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Theme of contest:

Antibiotics are critical for human and animal health, and it is not an exaggeration to state that they are one of a few critical discoveries that have improved human health dramatically in the past century. Yet, their use in humans and animals are not without risks and trade-offs. As with all medicines, there is a potential risk of adverse effects in humans (and animals), and antibiotic resistance – a natural consequence of increasing use of antibiotics – is considered by the World Health Organization as one of the greatest threats to global health today. How should we view antibiotics and how should we use them in the future?

Antibiotics – Humanity’s salvation; an insidious killer

Think of a world where there is no water to quench our thirst, no animals to satiate our hunger and no air for us to breathe. Absurd, is it not? However, it is undeniable that this will become of our planet Earth if it goes on being unappreciated. As years go by, humans constantly exhaust natural resources, leading to several global issues such as global warming, rising sea levels, extinction of animals; just to name a few. Yet humans still view greed ruling over the parts of the upper echelons, denying all these happenings, blinding the public so as to walk their path made of gold. Little did they care about the number of dead creatures buried under their path of carnage.

In the year 1985, a book titled *Origin of Species* was published by the renowned Charles Darwin. In his book, the idea of natural selection was proposed, of how animals may share a common ancestor but with slight variation on certain traits just for them to adapt to their environments. Humans however, has no claws or fangs of a lion, nor are they blessed with the immense strength of a bear. Yet humans survived, overcame the odds, and even rose to one of the highest tiers of a predator. While animals change themselves to adapt to their surroundings, humans are the only living organisms that change their surroundings to suit themselves. It is by this, that humans are able to defy deadly bacteria, defying what otherwise would be fatal, found the cure, and thus the invention of antibiotics came about.

What are antibiotics? Why do they hold a threat to humans when antibiotics are meant to be a remedy to infections? *Antibiotics* is a word derived from ancient Greek, bearing the meaning of *antibacterial*. However, upon breaking up the meaning, it bears the meaning of ‘*opposing life*’. At a basic level, antibiotics either has the effect of bactericidal or bacteriostatic, with the former being able to kill bacteria, and the latter being to inhibit bacteria’s growth. As mentioned, they are strictly designed to be effective against bacteria that comes with some adverse effects on humans.

Viruses, which are another threat to the human race, are non-living things. They lack the features for antibiotics to target, or in other words, antibiotics does not harm them at all. One might think that the simplest step to take would be to provide antibiotics for bacterial infections and avoid viral infections. Unfortunately, it is not as simple as it seems as they both present similar symptoms. Common cold, flu, sore throats, are among the most commonly treated for the longest time regardless of whether it is bacterial or viral origin. The advantage behind this

was that if it is indeed bacterial origin, it would be treated correctly, and even if it is viral caused, it would resolve eventually. This thus creates a veil of illusion showing the medical practitioner to be competent and effective in treatment.

In our body are countless other bacteria. With irresponsible prescription for bacteria treatment, it leads to exposure of antibiotics to surviving bacteria. These survivors are then responsible for building up resistance against said antibiotics. As time goes by, they exchange genetic materials with other bacteria by several mechanisms, with the most common antibiotic resistance trait sharing being via plasmid. Through conjugation, bacteria carrying antibiotic resistance plasmid will join with other bacteria, and the plasmid will then replicate a copy into the antibiotic sensitive bacteria. The bacteria will end up being resistant to the antibiotic and is thus ready to further share it with another bacteria.

Aside from the microscopic scale, let's look into human nature itself. Irrelevant treatment given was one thing noted above, with society awareness being the other issue. Ignorance is a disability far worse than blindness and a lost limb. At times, patients pressure their doctors to provide antibiotics, even if it means going against the doctor's advice. While ultimately the decision lies in the hands of the doctor, some do give in eventually. Even with given antibiotics, patient compliance also plays a part in the matter. Not finishing antibiotics prescribed not only contributes to resistance pandemic, but also saving the remaining for the next time cultivates old bacteria to be resistance to the antibiotic. In addition, consuming unfinished antibiotics would indicate the new infection being partially treated thus resulting in resistance as well. It is indeed much worse if both antibiotics are meant for different sources of infection as they do have their own target group.

A bullet can kill a man, but not Superman. When an antibiotic failed to kill the bacteria, it would be termed as *Superbugs*. These Superbugs or Multi-Resistant Organisms (MROs) are impervious to the common antibiotics. In year 2016, humans were finally exposed to a nightmare of unbelievable magnitude; the appearance of a pan-resistant organism, which resists all antibiotics available in the United States. A case of a lady in her 70s was infected by Carbapenem-resistant *Enterobacteriaceae*. The nightmare? Carbapenem was the last-line of defence at that period when all other antibiotics failed. When it rains, it pours. Further investigations noted that *Enterobacteriaceae* was resistant to all 24 antibiotics available in the facility. Ultimately, she passed away in isolation when the bacteria infected her bloodstream while healthcare prodigies have nothing at all as a solution to such infection. This led to the director of Centers for Disease Control and Prevention (CDC) Dr. Tom Frieden dubbing enterobacteria as a *nightmare bacteria*.

While the biggest issue with antibiotics was mentioned, there are other unwanted consequences of antibiotic abuse. Unwarranted antibiotic usage messes with balanced probiotics and microflora in the human body. Opportunistic infective agents such as fungal or other bacteria will proliferate due to lack of competition from normal microflora. Since humans took measures to kill most of the natural residence, these unruly organisms seize the moment to proliferate and make the human body their kingdom.

Prevention is better than cure, precaution is better than solution. Before reaching a dead end, it would be more ideal to put efforts into avoiding such catastrophe, which can be done on multiple levels of the society. For healthcare professionals, it would be reducing empirical treatment regimens and only provide antibiotics confirmed to be of bacterial infections. In other words, avoid malpractice and 'defensive medicine' way of

treatment. For the societies, it would be rejecting antibiotic abuse, learning about antibiotics and consuming them the right way, right dose, right time in the right person, and most importantly finishing the antibiotics given in timely manner.

It is always an insidious danger that lingers around endangering everyone. Smoking, pollutions, unhealthy lifestyles, drug abuses and antibiotic misuses are not things that will lead to immediate attention until it is too late. Humans are blessed with the capacity to grasp the looming danger, the knowledge to prevent such end. The right decisions are wrong decisions if made too late. With that being said, the time is now to say 'NO' to antibiotic abuse.

*Another fever with antibiotics procured
Nothing was evident of bacterial features
Thus comes a bug that we carelessly nurtured
Immense guilt we share was real yet obscured
Be it a professional or a plebeian in leisure
Immasurable burden none can picture
Only we can halt the abuse for a future
To our peers that's still young and pure
Initiate ourselves to take up measures
Control the misuse lest we face disposure*