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## **English**

Fighting Superbugs; more refined tactics need to be discovered

Frequent use of antibiotics promotes growth of antibiotic resistant bacteria or superbugs. These bacteria are immune to the strongest medications.

Despite the great progress in healthcare and medical technology, antibiotic resistant bacteria still need to be addressed very effectively. Superbugs are at rage against the humankind. An estimated one in twenty, or five percent, of patients now pick up a threatening superbug infection from the hospitals and this number is rising all the time. A recent study has shown that more than 1.7 million patients in the United States develop superbug bacterial infections from hospitals.

Antibiotic use in human medicine is one of the primary factors that drives development of antibiotic resistance in human pathogens. Its use also contributes to the resistant gene pool that facilitates the emergence and spread of superbugs. These bacteria are immune to the strongest medications. In recent years, various medical studies have revealed a clear relationship between increased antibiotic use and the development of resistance. Continuous use of antibiotics is a major risk factor for the development of the antimicrobial pathogens.

Bactericidal antibiotics not only inhibit the growth of bacteria but also kill them. Latest studies have shown that due to a consistent exposure, bacteria have developed various mechanisms to overcome the effect of the antibiotics. These mechanisms let the bacteria cope up with the harsh conditions. They develop and become more resistant. Bacteria are turning into superbugs and surely, the healthcare and scientific community need to

fabricate innovative procedures to eradicate them. The antibiotic-resistance mechanisms that have been identified so far include:

- Enzymatic modification or destruction of the antibiotic.
- Decreased uptake of antibiotic into bacteria.
- Increased removal of antibiotic from bacteria.
- Alteration of bacterial targets.

Various organizations including the Centers for Disease Control (CDC), the Alliance for the Prudent Use of Antibiotics (APUA) and World Health Organization (WHO) have been putting serious efforts to improve the antibiotic usage and research to limit the life threatening effects of Superbugs. In order to combat antibiotic resistance, CDC organised programmes as surveillance, research and development, and prevention and control.

MDR is found in globally-prevalent infections such as tuberculosis and *S. aureus*. Emerging antibiotic resistance is now being seen in Gram-negative pathogens including *P. aeruginosa*.

However, the scientists have discovered a few medicines in development to treat resistant forms of bacteria. It includes ESKAPE bacteria. Because of its particular importance, many of them are resistant to multiple medications:

- Enterococcus, including *E. faecium*
- Staphylococcus aureus (*S. aureus*)
- Klebsiella, including *K. pneumoniae*
- Acinetobacter baumannii (*A. baumannii*)
- Pseudomonas aeruginosa (*P. aeruginosa*)
- Enterobacter species, including *E. cloacae*

Gram-negative bacteria accounts for more than 30 percent of common hospital-acquired infections. In a 2009 study, 62 percent of patients hospitalized in an intensive care unit (ICU) with a respiratory infection had a Gram-negative infection (Vincent, Rello, and Marshall, 2009).

Various antibiotic resistant forms of *Pseudomonas aeruginosa* are becoming more widespread in U. S hospitals, a recent study revealed. This bacterium can cause blood infections, pneumonia, and intra-abdominal infections.

Resistance to antibiotics in this species has increased nine to 20 percent depending on the antibiotic, according to last measurements taken from 1998-2002. In *P. aeruginosa*, resistance to specific antibiotics can range from one to 31 percent strains, isolated from hospitals, according to studies.

Developing countries account for the 95% of the Tuberculosis (TB), *Mycobacterium tuberculosis* (MTB), cases and deaths among the adults (Joloba and Bwanga, 2010).

Enterobacteriaceae, a large family of bacteria, causes both nosocomial and community-acquired infections. This family includes many more familiar pathogens, such a *Salmonella* species and *Escherichia coli*, as well as *Citrobacter* species, *Enterobacter* species, *Klebsiella* species, *Morganella* species, *Proteus* species, *Providencia* species, *Serratia* species, and others (Andrade, Gales, and Sader, 2010).

“ Most of the large pharmaceutical companies have left the drug discovery field. And with bacteria becoming resistant to multiple drugs, it’s hard to know which antibiotic to use. People are dying from resistant infections every day”, Tuft’s Levy said, a medical professional. “ *C. difficile*, a toxic bacterium that can cause severe diarrhoea and death, could cut in half the

number of hospital-acquired infections with such combating strategies”, said Thomas Frieden, director of the Centres for Disease Control and Prevention. There is a prominent increase in the infections, caused by harmful bacteria that are untreatable with any medications, in the human population. This issue is a global concern. People die every day due to these infections. The world healthcare needs to formulate an immediate approach to deal with the deteriorating situation. Establishment of well-furnished medical and technological infrastructure and research labs with supporting research aura is the need of the hour. Also, the scientists from around the globe should collaborate or at least be updated with the latest findings and research. There is a definite need of productive scientific approach to combat the life-threatening superbugs.

