NOVICE 43

HUNTINGTON BEACH HIGH SCHOOL

World Health Organization
Antibiotic Resistant Bacteria

Evan Riederich
Katelyn Mai
Claire Pham

Welcome Letter

Dear Delegates,

On behalf of the Huntington Beach High School Model United Nations Program, we would like to welcome you to our Novice 43 conference!

Our annual Novice conference upholds the principles and intended purpose of the United Nations. Delegates can expect to partake in a professional, well-run debate that simulates the very issues that those at the United Nations discuss every day. Both novel and traditional ideas will be shared, challenged, and improved.

It is our hope that all delegates will receive the opportunity to enhance their research, public speaking, and communication skills as they explore the intricacies of global concerns through various perspectives, some of which may be very different from their own. We hope their experiences here give them new insight and values that they can apply outside of the realm of Model UN for the betterment of the world community.

Although we will be entertaining a new style of a virtual conference, we hope all delegates will experience a fruitful and enhancing debate. Please do not hesitate to approach our Secretariat or Staff Members with any questions or concerns that you may have throughout the day. We wish the best to all our participants and hope that they may share a fulfilling experience with us! Enjoy the conference.

Sincerely,

Summer Balentine
Secretary-General

Jenna Ali
Secretary-General

Kayla Hayashi
Secretary-General

Hailey Holcomb
Secretary-General

Meet the Dias

Evan Riederich

Hello delegates! My name is Evan Riederich and I will be one of your chairs for WHO at Novice this year. I am currently a junior at Huntington Beach High School and have been a part of MUN for three years. MUN has helped me immensely with stepping out of my comfort zone, as I am sure it has done the same for you, and I could not be thankful enough for that. Outside of participating in MUN, I am a captain on the HBHS football team. I joined freshman year, and have played varsity since I was a sophomore. Outside of school and football, I enjoy working out, listening to music, and absolutely destroying my family in UNO. I look forward to chairing you all! If you have any questions, please feel free to contact me or the other chairs (whonovice@gmail.com). Good luck with researching and see you all in debate!

Katelyn Mai

Welcome delegates! My name is Katelyn Mai and I am excited to be one of your chairs for WHO this Novice conference. I am also a junior at Huntington Beach High School and this is my third year in the MUN program, as well as my first time chairing! MUN is a fantastic program, despite the immense loads of stress that come along with the periodic conferences, and I hope that this conference will allow you to become motivated as a participant and a delegate. Aside from MUN, I am a member of the swim team, varsity since freshman year, not to flex (just kidding that was definitely a flex) and it is essentially my entire life, with a bit of room to squeeze for school. That was not funny at all. I also love to eat bread, it's just great: the fantastic texture, airiness, flavor and variety. Ironically enough, I cannot bake for my life. Once again, I am grateful to be chairing for you this conference and if there are any questions or concerns, even minor ones, don't be afraid to contact us at the email above!

Claire Pham

Hello delegates! My name is Claire Pham and I'm looking forward to being one of your chairs for the WHO at this Novice conference. I'm a junior at Huntington Beach High School who has been in the MUN program for three years. Although it can be stressful at times, I'm very grateful for the experiences that MUN has given me thus far and I hope you get something positive out of it as well. Outside of the MUN program, I am a part of other academically challenging classes where I can put my skills to the test. Taking school out of the picture, I use my free time to explore some of my hobbies like drawing and playing the piano. I can't wait to see all of your hard work and research pay off during this conference. Feel free to contact any of us using the above email address if you have any questions or concerns!

