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A REVIEW ON COMBATING ANTIBIOTIC RESISTANCE

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ABSTRACT:

"Every day we don't act to better protect antibiotics will make it harder and more expensive to address drug resistance in the future. Drug resistance can undermine both our ability to fight infectious diseases and much of modern medicine. Patients undergoing chemotherapy for cancer, dialysis for renal failure, and increasingly common treatments for diseases such as arthritis depend on antibiotics so common infectious complications can be treated effectively."

Keyword: *Antibiotic, FDA, COMBATING antibiotic resistance.*

INTRODUCTION:

For an American in the 21st century, it is hard to imagine the world before antibiotics. At the beginning of the 20th century, as many as nine women out of every 1,000 who gave birth died, 40 percent from sepsis. In some cities as many as 30 percent of children died before their first birthday. One of every nine people who developed a serious skin infection died, even from something as simple as a scrape or an insect bite. Pneumonia killed 30 percent of those who contracted it; meningitis killed 70 percent. Ear infections caused deafness; sore throats were not infrequently followed by rheumatic fever and heart failure. Surgical procedures were associated with high morbidity and mortality due to infection. Discovery of antibiotics in the early 20th century fundamentally transformed human and veterinary medicine. Antibiotics now save millions of lives each year in the United States and around the world. The rise of antibiotic-resistant bacterial strains, however, represents a serious threat to public health and the economy. The CDC estimates that annually at least two million illnesses and 23,000 deaths are caused by antibiotic-resistant bacteria in the United States alone. As more strains of bacteria become resistant to an ever-larger number of antibiotics, our drug choices will become increasingly limited and expensive and, in some cases, nonexistent. If this trend continues unchecked, a wide range of modern medical procedures, from basic dental careto organ transplants, likely would be accompanied by a much greater risk of developing a difficult-to-treat or untreatable antibiotic infection. The safety of many modern medical procedures is dependent on the ability to treat bacterial infections that can arise as post-treatment complication.

National Strategy to Combat Antibiotic-Resistant Bacteria

Antibiotic-resistant bacteria – germs that don't respond to the drugs developed to kill them – threaten to return us to the time when simple infections were often fatal. Today, antibiotic-resistant bacteria annually cause at least 2 million illnesses and 23,000 deaths in the United States. The *National Strategy for Combating Antibiotic Resistant Bacteria* identifies priorities and coordinates investments: to prevent, detect, and

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control outbreaks of resistant pathogens recognized by CDC as urgent or serious threats, including carbapenem-resistant *Enterobacteriaceae* (CRE), methicillin-resistant *Staphylococcus aureus* (MRSA), ceftriaxoneresistant *Neisseria gonorrhoeae*, and *Clostridium difficile*, which is naturally resistant to many drugs used to treat other infections and proliferates following administration of antibiotics ; to ensure continued availability of effective therapies for the treatment of bacterial infections; and to detect and control newly resistant bacteria that emerge in humans or animals. This *National Strategy* is the basis of a 2014 Executive Order on Combating Antibiotic Resistance, as well as a forthcoming *National Action Plan* that directs Federal agencies to accelerate our response to this growing threat to the nation's health and security. The *National Action Plan* will be informed by a report approved by the President's Council of Advisors on Science and Technology (PCAST) on July 11, 2014.

The *National Strategy* outlines five interrelated goals for action by the United States Government in collaboration with partners in healthcare, public health, veterinary medicine, agriculture, food safety, and academic, Federal, and industrial research. The goals include:

1. Slow the Emergence of Resistant Bacteria and Prevent the Spread of Resistant Infections.
2. Strengthen National One-Health Surveillance Efforts to Combat Resistance.
3. Advance Development and Use of Rapid and Innovative Diagnostic Tests for Identification and Characterization of Resistant Bacteria.
4. Accelerate Basic and Applied Research and Development for New Antibiotics, Other Therapeutics, and Vaccines.
5. Improve International Collaboration and Capacities for Antibiotic Resistance Prevention, Surveillance, Control, and Antibiotic Research and Development.

Goals and Objectives

The *Strategy* lays out five interrelated goals that guide collaborative action by the U.S. Government in partnership with foreign governments,individuals, and organizations aiming to strengthen healthcare, public health, veterinary .medicine, agriculture, food safety, and research and manufacturing. Those goals include:

1. Slow the emergence of resistant bacteria and prevent the spread of resistant infections;
2. Strengthen national One-Health surveillance efforts to combat resistance;
3. Advance development and use of rapid and innovative diagnostic tests for identification characterization of resistant bacteria;
4. Accelerate basic and applied research and development for new antibiotics, other therapeutics, and vaccines; and
5. Improve international collaboration and capacities for antibiotic-resistance prevention,surveillance, control, and antibiotic research and development.

