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# Antimicrobial Resistance: A Global Threat

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## Abstract

There is an old saying about death by thousands of paper cuts? But what if just took one! Antimicrobial resistance is occurring everywhere in the world, compromising our ability to treat infectious diseases, as well as undermining many other advances in health and medicine. The lack of new antibiotic classes calls for a cautious use of existing agents. Yet, every 10 minutes, almost two tons of antibiotics are used around the world, all too often without any prescription or control. The use, overuse and misuse of antibiotics select for resistance in numerous species of bacteria which then renders antimicrobial treatment ineffective. every time we use antibiotics, we create a selective pressure for bacteria to mutate or exchange pieces of DNA and possibly develop drug resistance. Worryingly, in developed countries, between 10 and 20 courses of therapy are prescribed to each individual, before the age of 18. Almost all countries face increased antimicrobial resistance (AMR), not only in humans but also in livestock and along the food chain. The spread of AMR is fueled by growing human and animal populations, uncontrolled contamination of fresh water supplies, and increases in international travel, migration and trade. the need for cross-sectoral and multi-disciplinary approaches to health for tackling this major issue actions at the level of the health system, the animal, the human side also in the agri-food systems. And a commitment of the whole society. Together, we can all work to reduce the burden of AMR.

***Keywords***: *Antimicrobial Resistance (AMR); Bacteria; Antibiotics*

## Introduction

Everything is covered with bacteria, in fact even you are full of bacteria, you might as well be a sentient sac whose main job is to carry around 100 trillion or so microbes. they aren't anything to worry about, because most bacteria aren't dangerous, some are even our friends. But sometimes we meet the bad ones in the form of bacterial infections, but no problem we have got antibiotic a few pills you're back to normal, right as rain ship shape.

Unfortunately, that might soon be a thing of the past we have got armies of superbugs laughing tiny bacterial laughs in the face of every drug we throw at them, how did this happen? To understand that we need to look at where antibiotic come from.

There is probably more bacterial mass on the earth than every other living thing combined. in one spoonful of soil there might be more than a billion microbes of more than 10,000 different species, not just bacteria but also fungi, some co-operating and others locked in chemical warfare.

### History

In 1928, That chemical warfare allowed Alexander Fleming to discover the first Antibiotic by accident while cleaning off his lab bench, he saw a petri dish had become contaminated with mold and on it all the bacteria had died, as if the mold was secreting poison. That fungus was a strain of penicillium and AB that was isolated from it, "penicillin".

The age of antibiotics had begun! Since then these drugs have saved millions of lives maybe even yours thanks to them we can treat pretty much every disease used to kill you.

But now that's changed nearly 700,000 people die from bacterial infection every 10 minutes one person dies with bacteria resistant to at least one antibiotic, so antibiotic resistance is here.

With resistance on the rise, we stand to lose our fight against life threatening infectious diseases such as pneumonia, TB, HIV and malaria, our battle against conditions such as cancer, surgical procedures like organ transplants and caesarean sections. AMR increase illness and suffering and death, increase costs and length of treatment, increase side effects from the use of multiple and more powerful medications.

So how some bacteria are resistant? how do they acquire this resistance? and what we should do to overcome or minimize this threat??

The phenomenon of antimicrobial resistance was predicted by Alexander Fleming who said "The time may come when penicillin can be bought by anyone in the shops. Then there is the danger that the ignorant man may easily under-dose himself and by exposing his microbes to nonlethal quantities of the drug make them resistant. And in 1945 Fleming himself had already seen bacteria become resistant to penicillin.

## Now we will investigate how some bacteria are resistant to antibiotics

The main mechanisms by which microorganisms exhibit resistance are: the first is Drug inactivation or modification by antibiotic degrading enzymes, the good example is beta lactamase which essentially breaks beta lactam rings which found in penicillin, some other bacteria also have the resistant genes to modify the antibiotic binding target for example penicillin, the genes modify the penicillin binding proteins basically changing the structure of the protein, the penicillin unable to bind anymore, the great example of this type is MRSA, other bacteria may also produce what's called efflux pump the bacteria can use efflux pump to pump out the AB and so the antibiotic tetracycline will have no effect on the bacteria.