All Papers are due on April 18th, 2021 by 11:59pm to

whonovice@gmail.com

ANTIBIOTIC RESISTANT BACTERIA

BACKGROUND

The rapid evolution of antibiotic resistant bacteria (ABR) is becoming a threat to both human and animal life; although the process is primarily natural, the misuse and abuse of antibiotics due to uneducated healthcare personnel and farmers contribute to the disappearing effectiveness of the medicine. This ever growing global issue occurs when microorganisms such as bacteria, fungi, viruses, and parasites genetically alter themselves following exposure to antimicrobial drugs, such as antibiotics. Antibiotics have been utilized for millennia to treat infections, however there was no knowledge on the cause of infections and the factor of bacteria. Despite the lack of scientific research, various methods such as molds and plant extracts were used to treat these infections, such as the ancient Egyptian use of moldy bread for infected wounds dating back to about 1550 B.C. Bacterial infections and the effectiveness of chemicals were only truly discovered in the early 20th century by German physician Paul Ehrlich who referred to his work as chemotherapy, or the use of chemicals to treat diseases. He discovered that certain substances could selectively kill bacteria, such as the chemical arsphenamine for syphilis treatment, which became the first modern antibiotic. The first commercialized antibiotic medicine, Penicillin, derived from the fungus *Penicillium notatum*, was created in 1928 by Alexander Fleming to treat *staphylococcus* bacteria.[1] The production of antibiotics later bloomed around 1940, and has since significantly reduced illness and death from infectious diseases. With the aid of these antibiotic medicines, the US leading cause of death changed from communicable diseases to non-communicable diseases from the period before antibiotics to the present day. Furthermore, the average American life expectancy at birth became a much higher 78.8 years, allowing the older population to make up 13% of the entire US population in comparison to the previous 4%.

However, along with the growth of medicine came the consequences of misuse and overuse. Antibiotic resistance falls under the umbrella of antimicrobial resistance (AMR), which is a more generalized term for any microbe, not just bacteria as in ABR, which is resistant to their designated drugs, and the global spread of multi resistant germs evolve into superbugs, which are untreatable with current existing medicines. AMR is found in all regions of the world and is especially prevalent with modern day globalization; global trade and travel has allowed for the increased spread of resistance. The most susceptible areas of spread lie within communities, the food supply, healthcare facilities, and the environment. Infections spread amongst patients in healthcare facilities and spread to the community and the environment, human activity introduces germs and bacteria into the environment, and animals that serve as food supply carry germs that spread to humans and the environment as well.[2] According to the US Department for Disease Control and Prevention (CDC), approximately 2.8 million people in the US are infected by ABR infections annually and 35,000 die as a result.[3] The most common fields where antibiotic drugs are used include chemotherapy for cancers, organ transplantation, diabetes treatment, and other major surgeries. With how rapidly these new bacteriophages are evolving, these practices that save tens of thousands of lives annually may become insufficient as treatment for specialized infections, putting research back at the start line for many medical fields.

The two most common types of microbes involved in antimicrobial resistance include bacteria and fungi. Bacteria and microbes develop resistance to their corresponding medicines by modifying their DNA or finding resistance genes in plasmids, fractions of DNA that can transfer information between germs.[4] Specific bacteria families include *Klebsiella pneumoniae* (a common intestinal bacteria), *Staphylococcus aureus* (skin bacteria), *Escherichia coli* (intestine bacteria), and *Salmonella enterica* (a common foodborne disease).[5] *K. pneumoniae* is a common intestinal bacteria that can cause life-threatening infections, and is a major cause of hospital-acquired infections such as pneumonia, bloodstream infections, and infection in newborns and intensive-care unit patients. In some countries, carbapenem antibiotics, a class of highly effective antibiotic agents used to treat severe or high-risk bacterial infections, do not work on over half of the patients treated for *K. pneumoniae* infections as a result of ABR. Other bacteria have developed similarly threatening levels of resistance to the most effective modern antibiotics, leaving a significant number of infected people at risk of death from ABR. Another major example of ABR falls under tuberculosis, specifically *Mycobacterium tuberculosis* (MDR-TB), which is caused by a multidrug resistant strain that is resistant to the most effective TB medications rifampicin and isoniazid. The number of drugs utilized for treatment of MDR-TB is significantly higher than that of non MDR-TB infections, and 4% of new TB cases and over 20% of those with previous TB treatment are estimated to be MDR-TB, thus making the specific infection one of the most dangerous and fatal cases of ABR.[6]

Modern medicine has been less effective as the number of infections, such as pneumonia, tuberculosis, gonorrhea, and salmonellosis, have become harder to treat; the result of ABR leads to longer hospital stays, higher medical costs, and increased mortality. Current common measures presented by the World Health Organization have worked to raise awareness for the issue, as well as prevent the rapid spread of infections.[7] For individuals in the community, it is essential to follow prescription instructions from certified health professionals, including the avoidance of sharing, using leftover antibiotics, and demanding antibiotics if not deemed necessary; the CDC recently estimated that thirty percent of antibiotics prescribed were not necessitated, and of that 30%, 50 % were given improper dosages or durations.[8] The CDC created a National One Health approach to the antibiotic resistance issue, which includes aspects such as working to implement effective data and surveillance systems, building lab and healthcare capacity, and ensuring effective access to information on antibiotic use. Additionally, policy makers are advised by WHO to create effective surveillance of ABR infections and establish policies, programs, and control measures as well as accessible information on the impact of ABR.

