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# We Will Miss Antibiotics When They're Gone

By NICHOLAS BAGLEY and KEVIN OUTTERSON JAN. 18, 2017

On Friday, the Centers for Disease Control and Prevention released a disturbing report about the death of an elderly woman in Washoe County, Nev. What killed her wasn't heart disease, cancer or pneumonia. What killed her were bacteria that were resistant to every antibiotic doctors could throw at them.

This anonymous woman is only the latest casualty in a war against antibiotic-resistant bacteria — a war that we are losing. Although most bacteria die when they encounter an antibiotic, a few hardy bugs survive. Through repeated exposure, those tough bacteria proliferate, spreading resistance genes through the bacterial population. That's the curse of antibiotics: The more they're used, the worse they get, especially when they're used carelessly.

Already, more than 23,000 people in the United States are estimated to die every year from resistant bacteria. That death toll will grow as microbes develop new mechanisms to defeat the drugs that, for decades, have kept infections at bay. We are on the cusp of what the World Health Organization calls a “post-antibiotic era.”

And we will miss antibiotics when they're gone. Minor scrapes and routine infections could become life threatening. Common surgeries would start looking like Russian roulette. Gonorrhea and other sexually transmitted infections might become untreatable. Diseases that our parents defeated — like tuberculosis — could come roaring back. The economic costs would be staggering: In September, the World

Bank estimated that between 1.1 and 3.8 percent of the global economy will be lost by 2050 if we fail to act.

Yet few new antibiotics are in development. Most large drug companies have fled the field. The reason is simple: To conserve their effectiveness, new antibiotics are put on the shelf to be used only when older antibiotics stop working. That makes perfect sense for public health, but companies can't make a profit on what they can't sell. This mismatch between the huge social value of new antibiotics and the relative indifference of drug manufacturers could spell disaster.

Aware of the problem, Congress has taken some initial steps to address it. In particular, the 2012 **Generating Antibiotic Incentives Now Act** grants to manufacturers an extended, exclusive period to sell newly approved antibiotics. By keeping generics off the market for longer, Congress hoped to sweeten the pot for manufacturers and encourage needed research.

But the law probably won't stimulate much innovation. A couple more years of poor sales are a small incentive and may actually promote overuse of antibiotics. The law is also poorly targeted. Some "new" antibiotics are similar to existing compounds — so similar that bacteria are already resistant to them. We don't need to reward manufacturers for tweaking antibiotics that we already have. We need them to develop entirely new antibiotics.

A few federal agencies have shown more initiative. Medicare, for example, has moved to require hospitals and nursing homes to adopt plans to prevent the spread of drug-resistant infections and to assure the proper use of antibiotics. The Centers for Disease Control and Prevention is taking steps to limit the spread of resistant infections and to reduce unnecessary use of antibiotics. The Food and Drug Administration has simplified approval standards and has worked with industry to limit the use of antibiotics in livestock, which today accounts for three-quarters of antibiotic sales in the United States. And the Biomedical Advanced Research and Development Authority has been working creatively to build public-private partnerships to support the most promising research.

But Congress needs to think bigger if it wants to fix the broken antibiotic business model. Although the patent system is good at producing new blood-

pressure medications and cardiovascular drugs, it's not the right fit for antibiotics. Because new antibiotics may be held in reserve for years, manufacturers can't sell enough during the patent term to justify large research investments. Congress should instead reward manufacturers that bring a targeted, highly innovative antibiotic to market with a substantial financial prize; in exchange, manufacturers would surrender their patent.

This kind of "market-entry" reward would enable public health officials and physicians to deploy new drugs precisely where they're needed. Manufacturers would no longer have an incentive to milk their patent, marketing the drug for inappropriate uses. The antibiotic could also be sold at a reasonable price in developing countries, which might otherwise be unable to afford a patented antibiotic.

Financing market-entry rewards would be expensive, perhaps \$4 billion per year in total, or about 10 percent of the annual global bill for antibiotics. But you can't defeat bacteria on the cheap. They've survived for billions of years because they're so good at adapting to new threats. Staying one step ahead will require ingenuity, money and radical change. Tinkering around the margins isn't going to cut it.

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