## How do bacteria acquire such resistance!

It through evolution or how? there are two ways they can acquire the resistant genes, one is through Vertical gene transfer and other through horizontal gene transfer, vertical gene transfer is where the resistant gene is passed through bacterial replication, the bacteria acquire a gene throughout evolution you can say spontaneous mutations, of course this is rare and does take some time. The other way is Horizontal gene transfer where the resistant gene is actually transferred to bacteria through three different means, the first is conjugation, Transduction, Transformation, the bacteria can form what's called pili that will attach to the other bacteria its kind of bacterial make out session and then the exchange occur, this process is called conjugation, another form of horizontal gene transfer is through a virus called bacteriophage, the bacteriophage will inject its DNA into a resistant bacteria and the bacterial DNA will be floating inside the damaged bacteria, viral replication will make lysis to bacteria releasing its DNA and the phage DNA out, and that will actually contain a resistant gene from bacteria because it accidentally packed the resistant gene of the bacteria instead of its own viral DNA, then bacteriophage can go attack another bacteria giving it a resistant gene, now this process is called transduction, the last type is called transformation, when a bacteria can harvest dead bacteria and collect DNA pieces containing resistant genes.

## Causes

we are doing our part to help the superbugs to succeed. The over use or under dose in taking antibiotics affect on our health very much, every year hundreds of thousands of people are prescribed antibiotics for viral infections, antibiotics do not kill the viruses. And every time you don't finish your full prescription, you run the risk of leaving super strong stragglers behind. uncontrolled sale in many 'low or middle income' countries, where they can be obtained over the counter without a prescription, potentially resulting in antibiotics being used when not indicated. This may result in emergence of resistance in any remaining bacteria. Releasing large quantities of antibiotics

into the environment during pharmaceutical manufacturing through inadequate wastewater treatment increases the risk that antibiotic-resistant strains will develop and spread. Special antibacterial soaps? no soap is antibacterial by definition. Those special additives do nothing to make us safer and probably make the bugs stronger.

Humanity holds between 20 and 30 billion animals as livestock to make meat cheaper, many animals are held in horrible conditions in very tight spaces and unhygienic conditions, perfect breeding condition for disease, so we use antibiotics as Growth promoter or a replacement of bad hygiene.

Resistant bacteria developed, spreading first from animal to animal, and then to humans without being noticed. On an average day, there are over 100,000 flights on earth, kind of connecting every human on the planet. By creating the modern world, we have also built the infrastructure for a dangerous pandemic. In the Environment the resistance come from, Discharge of Disinfectant and Heavy metal to water Waste water contamination, Hospital waste, Pharmaceuticals, Personal care products and Agriculture waste as animal manure.

## Drug resistant infections cost too many lives today

Every 10 minutes a patient dies because antibiotics no longer were effective against the bacteria responsible for the infection.

700,000 people die every year from drug resistant strains of common bacterial infections, HIV, TB and malaria. Nearly 200,000 people die every year from multi drug-resistant and extremely drug resistant (TB) alone.

Deaths from AMR could rise to 10 million lives each year by 2050, the death toll could be a staggering one person every three seconds.

So, what can we do with bacteria figuring out how to beat antibiotics within years of their release, AMR is not a problem that can be solved by any one country, or even any one region. We live in a connected world where people, animals and food travel, and microbes travel with them [1].

