Antimicrobial Resistance

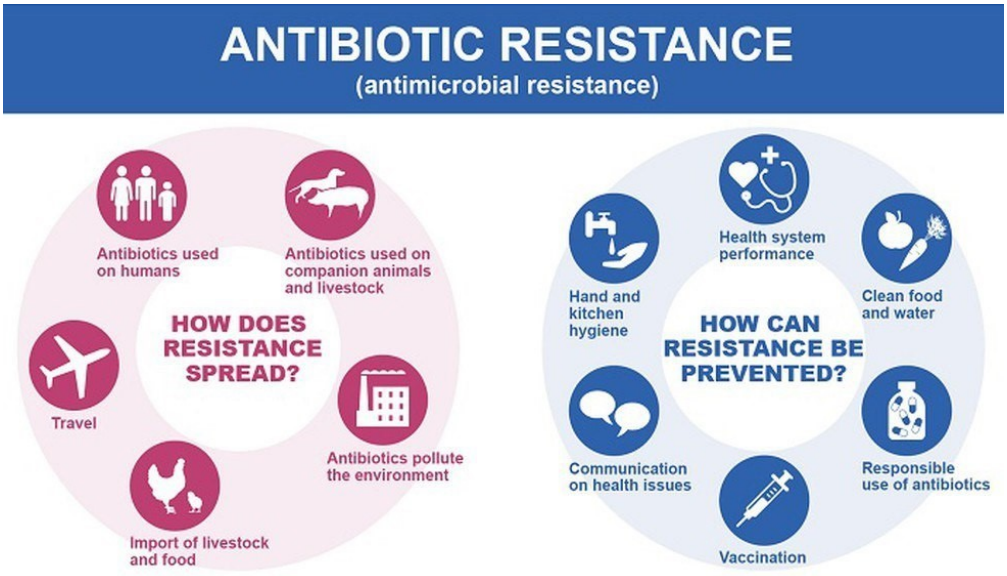
Mains Syllabus: GS II - Issues relating to development and management of Social Sector/Services relating to Health.

Why in the News?

A recent study funded by Wellcome and the United Kingdom Department of Health and Social Care's Fleming Fund, estimates that bacterial AMR alone will cause 39 million (3.9 crore) deaths between 2025 and 2050.

What is Antimicrobial Resistance (AMR)?

- **Antimicrobials** – These are medicines, including antibiotics, antivirals, antifungals and antiparasitic, used to prevent and treat infections in humans, animals and plants.
- **AMR** - It is defined as resistance of micro-organisms to an antimicrobial agent to which they were first sensitive.
- **AMR in India** - Multiple types of bacteria like E. coli, Klebsiella, Acinetobacter, Staphylococcus aureus, enterococcus have even become resistant to some of the latest generation antibiotics.
- **Causes of AMR**
    - **Natural evolution** - Microbes naturally adapt over time, developing resistance through genetic mutations.
    - **Overuse & misuse of antibiotics** - Excessive or inappropriate use of antibiotics in humans, animals, and agriculture accelerates resistance.
    - **Poor infection control** - Inadequate hygiene and sanitation in healthcare settings and communities allow resistant microbes to spread.
    - **Environmental contamination** - Pharmaceutical waste and improper disposal of antibiotics lead to the spread of resistant genes in soil and water.
    - **Global travel & trade** - Resistant microbes can spread across borders through travel, food, and environmental exposure.



What are the impacts of anti-microbial resistance?

- **Reversing progress in infectious diseases control** - AMR also threatens to undo decades of progress made against infectious diseases such as tuberculosis, typhoid and pneumococcal pneumonia, among others, with new multidrug resistant strains now in circulation.
- **Increase in mortality** - Bacterial AMR alone will cause 39 million (3.9 crore) deaths between 2025 and 2050, which translates to three deaths every minute.
- 30,000 newborns in India die annually in intensive care units as they are resistant to drugs.
- **Longer hospital stays** - Resistant infections require prolonged treatment, straining healthcare systems and increasing costs.
- **Burden on healthcare systems** - AMR increases pressure on already overburdened healthcare systems, especially in developing countries like India
- **Economic burden** - AMR could result in up to $3.4 trillion in GDP losses per year by 2030.
- **Fungal impact during COVID 19** - Only in India did COVID-19 patients contract ‘black fungus’, which she pointed out was the direct result of indiscriminate use of steroids.

What are the challenges in controlling AMR?

- **Over-the-counter availability of antibiotics** - In India, antibiotics are often sold without a prescription, making it easy for people to self-medicate.
- This leads to inappropriate use, such as not completing full courses or using antibiotics for viral infections where they are ineffective.
- **High population density** - In densely populated urban areas and slums such as in Mumbai, Delhi, poor sanitation and close human contact accelerate the transmission of drug-resistant pathogens.

Population density of major Indian cities

• The population density of India in 2011 was 382 per sq km.
• India has some of the most densely populated cities in the world. Here are a few notable ones
• **Kolkata**: Approximately 30,097 people per square kilometer.
• **Mumbai**: Around 20,634 people per square kilometer.
• **Delhi**: One of the highest densities, with 11,320 people per square kilometer.
• **Chennai**: About 2,555 people per square kilometer.

