**Forum:** The General Assembly First Committee

**Issue:** Developing Measures to Mitigate the Impacts of Antibiotic Resistance

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Introduction

Antibiotic resistance is a rising global public health crisis threatening millions of lives worldwide. The growing antibiotic resistance crisis is the rapid emergence of resistant bacteria worldwide, endangering antibiotics - medicines that revolutionized humans’ battle against bacterial infections. Antibiotic resistance occurs when harmful bacteria mutate to become immune to the drug that is designated to kill them. Antibiotic resistance is thought to be caused by the misuse and abuse of antibiotic drugs as well as lack of infection control. Furthermore, the lack of new drug development for bacterial infections in recent years due to reduced economic incentives also contributes to the growing crisis. In 2019, 1.27 million deaths were directly caused by antibiotic resistance, and more than 5 million deaths in the same year were associated with antibiotic resistance. Antibiotic resistance concerns not only public health but also food security and the development of modern medicines and treatments.

Despite the rapid growth of the antibiotic resistance crisis and the danger of antibiotic resistance, it is often a neglected problem in many nations due to the lack of a structured and unified way to identify and track antibiotic resistance. Especially in the last two years since the start of the COVID-19 pandemic, the attention of the public health world is entirely on the pandemic, the already underrecognized antibiotic resistant crisis is receiving little attention from member states. The lack of public awareness, knowledge, and limited prevention efforts further contributes to the accelerating process of antibiotic resistance. The cause of the rising trend of antibiotic resistance can be summarized into two categories, the inappropriate use of antibiotics and the lack of new antibiotics.

As the antibiotic resistance crisis becomes more pressing, a heavy burden is put on More Economically Developed Countries’(MEDCs) healthcare systems and pharmaceutical industries. On the other hand, the crisis is causing a rising mortality rate in common bacterial infections due to limited available antibiotics in Less Economically Developed Countries (LEDCs).

Definition of Key Terms

Antibiotic Resistance

A medical condition where a bacteria become immune to the antibiotic that is designated to kill or inhibit the growth of that bacteria. Antibiotic resistance makes bacterial infections more difficult and longer to cure and treat, leading to higher risks of death. On a larger scale, the worsened infection condition caused by resistant bacteria leads to extended hospital stays per individual, increasing the mortality rate of bacterial infections. Lengthened hospital stays also result in higher medical costs and delayed treatment of other patients, negatively impacting the local economy.

**Antibiotics**

A type of medicine designated to kill or inhibit the growth of bacteria. Antibiotics are primarily used to treat bacterial infections such as pneumonia and tuberculosis. Antibiotics are also used in certain cancer treatments. However, the consumption of antibiotics can potentially have complications such as developing antibiotic resistance. Examples of antibiotics include penicillin, cephalosporins, and tetracyclines.

**Bacteria**

Bacteria are single-celled organisms under a larger category called prokaryotic microorganisms. Bacteria can be found in most environments, include humans. Bacteria inside humans play a major role in degrading food, ridding toxins, and transforming nutrients. Most bacteria are beneficial or harmless to humans; however, a small group of bacteria is pathogenic, meaning that they can cause infectious diseases such as pneumonia and tuberculosis.

**Bacterial infections**

A medical condition occurs when a pathogenic bacterium enters the human body, creating an adverse reaction. Symptoms of bacterial infections typically include fevers, chills, and fatigue. With appropriate antibiotic treatment, most bacterial infections are not deadly.

History & Developments

History of antibiotics

Sir Alexander Fleming first discovered antibiotics in 1928. Since the discovery of the first antibiotic in the 1920s, penicillin, one of the most popular and used antibiotics from the second world war to the 1950s, treatment for bacterial infections revolutionized; once fatal diseases such as pneumonia, syphilis, and endocarditis can be cured conveniently. Not only did antibiotics contribute greatly to treating bacterial diseases, but antibiotics are also popular in cancer treatments and inspired the development of many other medicines.

