One Health: for the assessment of global threat of antimicrobial resistance

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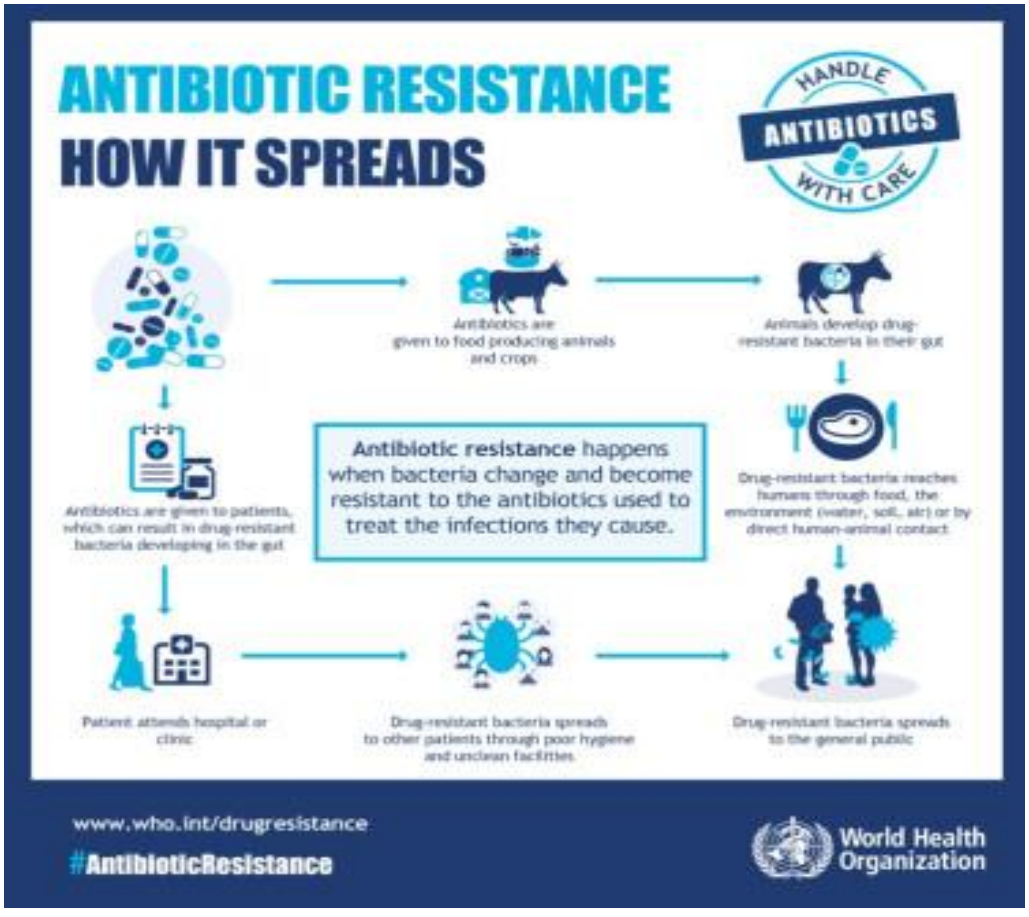
Introduction
One health is the collaborative efforts of multiple disciplines working locally, nationally and globally to attain optimal health of human, animals and environment. One Health is not a new concept, but it has become more significant in recent years because many factors have changed the interactions among humans, animals, and the environment. These changes have caused the emergence and reemergence of many diseases. There are many examples that show how the health of people is related to the health of animals and the environment. There are many diseases that can be spread from animals to humans and vice-versa; known as zoonotic and zooanthrapozoonotic diseases respectively. Research of International Organization For Animal Health, OIE has shown that 60% of existing human diseases are zoonotic and at least 75% of emerging infectious diseases of human (including Ebola, HIV and Influenza) have animal origin (http://www.oie.int/onehealth). For every 5 new diseases appear every year, 3 are of animal origin. Environment being the important component of epidemiological triad it has a significant role in spread of such diseases. Animals also share our susceptibility to some diseases and environmental hazards. Because of this, they can serve as early warning signs of potential human illness. For example, West Nile virus fever. There is no any doubt that successful public health interventions require the cooperation of the human health, veterinary health, and environmental health communities. To assure overall health; Use of antimicrobial agents had become the most easiest and convenient way for the destruction of microbes in every cases but it has created a serious problem due to its unscientific and haphazard use.

Actually, antimicrobial agents when used in optimum level improve human, animal and plant health, and increase life expectancy by destroying microbes, inhibiting their growth, or

preventing or counteracting their pathogenic action. Antimicrobial agents and antibiotics are usually used as a synonyms but antimicrobial is a wide concept; but we can't deny the fact of excessive use of antibiotics as an antimicrobial agents. Majority of individuals acknowledge the positive role of antibiotics while the topic of antimicrobial resistance is frequently misunderstood, misappropriated and polarizing. Antimicrobial resistance (AMR) is the ability of a microorganism (like bacteria, viruses, and some parasites) to stop an antimicrobial (such as antibiotics, antivirals and anti-protozoan, antifungal, etc.) from working against it. As a result, standard treatments become ineffective, infections persist and may spread to others. Several researches have shown that antimicrobial use is not limited to animal agriculture and human medicine. It is also used in plant agriculture. Global report of surveillance on antimicrobial resistance- 2014 by WHO (World Health Organization) had showed the following result of antimicrobial resistivity of following bacteria with specific drugs. Escherichia coli to third-generation cephalosporin & fluoroquinolones. Klebsiella pneumoniae to third-generation cephalosporin and to carbapenems. Staphylococcus aureus to methicillin and so on.