- **Prevalence of infectious diseases** - India has a high burden of infectious diseases like tuberculosis, typhoid, and respiratory infections.
- This leads to heavy antibiotic use, increasing the chances of resistance development.
- **Multidrug-resistant strains** - Diseases like tuberculosis (especially MDR and XDR-TB) are already showing dangerous levels of resistance in India, complicating treatment protocols.
- **Lack of awareness about AMR** – Adequate awareness about the causes and impact of anti-microbial resistance has not been created among people.
- **Weak enforcement** - Although rules like Schedule H1 of the Drugs and Cosmetics Act exist to regulate antibiotic sales, enforcement is inconsistent, especially outside major urban centers.
- **Inadequacy of genomic methods** - while genomic sequencing can help track how pathogens evolve and acquire resistance, it still doesn't have direct utility in helping clinicians make difficult, and urgent, lifesaving decisions.

What are the global and national initiatives against AMR?

- **UN meeting on AMR** - In 2016, the United Nations General Assembly (UNGA) convened its first High-Level Meeting (HLM) to address the root causes of AMR and develop national action plans, regulate antimicrobials, and promote awareness and best practices.
- With this mandate, many countries prepared their national action plans.
- **2nd High-Level Meeting on Antimicrobial Resistance (AMR)** – It was held in 2024 to identify gaps, invest in sustainable solutions, improve R&D, strengthen surveillance, and ensure constant monitoring in the lead-up to the next review in 2029.
- **India's Plan** - National action plan on AMR was launched in 2017, for improving awareness, reducing infections, optimising antimicrobial use, strengthening surveillance, increasing investment, and enhancing India's leadership in AMR.
- **Delhi Declaration on Antimicrobial Resistance (AMR)** – It is an inter-ministerial consensus signed by Indian government ministers in 2017.
- It outlines a commitment to addressing AMR through a One Health approach and emphasizes the need for multisectoral collaboration.
- **2011 H1 Rule** – It is the rule of Indian government to prohibit the sale of all antibiotics — first, second, and third-line — without a prescription.
- It was modified by the Indian government to allow the sale of first-line antibiotics.
- **Capacity building** - Government bodies such as the Indian Council of Medical Research (ICMR), the National Centre for Disease Control (NCDC) and the Indian Council of Agricultural Research (ICAR) have established surveillance networks to focus on priority pathogen groups and communicate critical data to policymakers and researchers.

- **Generating epidemiological data and trends** - At the Christian Medical College, Vellore (CMC), the country's reference AMR institution, researchers are sequencing representative strains to generate important epidemiological data and trends.
- They are also using genomic markers for rapid and robust diagnosis, supporting the national AMR efforts under the mentorship of ICMR.
- **Introduction of novel antibiotics** - Recent breakthroughs from India in antibiotics development such as cefepime-enmetazobactam, cefepime-zidebactam, nafithromycin, and levodifloxacin, mark a significant global advancement in the fight against multidrug-resistant pathogens.
- These drugs offer new therapeutic options that can reduce reliance on carbapenems and last-resort agents like colistin.
- **Use of AI** - A new AI-driven tool, AMRSense, developed by a team of researchers, has been deployed to use routine data that is generated in hospitals to generate accurate and early insights on antimicrobial resistance at the global level, national level and hospital level.

In early January this year, Kerala became the first State in the country to ban the over-the-counter sale of antibiotics without a prescription.

What lies ahead?

- Hospitals should conduct surveillance of infections on their premises, and the results should be made public.
- By analysing water let out by pharmaceutical industries and hospitals, we can get an idea of the level of antimicrobial resistance.
- Genomic testing laboratories set up during the COVID-19 pandemic can be used to measure the level of antimicrobial resistance by analysing effluents from pharmaceutical companies and hospitals.
- Public health experts can use genomic data to anticipate microbial evolutionary trajectories and emerging AMR trends.
- This can inform the most appropriate choice of antibiotics when patients are treated empirically (which is mostly the case).
- Diagnostic companies should use large-scale population genomics to build precision tools that could be made available at, or near the point-of-care.

• For example, genomic studies on Salmonella enterica serovar Typhi (the bacterium causing typhoid fever) reveal how the H58 lineage has acquired multidrug resistance over time.
• Researchers identified single nucleotide polymorphisms (SNPs) from whole-genome sequencing data, which are now being used to create targeted molecular diagnostics.
• This enables faster and more cost-effective detection of drug-resistant strains, instead of sequencing each circulating strain.

- Given the magnitude of the AMR crisis, genomic surveillance and integrated public health systems can only work efficiently if they are supported by a carefully designed communication strategy to improve awareness.

- Developing antimicrobial stewardship among healthcare professionals, including both physicians, pharmacists and other unorthodox or informal practitioners that form an important pillar of frontline healthcare delivery.
- India has the tools, the talent, and the urgency to lead the world in curbing antimicrobial resistance.
- But all scientific efforts need to be unified and communicated to the general public and experts alike, in ways that resonate with them.

Reference

[The Hindu | Surveillance, R&D innovation and communication for AMR]