Prior to the discovery of antibiotics, bacterial infections were one of the top three causes of death globally; the number reduced significantly after the invention of antibiotics. However, due to the extensive use of penicillin during World War II, the first “antibiotic resistance crisis” occurred in the 1950s. The problem then was not as severe as a global crisis, but bacteria began developing immunity against penicillin. For the first time, many years of pharmaceutical advances were threatened. Nevertheless, the thriving pharmaceutical and antibiotic industry at the time quickly resolved the issue by developing new antibiotics. In the decades following, the world experienced cases of methicillin resistance, vancomycin resistance, and other antibiotic resistances, but none became as severe as a global crisis. The downhill of antibiotics that ultimately led to the crisis today began in the late 1990s when the antibiotic development field began to dry up.

Rise of antibiotic resistance in recent decades

 Overuse and inappropriate prescription of antibiotics

Developing immunity against a drug that has a negative impact on bacteria is a natural process of evolution; however, the overuse of antibiotics accelerates the process of resistance development. The non-antibiotic-resistant bacteria would die, leaving the resistant bacteria to thrive and reproduce, spreading diseases that are nearly impossible to treat. The overuse of antibiotics is due to two major factors: uncontrolled access to certain antibiotics and the inappropriate prescribing of antibiotics in hospitals and clinics.

In most countries, antibiotics such as Neosporin and polysporin do not require a prescription. In certain developing nations, an even larger number of antibiotics can be purchased from the local pharmacy without a doctor’s approval. Combined with self-medication, easily accessible antibiotics often lead to overconsumption of antibiotics. Antibiotics are also often overused in agriculture. Antibiotics are highly popular supplements for livestock to prevent infections. However, giving animals antibiotics can promote alteration of bacteria in animals, killing non-resistant bacteria and leaving the resistant bacteria to thrive and reproduce. Although certain altered bacteria might not harm the food-producing animal, when humans consume the food, the resistant bacteria can cause an infection in the human body. Furthermore, the urine and stool of animals in surface runoffs and fertilizers can further spread antibiotic-resistant bacteria.

Inappropriate prescription of antibiotics further contributes to the unnecessary overuse of antibiotics. According to a study by the Center for Disease Control (CDC), treatment indication and choice of agent of antibiotic treatments are 30% - 50% of the time inaccurate. Additionally, according to another study published on Oxford Academic, 30% - 60% of antibiotic medicine prescribed by intensive care units (ICUs) are suboptimal and unnecessary. Inappropriately prescribed antibiotics expose patients to the complications of antibiotics while having minimal therapeutic benefits. Unnecessary antibiotics can alter certain gene expressions in humans, making bacteria more prone to developing antibiotic resistance.

Lack of new antibiotics

In historical rises of antibiotic resistance, the development of new antibiotics has always been an effective solution to combat antibiotic resistance. However, in recent decades, many large pharmaceutical companies have lost interest in the antibiotic field due to the lack of economic appeal. According to data published by the Oxford Academy, of the 18 largest pharmaceutical companies in the world, 15 of the companies have stopped investing in antibiotic development. Additionally, the funding for the antibiotic development field decreased drastically, resulting in insufficient research on antibiotics and a lack of new antibiotics. The two leading causes of companies’ lack of interest in the antibiotic development are economic uncertainties and the extremely high standards for antibiotic clinical trials.

Antibiotics are short-term and inexpensive drugs, making them less profitable than drugs patients are required to take for a long time, such as diabetes medicine and cancer medicine. New antibiotic treatments cost between $1000-$3000, while cancer chemotherapy treatments can cost up to $12,000. Furthermore, the net present value (NPV) of a new antibiotic is only $50 million, while the NPV of a drug for a neuromuscular disorder is 20 times the NPV of a new antibiotic. In addition to the lack of profit, the demand for new antibiotics is highly unpredictable. Although resistance is ultimately inevitable, the timeline of bacteria evolution can be affected by various factors, making resistance hard to predict. Since great amounts of time and money (a new antibiotic costs 1 billion dollars and takes up to 15 years to develop) are put into antibiotic research and development, most pharmaceutical companies are unwilling to take the risk for an unguaranteed return.

