

## Concepts in Human Health and Disease

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## **1. Bacterial Resistance to Antibiotics from Scientific and Socioeconomic Perspectives**

### **Introduction**

Antibiotic drugs target bacterial cells when they are administered in the body. The effect of an antibiotic may kill a bacterial cell, stagnate the bacterial growth, or only work to increase the multiplication of the bacteria or aid the development of a resistant strain of the bacteria. The rapid replication and multiplication of bacterial cells allow for evolution to occur at rapid rates. New strains of bacteria may have changes that may render the bacteria resistant to particular types of antibiotics. Some of the processes of microbial antibiotic resistance include enzymatic degradation, changes in membrane permeability, and bacterial genetic exchange among others. Socioeconomic factors such as drug misuse accelerate the development of antibiotic resistance. Strategies such as taking antibiotics responsible help to slow down the development of resistance to antibiotics.

### **Important biological processes for developing antibiotic Resistance**

Unlike animals, bacterial cells replicate and multiply within hours. Whenever a replication occurs, there is a chance that a new bacterial cell will have different cell properties. Changes could occur in the cell wall, in the cellular proteins, or the enzyme activity. The changes in the bacterial cell are called mutations. The mutations can make it impossible for antibiotics to stick to a bacterial cell, breach its wall, or destroy the bacterial cell. General, four different types of mutations within a bacterial cell lead to the development of resistance to antibiotics. These include enzymatic degradation of antibiotics, changes in membrane permeability, new ways of processing energy, and the ability to eject antibiotics form within the bacteria. The mutated bacteria can use one or some of these features to resist antibiotics and survive where non-mutant

bacteria die. For such strain of bacteria, only a new antibiotic can work to kill or stagnate their growth.

The enzymes in the mutated bacteria may have the ability to degrade antibiotics. The enzymes ingest the antibiotics and deactivate them, and the bacterial cell is not affected. The new mutated bacteria may also have changes in the cell wall permeability, which may make it impossible for the antibiotics to gain entry into the cell. The bacterial cell may also develop mechanisms that detect and eject antibiotics from the bacterial cell before they cause any harm to the cell. Other antibiotics target the energy supply within the cell. Mutated bacteria will develop new ways of processing energy to enable cells to survive. The development of resistance to antibiotics continues within the bacterial colony or film through processes such as a bacterial genetic exchange. Bacterial cells meet, share, and exchange genetic information regularly. A species that has managed to resist antibiotics may have its genetic material shared with the rest of the colony. In a short period of time, the whole colony will have developed resistance to the specific antibiotics.

#### **Socioeconomic Factors accelerating the development of antibiotic resistance**

Some of the most common socioeconomic factors that contribute to the development of antibiotic resistance include the misuse of antibiotics, poor drug quality, inadequate surveillance, and unhygienic conditions. Misuse of drugs occurs both at the clinical level and the public level. Skilled physicians, especially those who work in private hospitals, often prescribe unnecessary amounts of drugs for patients. Unskilled practitioners prescribe the wrong drugs for various ailments. For instance, those who sell drugs at the stores may offer alternatives when the specific antibiotics for a particular ailment are out of stock. Untrained practitioners often give wrong prescriptions to patients. In some countries, such as most of the developing countries, people do

not require a prescription to purchase antibiotics. Abusing drugs in such condition is, therefore, inevitable. Too much use of drugs helps accelerate the development of drug resistance by bacteria. Poor quality of drugs, especially in developing countries, also aids the resistance. Lack of resources in developing countries hampers the implementation of policies against antibiotic resistance. Healthcare is poorly regulated in such countries. Besides, there are few skilled practitioners. Low-quality drugs, including counterfeits, easily find their way into such countries. Reliance on such drugs only aids the development of resistance to antibiotics.

### **Slowing down the development of drug resistance**

The evolutionary theory provides information on how the issue of widespread resistance to antibiotics can be controlled. Slowing down the evolution of resistance is necessary to curb the widespread microbial resistance to antibiotics. Strategies for slowing down the development of drug resistance include simple practices that can be applied at the clinical and public levels. For instance, antibiotics should never be used to treat viral infections as this only introduces a selective pressure on the bacterial cells residing within the body. Mild doses over long periods help bacteria to develop resistance to that drug. Avoiding such mild doses of antibiotics helps slow down the development of resistance. It is also important to take all the pills as prescribed even when one feels recovered from an ailment. It is important to cause the extinction of the bacteria, causing the disease and not to leave room for their evolution. Using a combination of antibiotics to treat a bacterial disease may also help to destroy the bacteria, including the resistant strains effectively. The trashing of antibiotics should also be done responsibly to prevent drugs from reaching the bacteria living in the environment. If by chance the drugs get into contact with the bacteria in the soil or water, a resistant strain of bacteria may evolve making it challenging to deal with them in the instance they cause disease in the future.



