Antimicrobial Resistance Gallery

Reservoirs and transmission routes of antimicrobial resistance

(Cristina Calvo-Fernandez)

Designed by @Freepik (www.freepik.es)

Antimicrobial resistance (AMR) is a huge problem in healthcare, and the transmission of bacteria increases the risk of it. And do you know that humans, animals, and the environment are connected and share bacteria? That's where the concept of One Health comes in. Think of three parts: if one part gets a bacterium, the others may get it, too.

Also, if different types of bacteria become resistant in any part, it can affect the entire system. That's why caring for everyone's health and the correct use of antibiotics is essential. AMR impacts everyone, from the medicines we use to the food and water we consume. ***We are all components of a profoundly interconnected ecosystem!***

Animal reservoirs and agents of transmission on land and in the air

One primary reservoir of antimicrobial-resistant microbes is found in domestic animals. Livestock, such as cattle, poultry, and pigs, are often treated with antibiotics. However, the incorrect use (overuse or misuse) of antibiotics in animals contributes to the selection of resistant strains of bacteria. These resistant bacteria can then be transmitted to humans through direct contact or consumption of animal products.

This is also the same for all our pets, for example, our dogs, cats, or even our water turtles! For this reason, giving the animals complete antibiotic treatment is essential when the veterinarian decides to prescribe it; follow the instructions carefully!

Wildlife can act as carriers of antimicrobial-resistant microbes. For example, migratory birds that travel large distances may contact diverse environments, picking up resistant strains and spreading them across regions. The proximity of wildlife to human habitats increases the risk of transmission in the spread of resistant microbes. It is also common for some wildlife species to be in contact with landfills and human wastes containing resistant microbes, which increases the quantity and diversity of resistant microbes in wildlife. Therefore, avoiding direct

contact with wildlife, reducing their transmission of resistant microbes to use, and minimising exposure of our wastes to wildlife to reduce our transmission of resistant microbes to them is essential for our safety and theirs.

As mentioned, livestock animals are treated with antibiotics when they get sick, so using animal manure as fertiliser introduces antimicrobial residues, such as antibiotics or resistant microbes, into the soil. Resistant bacteria in dung-fertilised soils can be transferred to crops, posing a direct threat to food safety. Consuming contaminated vegetables and fruits provides another route for transmitting resistant microbes from the environment to humans.

Water Environments as reservoirs

In the context of water, it is essential to consider that while meeting the growing demand for seafood, the booming aquaculture industry also contributes to the spread of AMR. Fish reared in aquaculture pens are often exposed to antimicrobial agents to prevent and treat diseases in crowded conditions. Resistant bacteria can develop in these environments and be transmitted to humans through consuming contaminated seafood.

Urbanisation and industrialisation contaminate water bodies in the environment with materials that can carry or select resistant microbes. Wastewater from hospitals, pharmaceutical manufacturing plants, and households often contain residues of antibiotics. These residues can foster the development of resistant bacteria in water systems, affecting human populations through water consumption and environmental exposure.

What can we do?

Understanding the origins and transmission routes of resistant microbes is essential to effectively preventing further worsening of the problem. All environment compartments are connected: freshwater rivers are connected to land and seas, all surface waters are connected to groundwaters, and all planet surfaces are linked to air. And, whereas land does not move much, although flooding events, landslides, dust storms and extreme weather events regularly move around parts of its surface, air and water bodies move a lot, so there is constant mixing within and between environmental compartments. Superimposed on this interconnected and continuously mixing environment, which moves antimicrobial-resistant microbes around, are the animal vectors of transmission, which carry them around on land, in water, and the air. So, measures to combat AMR need to be taken into account.

Therefore, where the use of antibiotics is necessary, it must be strictly regulated. Moreover, we must improve how we handle our waste to reduce the contamination and spread of AMR in the environment. We must avoid unnecessary contact with wildlife. By caring for people, animals, and the environment, we can make an important contribution to efforts to prolong the efficacy of our medicines and, hence, the effectiveness of clinical treatments to restore good health.