

## Editorial

# Tackling the crisis of antibiotic resistance

The discovery of antibiotics in the 1930s led to a dramatic decline in mortality rates from bacterial infections. Seven decades of medical advances are now seriously threatened by rising antibiotic resistance globally, coupled with a rapidly diminishing antibiotic pipeline.<sup>[1]</sup>

Antimicrobial resistance is recognized as one of the greatest threats to human health worldwide.<sup>[2]</sup> Just one organism, methicillin-resistant *Staphylococcus aureus* (MRSA), kills more Americans every year (~19,000) than emphysema, HIV/AIDS, Parkinson's disease, and homicide combined.<sup>[3]</sup> In a survey from 2009, approximately half of patients in more than 1000 intensive care units in 75 countries suffered from an infection, and infected patients had twice the risk of dying in the hospital as uninfected patients.<sup>[4]</sup> Without effective antibiotics, diverse fields of medicine will be severely hampered, including surgery, the care of premature infants, cancer chemotherapy, care of the critically ill, and transplantation medicine, all of which are feasible only in the context of effective antibiotic therapy.<sup>[1]</sup>

Collectively, highly problematic antibiotic-resistant organisms are summarized by the ESKAPE mnemonic: *Enterococcus*, *Staphylococcus*, *Klebsiella*, *Acinetobacter*, *Pseudomonas*, and ESBL (*Enterobacter* and *Escherichia coli*). ESKAPE indicates that these bacteria have developed defenses that permit them to escape the actions of available, effective therapies. The ESKAPE pathogens are currently the most important causes of the antibiotic resistance crisis. Such pathogens also are spreading through developing countries (such as India), which already are experiencing significant public health problems from extreme drug-resistant (XDR) *Mycobacterium tuberculosis* (TB). Collectively, disease caused by the ESKAPE pathogens, TB, and other highly problematic antibiotic-resistant bacterial pathogens, including hypervirulent and fluoroquinolone-resistant *Clostridium difficile*, and multi-drug resistant (MDR) *Streptococcus pneumoniae* and *Neisseria gonorrhoeae*, result in enormous morbidity, mortality, and health care expense in the US and throughout the world.<sup>[1,3,5-9]</sup>

The problem of antimicrobial resistance is not specific to bacteria – medically important viruses (e.g., HIV, influenza), fungi (e.g., *Candida*, *Aspergillus*), and parasites (e.g., malaria) also develop antimicrobial resistance. However, a unique convergence of overuse and misuse of antibiotics, the remarkable genetic plasticity of bacteria, the acquisition of resistant bacterial infections in both community and hospital settings, and a market failure of antibiotic development has

created an enormous public health concern regarding antibiotic resistance in bacteria.<sup>[1]</sup>

A roadmap outlined by the authors of "The Chennai Declaration"<sup>[10]</sup> represents an effective initiative to tackle this challenge from the Indian perspective. The fundamental roots of this problem are broader for India than other countries such as the USA, and thus the Indian medical community's local partnerships with Indian authorities are paramount. Given the magnitude of this task, the introduction of step-by-step regulations described in this article is certainly a pragmatic step forward, though I do not believe it is the most ideal.

In addition, the formal training of post graduate physicians in India within the Infectious Disease specialty must be started soon. American models for Infection Control, Antibiotic Stewardship, Microbiology Laboratories standards, and formal training tactics for Infectious Diseases are available for physicians, and can be modified for the needs of India. Many physicians in the USA, including myself, are willing to join the medical community in India for these noble efforts. The Infectious Disease Society of America (IDSA) has published a policy recommendations paper to save lives.<sup>[1]</sup>

Importantly, infrastructural support from local, regional, and national committees in India is critical to implement this roadmap. Specifically, these committees should impose strict measures to track and follow-up on the progress of The Chennai Declaration. The article fails to describe a particular plan for this follow-up.

In conclusion, antibiotic resistance is causing a worldwide health crisis, which is already resulting in the deaths of patients.<sup>[1]</sup> Unless urgent action is taken in India, I believe this systemic problem will continue to affect local populations. The Chennai Declaration references in this paper should be taken very seriously as a declaration of war against the resistant organisms.

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