

# Crisis of Antibiotic Resistance, Methodologies for Management: A Review

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## Abstract

Antibiotic resistance is now become a major concern for many organizations and scientists. The resistance is developed in most of the pathogens we cannot undo that but what we can is use the strategies to combat and prevent further resistance which includes stewardship programs, proper prescriptions, dosages and antibiotics use. Also developing new agents for fighting the pathogens are now been developing and some are already approved by various organizations i.e., CDC [1]. Here different management techniques are discussed and what are new antibiotic agents available in the market.

**Keywords:** Antibiotics; Antibiotics Resistance; Pathogen; Infections; Management strategies

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## Introduction

Antibiotics are medicines used to kill the bacteria or ant pathogen that cause disease in human or other organisms. It had played a major role in treating various and diverse types of infections but now it's on the edge of existence as the resistance against antibiotics is increasing day by day [2]. The rate is so high that if it is not considered now, we will be like living in the old ages. Mortality rate will increase eventually. There are various reasons for developing the resistance which includes the over usage, improper prescription [3]. Our environment is also contributing in resistance as continues exposure to radiation leading to mutations and sometime this change contributes in resistances among the pathogen. Here in this article, we are discussing the ways that can be used to prevent or overcome the current threat of resistance against medicine. Some of the organizations involved are CDC The antibiotic resistance crisis the main article is divided into two parts, and the is its second part where different strategies are being discussed and new methods to overcome the antibiotic resistance. If you are interested to know what the reasons are and threats due to antibiotic crisis then you might have a view of the first part, where the causes and threat of antibiotic resistance are discussed [4].

## Managing the crisis

### Organizations

Various organizations are formed that works for developing ways and strategies to combat the current crisis. Center of disease control and prevention (CDC) is one of the major organizations contributing in this regard.

### Recommended steps to lessen the antibiotic resistance

CDC And various other communities and organizations have following suggestions to control the crisis of antibiotic resistance crisis

### Adoption of stewardship programs

Every medicine has their specific dosage and time limit which his to be followed by every doctor and pharmacologist [5]. Always try to prevent usage of antibiotic at first level, only prescribe it when it's serious. For all of the above activities a special team are organized and should be available in every health institute which regulates and watches all the above regulations' ICU proper teams knows as interventions are there to direct the specialists when to use the antibiotics. Antibiotic stewardship not only decreases the rate of antibiotic resistance but also plays effective

role in saving funds and money i.e., 17 million dollars were saved from the program in Maryland [6].

### Antibiotic prescription

Excessive use of antibiotic is very harmful for human health. But use of antibiotic increasing, this causes antibiotic resistance. Some doctors prescribe antibiotics without any reasons. Without laboratory prescribe antibiotics cause harmful effects. Some people demand antibiotic this cause antibiotic resistance. Due to antibiotic resistance bacteria grow in our body rapidly. Surveys shown that 40 to 75 percent of adults and children were given a prescription for an antibacterial agent. Another reason, excessive use of antibiotic is unawareness. Educational campaigns regarding antibiotic resistance have been implemented

### Better therapeutic regimen

These campaigns might be produced awareness in our society about antibiotic resistance. Unnecessary use of antibiotic cause resistance so we should use regimens. Regimens are a systematic plan for therapy. It involves a specific dose, dosage frequency and length of treatment. Many diseases cure from diet or many other therapies. Such regimens typically last five to seven days or longer. These therapies use in different diseases. One study showed that patients with hospital acquired infections cure with antimicrobial therapy. Most people who become ill with Covid-19 will be able to recover at home. Some of the things you do to feel better if you have symptoms- getting enough rest and staying well hydrated. Many other diseases can cure through therapies i.e., Ventilator associated pneumonia, community acquired pneumonia. Use of regimens eradicates the infecting pathogen from the body and it reduces the infection at early stage.

### Antibiotic in agriculture

Antibiotic not only use for the human but also use in the agriculture. In agriculture antibiotic used for the early growth of crops or increase productivity. Like humans, in agriculture excessive use of antibiotic leads disastrous effects. Process of awareness still slow. Government starts some project for awareness of antibiotic resistance. In these projects, they evaluate some antibiotic resistance threats. Health care safety networks emphasize report infections, antibiotic use and resistance. Some infections transmitted through animals to humans such as Salmonella and Campylobacter. Today, antibiotic use for growth promoter in animals and these causes dangerous effects.