In recent years, the standard for antibiotic clinical trials has become extremely strict. All drugs and treatments must undergo three clinical trials before they can be approved and produced in large quantities. Three clinical trials for antibiotics combined can cost an average of $41.2 million and take up to 15 years. Due to the strict regulations, some research will be required to be redone. Smaller pharmaceutical companies cannot afford the significant price and time, while larger companies see antibiotic development as an unworthy investment. Currently, there is a lack of incentive and appeal for pharmaceutical companies to pursue antibiotic development, a crucial step to resolving antibiotic resistance.

Antibiotic resistance in developed nations

 The primary problems in developed nations contributing to rising antibiotic resistance rates are the limited public knowledge of medicines, lack of antibiotic use regulation in hospitals, and use of antibiotics in agriculture.

 Limited public awareness of the complications of certain medicines and the lack of general knowledge on medicines make self-medication highly common. Leftover medicines from a previous prescription or prescribed to another individual are a popular choice of treatment in many middle-income to low-income households. Consuming antibiotics before an official diagnosis and prescription can lead to misuse and overuse of antibiotics. Additionally, if the “leftover” antibiotic is expired or stored in the wrong condition, it can further accelerate the process of antibiotic resistance. In rural areas where health care is hard to access or unaffordable, many people try to obtain medicine directly, sometimes through questionable methods. According to a study published in The Journal of the American Board of Family Medicine, many Americans frequently cross the border to Mexico each year to purchase antibiotics without a prescription due to the lack of accessible and affordable healthcare in their local community. Having individuals turn to unguaranteed healthcare services due to the inability to access public healthcare reflects an underlying problem in most nations: the unequal distribution of basic healthcare services. Unlike the lack of attention from the government on antibiotic resistance due to insufficient resources, most developed nations’ governments are aware of the ongoing crisis and have taken some measures to mitigate the impact; however, in order to truly slow down the antibiotic resistance crisis, individuals must be aware of the issue and take according measures.

 Hospitals are one of the biggest sources of developing antibiotic resistance; this is known as hospital-acquired antibiotic resistance. Antibiotics are commonly used in hospitals for antibiotic treatments as well as for bacterial infection prevention. The extensive use of antibiotics in hospitals promotes antibiotic resistance development; furthermore, patient-to-patient interactions and health professional-to-patient interactions increase the risk of resistance transmission. The over-prescription of an antibiotic is also an actively present issue. To mitigate the impact of antibiotic resistance, the rate of developing antibiotic resistance must be lowered, which can be achieved by minimizing the use of antibiotics in a hospital setting, and further regulating the prescription of antibiotics. Although hospital-acquired antibiotic resistance is certainly not limited to developed nations, multiple studies show that hospital-acquired antibiotic resistance is more common in developed nations than in developing nations. This could be because antibiotics are more commonly used and used in greater amounts in hospitals of developed nations.

Antibiotic resistance in developing nations

 Antibiotic resistance in developing nations is increasing the mortality rate of bacterial infections more often than in developed nations due to the less advanced medical facilities. The primary problems in developing nations contributing to rising antibiotic resistance cases are the easy access to antibiotics with questionable quality, mis-prescription and over-prescription on antibiotics, and the lack of awareness of the antibiotic resistance crisis from the government.

 The quality of medicine and whether it satisfies consumption standards are determined by multiple factors. If a medicine does not meet the qualifications and specifications of that type of drug, it is considered to be substandard. A primary determinant of drug quality is the storage environment of the drug. Antibiotics cannot be exposed to extreme sunlight, high temperature, or moisture. If antibiotics are stored in an undesired condition, they can become a substandard drug. Substandard antibiotics increase the risk of developing antibiotic resistance by 2-6 folds. According to a study in Nigeria, 25%-40% of ampicillin/cloxacillin antibiotic formulas were substandard. In rural areas, local pharmacies might not be able to afford such storage and transportation condition, leading to the purchase and consumption of substandard medicine. Due to self-medication, many people accidentally consume expired medicines, which is also substandard medicine. For rates of antibiotic resistance to decrease in developing nations, ensuring the quality of antibiotics people access is crucial.

