



ANTIBIOTIC RESISTANCE: AN EMERGING ENVIRONMENTAL HEALTH THREAT

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Policymakers face the challenge of creating the right incentives to convince manufacturers and users of antibiotics to consider the societal costs, as well as the benefits, of using these powerful drugs.

Modern medicine depends on the availability of affordable and effective antibiotics. However, widespread reliance on antibiotics has spurred an alarming rise in resistant strains of bacteria, complicating the treatment of infectious diseases. Many blame the situation on doctors, patients, and livestock farmers who overuse, and sometimes even misuse antibiotics. These factors have led to increasing antibiotic concentration in the natural environment, which in turn has facilitated the development of resistance in both disease- and non-disease causing bacterial organisms. The challenge for policymakers is to create the right incentives for those who manufacture and use antibiotics to consider the societal costs, as well as the benefits, of using these powerful drugs.

From a human health perspective, increasing bacterial resistance and, consequently, our inability to rely on the availability of an arsenal of effective antibiotics places enormous costs on society in the form of increased hospitalizations, higher mortality rates, and the diversion of resources from other medical needs to the development of new and more powerful antibiotics. Although the magnitude of costs that antibiotic resistance imposes worldwide is not known, estimates of the societal costs of resistance in the United States range from \$350 million to \$35 billion.

If antibiotics are to be used judiciously, it may be necessary to create a system that forces users to recognize the economic value of preserving the effectiveness of the drugs. In the language of economists, antibiotic resistance is a negative “externality” associated with antibiotic use, much as pollution is an undesirable externality associated with the generation of power at a thermal power plant. The externalities associated with antibiotic use are not all negative. A positive externality associated with antibiotic use is that it may cure infections, thereby reducing the likelihood of the infection being transmitted to uninfected individuals. Therefore, the favorable and unfavorable effects must be weighed against one another to determine the optimal antibiotic use policy.

Thinking about antibiotic effectiveness as a social resource could help devise strategies to use antibiotics in a manner that maximizes benefits to society. For instance, a recent economic analysis showed that when resistance arises as a consequence of antibiotic use it may be shortsighted to use a single antibiotic on all patients just because that antibiotic appears to be the most cost-effective option. Indeed, it may be optimal, from society’s point of view, to use different drugs on different, but observationally identical, patients and include among this menu of drugs some that may not be cost-effective from the individual patient’s perspective; in doing so, the effectiveness of a greater range of drugs would be preserved.

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With global travel and widespread commerce, antibiotic resistance that develops in one country can spread easily to another. Therefore, nations have an incentive to cooperate to ensure that antibiotics are used responsibly throughout the world. The cost of new antibiotics necessitated by growing resistance to older drugs are particularly severe for developing countries because of the. Unlike in developed countries, where more people can afford more effective and expensive alternatives, drug resistance in developing countries could significantly increase mortality from common infectious diseases. The link between antibiotic effectiveness and sustainable development is becoming increasingly evident to policymakers, as is the need for collective action to tackle the problem.

In spite of our best efforts to manage resistance, antibiotics and pesticides that are currently in use will inevitably be less effective in the future. Economists can help design incentives that encourage research into and development of new products and solve the common property problem associated with antibiotics. The common property problem arises because different firms sell similar antibiotics with similar modes of action, and no firm bears the full resistance cost of its production decisions. One potential solution is to grant broader patent protection for new antibiotics such that patents cover an entire class of compounds and pre-empt me-too antibiotics that increase competition for the same mechanism of action. This would give drug firms an incentive to care about the evolution of resistance, since the firm owning the patent would have a greater stake in the effectiveness of the antibiotic.

There is an urgent need for research on the impacts of the widespread use of antibiotics in medicine and agriculture on the development of reservoirs of resistant bacteria in nature. As we learn more about the relationship between antibiotic use and resistance, we can better quantify the social costs of overusing the drugs. Other research should investigate the optimal antibiotic use in community settings, design incentives to promote the judicious use of antibiotics, and analyze the behavior of drug firms investing in the development of new antibiotics.

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