Forum: Environment Commission

Issue: Developing a framework to prevent a global antibiotic apocalypse

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Introduction

Ever since the discovery of antibiotics, a chemical that has a potential to cure diseases, the life expectancies of people increased drastically. As more types of diseases outbreak, a great demand for more antibiotics followed. Nowadays, antibiotics can be seen in almost every health care facilities. However, as the usage of antibiotics increase, so did the bacteria's resistance against antibiotics.

Bacteria are the microorganisms that are abundant almost everywhere in our daily lives. Among these bacteria, some have the potential to cause diseases in organisms, called microbes. Even though antibiotics can eliminate these kinds of bacteria, mutations in bacteria will eventually lead to resistance against the antibiotics. This phenomenon is so-called "antibiotic resistance".

Antibiotic apocalypse is a situation when antibiotics become obsolete due to resistance evolved in bacteria. According to the United Nations (UN), if no action is taken, the estimated deaths caused by antibiotic resistance will reach 10 million per year by 2050. In order to prevent this case, World Health Organization (WHO) and other associations have taken initiatives that will help prevent this apocalypse. Moreover, national health agencies and people in medical fields are also working to prevent the worst scenario.

As noted in the third goal of the United Nations Development Programme (UNDP)'s Sustainable Development Goals (SDGs), UN aims for better health care and life standards for world population. Good health and well-being are recognized as essential needs to all population. Therefore, preventing antibiotic apocalypse is one of the most important things for the safe of future population.

Definition of Key Terms

Antibiotic

A type of antimicrobial that is used to prevent and kill bacteria.

Antibiotic apocalypse

A situation where antibiotic resistance is prevalent in bacteria, causing antibiotics to be ineffective.

Antibiotic resistance

Ability of a microorganism, such as bacteria, to withstand the effects of an antibiotic

Antimicrobial

Drugs/medicines that kill or prevent the growth of targeted microorganism.

Antimicrobial Resistance (AMR)

Ability of a microorganism, such as bacteria, to withstand the effects of an antimicrobial. This is a more generalized term compared to antibiotic resistance.

Microbes

Living organisms, like bacteria, fungi, or viruses, which can cause infections or diseases.

Sustainable Development Goals (SDGs)

Collection of 17 global goals set by UN that are designed to achieve a better and more sustainable future for all population.

Resistant bacteria

Bacteria that are resistant to certain type of antibiotic.

Resistance mutation

A change in genetic make-up (due to some environmental reason) of a microbe that results in that microbe to become resistant to one or more drugs.

Multi-drug resistant (MDR) bacteria

Bacteria that are resistant to more than one type of antibiotic.

Infection

Invasion of a disease-causing agents into an organism's body, resulting illness. Bacterial infection refers to infection caused by bacteria; viral infection refers to infection caused by virus.

Background

Since the discovery of the very first antibiotic, penicillin, pharmaceutical industry has thrived and numerous types of antibiotics have been synthesized. In order to extend the life expectancy, human have attempted

to conquer many types of threatening diseases. Rise of new medicines and treatments have eliminated most of the diseases, not until the recent emerge of antibiotic resistant bacteria.

Antibiotic resistance is known to be happened since 1930s, but it has been rapidly increasing since the beginning of the 21st century. The cause of antibiotic resistance is mainly overuse and misuse of antibiotics. Overuse of drugs will cause faster development of resistance within human body, which will lead to birth of drug-resistant bacteria. Misuse of drugs is when antibiotics are used in wrong purposes, such as antibiotics used as growth promoters, or used to prevent diseases but not treating diseases. As a result, Tuberculosis, malaria, the human immunodeficiency viruses (HIV), and influenza are common types that are becoming more and more resistant to existing antibiotics.

According to WHO, there are annually 700,000 people die from drug-resistant diseases. Antibiotic apocalypse is threatening public health and medicines are on the verge of being useless. This phenomenon is known to be irresistible, because there the procedure of making effective medicine will require more time and effort and riskier, if not being impossible. Furthermore, spread of these drug-resistant bacteria will cause enormous economic and health catastrophe. “We are at a critical point in the fight to protect some of our most essential medicines,” said Tedros Adhanom Ghebreyesus, WHO director and Co-chair of the UN Interagency Coordination Group (IACG).