 Misuse and mis-prescription of antibiotics are also common problems in developing nations that are accelerating antibiotic resistance rates. A study conducted in China shows that out of 1025 cases of antibiotic prescription, only 39 cases were thoroughly examined to determine the source of infection. Additionally, 78% of the patients were prescribed more than one antibiotic. Another study shows that antibiotic prescription is more common in private medical facilities; the study showed that in a public hospital, the prescription rate of antibiotics is 6.8%, while the prescription rate of antibiotics in a private medical setting is 30.8%.

 Antibiotic resistance remains one of the underrecognized crises in the world. In many developing nations, governments neglect or dismiss the growing public health crisis, leading to a lack of knowledge on the topic from the government and the public. Different to developed nations, lack of awareness on antibiotic resistance in developing nations comes from the government. The government is neglecting the issue of antibiotic resistance due to the lack of resources to resolve the issue on a national scale, or the consequence. Lack of awareness often means the lack of action and effort taken to resolve the issue, which is why many developing and developed nations lack a comprehensive system to track and research antibiotic resistance. In 2014 when the World Health Organization (WHO) released the first report on antimicrobe resistance, out of the 194 countries part of the organization, only 129 responded with data on infectious diseases, and only 22 of the countries provided data on all nine leading infections the WHO requested for. In order to effectively address the issue of antibiotic resistance worldwide, countries must first acknowledge the importance of the topic.

Geopolitics

The United States of America, the Federal Republic of Germany, the Swiss Confederation

 As the three nations leading in the fields of pharmaceutical development and pharmaceutical export, the role of the USA, Germany, and Switzerland is crucial to combatting the antibiotic resistance crisis. Combined, the USA, Germany, and Switzerland have more than 2775 pharmaceutical companies and pharmaceutical manufacturing businesses, accounting for 32.8% of the world’s total pharmaceutical exports. One of the major concerns that is increasing the cases of antibiotic resistance is the lack of new antibiotics and treatments for bacterial infections. The world is highly dependent on countries leading in the medical and pharmaceutical field, such as the USA, Germany, and Switzerland, to develop new medicines. Thus, a heavy economic burden and pressure to produce new antibiotics are put on countries like the USA, Germany, and Switzerland. Incentivizing large pharmaceutical companies to invest in antibiotic development and research and increasing the economic attraction of antibiotic development is a crucial step to solving antibiotic resistance.

**The People’s Republic of China, the Republic of India**

 As the two countries with the highest number of antibiotic resistance cases and highest antibiotic resistance rate, China and India have many responsibilities in the global combat against antibiotic resistance. In the recent two decades, the rate of antibiotic resistance has increased staggeringly in China and India due to the increased use of antibiotics for treatments and self-medication. According to a study conducted in India, units of antibiotics sold increased by 40% within four years. In 2017, there were an estimated 73,000 cases of multi-drug-resistant tuberculosis, which is more than 13% of the total cases of drug-resistant tuberculosis worldwide. In recent years, antibiotic resistance has only become a seriously addressed topic in China. Although changes have been made, more action will be taken to improve the current situation. The people of China and India are the most threatened by antibiotic resistance; thus, the active participation and effort of China and India are extremely important to mitigate the impact of antibiotic resistance and prevent the growth of the crisis. As a country leading amongst developing nations, China should adopt a representative and leading role for developing nations in addressing the issue.

**World Health Organization (WHO)**

 The WHO is an international, non-governmental health organization that works with 194 member states around the world. In the face of a global antibiotic resistance crisis, the WHO’s role in combining and uniting forces between nations is crucial. In order to truly combat the antibiotic resistance crisis, the problem must not only be tackled on a local level but a global level as well. Antibiotic resistance is not a “developed nation problem” nor a “developing nation problem”; it is a public health crisis that is threatening the lives of people from all places since anyone can develop antibiotic resistance. Thus, a cross-nation organization such as the WHO should act as a bridge to ensure the global resolution of the antibiotic resistance crisis with efforts from all nations.