### Advanced diagnostic tools

We improve diagnosis of different diseases by using diagnostic tools. Effective way to reduce inappropriate antibiotic use is to eliminate diagnostic uncertainty. Some doctors prescribe antibiotics without verify diseases. In past, for disease diagnosis using traditional methods. These methods take few weeks and month. Now, new methods establish for the best diagnosis and early result i.e., real time PCR. In Covid-19, PCR play significant role, we obtain our results within two to three hours. New diagnostic tools diagnose accurately and provide early results. These tools also provide exact growth of bacteria and viruses in body these are very beneficial. Such advanced technologies

enabling the rapid identification of pathogens. Without using advanced diagnostic tools prescribe antibiotics cause antibiotic resistance.

## Prevention of Bacterial Transmission

### Modes of Transmission

The term mode of Transmission refers to how an infectious disease also called pathogen can be transferred from one person to another person for example virus's parasite and bacterial can cause infectious diseases. Principal mode of transmission of bacterial disease includes duplet vectors contact and dead airborne for example bacteria are also transmitted to humans through air, water food or Living vectors others mode of Transmission also include direct contact droplet etc. Prevention of bacterial transmission include one of the most effective way proper hand washing to prevent the separate of infections in hospitals was your hands before eating or touching your eyes or mouth wash your hands after touching anyone who is sneezing and coughing or blowing their nose preventive measures have a dramatic impact on mobility and mortality search my year include water treatment personal hygiene and safer sex practices.

### Different Policies and Initiatives around the world to manage the crisis of antibiotic resistance

Now days, one of the major concerns is how to avoid the infections, also to prevent the resistant bacteria to spread. National plans, regulations, guide for the different pharmaceutical industries, and doctors are made and made them follow. Funds for development of new antibiotics have been distributed. Government initiative, like to convey and spread message through advertisement. Some of the steps to control the resistance, preventing infection, keep record of resistance bacteria, proper use of antibiotics, and awareness of new diagnostic tools. Each country has its laws and has to be followed, by each health settings, and most of these initiatives. Government passes the legislation, to provide funds and resources to different institutes. Internationally, World Health Organization (WHO), provided various funds and supplements to 45 different countries for the research. It also formulated new resolutions benefiting the research centers and motivates the m to develop new antibiotics and perform their researches.

### New agents for the treatment of bacterial infections

New agents for the treatment of the bacterial infections are approved by FDA and are given below

**Tigecycline:** It is a drug and has bacteriostatic activity, play role in the treatment of many infections that are caused by bacteria i.e., skin and skin structure infection are due to E. coli are treated by using this drug. It helps to stop the bacterial growth and active against the MRSA

**Doripenem:** It is antibiotics drug. Gram negative bacteria cause some infection and these are treated by this drug. CRE reduced this drug activity. Dopipenem injection used for the treatment of

kidney, urinary tract infection caused by bacteria.

**Telavancin:** It is also antibiotic drug and used for the treatment of skin and skin structure infection and these infections are due to gram positive organisms. It works against MRSA and kill the bacteria. Serious skin infection is treated by TELAVANCIN injection.

**Ceftaroline:** It is cephalosporin antibiotic and helps to kill bacteria. It works against MRSA and VRSA. Lung infection can be treated by using CEFTAROLINE Injection. This drug shows some side effects like pain, redness and swelling.

**Tedizolid:** It is oxazolidinone antibiotics and FDA give approval to this drug that used for acute bacterial skin and skin structure infection treatment. It shows bacteriostatic activity against gram positive organisms.

**Dalbavancin:** It is glycopeptide antibiotics and used for the skin and soft- tissue infection treatment. It is active against gram positive bacteria and it is administered via intravenous infusion and it takes 30 minutes to reduce the risk of infection.

**Oritavancin:** Like DALBAVANCIN, it is also glycopeptide antibiotic and acute bacterial skin and skin structure infection is treated by this drug It kills the gram-positive bacteria and work against MRSA. It is also administered via intravenous infusion.

