Ultraviolet Light and Viruses

Why in News

As nations begin relaxing restrictions, scientists are studying the use of **ultraviolet germicidal irradiation** (UVGI) to detect the virus in public places and disinfect contaminated public spaces to stop the transmission of the virus.

Key Points

Ultraviolet Light:

- UV light from the sun has **shorter wavelengths** than visible light so it is **not visible to the naked eye.**
- UV radiation's full spectrum is **sourced from the sun** and can be **classified into UV-A, UV-B and UV-C** rays according to their wavelength.
- They differ in their biological activity and the extent to which they can penetrate the skin.
  - The **shorter the wavelength,** the **more harmful** the UV radiation.
  - However, **shorter wavelength** UV radiation is **less able to penetrate** the skin.
- Research shows that UV light kills cells and increased exposure can cause cells to become **carcinogenic** (cancerous) and increases the risk of getting **cancer.**

Classification of UV Radiation

- **UV-C:**
  - **Short-wavelength.**
  - Most harmful but are completely absorbed by the Earth's atmosphere and does not reach the Earth's surface.

- **UV-B:**
  - **Medium-wavelength.**
  - Biologically active but cannot penetrate beyond the superficial skin layers.
  - Responsible for delayed tanning and burning.
  - Enhances skin ageing and significantly promotes the development of skin cancer.
  - Exposure to UV-B rays can cause DNA and cellular damage in living organisms.
  - Most solar UVB is filtered by the atmosphere.
- **UV-A:**
  - Relatively **long-wavelength.**
  - Accounts for approximately 95% of the UV radiation reaching the Earth's surface.
  - Penetrate into the deeper layers of the skin and is responsible for the immediate tanning.
  - Enhances the development of skin cancers.

- **UVGI Working Method:**
  - **UVGI replicates UV wavelengths** and uses its **destructive properties to target pathogens.**
  - It disinfects contaminated spaces, air and water and helps in preventing certain infectious diseases from spreading.
  - According to the **US Centers for Disease Prevention and Control** (CDC), UVGI is a **promising method for disinfection.**
    - In 2005, the CDC revised its guidelines for using UVGI with regards to the spread of **tuberculosis** (TB) in hospital settings.
    - The guidelines intended to eliminate the spread of infection to healthcare workers from patients or others with unsuspected or undiagnosed infection.
  - Scientists advise that **fixtures containing UVGI lamps** can be mounted on the walls or suspended from the ceilings.
    - Such fixtures will shine light on the upper interior surface of a room and trap pathogens.
    - Installing a fan in such spaces can further draw the air upward, which will increase the speed with which the UVGI can destroy pathogens.
  - UVGI lamps can also be installed in **room corners,** in **air ducts of ventilation systems** or portable or fixed **air cleaners.**
  - UVGI fixtures are and should be installed above people's heads because their **short wavelengths can irritate the skin and eyes.**

- **Effectiveness:**
    - According to research papers, UVGI is **most effective in preventing infections** which are mainly spread through **smaller droplets** and **not by direct contact or larger respiratory droplets.**
    - The **efficacy** of UVGI depends on several factors, such as:
        - Sensitivity of microorganisms to UVGI.
        - Dose/ intensity of UVGI required to kill pathogens.
        - Humidity and weather conditions.
        - Air circulation in a room.

            It should be such that the air from below the room, where the pathogen is generated reaches the upper-portions of the room, where the UVGI can trap and kill the pathogen.
    - However, using **UVGI on a mass-scale** in public spaces like schools, universities, restaurants and cinema halls is **not a very cost-effective way** for disease prevention.
- **DRDO's Latest UV Developments:** The **Defence Research and Development Organisation** (DRDO) has recently developed **automated contactless UV-C devices** namely DRUVS (Defence Research Ultraviolet Sanitiser) and NOTESCLEAN.

Other Measures

- Apart from using modern technology to combat viruses, it has been suggested to bring **behavioural changes** like **social distancing** and **wearing masks.**
- Few countries have considered issuing **immunity passports** or **risk-free certificates.**
    - Such certificates are based on the idea that the **natural immunity** a person develops to any infection will protect them from contracting the disease again.
        - **Once infected** with a viral pathogen, the **body's innate immune response kicks in** and **slows the spread** of the virus.
        - This response is **followed by an adaptive response,** wherein the **body makes antibodies,** which bind to the virus and help eliminate it.
        - If this response is strong enough, it might prevent reinfection from the same pathogen.
    - However, the **World Health Organisation** (WHO) has warned against using immunity passports because there is, yet, no proof of immunity from the reinfection of **Covid-19.**

        Even if there is an immunity, its **duration is not known.**

Source: IE