Cause of antibiotic resistance

In general, antibiotics usage and development of antibiotic resistance in bacteria are inevitable. Also, these two events must come together because they have a cause and effect relationship. When someone uses antibiotic to cure or prevent disease, bacteria are slowly developing a resistance mechanism against the antibiotic. However, antibiotic apocalypse is an unnaturally fast pace in development of antibiotic resistance among bacteria. The main reason for this is improper uses of antibiotics.

The important fact about antibiotic is that it is a cure for bacterial infection or disease, but not those caused by viruses. And since viral infections, such as cold or flu, are very common in real life, people often misunderstand when to use the antibiotic and its differentiation with other treatments such as vaccines. Also, widespread use of antibiotics expediates the communication between bacteria and their reproduction. For another examples, using antibiotics as growth promoters in animals, repeatedly using leftover antibiotics, and taking antibiotics that are not prescribed on the person him/herself are reasons that cause fast development of antibiotic resistance. In order to prevent these, detailed instruction in writing prescription antibiotics, and awareness in safe usage of antibiotics are critical in preventing the resistance. WHO and other agencies are working together to prevent these cases of misusing antibiotics, thus safeguard the medicines.

Threats and potential consequences

Antibiotic resistance is regarded as one of the biggest threats to global health, food security, and medical development. First of all, new resistance mechanisms are known to spread so quickly, and this will cause a great

number of deaths. Because creating new types of antibiotic take huge amount of time and effort, it is impossible to eliminate the resistant bacteria without causing any deaths. Also, one type of resistant bacteria can lead to more different types of new bacteria to emerge, this chain reaction is very hard to encounter in a global scale. Secondly, antibiotic resistance will affect the food security since antibiotics are taken by animals and livestock as well. The potential harm of infection is then not only limited to human beings, but also the other organisms that human consumes. Therefore, the outbreak of antibiotic resistance will have a huge impact on nation's agriculture industry and health. Lastly, antibiotic resistance will hinder the medical procedures and developments by making the existing cures to become useless. If the medicines are no longer effective, it will not only slow down the development of new antibiotics against new diseases, but also make old diseases harder to cure, increasing the morbidity.

Aside from hazards in public health, such as increasing mortality, there are also economic concerns. As more new antibiotics are required, so do the funds. Scientists need money to conduct experiments and researches on finding a new solution for curing diseases. Also, the inabilities of existing antibiotics are huge loss in terms of wasting resources in creating the antibiotics. In terms of governmental policies, limited funds will make the health policies and public medical services harder to implement. As there are more economic burdens laid on governments, organizations, and even individuals, this will also delay the creation of a more effective policies to prevent the apocalypse. In addition, the need for a more intense and sophisticated cares on patients will raise the prices for public health cares, making some population not being able to afford for it. Limited number of hospitals and medical supplies will also cause more people to have no chance in receiving a proper health care. For these reasons, antibiotic resistance endangers third goal of UNDP's SDGs, good health, and well being.

Multi-drug-resistant tuberculosis MDR TB

Tuberculosis is a disease caused by bacteria. Multi-drug-resistant tuberculosis (MDR-TB) is referred to tuberculosis bacteria that have developed resistance towards antibiotics. Mismanagement of TB treatment is the most likely reason attributes to emerging resistance. This cause antibiotics to become futile and makes the conditions extremely difficult to treat. Especially in the case of MDR TB, due to bacteria's resistance towards multiple antibiotics, the way to cure the disease is becoming extremely limited. Some scientists even estimate that there is no solid way to develop a perfect antibiotic to this kind of bacteria. This case is reported in 117 countries worldwide, and is threatening the usage of medicine. New WHO recommendations aim to speed up detection and improve treatment outcomes for MDR-TB through use of a novel rapid diagnostic test and a shorter, cheaper treatment regimen. New approaches to drug resistance are initiated by WHO by providing more access to diagnosis and appropriate treatment.

Global impact of antibiotic resistance

Since most of the bacteria can travel through various medium, such as air and water, it's impossible to block the spread of bacteria. Also, due to their small size, bacterial infection is extremely easy to occur, as well as the transmission from one individual to another. As a result, spread of a bacterial disease can only be solved through developing a new medicine. Recent cases of disease outbreak have even appeared in many countries at

similar time frame in short amount of time, making it extremely dreadful. The global impact of antibiotic resistance is deemed as highly influential in areas such as, but not limited to public health, global economy, education, and social environment. Therefore, in order to prevent further negative outcomes, UN, WHO, and other parties are trying to solve for this incident in a global scale by encouraging as many nations to collaborate on possible solutions proposed.