**Previous Attempts to Solve the Issue**

**International efforts**

In May 2014, the World Health Assembly passed and adopted resolution WHA67.25 addressing antimicrobial resistance. The resolution requested the development of a global action plan to combat the resistance crisis. In 2015, the UN launched the “Global action plan on antimicrobial resistance” to raise global awareness of the growing antimicrobial resistance crisis. The global action plan on antimicrobial resistance had five main objectives: “Improve awareness and understanding of antimicrobial resistance through effective communication, education, and training. Strengthen the knowledge and evidence base through surveillance and research. Reduce the incidence of infection through adequate sanitation, hygiene, and infection prevention measures. Optimize the use of antimicrobial medicines in human and animal health and increase investment in the development of new medicine and diagnostic tools, vaccines, and other interventions.” In the global action plan, a detailed guide for recommended actions from member states, the UN, as well as international and national organizations are included. The UN estimates to solve the antimicrobial resistance crisis in 5-10 years after the launch of the global action plan. Due to the COVID-19 pandemic, efforts made to address the antibiotic resistance issue were interrupted, holding back the progress towards combatting global antibiotic resistance.

**National efforts**

The USA released the US National Action Plan for Combating Antibiotic-Resistant Bacteria in 2015 to address rising cases of antibiotic resistance on a national level. The US’s national action plan prioritizes infection control, careful use of antibiotics, and investment in antimicrobial-resistant projects. According to CDC, between 2016 and 2020, they invested in more than 330 antimicrobial resistance projects and received $200 million from Congress to work towards national goals of combating antimicrobial resistance.

 Other countries such as India and the UK have also released national action plans to combat antibiotic resistance. While national action plan is crucial to resolving local problems, antibiotic resistance is ultimately a global crisis; thus, collaboration among nations is also extremely important.

Relevant UN Treaties and Events

* WHA67.25 2014
* Global action plan on antimicrobial resistance, 2015

Possible Solutions

 The antibiotic resistance crisis can be tackled from a variety of perspectives and scales. Depending on each nation’s experience with antibiotic resistance and available resources, the priorities and role of each nation will differ.

**Incentivize and support pharmaceutical companies to invest in antibiotic development**

Member states should incentivize local pharmaceutical companies to invest in antibiotic research and development through ways such as funding. The constant development of new antibiotics is crucial because all antibiotics will eventually be resisted by bacteria; thus, new antibiotics are needed to replace old ones to treat bacterial infections. The development of new antibiotics is also how the world overcame the first few waves of antibiotic resistance. Clinical trial standards should also be lowered and loosened in countries with a developing pharmaceutical industry until there are enough new antibiotics on the market to encourage new antibiotic development further. Additionally, governments should provide financial support for pharmaceutical companies in antibiotic clinical trials to lift the economic burden that is discouraging many small pharmaceutical companies from pursuing the antibiotic development field.

**Strengthen antibiotic use and prescription regulation in hospitals and clinics**

Member states should release a strict prescription guideline for antibiotics, and a maximum dose of antibiotic a patient can be prescribed each time to prevent over-prescription and over-consumption. The overuse of antibiotics will increase the risk of one developing antibiotic resistance, ultimately decreasing the effectiveness of an antibiotic. Furthermore, member states should encourage hospitals to minimize the use of antibiotics for in-hospital infection prevention and consider other methods of infection prevention to replace antibiotics to prevent resistance transmission in hospitals.

**Raise awareness on antibiotic resistance**

 Member states should educate the public on the antibiotic resistance crisis, the cause of the crisis, and methods individuals can adopt to lower the risks of developing antibiotic resistance. One of the biggest causes of self-medication is the lack of knowledge on the consequences of overconsuming specific medicines and the complication of certain medicines when misused. Additionally, due to the general lack of knowledge on antibiotic resistance, people are unaware of their actions contributing to the growth of the public health crisis. Thus, public education on essential health and medication topics will lower the rate of antibiotic resistance caused by individual misuse of antibiotics. Along with raising awareness, member states should help provide easier access to healthcare or safe access to quality guaranteed medicine.

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