Over 60% of the world's population carries multi-drug resistant bacteria, and as antibiotic resistance rises, treatment becomes more expensive, costing an average of 700 USD, paired with the extended duration of illness, increased tests, and more expensive drugs; the most effective forms of treatment can also cost tens of thousands, leaving the general population unable to afford it. As of 2019, WHO has identified 32 antibiotics in clinical development to address a number of infectious diseases within the priority pathogens list as a focus for medical study and preparation for the loss of effectiveness within various other antibiotics. Furthermore, the focus of the SDG monitoring Framework has expanded to recognize a new AMR indicator, encouraging nations to improve and increase surveillance for these detrimental pathogens.

UNITED NATIONS ACTION

In order to sufficiently address the ever growing prevalence of antibiotic resistant bacteria, the United Nations has passed and put forth an abundance of resolutions and campaigns. The first of these resolutions was WHA A51/9, which was passed in 1998 and addressed the growing necessity for improved surveillance to determine in what regions antibiotic resistant pathogens were becoming prevalent, so nations could modify national treatment and protocol.[9] It also focused on implementing national policy workshops, which would work to educate healthcare professionals on how to efficiently and safely distribute antimicrobial agents.[10] This resolution failed overall due to a lack of enforcement by many nations. Seven years later, resolution WHA A58/14 was passed, successfully establishing antimicrobial resistance as a threat to global health security, while simultaneously advising nations to follow the rules stated by the First International Conference on Improving Use of Medicines.[11] The most recent resolution, A68/20, passed in 2015, drew attention to the abuse of antibiotics within the agricultural setting and in farm animals.

In addition to the resolutions the UN passed, the establishment and implementation of guidelines and specific initiatives have had major success in combating the issue. WHO developed: World Antimicrobial Awareness Week(WAAW), Global AMR Surveillance System(GLASS), Global Antibiotic Research and Development Partnership(GARDP), the Interagency Coordination Group on AMR(IACG), and the Global Action Plan on AMR.[12] WAAW was established in May of 2015 by the World Health Assembly(WHA), and has the primary initiative of educating the general public and health care personnel on the antimicrobial resistant bacteria through effective communication, education, and training.[13] Also established in 2015, GLASS has made tremendous strides in aiding nations in tracking and determining what sections of their nations are being most affected by antibiotic resistant bacteria. This initiative was successful through the employment of tools and sufficient analysts within nations' clinics and laboratories. The employment of these resources provided WHO authorities with sufficient data, which allowed them to effectively pinpoint what areas of a nation need the most relief, resulting in efficient national action.[14] First discussed in 2014, GARDP and their partnership with Drugs for Neglected Diseases Initiative (DNDi) successfully launched in 2016, and has since been working constantly to develop new treatments in order to combat antibiotic resistant infections that have been deemed a threat to global health.[15] In order to further unite nations in taking a stand, the UN Secretary-General established the IACG to enhance cooperation between individual and international organizations, so the world may concoct an outline that covers all issues that may arise when combating antibiotic resistant bacteria.[16] Lastly, the WHA published a global action plan in order to tackle the issue at hand, and in the years since it was established it has proven to be the most significant. This action plan established five main objectives: improve awareness, strengthen surveillance and research, reduce infection rates, efficiently utilize antimicrobial medicines, and ensure nations invest in countering the issue at hand.[17] Since this was established in May of 2015, the UN has worked consistently to bring hope to the world in slowing the spread of this seemingly unstoppable issue by organizing and implementing each of the initiatives and guidelines listed above.