Major Parties Involved

World Health Organization (WHO)

WHO is a branch of UN that is specialized with health care problems and policies. They work worldwide to promote health, keep the world safe, and serve the vulnerable. WHO's goal is to ensure that more population to get access to universal health coverage. They are also in charge of dealing with health emergencies, such as antibiotic resistance. They focus primary health care to improve access to quality essential services, support people's participation in national health policies, and improve monitoring, data, and information. In the case of antibiotic resistance, WHO takes the most initiatives in terms of approach to solve the problems. They view this case as the most priority and importance since billions of lives are threatened. For examples of current actions undertaken, there are World Antibiotic Awareness Week and Global Antimicrobial Resistance Surveillance System (GLASS).

Food and Agriculture Organization (FAO)

FAO is a specialized agency of the UN that leads international efforts to defeat hunger. Their main aim is to achieve food security and make sure world population have regular access to enough high-quality food and healthy lives. There are more than 130 countries involved and collaborate with FAO. FAO has been focusing on the issue of antibiotic resistance because of its harm on international food security. Similar to WHO, FAO is contributing to issue of antibiotic resistance, aiming to get rid of catastrophic effects from this. They are trying to provide enough of necessaries in good qualities to world population in order to ensure safety and to defeat hunger. Also, FAO's collaboration with WHO and other health agencies is looking for a faster and more sustainable solutions to antibiotic resistance by controlling the food chains and consumptions worldwide, and thus raise the life standards and maintain healthy conditions.

World Organization for Animal Health (OIE)

OIE is an international organization signed by 179 member countries and territories. It is an intergovernmental organization that aims to ensure and effectively encounter global animal disease situation by collecting and analyzing necessary scientific information. They encourage international solidarity and expertise on animal diseases issue. OIE has been involved in antibiotic resistance and raised concerns regarding the animals' securities against bacterial infection. OIE's attempts in raising awareness in international agriculture sector is helping to promote an appropriate usage of antibiotics. Also, OIE is mainly safeguarding international trade of

animals and animal products by publishing standards that should be followed. These efforts are important in making sure the international trade is healthy and reliable, protecting the world health.

World Health Organization / World Organization for Animal Health / Food and Agriculture Organization Collaboration (WHO/OIE/FAO Tripartite)

Three parties mainly involved in tackling global health related issues, WHO, OIE, and FAO created a tripartite, or collaborating association in order to produce a more effective and powerful solutions to world health problems. Recently, FAO/OIE/FAO Tripartite collaboration on Antibiotic Resistance Apocalypse has been published. Three parties distribute the role on solving this problem to each, and thus limit to spread of antibiotic resistance and prevent further deaths.

Previous Attempts to Resolve the Issue

The World Health Assembly (WHA) in May 2015 tackled the issue of antibiotic resistance in bacteria. This Assembly was held mainly in purpose of world health and social goods. It was successful in terms of building the protocol for future action plans. The global action plans on antimicrobial resistance include improving awareness and understanding of antibiotic resistance issue, strengthening surveillance and research, reducing the incidence of infection, optimizing the use of antibiotic medicines, and ensuring sustainable investment in countering antibiotic resistance. Aside from WHA, there were also political declarations endorsed by Heads of the State at the UN General Assembly (GA). UNGA is the six principal organs of the UN, each representing a certain topic in global issues. These representations are equally responsible and empowered to make policies and potential solutions that can be implemented to solve a particular issue.

There are other initiatives taken by WHO in order to prevent the spread of antibiotic resistance. These actions encompassed many member nations and professionals and were decided after number of meetings. Currently, there are four major solutions proposed by WHO. Firstly, World Antibiotic Awareness Week is an annual activity that is ran by WHO, starting from November, 2015. This week undertakes some planned activities during week of the campaign. This was done in purpose of raising public awareness and provide information about antibiotic resistance and ways to prevent it to a larger population. Secondly, GLASS is an international data that collects information related to antibiotics. GLASS provides WHO and different member nations collective system with a standardized approach to the analysis and collection of dat. Thirdly, Global Antibiotic Research and Development Partnership (GARDP) is started to control the usage of antibiotics. This is a joint initiative of WHO and Drugs for Neglected Diseases initiative (DNDi) which aims to develop and deliver new treatment and drugs to different nations. Lastly, IACG on Antimicrobial Resistance was convened by UN after the UN High-Level Meeting on Antimicrobial Resistance in 2016. IACG and UN signed the partnership to work together and prevent the antibiotic apocalypse. This action involves expertise across human, animal, and plant health across environment sectors to plan for future actions.

