

# Antimicrobial Resistance- Combining the Sciences of Microbiology and Public Health

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## Editorial

One of the greatest global challenges facing medicine and public health these days is that of antimicrobial resistance. This current, ever-increasing problem is the topic of much research, policy, and survey worldwide, even being addressed by the World Health Organization (WHO) with the first 'World Antibiotic Awareness Week' campaign held in November 2015 [1]. This global initiative sought to bring awareness to the topic of antibiotic resistance and to recommend guidelines to the public, health professionals, and policymakers for antibiotics usage. This was held alongside the release of the results of WHO's multi-country survey that studied public awareness of antibiotic resistance. At this time, there is a global call and new initiative for a multi-pronged approach to the problem of antimicrobial resistance, surely one that combines the sciences of microbiology and public health.

Antimicrobial resistance is the evolutionary result that occurs when selective pressure is exerted on bacteria, viruses, protozoa, and fungi. However, there is more concern with bacterial resistance due to their rapid evolution, the abundance of bacteria, the abundance of bacterial diseases, disinfectant use, environmental pollutants, and the abuse of antibacterial drugs. It is concerning because this resistance considerably decreases the efficacy of infectious disease and infection treatments, increasing morbidity and mortality rates [2]. Resistance has been found in entire classes of antibiotics, such as tetracyclines, glycopeptides, macrolides, beta-lactams, and quinolones.

The anthropogenic activity that adds to this bacterial resistance may be considered the most important contributor and comes in the forms of over-prescription of antibiotics, increasing use of broad-spectrum antibiotics, use of poorly-targeted antibiotics, dumping of noxious xenobiotics, and the use of antibiotics in agriculture and aquaculture. This man-made situation of multiple generations of antibiotic-resistant bacteria is present throughout the world, especially in developing countries that also have a higher stake in the infectious disease specialty [3].

Many developing countries have become a playground for bacterial resistance. In some, antibiotics are available over-the-counter or doctors are pressured to prescribe them even for a cold. In India for example, since 60% of medical care is out-of-pocket (and ranked third in the Southeast Region for this), patients' primary concern is saving money. It has been reported that due to the economic burden of medical expenses, patients take shortened or self-prescribed courses of antibiotics without either an appropriate dosage or length of prescription. Since there are thousands of different drug formulations available when only 350 are considered safe and effective for the disease that they are meant to treat, as per the WHO's list of 'Essential Medicines', regulation may be considered nonexistent. It has been estimated that only about 10% of the available drugs in India are necessary to treat 90% of the drug-treatable conditions [4]. These behaviors also coincide with the WHO report that found that few countries have any type of system for monitoring the use of antimicrobial drugs.

Combine these public health concerns with decreased research and development put towards novel antibiotics by large pharmaceutical companies and the threat is put into stark relief. It is reported that a greater profit may be made by pharmaceutical companies in the development of drugs that do not lose effectiveness and can be prescribed and taken regularly, such as antidepressants and musculoskeletal drugs [5]. Further new regulations on doctors in developing countries for the receipt of gifts from pharmaceutical companies may indicate that prescription practices may be more at the behest of the drug companies.

It is the current situation that 80% of new research and development of antibiotics are coming from small drug companies, research hospitals, and universities. But these developments are slow, as there have been no new classes of antibiotics discovered since 1987. All of the most recent developments have been variations on old drugs or combinations of well-used antibiotics with each other or in combination with efflux pump inhibitors. These are used sparingly in specialized settings, such as spectinomides, a semisynthetic agent for treatment of drug-resistant

tuberculosis. Further, research for treatment against gram-negative bacteria is no longer being done by large pharmaceutical companies, but constitutes a major cause of nosocomial infections that cause high morbidity and mortality worldwide.

This increase in antibiotic resistance via poor human control and the mere trickle of new drug development may be considered the perfect storm to affect a post-antibiotic era. Right now we take for granted the medical advancements that allow us to have progressive interventions such as surgeries, cancer therapies, transplants, and the successful neonatal care. Without effective antibiotics, these advancements may not be possible.

Maintaining effective antibiotic treatments and options is feasible if the sciences of public health and microbiology work together. Strategies for public health and policymakers for controlling the spread of antimicrobial resistance should include more surveys in developing countries to determine the knowledge, attitudes, and practice of the medical community about antibiotics. These would determine the scope of the irrational drug prescriptions in these regions [6]. This would be proof positive to convince policymakers that antibiotics should not be available over-the-counter, that a strict drug act should be implemented, and that even the most rural of communities should be educated on the proper use and limitations of antibiotics. For microbiologists, more funding and budgetary

incentives for antibiotic research would actively promote research and development for new classes of antibiotics, and failing that for antibiotic medicines with novel mechanisms of action. Last, biological surveillance and use of rapid diagnostic testing where feasible, especially in rural environments, would fulfill the criterion for cross-discipline advancements. As antimicrobial resistance is a global problem with such a large scope, it is only fitting that everyone gets involved.

## References

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