

EDITORIAL

Changing Patterns of Anti-Microbial Resistance and Their Financial Impact on Patient Care

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As defined by World Health Organization (WHO), "Antimicrobial resistance (AMR) occurs when microorganisms such as bacteria, viruses, fungi and parasites change in ways that render the medications used to cure the infections they cause ineffective."¹

AMR is a very serious threat of present time to the human health security all over the world. It has been reported against almost every anti microbial discovered so far and in every country or community on the surface of the globe. The antibiotic resistance (ABR) shown by bacteria is more prevalent globally and specially in low and middle income countries resulting in devastating results. The WHO, in one of the latest reports has described that globally 3.6% of all new cases and 20.2 % of previously treated cases of Tuberculosis (TB) are estimated to have multi drug resistant TB (MDR-TB) and on the average 9.7% of these MDR-TB cases are found to be extensively drug resistant (XDR-TB). Great concern has been aroused by antibiotic resistance shown by particular bacteria against specific antibiotic groups like methicillin resistant *Staphylococcus aureus* (MRSA), the extended spectrum beta lactamase (ESBL) producing gram negative bacilli and cocci leading to resistance against fluoroquinolones and 3rd generation cephalosporins, carbapenemase producing members of bacterial family enterobacteriaceae becoming resistant to almost all antibiotics including carbapenems, the last resort antibiotics for these and NDM-1 producing bacteria resistant to most antibiotics except Polymyxin. The other emerging threatening pathogens include 3rd generation cephalosporin resistant *Neisseria gonorrhoeae*, Vancomycin resistant Enterococci and Staphylococci, multidrug resistant Salmonellae and Haemophilus influenzae.²

About 10-17% of all new patients of HIV infection in

Australia, Europe Japan and USA are infected by virus resistant to at least one antiretroviral drug. Emergence of plasmodium falciparum resistant to almost the last resort antimalarial named Artemisinin is another dreadful threat. Similarly antimicrobial resistance against antivirals like adamantanes by influenza virus type A, and against anti-fungals like fluconazoles by candida is among all types of antimicrobial resistances.²

Out of the above mentioned list, almost every type of antimicrobial resistance is present in Pakistan. But the most devastating and alarming are MDR and XDR Mycobacterium tuberculosis, Chloroquin and multi resistant plasmodia, ESBL and carbapenemase producing enterobacteriaceae, MRSA, Vancomycin resistant Enterococci and Staphylococci and multidrug resistant typhoid salmonellae.^{3,4,5,6}

Although sufficient numbers of comprehensive studies covering all aspects of the additional financial burden faced with infections by multi-resistant microbes are not found in medical literature, yet the longer hospital stay, increased hospital cost, and higher mortality have been reported in various studies.^{2,7} However it is confirmed that the increasing microbial resistance has got great economic impact on the patient care because 2nd and 3rd line regimens have been reported to be 3 times and 18 times more expensive respectively than the first-line drugs.⁸ More importantly, we are facing a global scenario where sporadic antimicrobial resistance has been found even to the last resort antimicrobials.⁹

In 2009 a joint technical report presented a data of financial impact of infections with multi resistant bacteria and reported death of 25 thousand patients who died in a year from infection by multi resistant bacteria in European Union (EU), Iceland, & Norway. In addition there were approximately 2.5 million extra hospital days due to infection by these organisms. The estimated financial burden both direct and indirect due to antibiotic resistant bacteria was found to be €1.5 billion (EURO) each year in EU.¹⁰ Centre for disease control and prevention (CDC) USA has cited a study of 2009 showing an estimate of as high as \$20 billion in excess as direct healthcare costs, and additional cost to society for lost productivity as high as \$35 billion a year in USA as a result of infections by multi resistant

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bacteria.¹¹ A recent study chaired by an economist have estimated that if the ever increasing bacterial resistance is not checked at this stage there would be 300 million deaths prematurely in the next 35 years leading to economic loss of 60 to 100 trillion USD by the year 2050.¹²

Pakistan is one of the top 10 countries in the world with high burden of tuberculosis. With an average of 510,000 new cases of tuberculosis including 26,000 cases of MDR TB and about 2,500 estimated cases of XDR TB puts a huge economic burden for its management and treatment in view of the estimated per person treatment cost for TB ranges from 100 to 1,000 US dollars in susceptible infection and 2,000 to 20,000 dollars for MDR TB. Moreover the success rate of TB treatment is up to 83% in susceptible patients, 52% for MDR TB and 28% for XDR TB.¹³ This shows that a very comprehensive infrastructure and huge funds other than current international donations are required to cope with the situation.

Similarly addition of 1.5 million cases of malaria every year with about 12% of these caused by Plasmodium falciparum and rest by P. vivax is a big figure for consideration. The current eruption of Chloroquin resistance in P. vivax can lead to a huge burden on health care budget of the country.⁶

A research report showing the total costs per malaria episode (including direct and indirect household costs and health system costs) based on disease severity and the presence of complications and comorbidities ranged from US\$ 7.99 to \$ 229.24 in Ghana, from US\$ 5.2 to \$ 137.74 in Tanzania, and from US\$ 11.24 to \$ 287.81 in Kenya.¹⁴

Due to non availability of a comprehensive data the financial burden due to infections by MRSA, ESBL and carbapenemase producing organisms for our country is difficult to calculate. We have compared the cost of the antibiotics only for 10 days treatment of a patient suffering from some systemic disease caused by Escherichia coli sensitive to 3rd generation cephalosporins and resistant to that and treated with meropenem. The cost of antibiotics comes to Rs 7,500 -15,000 and 30,000 -60,000 respectively. This example can show us how multi resistant organisms can influence the health care budget of a hospital, family and a country.¹⁵

In view of above, there is an utmost requirement of having serious considerations is planning and execution of preventive measures against rapid development & spread of AMR at individual, hospital, community, national and international level.

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