Taken together, implementation of specific objectives provided under each goal will help reduce the incidence of the priority pathogens . National targets for reducing serious and urgent threats by 2020.. Development and implementation of the *National Strategy* also supports World Health Assembly (WHA) resolution 67.25 (Antimicrobial Resistance), which was endorsed in May 2014 and urges countries to develop and finance national plans and strategies and take urgent action at the national, regional, and local levels to combat resistance. The resolution specifically calls on WHA Member States to develop practical and feasible approaches to extend the lifespan of drugs, strengthen pharmaceutical management systems and laboratory infrastructure, develop effective surveillance systems, and encourage the development of new diagnostics, drugs, and treatment options.

Antibiotic Resistance

The discovery of penicillin opened a new era in the treatment of infectious diseases, described as the "golden age" of antibiotic research (1940–1962) . Discovery of other antimicrobials soon followed, and included widely used antibiotics including streptomycin, chloramphenicol, and tetracycline. For the first time, many common bacterial diseases could be cured. Moreover, the first antibiotics played a crucial role in the treatment and prevention of infections during World War II. Antibiotics were so successful that they were considered the ultimate cure, the

"miracle drugs" which the medical world was craving. As a result of the initial success of antibiotics, bacterial diseases were naively considered to be permanently defeated.

However, with increasing use of antibiotics, more and more pathogenic bacteria developed resistance to their inhibitory effects. Consequently, despite their initial effectiveness, most antibiotics have a limited life, and from their first introduction they select for pathogen variants that have intrinsic or acquired resistance mechanisms. Currently, antimicrobial resistance threatens the effective prevention and treatment of an ever-expanding range of infections. It is an increasingly serious threat to global public health that requires immediate action, and affects all parts of the world as new resistance mechanisms emerge and rapidly spread around the globe.

In recent years, we have gained a better understanding of the intra- and inter-cellular processes that govern bacterial ecology. Far from being isolated cells, at least some bacteria are perhaps more appropriately viewed as disseminated multicellular organisms, whose interactions are mediated by complex cell-cell signaling. Cell-cell interactions can lead to the formation of spatially complex matrices of polysaccharide and extracellular DNA into which cells are embedded to form a biofilm community. COMBATING bacterial infections thus requires both an understanding of intracellular genetics and biochemistry, and an understanding of how the biofilm mode of life affects antibiotic uptake and resistance

Combating Antibiotic Resistance

Antibiotics are drugs used for treating infections caused by bacteria. Also known as antimicrobial drugs, antibiotics have saved countless lives.

Misuse and overuse of these drugs, however, have contributed to a phenomenon known as antibiotic resistance. This resistance develops when potentially harmful bacteria change in a way that reduces or eliminates the effectiveness of antibiotics.

A Public Health Issue

Antibiotic resistance is a growing public health concern worldwide. When a person is infected with an antibiotic-resistant bacterium, not only is treatment of that patient more difficult, but the antibiotic-resistant bacterium may spread to other people.

When antibiotics don't work, the result can be:

- longer illnesses
- more complicated illnesses
- more doctor visits
- the use of stronger and more expensive drugs
- more deaths caused by bacterial infections

Examples of the types of bacteria that have become resistant to antibiotics include the species that cause skin infections, meningitis, sexually transmitted diseases and respiratory tract infections such as pneumonia.

In cooperation with other government agencies, the Food and Drug Administration (FDA) has launched several initiatives to address antibiotic resistance.

The agency has issued drug labeling regulations, emphasizing the prudent use of antibiotics. The regulations encourage health care professionals to prescribe antibiotics only when clinically necessary, and to counsel patients about the proper use of such drugs and the importance of taking them as directed. FDA has also encouraged the development of new drugs, vaccines, and improved tests for infectious diseases.

Antibiotics Fight Bacteria, Not Viruses

Antibiotics are meant to be used against bacterial infections. For example, they are used to treat strep throat, which is caused by streptococcal bacteria, and skin infections caused by staphylococcal bacteria.

Although antibiotics kill bacteria, they are not effective against viruses. Therefore, they will not be effective against viral infections such as colds, most coughs, many types of sore throat, and influenza (flu).

Using antibiotics against viral infections

- will not cure the infection
- will not keep other individuals from catching the virus

- will not help a person feel better
- may cause unnecessary, harmful side effects
- may contribute to the development of antibiotic-resistant bacteria

Patients and health care professionals alike can play an important role in combating antibiotic resistance. Patients should not demand antibiotics when a health care professional says the drugs are not needed. Health care professionals should prescribe antibiotics only for infections they believe to be caused by bacteria.As a patient, your best approach is to ask your health care professional whether an antibiotic is likely to be effective for your condition. Joseph Toerner, M.D., MPH, a medical officer in FDA's Center for Drug Evaluation and Research, says that the symptoms of a cold or flu generally lessen over the course of a week. But if you have a fever and other symptoms that persist and worsen with the passage of days, you may have a bacterial infection and should consult your health care provider.

