

# Global Antimicrobial Resistance Alerts and Implications

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The Global Advisory on Antibiotic Resistance Data (GAARD) initiative of the Alliance for the Prudent Use of Antibiotics (APUA) is the first project to assemble the data and findings from many of the world's largest antimicrobial surveillance systems into a comprehensive report on the state of antimicrobial susceptibility in the world today. The products of this project include in-depth analyses of the drug resistance of particular organisms on a global scale [1] and reports that highlight common features of drug resistance among all microbes (antibacterial fungi, viruses, and parasites). This supplement issue of *Clinical Infectious Diseases* is one such product. Its purpose is to present a coherent overview and evaluation of antimicrobial resistance as it confronts us today. The situation is serious and global. Although reports on the problem are plentiful [2–4], the minimal funding allocated to reversal of drug resistance at the local, national, and international levels does not match the magnitude of the public health problem. The GAARD project reflects the concerns of a unique partnership involving industry, government, and academic groups that are concerned about the increasing potential of epidemics of infec-

tions that are too resistant or too costly to treat effectively.

While clinicians battle greater numbers of organisms with resistance to many or all of the available therapeutic agents, and while pharmaceutical companies strive to find yet another “magic bullet” that will be effective for more than a few years, there are many countries in the world that lack adequate access to antimicrobials and training programs to ensure that treatments are effective and do not unnecessarily propagate drug resistance in the community. Many of those countries, particularly those in the developing world, also lack a coordinated system for tracking the resistance profiles of the major pathogens and for measuring the impact of interventions. Resistance begins locally and is influenced by a myriad of local factors that will ultimately determine its potential to expand or to wither. Thus, knowledge at the local level is imperative. However, in our closely knit global society, in which deadly pathogens are no further away than a 1-h-long airplane ride, the need for a coordinated system of tracking antimicrobial resistance on a global scale is increasingly more urgent. The failure to rein in such high mortality threats as tuberculosis, malaria, and AIDS, coupled with the ever-increasing frequencies of drug resistance among infectious agents, has indeed cast an ominous shadow across our planet—one that has been growing unabatedly for >4 decades.

As the articles in this supplement demonstrate, the resistance phenomenon

compromises treatment of all microbial diseases. Moreover, multidrug resistance—that is, the accumulation of multiple resistance genes within a single pathogen—is now the norm, rather than the exception. Of note are the multidrug-resistant *Staphylococcus aureus*, *Streptococcus pneumoniae*, and *Neisseria gonorrhoeae* strains, as well as the multidrug-resistant *Escherichia coli* strains and *Klebsiella* species with extended-spectrum  $\beta$  lactamases. Although resistance to a single drug (i.e., chloroquine) predominates in malaria, the impact of this resistance is enormous, because the loss of this therapeutic agent means the loss of an inexpensive and convenient treatment.

The dreaded multidrug-resistant *S. aureus* (MRSA) strains have spread to and from large city hospitals and community health care facilities. A new form of MRSA, known as “community-acquired MRSA” (CA-MRSA), bears a virulence that makes it more infectious and harmful even to otherwise healthy people. It has emerged in communities throughout the United States, Europe, and Southeast Asia. Probably one of the more devastating events has been the emergence of HIV strains that are resistant to single and multiple drugs. This phenomenon might have been predicted, given that these viruses are prone to mutate and that poor compliance with anti-HIV drug treatment contributes greatly to the development of resistance. As we make progress in the treatment of cancer and in transplantation of organs, many home-dwelling patients are ren-

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dered immunocompromised as a result, such that formerly harmless microbes are increasingly the cause of serious infections that do not respond to treatment and that lead to death and high morbidity.

This report from the GAARD initiative has been fashioned, in particular, to answer the need of decision makers—that is, legislators and public health officials—for information that will assist in advancing actions toward the reversal of resistance, including improved accessibility to drugs and rational treatment approaches. The emergence of drug-resistant strains in any part of the world presents not only a local threat but also a potential resistance problem anywhere else. This phenomenon has been demonstrated repeatedly and is discussed in this supplement and in other reports [5, 6]. It behooves governments worldwide to aggressively support measures to improve antimicrobial use and availability and to take steps to curtail and reverse drug resistance. The 2001 World Health Organization document “Global Strategy for Containment of Antimicrobial Resistance” [7] defines the problem and outlines an approach to its solution, but action is needed if there is to be any resolution. In May 2005, the 58th World Health Assembly passed a resolution stating that antimicrobial resistance has reached proportions that require urgent action, especially in view of the decreasing

development of antimicrobials. With its 50 country-based chapters worldwide, the APUA will continue to provide leadership in mobilizing human and financial resources and in coordinating global and local research and educational programs to minimize antimicrobial resistance and to promote the rational use of antimicrobial agents. All public health leaders are encouraged to invest in reversing drug resistance, as it negatively impacts the treatment of all infectious diseases. Clearly, we are in the midst of a “shadow epidemic” [8], the expanding perimeter of which threatens to undermine our antimicrobial armamentarium. Our mission is clear: we must work together to preserve the power of antimicrobials and to return these miracle agents to their rightful position as effective treatments of infectious disease.

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