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### Reporter/Journalist Perspective

English

Antibiotics misuse threatens patient’s lives

Antibiotic resistance by microbial organisms especially bacteria has become a global public health concern to address as revealed by the eminent medical personalities. These harmful bacteria, also known as ‘superbugs’ cause serious infections that leads to severe illness and even death.

However, most of these infections can be acquired from a hospital; they are now prominent even outside. More than 1.7 million patients in the United States develop such bacterial infections while in the hospital.

Antibiotics are the drugs that fight infections caused by bacteria. They are not effective against the viral infections triggered by bacteria. Bacterial infections were life threatening before the discovery of antibiotics. The infections were easily treated with the help of these antibiotics. New methods were developed for mass production of these drugs. But the bacteria have fought back. The bacteria withstand against the use of antibiotics and develop the potential to overcome its effect through natural selection. For instance, many insects have become resistant to insecticides.

In a similar manner, some types of bacteria respond to the increasing presence of antibiotics by becoming resistant to them. So, bacterial infections are still a threat to the human race.

Bacteria live on or in just about every material and environment on Earth from soil to water to air. They are also present in ice and volcanic vents. They also exist in the human body, on the skin and in the gut. A single teaspoon of topsoil contains more than one billion (1, 000, 000, 000) bacteria.

Bacteria that are no longer susceptible to antibiotics and can survive in the presence of the drug are called antibiotic-resistant. There can be several types of strains of same bacteria present in an infected person. Antibiotic kills only the susceptible strains of a bacterium and leaves the resistant strains unaffected. Also, in some cases, bacteria can be resistant to multiple drugs and accordingly, these strains are considered multi-drug resistant (MDR). Existing medicines may hardly be effective in treating these infections.

The first antibiotic-resistant strains of bacteria were identified more than 60 years ago. The Multi-drug resistant bacteria infections are present around the globe and amongst them, tuberculosis (TB) and *Staphylococcus aureus* are the most prevalent. Emerging antibiotic resistance is now being seen in many pathogens including *Pseudomonas aeruginosa*.

The main reason for the development and spread of antibiotic resistance or antimicrobial resistance (AMR) is due to misuse, overuse and indiscriminate use of antibiotics by doctors, nurses and pharmacists. It also occurs due to non-compliance and self-medication by the patients. According to the

director of the Centers for Disease Control and Prevention, Thomas Frieden, misuse of antibiotics puts patients at serious risk of developing an antibiotic-resistant infection. Bacteria can acquire the ability to survive in the presence of drugs that normally kills them. Poverty and inadequate medical availability is one of the main causes of acquiring the antimicrobial resistance in developing countries.

Previously, the drug resistant bacteria were identified only in hospitals such as Methicillin-resistant Staphylococcus aureus (MRSA) but now, they are present even outside community. Hospitals have a larger number and diversity of disease-causing micro-organisms than is typically found in the community. A recent study has shown that various antibiotic resistant forms of Pseudomonas aeruginosa are becoming more prevalent in U. S hospitals. This bacterium can cause disease at multiple sites in the body. It is a common cause of blood infections, pneumonia, and can also cause intra-abdominal infections.

Governments from around the world and the pharmaceutical industry are in search of effective methods to tackle the threatening life issue. U. S Government has already taken some serious steps to fight such problems effectively. According to an announcement from the Department of Health and Human Services, Barrack Obama, the president of America, proposed a budget that includes thirty million U. S dollars (\$30) annually for the next five years to detect and prevent "superbug" infections. More than 2 million Americans are sickened every year by antibiotic-resistant infections and at least 23, 000 die from them, according to the Infectious Diseases Society of America.



Some studies have shown that a large number of antibiotic research companies no longer deal with detection, research and manufacture of antibiotics. “ Most of the large pharmaceutical companies have left the drug discovery field. And with bacteria becoming resistant to multiple drugs, it’s hard to know which antibiotic to use. People are dying from resistant infections every day”, Tuft’s Levy, a medical professional said. “ C. difficile, a toxic bacterium that can cause severe diarrhoea and death, could cut in half the number of hospital-acquired infections with such combating strategies”, said Thomas Frieden, director of the Centres for Disease Control and Prevention.

Although U. S healthcare industry is working on the problem, doctors and other medical professionals and even the public also need to put their best efforts. “ We recognize we must improve our practices, not only for the benefit of patients under our care but to preserve the effectiveness of antibiotics for future patients,” John Combes said, senior vice president at the American Hospital Association.

Drug resistant superbugs are one of the immediate threats to the global population. However, in order to avoid the life threatening infections, the global public, drug industries and the governments of all the countries have to be accountable to address the pandemic issue effectively. Without effective antibiotics, the human civilization is no longer secure from a global epidemic. It may be similar to Black Death that the ancestors of humankind faced.

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