## Global action plans

WHO estimate that by 2050,10 million lives a year and a cumulative 100 trillion USD of economic output are at risk due to the rise of drug resistant infections if we do not find proactive solutions now to slow down the rise of drug resistance. Even today, 700,000 people die of resistant infections every year. Most of the direct and much of the indirect impact of AMR will fall on low and middle-income countries. It does not have to be this way. It is in policy makers and governments' hands to take steps to change this situation. Because microbes travel freely, some of the steps that are required will need to be taken in a coordinated way internationally. What is certain is that no single country can solve the AMR problem on its own and several of our proposed solutions will require at least a critical mass of countries behind them if they are to make a difference [2].

## Firstly, reduce demand and that will be obtained by

1. **A massive global public awareness campaign:** We need to improve global awareness of AMR across the board, so that patients and farmers do not demand, and clinicians and veterinarians do not prescribe, antibiotics when they are not needed.
2. **Improve hygiene and prevent the spread of infection:** Improving hygiene and sanitation was essential in the 19th century to counter infectious diseases. the less people get infected, the less they need to use medicines such as antibiotics, and the less drug resistance arises.
3. **Reduce unnecessary use of antimicrobials in agriculture and their dissemination into the environment:** Three steps to improve this situation. First, 10-year targets to reduce unnecessary antibiotic use in agriculture, for this to succeed, governments must support and speed up current efforts, including those of the World Organization for Animal Health (OIE) and others, to measure antibiotic use and farming practices. Second, restrictions on certain types of highly critical antibiotics. Too many antibiotics

that are now last-line drugs for humans are being used in agriculture; action should be taken on this urgently by an international panel. Third, we must improve transparency from food producers on the antibiotics used to raise the meat that we eat, to enable consumers to make more informed purchase decisions.

4. **Improve global surveillance of drug resistance and antimicrobial consumption in humans and animals:** Surveillance is one of the cornerstones of infectious disease management. At the local level, information would help improve patient health. At the national level, surveillance data would help inform health policies and responses to health emergencies. Finally, at the global level, it would provide early warnings of emerging threats and help identify long-term trends.
5. **Promote new, rapid diagnostics: Rapid diagnostics could transform the way we use antimicrobials in humans and animals:** reducing unnecessary use, slowing AMR and so making existing drugs last longer.
6. **Promote development and use of vaccines and alternatives:** Vaccines can prevent infections and therefore lower the demand for therapeutic treatments, reducing use of antimicrobials and so slowing the rise of drug resistance. vaccination coverage make reduction by 47% in the antibiotic use, alternative product for tackling infections such as phage therapy (natural or engineered viruses that attack or kill bacteria), antibodies (binding to particular bacteria or their product restricting their ability to cause disease), lysins ( enzymes that directly and quickly act on bacteria), immunostimulant (to boost patient natural immune system), and probiotics that prevent pathogenic bacteria colonizing the gut.
7. **Improve the numbers, pay and recognition of people working in infectious disease:** Infectious disease doctors are the lowest paid of 25 medical fields that analyzed in the United States. It is no surprise that there are not currently enough candidates to fill hospital training vacancies. To change this, we need an urgent rethink and improved funding to improve career paths and rewards in these fields.

Secondly, we must increase the number of effective antimicrobial drugs to defeat infections that have become resistant to existing medicines and this by will be obtained by

1. Establish a global innovation fund for early-stage and non-commercial research
2. **Better incentives to promote investment for new drugs and improving existing ones:** None of this will succeed without building a global coalition for action on AMR and we consider that to be our tenth recommended intervention.

## Conclusion

We often take antimicrobials for granted, assuming that, they will be there to protect us if we have an infection. It is well within our power to change this situation, we need to do is to galvanize action, at the individual, organizational, state level and global level. At the individual level everyone can, and must, play their part in only taking antibiotics when they are needed and completing their course. At the organizational level need to make further progress on commitments. And at the state level, there needs to be more focus from across government departments.

We are playing a game of coevolution, an arms race with our health at stake. Drugs and bacteria are like cheetahs and gazelles, the cheetah gets faster and the gazelles have to speed up to survive. Except I think maybe we are the gazelles and I am not sure about how much we can run.

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