Possible Solutions

- Inform individuals to use antibiotics under right condition and for right purposes through means such as butt not limited to teaching, advertising, and collaborating with other institutions or companies. Ways to publicize healthy usage of antibiotics should not be limited to any extent, and governments should prioritize on promoting appropriate antibiotic usage between the citizens. For example, government should consider all population, including anyone who has ability to medicate themselves and have access to antibitoics. This is important since scientists believe the main cause of antibiotic resistance is misuse of antibiotics. Examples of misusing antibiotic are sharing antibiotics and using leftover antibiotics for multiple times. Therefore, reinforced education regarding how to use antibiotics appropriately can slow down and prevent the development of drug-resistant bacteria.
- Public sanitation and necessary hygiene practices such as washing hands regularly and avoiding close contact with sick people are important. It is also important to alert people to be mindful of certain environment-borne bacteria, and carefully behave whenever there is a contact with things that have potential of bacterial infection. Stepping away from dangerous areas (or environment) is an essential knowledge to prevent oneself from getting infected.
- Global and regional policies are critical in advertising the issue. Certain policies, programmes, and implementation of infection prevention and control measures would be helpful in raising awareness. WHO has been encouraging member nations to create policies and action plans that can prevent the antibiotic resistance. One example of this action can be creating policies that will aid the supplies of antibiotics to all population and especially to Least Economically Developed Countries (LEDCs) and underdeveloped regions. It is then important to bring pharmaceutical products into these areas and open market, so that people will become easily accessible to those products.
- It is the duty of government and organizations to do their best to develop new antibiotics that are effective to counter the resistant bacteria. Especially encourage people in medical field for a robust research in developing these new products. Also, it's important to raise funds from businesses to purchase necessary items in developing new antibiotics. Developing a new drug is known to be extremely complicated process since it has to be tested numerous times before being commercialized on human beings. Therefore, an enough time and money is integral in developing new antibiotics.
- Encourage More Developed Countries (MEDCs) to supply basic needs to Less Developed Countries (LEDCs), and establish a special institution for extra support on LEDCs. Furthermore, fund engineers and pharmacologists to quickly cope with dangerous situation or outbreak of unexpected disease. Other than coping with diseases, it is also important to mass produce cheap medical products that can easily check if one is infected or not: tools such as foldscope and paperfuge are good example. Governments of LEDCs are responsible to import those useful products and initiate accessible medical departments.
- WHO and other agencies, as well as pharmaceutical industries can work for developing new, cheap supplies that will secure people from infection. Recent reports have published that release of new technologies have helped more population to easily detect whether they are infected by resistant bacteria or

not. These cheap and easy tests or medical kits for people hence allow people to easily diagnose themselves before come to see the doctor. This can then make the whole process much easier and faster, so that it will optimize the efficiency of human resources (professionally trained doctor).

- Agriculture, pharmaceutical industry, and other businesses can help to produce better environment to prevent the spread of bacteria. It is important to maintain a safe condition for population to thrive. Prevention of antibiotic apocalypse can be done through aids from these sectors, by making use of nature, chemicals, and funds. Also, governmental regulations on these businesses might be helpful in terms of securing the amount of antibiotics produced and traded.

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Appendix or Appendices

I. https://www.who.int/antimicrobial-resistance/en/ (Antimicrobial resistance WHO)

This website is the general introduction to antimicrobial resistance. It contains facts about this incident and all possible sites in researching about antibiotic resistance issues. (Antimicrobial resistance is basically same as antibiotic resistance). It is an officially published site by WHO, and thus credible and contains many useful contents.

II. https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance (Antibiotic Resistance WHO)

This website focuses on the general information about antibiotic resistance, such as what is it, what are the consequences, what should we do about it…. It is an official publication from WHO, and it contains fruitful contents, including the past and present actions taken by WHO and examples of other possible solutions. This website is very similar to the first website in terms of explaining the topic in general.

III. https://www.rxlist.com/antibiotic_resistance/drugs-condition.htm

This website talks about what you can do to prevent antibiotic apocalypse. It contains general information about what is antibiotic resistance, and actions that you must take to prevent the worst scenario.