## **2. The good and the bad sides of smallpox eradication.**

### **Introduction**

Smallpox is probably the most deadly infection the world has ever seen. Prior to the discovery of its vaccine, those who acquired the virus would suffer severe symptoms, including the disfigurement of the face, before succumbing to the disease. The disease remains to have no cure, even after centuries have passed since its vaccine was discovered. The discovery of the smallpox vaccine was key for the eradication of the infection. By the onset of the twentieth century, the case numbers and deaths caused by the infection had significantly declined. The world health organization's mandate to eradicate the infection led to the spread of the vaccinations programs throughout the world. With the last case of the infection recorded before 1980, it is surprising that people are still worried about smallpox infection. The virulence of the virus causing the disease and the fact that it still has no cure are some of the reasons for this worry.

### **Why the eradication of smallpox was so successful**

Smallpox was once the most deadly endemic disease in the world. The disease caused intense suffering and disfigured the faces of those infected. The variola virus causes smallpox. There exist two strains of the virus, namely, the variola major and the variola minor. The variola major caused the more severe type of smallpox while the minor strain caused a relatively weaker form of smallpox infections. The disease was quite deadly that it cleared millions of lives across all the continents. Between the nineteen twenties and 1978 only, the number of reported cases of the disease amounted to over eleven million. As a vaccine for the virus already existed during this time, the numbers were probably even more significant in the earlier days. Until today, smallpox remains to be the only human infection that health leaders have eradicated successfully.

The cure for smallpox had never existed since the olden days. Also, before the invention of the smallpox vaccine, no vaccines for any disease had been developed.

The invention of the smallpox vaccine in 1796 came as a breakthrough in the field of medicine and was vital in the active eradication of smallpox. Edward Jenner, a British surgeon, invented the vaccine. The practice of inoculation had been in practice before Edward Jenner's time. People in different cultures exposed children to the infection so that they could gain protection against the virus. Edward himself had been inoculated with the virus at the age of eight. People who had been vaccinated could, in some cases, infect others as they acted as carriers. Also, sometimes the inoculation may lead to a full-blown infection. Edward studied the relationship between cowpox infection and smallpox. He learned that patients with cowpox only developed mild reactions when infected with the smallpox-causing virus. He discovered that the viruses belonged to the same virus family. Inoculations with the cowpox vaccine would eradicate the dangers of people infecting others or developing smallpox symptoms. A trial on a boy showed that the cowpox inoculation worked to prevent smallpox infection.

The eradication of smallpox was only successful due to the discovery of its vaccine. Since the discovery of the vaccine at the end of the eighteenth century, the cases and deaths of smallpox slowed down remarkably. The last case of the disease involving the variola major was reported in 1975. The last documentation on smallpox infection was later done in 1977 in Somalia. Since then, there have never been any case reports regarding the smallpox infection.

**Since smallpox was eradicated by 1980, why would we still need to worry about the virus?**

Smallpox, as aforementioned, is still recognized as one of the world's most dangerous infections. If the disease resurfaces anywhere in the world, lots of people may die. While the vaccine for the infection was discovered many years ago, the cure for the infection, until to date, has never been invented. The fact that experts have never discovered the cure for the condition still makes it very deadly. People still worry about the variola virus even after its eradication in the 1970s. There are worries that some governments still have reserved samples of the virus. There is information that some people still stores samples of the virus in their laboratories. There is also the concern that terrorist groups may get their hands on the virus and use it to carry out attacks on populations.

The anthrax scare and the nine eleven attacks in 2001, in the US, for instance, scared the United States government and the public. It was recognized that the country must be ready to defend itself and protect its people against any uncertainties. The US government asked several companies to start making the smallpox vaccine as it may come in handy. In a situation where an attack using the virus is made, millions of people may die if the vaccine is not readily available. The fact that there is no cure for the infection makes it even riskier not to have the vaccines for the whole population. Vaccines can work to prevent infection up to four days of contraction of the virus. In the instance that people report a case about an outbreak, effective vaccination would help stop the spread and infection.