CASE STUDY: STREPTOCOCCUS AND KLEBSIELLA PNEUMONIAE

Responsible for causing Pneumococcal pneumonia, *Streptococcus pneumoniae* is a well-known bacteria that has been a challenge to combat, with the disease hospitalizing 150,000 Americans annually.[18] Due to its growing presence after being recognized for causing pneumonia in the 1900s, scientists have developed various vaccines created with the intention of preventing the spread of the disease and its effects. For instance, the WHO's recommended childhood pneumococcal vaccination is implemented in childhood immunization in various countries such as the United Kingdom, United States, and South Africa.[19] Although it is recommended to get vaccinated in order to combat this disease, the continued usage of other antibiotics has led *S. pneumoniae* and other bacteria to develop high resistance to these antibiotics.[20] 26 years after the release of the antibiotic Penicillin in 1941, *S. Pneumoniae* became resistant to this antibiotic, and these Penicillin resistant versions of the pathogen proceeded to become increasingly abundant as time progressed.[21] In the past decade, incidences of Penicillin-resistant *S. Pneumoniae* in strains increased 60-fold from 40% in select areas of the United States.[22] Despite the fact that this resistance to the antibiotic does not make the pathogen more fatal, such antibiotic resistance makes *S. pneumoniae* more arduous to exterminate.

To make matters worse, as more antibiotics were released and misused, including Imipenem and Ceftazidime-avibactam, more pathogens became antibiotic-resistant. One such pathogenic bacterium is *Klebsiella pneumoniae*, which causes pneumonia similarly to *S. pneumoniae*. A ceftazidime-avibactam-resistant (CAZ-AVI) KPC-2 producing *Klebsiella pneumoniae* strain was initially isolated in a Finland hospital in December 2018.[23] With *K. pneumoniae* having the ability to produce an enzyme, carbapenemase, it renders all antibiotics in the subcategory carbapenems unable to destroy the bacteria thus making the process of eliminating it an all the more difficult task.[24] This is especially the case due to the fact that carbapenem antibiotics are often utilized as a last resort when treating antibiotic-resistant, Gram-negative infections. Although much has been done to combat this bacteria, there are many complications when it comes to treating it within patients especially due to its mortality rate ranging from 30% to 50%.[25] To elaborate, healthcare teams that monitor patients infected with *K. pneumoniae* can only follow strict control protocols to prevent the spreading and transmissioning of the infection. Nurses are unable to carry out antibiotic prescriptions, which only worsen the problem by encouraging the disease to develop drug resistance and thus highlights the difficulties healthcare teams face when it comes to treating the infection and finding methods to eradicate it on a larger scale.

Although the patient who initially contracted the CAZ-AVI resistant *K. pneumoniae* ultimately recovered from the infection, what is most notable about this case is what the National Institute for Health and Welfare (THL) discovered about this particular isolate. The isolate in Finland was the first with the blaKPC gene to be isolated. On several occasions, CAZ-AVI treatments resulted in the development of CAZ-AVI resistance as well as the emergence of the blaKPC gene, showing the rapid growth and adaptability of *K. pneumoniae* as well as the gene's relation to CAZ-AVI resistance. With such KPC-variants harboring the capability to develop both CAZ-AVI and carbapenem resistance, it is imperative that these cultures are closely monitored for resistance advancements and that efficient measures to control these infections are taken.

QUESTIONS

1. Has your nation been affected by antibiotic resistant bacterias? If so has it heavily affected health protocol in your nation? Has it made other health issues and concerns rise?
2. If your nation has been affected, has their response been effective? Why or why not?
3. When addressing the issue of antibiotic resistant bacterias, what are some of the main concerns a nation should address and plan around?
4. What are your nation's policies regarding the usage of antibiotics? Is your nation willing to alter their policies in order to resolve the current issues?
5. With a growing number of ineffective medicines, what steps should be taken to improve overall healthcare and treatment for ABR?
6. How can international travel be altered or monitored in order to prevent the mass spreading of viruses internationally?
7. Given that a major factor of transfer for ABR infections occurs within healthcare facilities between patients, what procedural changes should be taken into consideration?
8. What should be done about the growth of antibiotic resistance in animals and plants, given that farmers and agricultural industries believe it is essential to treat them with antibiotics for growth promotion and protection from diseases?

ENDNOTES

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