

- Why do bacteria become resistant to antibiotic?
  » **Natural Phenomena**: **Evolution** - Selective pressure for the survival of resistant strains of bacteria.
  » **Human Action:** Current higher levels of antibiotic resistant bacteria are attributed to the **overuse and abuse of antibiotics**.

- **Why Anti-biotic resistance is more prevalent in India: Key Factors**
  » **Easy availability and overuse** of anti-biotics is the most important factor: Over the Counter Availability; Irrational Use; over-prescription by doctors
    - For e.g. Children often receive multiple courses of antibiotic every year since the viral infections are recurrent. This makes them more vulnerable to anti-microbial resistance.
  » **Poor Health Sector** -> improper treatment -> Development of anti-biotic resistance
    - Further, exposure to subtherapeutic levels of anti-microbials or non-adherence to prescribed medications has also been cited as a driver of AMR
    - E.g.: in case of TB
      Increasing and completely unregulated use of antibiotic **in Agriculture, live stocks and Poultry** sector.
    - Amount of antibiotics used in the farm animal and food industry is three to four times more than those used by humans.
    - For instance, Colistin is extensively used in veterinary practices as a growth promoter. This leads to generation of colistin-resistant bacteria in poultry and fresh water fish.

  » **Poor Sanitation conditions ->** More diseases -> More use of medicines -> More AMR development
  » Unchecked **discharge of effluents by the pharmaceutical industrie**s -> high concentration of pharmaceutical substances are found in surface and ground water systems near production facilities -> anti-biotics cause development of anti-microbial resistance in environment.
  » Cultural factors such as bathing in Ganga.
    - A study published in Nov, 2017 shows that mass bathing is one important source for the transfer of AMR.

- **Steps that government has taken and Steps that we further need to take**
  » **National Policy** for Containment of Antimicrobial Resistance, 2011
  » Guidelines for appropriate antibiotic usage which have revised Schedule H drugs to make over-the-counter availability of certain antibiotics nearly impossible
  » Programs such as Red Line Campaign
  » Sanitation campaigns such as Swatch Bharat Mission etc.
  » National Surveillance system for AMR (April 2017)

» **National Action Plan on Antimicrobial Resistance (April 2017):** Focused on enhancing awareness, strengthening surveillance, improving rational use, promoting research, and supporting neighboring countries

12. SMOKING/DRINKING ETC.

1) SPURIOUS LIQUOR/ HOOCH TRAGEDIES/ METHYL ALCOHOL

- **Why do spurious drinks become poisonous sometime?**
  - » **Excess Methanol:** Illicit brewing is also unscientific, hooch brewers inadvertently mix excessive amounts of methanol in their liquor every once in a while, leading to mass death.
  - » **Why Methyl Alcohol (Methanol) is used**
    - It is similar in appearance and test to Ethyl Alcohol
    - It is easily available
      - In Industry it is used as antifreeze, solvent, fuel, and ethanol denaturant.
  - » The potential lethal dose of methanol is variable, adverse effects has reportedly occurred at 30 ml. The toxicity of methyl alcohol manifests as permanent blindness or ultimately death due to respiratory failure.
  - » **Why is Methanol poisonous?**
    - Due to accumulation of formic acid, a metabolite of methanol metabolism.

- **Why do people go for this kind of drink?**
  - » **Cheap Price:** The cost of these drinks are very cheap, mostly as it is manufactured in unregulated sectors. Spurious liquor is brewed in obscure places and attracts no taxes or duties, so even if there is no quality control, it is much cheaper.
  - » **Availability:** Some states where alcohol is banned, these can be manufactured in hidden locations and thus can be easily available
  - » **Strong kick:** These illegally made hooch drinks have high percentage of alcohol so even if a person can afford normal alcohol products, they sometimes prefer this to get high easily.

- **Other reasons Spurious liquor prospers**
  - » Police getting Haftas

- **What steps should be taken?**
  - » Along with strict punishment and educational exercise, whenever an illegal manufacturing unit is found, the beat officer of the area should also be punished in some way.

13. INTERNATIONAL INITIATIVES

1) THE LANCET

- **Details about the Lancet:**
  - » The Lancet is a weekly peer-reviewed general medical journal and one of the oldest of its kind. It is also world's highest-impact academic journal. It was founded in 1823.
  - » It publishes original research articles, review articles, editorials, book reviews etc.
  - » The journal has editorial offices in London, New York City, and Beijing.

- **The Lancet announced a new commission on Dec 15, 2022,** to address **public health threats**.

» The scope of work by *The Lancet Commission on 21st-Century Global Health Threats* includes demographic changes and inverted population pyramids, high body mass index, anti-microbial resistance, eroding sexual and reproductive rights for women, food security, and fraying multilateralism.
» In 2024, the body will release its report after detailed study of 2 years.

14. FOOD SAFETY

1) LAWS AND INSTITUTIONS

A) FOOD SAFETY AND STANDARDS ACT, 2006

- Came into force in 2011
- **Key Provisions**
  i. **Consolidation of existing mechanisms**
     - The FSS Act consolidated a number of food legislations, rules, orders etc and established a single law for all matters relating to food safety and standards.
     - It subsumes acts like Prevention of Food Adulteration Act, 1954, The Fruit Product Order, 1955 etc.
  ii. **Classification into standardized and non-standardized**
     - **Standardized Food products** - Standards are prescribed and do not require product approval prior to manufacture, sale distribution, or import. The first time manufacturer or importer only requires an FSSAI license to begin a food business.
     - **Non-standardized food products** - don't have standards as their safety parameters are either not known or either not yet ascertained.
  iii. **Statutory Authority: Food Safety and Standards Authority of India (FSSAI) and State Food Safety Authorities**
     - FSSAI is the apex body for food quality regulation in the country. It is responsible for setting standards and regulate, manufacture, storage, distribution, sale and import of food items to ensure food safety.
  iv. **Commissioner of Food Safety of state**
     - Appointed by respective state governments
     - For efficient implementation of the Food Safety Act and various rules and regulations regarding food safety
     - Commissioner also responsible for appointing Food Safety Officers for various local areas
  v. **Graded Punishment and penalties** for contravention of the Act
  vi. **Adjudicating and Appellate Tribunal**

