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Editorial

Antibiotic Resistance. A Major Threat to Public Health

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Antibiotics have been the cornerstone of therapy for infectious diseases since the discovery of penicillin in 1928, saving the lives of millions of people worldwide. The ability of these agents to fight infections, with little harm to the host, has helped to define them as "miracle drugs" [1]. However, the increasing prevalence of antimicrobial resistance has become one of the pressing problems faced by the healthcare system. Millions of people have to fight infections with resistant bacteria and many of them die as a direct result of these infections. Antimicrobial resistance can be attributed to the indiscriminate or inappropriate use of broad-spectrum antimicrobial products in the community, healthcare facilities, agriculture and farming. The other major factor in the surge of antibiotic resistance is the spread of resistant strains of bacteria from person to person, or from non-human environmental factors, including food. Misuse and over-use of antibiotics in healthcare and food production continues to accelerate the development of bacterial resistance, leading to the loss of efficacy of existing antibiotics.

The molecular mechanisms by which bacteria have become resistant to antibiotics are diverse and complicated. Antibiotic resistance results from mutations or the acquisition of new genes in bacteria that reduce or eliminate the effectiveness of antibiotics. Pathogenic bacteria continually evolve heterogeneous genetic mechanisms for acquiring and developing resistant genes to almost every class of antibiotics discovered to date. Antibiotic resistance, initially a problem limited to the hospital setting, has now extended into the community causing severe community acquired infections with pathogens resistant to multiple types of antibiotics [2,3]. New forms of antibiotic resistance are nearly impossible to contain, able to cross international borders and spread between countries and continents rapidly.

The study of Chyer., *et al.* [4] evaluating the prevalence of antimicrobial resistance in animals, wildlife and food samples in the Eastern United States draws attention to the increased resistance to commonly used antibiotics.

The authors evaluated the prevalence of antimicrobial resistance in *E. coli, Salmonella* and *Campylobacter* isolates obtained from animal and food samples between 2007 and 2013 in the Eastern United States. A total of 265 bacterial isolates consisting of *E. coli, Salmonella* and *Campylobacter* were tested for their susceptibility to 12 antimicrobials, representing nine different categories. Tetracycline was the antimicrobial agent that showed the highest frequency of resistance among *E. coli* and *Salmonella* isolates (62.1% and 13.2%, respectively), while the most frequent trimethoprim/sulfamethoxazole resistance was detected among *Campylobacter* isolates (58.3%). Approximately 19.7% of *E. coli*, 5.0% of *Salmonella* and 23.1% of *Campylobacter* isolates was resistant to three or more categories of antimicrobials, meeting criteria for multi-drug resistance (MDR). Eighty-three percent of *E. coli*, 31% of *Salmonella* and 94% of *Campylobacter* isolates were found to be resistant to at least one of the antimicrobials tested in this study.

The loss of antibiotics that inhibit the growth of microorganisms means that we can no longer take for granted reliable treatment of common bacterial infections, both community acquired and healthcare-associated. Moreover, antibiotic resistance also threatens animal health, agriculture, and the economy [2].

The results of the study of Chyer., *et al.* draw attention to the increased risk of resistance to commonly used first line antibiotics and are in accordance with the evidence from a plethora of references proving that antibiotics found in food and animal samples contribute dramatically to the problem of antimicrobial resistance.

Antibiotic resistance is a worldwide issue that cannot be addressed by one nation in isolation and requires international attention and collaboration in order to keep new bacterial resistance from developing and to prevent the already existing resistance from spreading.

A number of ways to avoid the vicious cycle of antibiotic resistance have been described in the current literature [5,6] such as:

- Implementing judicious use of antibiotics in healthcare and agricultural settings
- Promoting the development of new antibiotics and developing new diagnostic tests for resistant bacteria
- Slowing the emergence of resistant bacteria, preventing the spread of resistance
- Improving detection and control of drug-resistant organisms by integration of data from surveillance systems that monitor human pathogens with data from surveillance systems that monitor animal pathogens.
- Monitoring antibiotic sales, usage, resistance, and management practices at multiple points along in the food-production chain
- Accelerating research and efforts for the development of non-antibiotic alternatives, such as adjunctive therapies and vaccines
- Improving international collaboration for antibiotic-resistance prevention, surveillance, control, and research.

Findings from the study of Chyer., *et al*. confirm the high prevalence of bacterial resistance in the environment, re-emphasizing the need for judicious and careful use of antimicrobials in human and agricultural practices in an effort to reduce future manifestations of resistant bacteria. Furthermore, local microbiologic data provided in this study are extremely important to predict the type of resistance and to guide antibiotic choices.

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