**Ceftolozane/tazobactam:** It is cephalosporin antibacterial drugs. it inhibits beta lactamase. Infection occurs due to gram negative bacteria can be treated by this drug. Urinary tract and intra-abdominal infections can be cured by this drug

**Ceftazidime/avibactam:** It is cephalosporin antibiotic and inhibitor of beta lactamase. It kills gram negative bacteria that cause infection. Stomach infection, Urinary tract infection and intra- abdominal infections are cured by using this drug.

## Antibiotics in Development Pipeline

Many antibiotics has developed and used in pipeline. Following drugs are frequently using now-a-days: Aminoglycosides, beta-lactase inhibitor, quinolone, keloids, tetracycline and Oxazolidinones.

**Aminoglycosides:** It can be used in combination with other antibiotics and has toxicity effect. Plazomicin belong to this class and is used to treat variety of bacterial infections. It acts against both gram positive and gram-negative bacteria such as Pseudomonas and MRAS.

**Avibactam:** It is non-beta-lactam beta lactamase inhibitor used in combination with ceftazidime for treatment of intra-abdominal and urinary tract infections and hospital acquired pneumonia.

**Quinolone:** Quinolone are bactericidal antibiotics that directly kill bacterial cells. Nemonoxacin is non-fluorinated quinolone and it inhibits DNA gyrate and preventing DNA synthesis. Delafloxacin is used to treat acute bacterial skin and skin structure infections.

**Solithromycin:** It is ketolide antibiotic undergoing clinical development for treatment of community- acquired pneumonia and other infections.

**Tetracycline:** Omodacycline and Eravacycline are belongs to class

of medicines known as tetracycline antibiotics. Omodacycline works by killing bacteria or preventing their growth. Eravacycline is a novel, broad- spectrum, synthetic fluorocycline antibiotic for the treatment of complicated urinary tract and intra- abdominal infections.

**Oxazolidinones:** Radezolid belong to class of oxazolidine drugs. It is used in the treatment of abscess, bacterial skin disease, streptococcal infections, and infectious skin disease and skin infections.

## New approaches to for the treatment of Bacterial Infections

Antibiotic senses of bacteria and fungi produced organic substances in 1940 to 1980, 20 classes of antibiotics were made and since then any new antibiotic made is placed in them as a new variant. 99% of microorganisms can't be cultured in artificial medium in laboratory that is why; companies have started Research on synthetic molecules for antibiotic activity.

## New Methods

Some new techniques for antibiotic Discovery such as resistance and virulence inhibition and rare drug combinations are supposed to protect natural products samples from mycobacteria, extremophiles bacteria Marine bacteria are being studied and researched as a new source of natural antibodies.

## Introduction of iChip Method

Discovery of Teixobactin, the pioneer of a new class of antibiotic was done in January 2015. It was done using a new method (iChip) to grow ex impossible to grow microbe, *Eleuthera terrae*. This microbe only grows in soil and the utilization of the iChip Method possible to grow it in laboratory soil. Teixobactin as perfect activity against Gram Positive Bacteria including resistant strain. New methods of curing infections without killing the microbe are also being research this includes this Army pathogens Starving Microsoft nutrients and using probiotics.

## Molecular Genomic Method

Jinom antibiotic source organisms i.e., *Streptomyces* species from soil have been studied and biosynthetic pathways identified. Genetic engineering of those Pathways as a generated new metabolite with antibiotic activity. Experiments have also shown that large amount of potential new bacterial target sites are present including the virulence suppressing ones.

## Discussion

Antibiotics has been one of the main ways to cure a certain disease, but now due to overuse in appropriate prescription, and various other environmental factors lead the development of antibiotic resistance among diverse family of pathogens. Although new methodologies and management strategies are development and are now being practiced, there is still threat. It's like we are going backward to the pre- antibiotic era. The years when death rate was high and health rate was low, no proper medications. Today, if we had the remedy however the use was unsuitable and alas, we've now turn out to be weapon less in opposition

to numerous diseases. New strategies are being developed which can be used to decrease the incidence, prevalence and frequency of the disease related to pathogens and ultimately develop new chemicals. New agents for fighting are underdeveloped many more are approved by the federals. But it will take time,

resources and money. Until then we must follow some rules like discussed above, and play our role in preventing the resistance.

## Competing interests

The author and the co-authors have no competing interests.

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