

Editorial

Antimicrobial Resistance: Threat to the World

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Infectious diseases (IDs) are threats to all societies irrespective of age, gender, ethnicity, and socioeconomic status. There could be unexpected outbreaks of IDs any time causing mortality and morbidity. These diseases could be treated with antimicrobials including antibiotics. In spite of tremendous efforts made to develop new antibiotics, only two novel classes of antibiotics: oxazolidinones and cyclic lipopeptides have been marketed over the past 30 years (1). The introduction of new vaccines may reduce the prevalence of IDs decreasing the need for antibiotic use (2). Currently, there are very few effective antimicrobials (AMs) employed for treatment of multidrug-resistant infections due to Gram-negative bacteria that represent the main threat at present (2).

Their treatment imposes financial burden on the society specially to those in developing countries. Besides treatment, AMs are used for prophylaxis and as growth promoters in food animals which might lead to drug residue resulting in resistance emergence. Moreover, they are also used to control zoonotic pathogens, such as salmonella and campylobacter, *E. coli* and *Enterobacter*.

AMs could have differential sensitivity (narrow or broad spectrum of activities) and static or cidal activities. The broad spectrum orally administered AMs may also induce superinfection leading to diarrhea. Microorganisms (MOs) could develop resistance to AMs through different mechanisms in an attempt to protect themselves from drug attacks. Antimicrobial resistance (AMR) is the ability of MOs to survive and/or multiply in the presence of tolerable doses of antimicrobial drugs. It is an urgent global public health threat, killing at least 1.27 million people worldwide and associated with nearly 5 million deaths in 2019 (3).

AMR could be Natural that occurs due to spontaneous gene mutation/s without getting exposed to AMs or Acquired that occurs after exposure to AMs with selective pressure (4). The one which threatens the world is the acquired one. Acquired resistance could be multidrug resistance occurring because of two or more drugs co-administration; Cross-resistance which occurs to different antimicrobials belonging to same pharmacological class limiting the choice of AMs, or Co-resistance in which more than one mechanism of resistance are involved by same organism to a given AM making it difficult to fight against resistance.

There are several factors which contribute to AMR (5, 6). These factors include i) Natural disasters like climate change which creates favorable conditions for the spread of IDs like malaria; ii) Civil wars leading to displacement of peoples to over-crowded camps with poor hygiene resulting in the spread of resistant organisms; iii) Epidemics of IDs which lead to overuse of AMs, for example, AIDS epidemic has led to emergence of opportunistic infections.

forcing use of excessive antimicrobials resulting in development of resistant pathogens; iv) irrational antimicrobials use. i.e., irrational consumption like practicing self-medication, irrational prescribing due to inappropriate diagnosis of infection, prescribing expensive broad spectrum antimicrobials and inappropriate use of antimicrobials for surgical prophylaxis, Irrational dispensing of AMs without prescription; v) Manufacturers' pressure which could have impact on prescribing reserve AMs; vi) Inefficient drug procurement process leading to unavailability of AMs vii) inadequate health service centers resulting in catering patients with acute or chronic infection who serve as reservoirs of resistant pathogens leading to intensive and prolonged AM use; viii) Environmental contamination with AMs from human, animal, agriculture and pharmaceutical industries spillovers contributing for environmen-

tal selection on AM resistant organisms; ix) Use of AMs in food animals as growth promoters or for prophylaxis/treatment leading to drug residue in the animals.

AMR has impacts both on economy and health of the population. Such impacts include prolonged illness leading to prolonged absence of work resulting in reduced productivity, and prolonged period of infectiousness leading to increased spread of infection and longer hospital stay.

What should be the solution then? We need to take measures towards containment of AMR. Such strategies (7, 8) include but not limited to i) Infection control measures and antimicrobial stewardship programs administered by multidisciplinary teams of experts including ID specialists, clinical pharmacists, clinical pharmacologists, clinical microbiologists, and other relevant health professionals at a hospital level (9); ii) Creating awareness of the public and health professionals on the danger of AMR; iii) Keeping track of resistance profile by the regulatory body; iv) Keeping AMR surveillance systems in place to help identify most prevalent pathogens together with their status of resistance, and suggesting more appropriate choices of treatment; v) Keeping public health officials alert to new pathogens; vi) implementation of control policies; vii) Preparing Guidelines for AMs use, optimal AM prophylaxis for surgery, choice and duration of empirical therapy; viii) Controlling hospital infection through development of protocols for prevention, detection and control of AMR; ix) Improving public health through application of WASH, ix) Disease control and vaccination; x) Improving diagnostic quality; xi) Promoting rational use of drugs, i.e., rational prescribing, dispensing and consumption of AMs; xii) Research and development of new AMs that act by novel mechanisms.

In conclusion, as long as AMs are used, AMR will remain a challenge. Our goal should, therefore, be to make drug resistance a manageable problem that does not compromise availability of effective and safe drugs to treat IDs. We all have a shared responsibility to tackle this problem before it gets late.

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