### **3. The effect of Tobacco advertisement/promotion on our society**

#### **Introduction**

Tobacco use, particularly in the US, rose quite rapidly during the twentieth century. Over the last hundred years, the numbers of tobacco users have increased at an alarming rate. Various groups in the society who did not use tobacco products previously began using the products



during this time. More women started smoking cigarettes after 1920. More youths began smoking around the same time. By the mid-twentieth century, almost every American adult smoked cigarettes. The rise in tobacco was much dependent on the use of mass media advertisements and promotions. Companies spent lots of money advertising and promoting tobacco products in order to get more people to smoke. As a result, more people got introduced into smoking, and other fatalities reported more lung cancer cases. Today, with the stringent regulations on the advertisement and use in place, there still exists the worry of the effects on the youth. It is mainly due to the availability of many other platforms through which the use of tobacco can be promoted.

#### **Effect of tobacco advertisement/promotion during the last 100 years.**

The twentieth century was the era of the tobacco epidemic. Tobacco use climaxed in the 1960s and started to decline towards the end of the twentieth century. The rise of the industry the use of tobacco in the society was possible mainly through the use of mass media advertisement and promotion. Companies advertised tobacco products through the various mass media platforms that existed at the time. In the earlier part of the century, the world was not yet aware of the dangers that tobacco posed to the health of users. Cigarettes smoked at the time did not even have filters. It is until the 1960s that filters began to be fitted onto the cigarettes. Tobacco advertisements and promotions during the last one hundred years saw more people start smoking, led to more women becoming smokers, more youths became smokers and more death due to lung cancer were reported.

The use of mass media for advertisement took root around the 1920s. Companies began to advertise and promote their products and services through mass media during this time. Before this time, smoking was only popular among older adult men. Very few women smoked tobacco.



It was very uncommon to find young people and women smoking. Advertising through the magazines and the radio was adopted and worked to bring tobacco products to more people. More people got used to the idea of smoking cigarettes. The youths yearned to smoke through the promotional strategies used in the advertisements. By the mid-twentieth century, lots of women and youths smoked cigarettes. Companies spent lots of money advertising and promoting tobacco products just to get more people to use the products. The practice paid off as lots, and lots of people got recruited each year. Tobacco use climaxed in the 1960s and began declining in the years that followed. The decline happened after tobacco use was found to cause some serious diseases, including lung cancer. The lung cancer death rates increased throughout the century with the increase in the numbers of smokers.

Approaching the new millennium, more people began quitting smoking due to the counter-advertisement and health promotion campaigns against smoking. With more people dying of lung cancer, more people became afraid of smoking. The counter-advertisements made people aware of the dangers of smoking and helped bar the youth from smoking. Actions were taken by the World Health Organization and government to regulate the production and use of tobacco. After linking tobacco and lung cancer in the 1960s, for instance, it was then made mandatory that filters be fitted to the cigarettes. Also, advertisements and promotional programs for tobacco products were effectively regulated. Today, there are hardly any advertisements or promotional programs for tobacco use. Also, more and more people are quitting smoking.

**Since advertisements and the use of cigarettes are highly regulated today, why would we still need to worry about their effects on young people?**

The advertisements and use of cigarettes have been efficiently regulated over the past couple of years. The worry of the effects of tobacco advertisement and promotion on the youth

is, however still apparent even today. Direct advertisement on various mass media platforms have been regulated, but the promotion and use products still find their way in other mass media platforms. The digital era of today also makes it quite challenging to regulate activities on the media. There numerous social media sites where millions of people communicate. Also, almost every company today has its online website where it advertises its products and services, and users access these sites voluntarily. The youth are the majority of those using or accessing the internet. The youth are, therefore, most vulnerable to tobacco use. Adverts may appear in various social media sites, sales, and store sites and the specific tobacco company sites.

Other than the internet, another avenue through which tobacco use promoted is the film industry. It is not easy to bar children or the youth in general from any types of movies today given that they can to view the movies from very many different platforms. Some films show young children smoking r the youth smoking cigarettes, which impacts quite negatively on the viewers. The pressure to look 'cool' and watching an admirable character smoke tobacco sometimes drives youths into smoking. The worry about the effects of tobacco advertisements and use on the youth, therefore, still exists even though measures have been taken to regulate tobacco advertisement and use.

