Introduction

Antimicrobial Resistance (AMR)

Antibiotics, also known antimicrobials, are drugs used to treat patients with bacterial or fungal infections. Commonly known infectious diseases include pneumonia, tuberculosis (TB) and urinary track infections (UTIs) [ ]. Since the discovery of penicillin by Sir Alexander Fleming in 1928, these drugs have greatly reduced infection-related illness and death. However, extended use of antibiotics can cause microorganisms to become adapted to them through genetic alterations, making the drugs less effective [ ]. This phenomenon is called antibiotic resistance (AMR), which has seen dramatic increase in recent years. According to Center for Disease Control (CDC), it is now a major global health concern, threatening to become the next "Pandemic". Each year in the United States alone, there are over 2 million people infected with antibiotic-resistant bacteria, directly responsible for more than 23,000 deaths. The cost associated with antibiotic-resistant infections in the U.S. alone is nearly $30 billion each year with over 8 million additional hospital days [ ].

A number of factors contribute to the increasing antibiotic resistance [2]. Antibiotics are among the most commonly used medicine, but they are often not optimally prescribed. Their widespread use in food animals can also lead to drug resistance and transmission of resistant pathogens to humans. The increased migration, trade and travel make it easier for resistant pathogens to spread. Finally, the lack of novel antimicrobial drugs makes it difficult to eradicate resistant infections. Because of the staggering costs and extended hospitalization, it is essential to improve the diagnosis and treatment of resistant infections. Developing innovative new technologies to detect the emergence of antibiotic resistance will drastically improve the timeliness and choice of treatment methods. Success treatment of microbial resistance also critically relies upon availability of new drugs. Currently, only a small collection of antibiotics approved for use in the United States [ ], which will not provide an adequate solution to the growing threat. Therefore, it is necessary to develop cheaper and more efficient methods for rapidly screening and testing novel antimicrobial agents. Antibiotics usually are required to be effective against multiple pathogenic species, and also used at much higher dosages. Thus innovative testing methods are urgently needed for developing new antibiotics