Extended Abstract Journal of Infectious Diseases & Immune Therapies 2020
Vol.4 No.1

Euro Infectious Diseases 2020: Global solutions for antibiotic resistance - Reza Nassiri - Michigan State University

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The cause of Antibiotic resistance (ABR) is complex which requires global solutions. The decreasing effectiveness of antibiotics in treating common infections has been a challenge worldwide. The selection pressure caused by millions of tons of antibiotics over decades has resulted an epidemic of ABR disproportionately, especially in those countries where proper antibiotic prescription guidelines lack commitment and enforcement to mitigate the high burden of resistant infections.
The agency and WHO police work information shows that the resistance in *E. coli* is generally and consistently the highest for antibacterial agents in both human and veterinary medicine. With more than 1 billion people travelling each year, bacteria are becoming more mobile. In the U.S. alone, 2 million infections and 23,000 deaths annually are directly attributable to drug-resistant bacteria. The ABR can kill 700,000 worldwide each year and it has been estimated to kill 10 million by 2050. For example, the WHO estimates 78 million people in a year get gonorrhea - there is a widespread resistance to the first-line medicine ciprofloxacin as well as increasing resistance to azithromycin.

Human behaviour plays a significant role in the spread of antibiotic resistant genes. In addition to the human behaviour, the drivers of resistance include agriculture sector, animal husbandry, household, and industry – these factors contribute significantly to the spread of the resistant genes within the ecosystem. India is a classic example that is faced with ABR issues. India's resistance problem extents some of the highest ABR rates in the world, according to a 2017 report from the government's Ministry of Science and Technology. Tests conducted by regional public health departments and health research centers showed that 70% of four bacteria species commonly found in hospital patients were resistant to typical first-line antibiotics. From 12% to 71%, depending on the bacterial species tested, were also resistant to carbapenems, which once considered the last line of therapy.

The patterns of ABR to carbapenems are now being recognized – numerous countries reported at least half of *E. coli* infections resisted both classes of drug, making many urinary tract infections, usually regarded as ineffective. Countries worldwide reported that half or more of Staphylococcus infections were MRSA. Community-associated MRSA is now highly prevalent in both hospital and community settings, requiring second-line treatment with glycopeptides, linezolid, or daptomycin.

These agents require careful monitoring for adverse effects and have increased treatment costs. Among countries providing *S. aureus* information, four hundred- and forty-yards according MRSA (in proportions of 2 hundredth or greater) among their isolates.

Although China has recently moved on improving judicious use antibiotics in human and veterinary medicine, there is yet a high demand on the animal husbandry and agricultural sectors, which by some studies has reach almost 10,000 tons per year. The high prevalence of the mrc-1 gene in *E. coli* samples both in animals and raw meat, with the number of positive-testing samples are public health concerns in China. Numerous European countries have reported the existence of mrc-1 gene in the isolates from human, isolates from animals used for food, isolates from food, and isolated from the environment.

Several national and international evidenced-based recommendations exist as action plan for combating ABR. Most recommendations acknowledge that there is a substantial need to improves surveillance by collecting and sharing resistance information across global networks of laboratories; to step up the development of new antibiotics; to strengthen national drug regulatory authorities on low- and middle-income countries; to conduct public health monitoring of ABR; to avoid unnecessary antibiotics prescription and use (agriculture and food production sectors); to create a sustainable partnership among various health, industry, and regulatory stakeholders; and most importantly, to advocate for the role of world-class research universities to conduct state-of-art research and come up with science-based solutions.

The causes of antibiotic resistance are complex and include human behaviour at many levels of society; the results affect everybody within the world. Similarities with climate change are evident. Many efforts are made to explain the various different facets of antibiotic resistance and therefore the interventions needed to satisfy the challenge. However, coordinated action is essentially absent, especially at the political level, both nationally and internationally. Antibiotics paved the way for unprecedented medical and societal developments and are today indispensable altogether health systems. Achievements in trendy medication, like operation, organ transplantation, treatment of preterm babies, and cancer therapy, that we tend to these days consider granted, would not be attainable while not access to effective treatment for bacterial infections.

This work is partly presented at 12th Euro-Global Conference on Infectious Diseases October on 05-06, 2020 held at Vienna, Austria