Antibiotic misuse and antibiotic-resistant bacteria

Friedrich Nietzsche said: "what does not kill me, makes me stronger". I am sure that when Nietzsche was commenting on what made him stronger, he did not consider the underlying mechanisms for bacterial resistance. Prior to Alexander Fleming's discovery of penicillin in 1928, many millions of people died prematurely because of infectious diseases. During the next decades, other antibiotics became available to effectively treat the growing number of infections.

Having this new powerful weapon in their arsenal, physicians thought they were in a position to win the battle against infectious diseases. Nevertheless, antibiotics were thought to be an inexhaustible gift and were used without due attention to microbial resistance.

Much evidence shows that irrational use of antibiotics causes the development of resistant bacterial strains. For example, physicians might prescribe antibiotics to treat non-bacterial infections, such as viral diseases, for which antibiotics are completely useless. The irrational use of antibiotics is not restricted to human beings. Antibiotics are reportedly overused in veterinary medicine, poultry, and fishery industries, which causes the emergence of resistant microbial strains and their spread to people through the food chain.

There are alarming reports of the increasing frequency of community-acquired infections caused by antibiotic-resistant bacteria. The European Centre for Disease Prevention and Control has reported the spread of antibiotic-resistant bacteria across Europe. Meticillin-resistant *Staphylococcus aureus* (MRSA) is a Gram-positive bacteria of particular concern. Some MRSA strains are even resistant to the newly introduced potent antibiotics daptomycin and oxazolidinones. The situation is even worse for Gram-negative bacteria. Many European Union states have reported infections with *Klebsiella pneumoniae* that are resistant to carbapenems. There are also many reports of antibiotic resistance in bacteria strains that had previously been sensitive to standard antibiotics—eg, *Neisseria gonorrhoeae*, *Salmonella* spp, and Enterobacteriaceae (such as *Escherichia coli*). In many countries, the situation is so grave that most cephalosporins can no longer be used for empirical treatment, and carbapenems—the antibiotic that is considered the last available line of defence against many Gram-negative bacteria—should now be used for empirical treatment.

This increasing trend of antibiotic resistance is not restricted to Europe. The situation is worse in the Middle East where antibiotics are used more extensively. There are many reports of bacterial resistance from Iran, Lebanon, United Arab Emirates, Turkey, and other countries in the region. These include multidrug-resistant tuberculosis. Antibiotics are cheap in most countries in the Middle East and can be obtained from a pharmacy without prescription. Culture is also an important contributing factor, because non-professionals in the region can give advice to their friends and relatives about use of medicines (including antibiotics).

Because antibiotic-resistant strains can easily be spread to the region or other continents by international travel or during gatherings such as Hajj, we should explore avenues for the containment of microbial resistance by emphasising good clinical practice. A Cochrane systematic review has concluded that because there are many prescribing behaviours and barriers in a particular community, no single intervention for antibiotic prescribing can be recommended in any setting. However, a study from Turkey showed that a nationwide antibiotic restriction programme would effectively lower the antibiotic-resistance rate.

I think all countries in the region should adopt a policy to prevent antibiotic resistance by a multi-faceted approach to improve public health in the Middle East. Because the most important cause of bacterial resistance is misuse of antibiotics, the strategy should address the rational prescription of antibiotics both in human and veterinary medicine.

Antibiotic resistance is a global health problem and—unlike global warming, for which developed countries should be mainly blamed—the brunt for antibiotic resistance is borne by developing countries. Despite substantial technological advances, the development of new antibiotics is slow. To achieve the UN Millennium Development Goals, particularly goal 6 (to control HIV/AIDS, tuberculosis, malaria, and other diseases), we should pay more attention to this global threat.

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For the **Cochrane review on antibiotic prescribing** see http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003539.pub2/abstract