Follow Directions for Proper Use

When you are prescribed an antibiotic to treat a bacterial infection, it's important to take the medication exactly as directed. Here are more tips to promote proper use of antibiotics.

- **Complete the full course of the drug.** It's important to take all of the medication, even if you are feeling better. If treatment stops too soon, the drug may not kill all the bacteria. You may become sick again, and the remaining bacteria may become resistant to the antibiotic that you've taken.
- **Do not skip doses.** Antibiotics are most effective when they are taken regularly.
- **Do not save antibiotics.** You might think that you can save an antibiotic for the next time you get sick, but an antibiotic is meant for your particular infection at the time. Never take leftover medicine. Taking the wrong medicine can delay getting the appropriate treatment and may allow your condition to worsen.
- **Do not take antibiotics prescribed for someone else.** These may not be appropriate for your illness, may delay correct treatment, and may allow your condition to worsen.
- **Talk with your health care professional.** Ask questions, especially if you are uncertain about when an antibiotic is appropriate or how to take it.

It's important that you let your health care professional know of any troublesome side effects. Consumers and health care professionals can also report adverse events to FDA's Med Watch program at 800-FDA-1088 or online at Med Watch.

FDA Is Doing:-

FDA combating antibiotic resistance include:-

- **Labeling regulations addressing proper use of antibiotics.** Antibiotic labeling contains required statements in several places advising health care professionals that these drugs should be used only to treat infections that are believed to be caused by bacteria. Labeling also encourages health care professionals to counsel patients about proper use.
- **Partnering to promote public awareness** FDA is partnering with the Centers for Disease Control and Prevention (CDC) on "Get Smart: Know When Antibiotics Work," a campaign that offers Web pages, brochures, fact sheets, and other information sources aimed at helping the public learn about preventing antibiotic-resistant infections.
- **Encouraging the development of new antibiotics.** FDA is actively engaged in developing guidance for industry on the types of clinical studies that could be performed to evaluate how an antibacterial drug works for the treatment of different types of infections.

Here is that we can do to help prevent antibiotic resistance:

- Tell your healthcare professional you are concerned about antibiotic resistance.
- Discard any leftover medication.
- Ask your healthcare professional about vaccines recommended for you and your family to prevent infections that may require an antibiotic.

- Never skip doses.
- Never take an antibiotic for a viral infection like a cold or the flu.
- Never save antibiotics for the next time have you got sick.
- Never take antibiotics prescribed for someone else.

Healthcare professional can prevent the spread of antibiotic resistance by:

- Prescribing an antibiotic only when it is likely to benefit the patient.
- Prescribing an antibiotic that targets the bacteria that is most likely causing their patient's illness when an antibiotic is likely to provide benefit.
- Encouraging patients to use the antibiotic as instructed.

Conclusion

Antibiotic resistance is an urgent public health threat that demands immediate action. Drug-resistant infections are on the rise, making antibiotics less effective and putting routine and common and life-saving procedures in jeopardy. Antibiotic resistance is changing the practice of modern medicine by compromising our ability to treat sick people and animals. Additionally, it is a serious threat to economic and national security. It is estimated that by 2050 a person will die every three seconds from a drug-resistant infection and $100 trillion in global economic productivity will have been lost.152 Antibiotic use and overuse in people and in food animal production are important drivers of antibiotic resistance. However, this report focuses specifically on antibiotic use in food-producing animals because 70% of medically important antibiotics sold in the U.S. (i.e. those identical or belonging to the same class as antibiotics used in human medicine) are sold for use in food-producing animals, not people. Additionally, the U.S. has taken significant steps in promoting better antibiotic stewardship policies and programs in human medicine, but falls woefully short in doing the same as it relates to food animal production.This Commission wants to keep the existing arsenal of antibiotics effective for as long as possible. We came together to craft this policy roadmap because we strongly believe the U.S. cannot fully respond to this public health crisis unless it does a better job to address the contribution to antibiotic resistance antibiotic use in food animal production. Our recommendations are steps that will help ensure that on-farm use of medically important antibiotics is monitored and reduced, and that there will be adequate surveillance of the development and spread of antibiotic resistant bacteria. Success, we believe, depends on leadership that builds on approaches that have proven successful elsewhere. While state and federal policymakers have important roles to play, action is need from all stakeholders. Health professionals and hospitals, as well as food companies and other major meat and poultry purchasers also have key roles to play. The appendices that follow outline actions for each sector.We all stand to lose when antibiotics no longer work. Steps must be taken today to help ensure that our existing supply of antibiotics stay as effective as possible, now and for future generations.

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