The post-antibiotic era is here

Imagine a world where routine surgery or chemotherapy is considered too dangerous because there are no drugs to prevent or treat bacterial infections. Unless researchers develop new antibiotics and therapeutics, the decimation of modern medicine will soon become a reality. Scientists have long recognized that much stronger incentives for research and development are needed to avoid this scenario. Yet, the rise of “superbugs” has continued, making a pandemic of antibiotic resistance a major threat to global health.

One could blame slowed action against antimicrobial resistance (AMR) on an upstaging by COVID-19. Health and industry sectors deferred prepandemic AMR work to focus on tracking and preventing severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission. Worldwide, scientists pivoted toward SARS-CoV-2 research. This “all hands on deck” response was prudent but likely affected the already lagging progress on battling AMR. What about efforts before COVID-19?

Prepandemic, experts noted that drug-resistant infections could, annually, kill 10 million people worldwide by 2050, and by 2030, AMR could force up to 24 million people into extreme poverty. Reports from the United Nations, the World Health Organization, and the UK and US governments promoted renewed public health and research programs, including targeted funding through the US National Institutes of Health and the Biomedical Advanced Research and Development Authority, to develop new drugs. Sadly, according to a March 2021 report by The Pew Charitable Trusts, there are only 43 new antibiotics in development. Of these, 13 are in phase 3 clinical trials, and only about half of these might be approved.

It’s no secret that the major problem is the lack of private-sector interest in bringing novel antimicrobial therapies through development. The war against AMR requires innovation, which is costly. It typically takes 10 to 15 years to develop an antibiotic through regulatory approval. According to the Pew report, among the 38 companies working on AMR, only two rank among the top 50 pharmaceutical companies (by sales). And only about one in four developments represents a novel drug class or a mechanism of action. We need new pharmaceutical targets to combat microbial virulence, new methods to inhibit the genetic transfer of antibiotic resistance between bacteria, new drugs that bolster host immunity against AMR, and microbiota-based therapies. To better track AMR, next-generation diagnostics are needed that use whole-genome and metagenomic sequencing and molecular techniques to detect AMR organisms in humans, animals, and the environment.

Prior to 2020, the United States started paying attention to market-place incentives that would rekindle private investment. In 2013, the US Centers for Disease Control and Prevention (CDC) released its first Antibiotics Resistance Threats report, which prompted a National Action Plan for Combating Antibiotic-Resistant Bacteria in 2015. Fortunately, last October, the strategy was renewed for 5 years, directing federal agencies to spur new drug development. Also, the Pioneering Antimicrobial Subscriptions to End Upsurging Resistance (PASTEUR) Act was reintroduced in Congress last month. If the bipartisan bill passes, it will support a funding model that is not linked to sales, among other economic incentives. Although the White House’s fiscal year 2022 budget plan leaves gaps in resources to address AMR, increases in health security budgets could be directed at incentivizing drug development. Given that the CDC’s 2019 Antibiotic Resistance Threats report indicated that 2.8 million Americans acquire infections caused by AMR bacteria each year (with more than 35,000 resulting deaths), the government must do more to encourage private-sector interest.

COVID-19 has shown that it is possible to create robust public-private partnerships across research, industry, and public health that accelerate research and clinical trials and spur proactive regulation in the context of a global public health threat. Collaborative action is equally necessary to battle AMR. The Combating Antibiotic-Resistant Bacteria Biopharmaceutical Accelerator, a global public-private partnership established in 2016, committed $500 million, through 2022, to support the development of new antibiotics and rapid diagnostics to tackle AMR. We need many more such creative partnerships.

The scientific community should leverage lessons learned from COVID-19 to unite academia, industry, government, and policy-makers toward preserving the benefits of modern medicine. Continued procrastination will only lead to countless lives lost to AMR.

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