How does antimicrobial resistance occur?

A historical look at antimicrobial resistance shows it is not a new phenomenon but existed before widespread use in human and animal medicine. So, how does antibiotic resistance occurs then? The resistance may be natural or acquired. The natural resistance is genetically determined, e.g. normally, gram-negative bacilli are not affected by penicillin G. In acquired resistance, microbes that initially respond to an AMA (Anti-Microbial Agent) later develop resistance to the same AMA by mutation or gene transfer, e.g. gonococcal resistance to penicillins. The transfer of genes for drug resistance occurs by the following mechanisms: Transduction, Transformation and Conjugation. Antibiotic resistance mainly occurs via three mechanisms, each requiring only minor changes in biochemistry: 1) Bacteria may possess enzymes that degrade antibiotics; 2)



Bacteria may replace or alter the method through which the antibiotic enters the cell; and 3) Bacteria may alter the cellular target site of the antibiotic.

Threats due to antimicrobial resistance

For several decades antimicrobial resistance (AMR) has been a growing threat to the effective treatment of an ever-increasing range of infections. AMR results in reduced efficiency of antibacterial, anti-parasitic, antiviral and antifungal drugs, making the treatment of patients difficult costly, or even impossible. The treatment of patients infected with drug-resistant pathogens is much more expensive as a result of longer hospitalization times and the use of more expensive last-resort drugs is required. The threat in least developed and developing countries is more vulnerable. The impact on particularly vulnerable patients is most obvious, resulting in prolonged illness and increased mortality. The magnitude of the problem worldwide and the impact of AMR on human and animal health, on costs for the health-care sector and the wider societal impact, are still largely unknown. Threats are not limited up to these, Environment is acting as a largest reservoir of antibiotic thus develop antimicrobial resistant microbes. WHO and CDC finally concluded to consider infections caused by multidrug-resistant (MDR) bacteria as an emergent global disease and a major public health problem. The emergence of resistant microorganisms, either by mutations or the acquisition of mobile genetic elements carrying resistance genes, may take place irrespective of the presence of antibacterial agents.

Assessment of the problem

It is not merely a consequence of use; it is a consequence of use and misuse, with each community-animal health, human health and environmental health-responsible for antibiotic stewardship.

1. **Role of International organizations**: WHO(World Health Organization), International Organization for animal health or OIE, CDC(Centre for Disease Control and Prevention), FAO(Food And Agricultural Organization) are working globally through research, surveillance, symposium, conference, Awareness campaign, etc. Recently B-Debate (Bio-Cat) and the Barcelona Institute for Global Health (IS Global) also come up with a coordinated set of strategies to fight antimicrobial resistance in a multifaceted approach i.e. human, animal and environment (https://www.ncbi.nlm.nih.gov/pmc/articles).

2. **General strategies:** Most of all the awareness and education regarding the judicious use of antibiotics to concerned target groups like employees/ producers/ suppliers/ professionals/ consumers and all individuals. Commitment especially for professionals about existing judicious use guidelines is the immediate need. Adequate and appropriate research should be conducted which could yield practical and implementable results.

3. **Specific strategies in animal health and medical sector:** Interventions to limit the emergence and spread of resistant bacteria in the animal setting may include the following: (a) banning antibiotic use as growth promoters and limiting its use for other non-therapeutic applications, (b) reducing the dissemination of resistant bacteria through the food chain by improving farm bio-security and developing alternative treatment strategies and increasing hygienic conditions and practices along the food chain, (c) developing education programs, mainly directed at veterinarians, farmers, and food handlers and (d) linking surveillance systems on antibiotic resistance established for humans and animals. Antibiotics that have become critical for human health should be clearly identified and their use restricted to humans only in order to avoid cross-resistance. In this respect, the WHO has established a list of essential antimicrobial agents for human use to be avoided in non-human interventions.

Conclusion

Thus it can be concluded that the global threat of AMR is increasing day by day and we along with the concerned authorities should be aware to such issues. The time has come when academia, government researchers, the scientific community and stakeholders within animal agriculture, human medicine and the environment seek resolution and create a common global platform to deal with such issues. Complexity of animal and human medical challenges embedded in a changing environment demand that those within the animal, human and environmental health fields move beyond the confines of their own disciplines and explore new organizational models for team science. With animal, human and environmental health inextricably linked, one logical answer is to take an initiative approach i.e. One Health approach. This approach would call for all to think in a much larger dimension and work toward improving and defending the global issues like: antimicrobial resistivity as well as health and well-being of all species by enhancing cooperation and collaboration between physicians, veterinarians, other scientific health and environmental professionals, and by promoting strengths in leadership and management to achieve these goals.