#### **4. Acceptance/rejection of vaccination**

##### **Introduction**

It is rarely possible for everyone to accept a particular concept. Such is the case of vaccination. Many diseases, such as tuberculosis, measles, tetanus, rubella, and mumps, among many others, have been controlled due to effective immunization programs. The deadly smallpox is no more due to vaccination. Anti-vaccine movements have existed since the inception of the practice of vaccination. Most of the claims against vaccinations are irrelevant today, while others

do not have any strong grounds. Vaccine rejection may have significant effects on public health, which makes it necessary for immunization programs to be made mandatory.

**Why vaccines have bad public relations? Describe the most common claims by the anti-vaccine movements.**

Amateur administration of vaccines begun as early as the tenth century in China. Ever since the idea to inoculate viral components into the skin of a healthy individual was constructed, there have been oppositions as well. The first known vaccine to be invented was the smallpox vaccine of 1796. The smallpox vaccine eventually led to the active eradication of the infection. Even with such breakthroughs in public health, oppositions still opposed vaccination practices. Some parents do not take their children immunization, believing that the practice is much more dangerous as compared to the diseases that may attack the children. While it is true that vaccines may come with some side effects and in some cases complication, they have done much good than bad. In other cases, vaccination programs have led to disasters involving infections, injuries, and deaths of people. For instance, a polio vaccination program in California in 1955 led to forty thousand cases of polio infection and five deaths. Apparently, live polio virus was also contained in the vaccine doses. Such incidents put fear into the minds of the public and make people repulsive to the idea of immunization.

Some of the claims by various anti-vaccine movements over time include the safety and sanitation of the practice, religious reasons, the efficacy of the vaccines, and interference of the government. During the earlier times, there were no proper medical tools and equipment. Vaccination involved the inoculation of lymph from an infected person, under the skin of a healthy person. The anti-vaccine movements of the time condemned such practices as immoral, unhygienic, and unsafe. In the olden days, disease epidemics were believed to be a punishment



from God, and that vaccination was irrelevant. Most vaccines today are about eighty to ninety-five percent effective. The fact means that there still exists a chance that the vaccine may not work against infection. The anti-vaccine movements cite side effects and other complication that may occur as a result of complications and maintain that there is no point in committing to such a practice which does not guarantee the health and survival of an individual. The anti-vaccine movements also oppose the action of governments to force people into immunization programs. According to the movements, immunization should be a personal choice.

**Suggest some specific answers for these claims**

The claim about the safety and sanitation of the practice was only relevant centuries ago and is irrelevant today. There are better vaccine forms and equipment for administering the vaccines. The vaccines given to people today are safe, and physicians administer them under hygienic conditions. Similarly, religious claims are irrelevant in the modern world. Most vaccines are about ninety percent effective. Considering the severity of some of the immunizable diseases, this is an excellent efficacy ratio as a society can save a large percent of the population in case of an outbreak. With regards to disease outbreak or epidemics, the always acts in the best interest of the public. Also, if other people are left unvaccinated, they put risk on those already vaccinated. It is, therefore, important that everyone is vaccinated.

**Describe and give specific examples for the effect of vaccine rejection on public health**

Vaccine rejection has significant effects on public health. After the discovery of the smallpox vaccine, epidemics still erupted due to the perceptions put on the public by the anti-vaccine movements regarding the immorality and sanitation of the practice. Between 1920 and 1980 only, health leaders documented more than over eleven million deaths resulting from



smallpox infection. The prime reason for the high numbers of deaths is opposition to vaccination.

In various places in the US such as Georgetown, mobs attacked health professionals who attempted to bring immunization services to the people. One example of the impacts of vaccine rejection on public health is the active spread of an infectious disease. If the rejection is quite extreme, lots of people may get infected in the instance an epidemic erupts.

Also, those who do not get vaccinated risk infecting those already vaccinated in case an infectious disease presents in an area. Vaccines, as mentioned above, are about ninety percent effective. There is thus a small chance that a person may still get infected. The cooperation of the whole population enhances the effectiveness of the vaccination process.

**What do you think: should vaccines be mandatory?**

On a personal perspective, vaccines are some of the best mechanisms for fighting infectious disease. Vaccines do not only prevent the occurrence of an infection but also save a person, a family, or the government lots of money which will have been used to cure the disease. Also, some diseases do not have a cure, like in the case of smallpox, and vaccination stand as the only solution. Vaccines should, therefore, be mandatory in order to protect the whole population.