B) FOOD SAFETY AND IPC

- **Section 272 of IPC** prescribed punishment for adulteration of food or drink **intended for sale**.
- **Section 273 of IPC** punishes sale of noxious food or drink.
  - These two sections provides for imprisonment (upto six months) and/or fine (upto 1,000 rupees)
- **Amendments by States**
  - States of Uttar Pradesh, WB and Orissa have amended Section 272 of IPC, wherein the punishment for adulteration of food and products Is enhanced to imprisonment for life and also fine

C) FSSAI NOTIFIES COMPREHENSIVE REGULATORY STANDARDS FOR BASMATI RICE (JAN 2023)

- **Why in news?**

- For the first time in India, FSSAI notifies comprehensive regulatory standards for Basmati Rice; Will be enforced from 1st Aug, 2023 (Jan 2023)

- **Details:**
  - **Food Safety and Standards** (Food Products Standards and Food Additives) First Amendment Regulations, 2023
    - » It covers Basmati Rice (including brown basmati rice, milled basmati rice, Parboiled basmati rice, and Milled Parboiled basmati rice)
    - » As per these standards, Basmati rice should possess natural fragrance characteristic of basmati rice and be free from artificial colouring, polishing, agents and artificial fragrances.
    - » Various identity and quality parameters for basmati rice such as average size of grains and their elongation ratio after cooking; maximum limit of moisture, amylose content, Uric acid, defective/damaged grains and incremental presence of other non-basmati rice.
  - The standard aimed at establishing fair practices in the trade of Basmati rice and protect consumer interest, both domestically and globally.
  - It will be enforced from 1st Aug 2023.

TOP & BOTTOM IN EACH GROUP

RANK	STATE/UT	SCORE
LARGE STATES		
1	Tamil Nadu	82
2	Gujarat	77.5
3	Maharashtra	70
15	Telangana	34.5
16	Bihar	30
17	Andhra	26
SMALL STATES		
1	Goa	56
2	Manipur	44
7	Mizoram	22.5
8	Arunachal	21
UNION TERRITORIES		
1	J&K	68.5
2	Delhi	66
7	Dadra & NH & Daman & Diu	27.5
8	Lakshadweep	16

D) FOOD SAFETY INDEX (FSI)

- **Why in news?**
  - FSSAI released the State Food Safety Index (SFSI) 2021-22 (June 2022)

- **Details**
  - SFSI is an index developed by FSSAI. It aims to measure the performance of states and UTs on selected parameters of food safety.
  - It is aimed at **encouraging states and Uts to improve their performance** and work towards establishing a proper od safety ecosystem in their jurisdiction.
  - It is an annual report which has been released since 2018-19.
  - The present report is the fourth edition of the report and is for the year 2021-22.
  - **Key Parameters used**:
    - » **Human Resources and Institutional Data (20%)**:
    - » **Compliance (30%)**
    - » **Food Testing - Infrastructure and Surveillance** (20%):
    - » **Training and Capacity Building** (10%)
    - » **Consumer Empowerment** (20%)

  - **Performance of various states**:
    - » The states are segregated into three categories - **Large States, Small States, and UTs** - and assessed separately within their respective categories, based on their performance on the selected food safety parameters.
    - » **Top and Bottom performers**:

15. MAKING MEDICINES AFFORDABLE

1) GENERIC MEDICINES – CLASS DISCUSSION

2) JAN AUSHADHI KENDRAS

- **Why in news?**
  - » The Government has approved the proposal of Pharmaceutical and Medical Devices Bureau of India (PMBI), the implementing agency of Pradhan Mantri Bhartiya Janaushadhi Pariyojna (PMBJP) to invite applications for opening new Jan Aushadhi Kendras in 651 districts of different states and Uts. (Jan 2023)

- **Intro:**
  - » **Pradhan Mantri Bhartiya Janaushadhi Pariyojna (PMBJP)** was launched by Department of Pharmaceuticals, Ministry of Chemical and Fertilizers, Government of India as a direct market intervention scheme in 2008.

- It aims to make quality generic medicines available to all at affordable prices through Jan Aushadhi Stores (JAS) opened in each district of the states.
  - » First Jan Aushadhi Store (JAS) was opened at Amritsar Civil Hospital in 2008.
- Other key focus of the scheme is to create awareness and demand for generic medicine

- **Incentives given:**
  - » The scheme provides an excellent opportunity of self-employment with suitable and regular earnings.
  - » An incentive of **Rs 5,00,000** is provided to the Jan Aushadhi Kendras as financial assistance and one time additional incentive of Rs 1 lakh (as reimbursement for IT and infra expenditure) is provided to Jan Aushadhi Kendra opened in **North-Eastern India**, Himalayan state, island territories, and backward areas identified by NITI Aayog as aspirational districts or if opened by women entrepreneurship, Ex-Serviceman, Divyangs, SCs and STs.

- As of Jan 2023, **9,000 Jan Aushadhi Kendras** are functional across the country.
  - » The government has set up a target to increase the number of Jan Aushadhi Kendras to 10,000 by March 2024.
    - It offers 1759 medicines, and 280 surgical devices covering all major therapeutic groups.