

The global fight against antibiotic-resistant bacteria

The threat of a post-antibiotic era, when there will be no effective treatments against infection, is real.

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In December 1940, a man who accidentally scratched himself with a thorn while gardening was admitted to the Radcliffe Infirmary in Oxford, England. His scratch became infected, and despite receiving the best available treatment, he died the following March.

In August last year, a woman who broke her leg while travelling in India was admitted to a hospital in Nevada, United States, with a hip infection. Despite receiving the best available treatment, she died the following month.

What links these two stories, separated by thousands of miles and 75 years of medical advances, is the failure of antibiotic treatments. In 1940, the best available treatment was penicillin, a recently discovered antibiotic; Mr Albert Alexander, the unlucky gardener and first patient to receive this ground-breaking treatment, died because his doctors could not synthesise enough of it in time to save him. Last year, the unfortunate traveller suffered an infection resistant to 26 different antibiotics – the best available treatment was nothing.

Scientists, doctors and public health leaders warn that the day could soon come when infections are once again untreatable and a simple scratch from a rosebush could prove fatal.

Drug-resistant infections kill 700,000 people annually. Without immediate action, this number will rise tenfold by 2050, and half of

those deaths will occur in Asia. Besides deaths, drug-resistant infections, including bacterial infections resistant to antibiotics, prolong hospital stays and require treatment with more expensive drugs, increasing healthcare costs. And without effective antibiotics, we could lose the ability to perform advanced medical procedures such as surgeries and transplantations, which rely on antibiotics to prevent infections.

These dire circumstances, increasingly witnessed in hospitals and clinics worldwide, result from decades of irresponsible antibiotic use. Indiscriminate use of antibiotics kills off drug-sensitive bacteria, but creates a niche for antibiotic-resistant bacteria to thrive, rendering our antibiotics increasingly ineffective. Overuse of antibiotics to treat conditions for which they are unnecessary or ineffective is a major cause of antibiotic resistance. But inappropriate use of antibiotics is also widespread in agriculture, to promote faster growth in animals and feed the increasing global demand for animal protein. Between 60 million and 240 million kilograms of antibiotics are used in livestock each year. Three-quarters of these are antibiotic classes important in human medicine, so development of resistant bacteria in animals could directly affect our ability to treat infections in humans. Equally worrying, improper disposal of animal waste contaminates the environment with antibiotic residues, making it easier for antibiotic resistance to develop and spread.

How can we curb the rise of antibiotic resistance?

This year, countries are developing national action plans to tackle antimicrobial resistance,

with coordination from the World Health Organisation. Key elements of this response need to include:

- **Legislation:** Many countries lack restrictions to limit access to antibiotics without a physician's prescription, both in humans and animals. Tighter regulation is also needed to limit environmental contamination with antibiotics from agriculture, healthcare and industry.
- **Infection prevention and control:** Many countries have made progress to prevent and control infections in healthcare institutions, but cross-sectoral interventions to reduce antibiotic resistance have received less attention. Making better use of new and existing vaccines in humans and animals, and improving farming practices can help to prevent infections, reducing the need for antibiotics.
- **Responsible use:** Curbing antibiotic use need not have adverse effects, either in health or economic terms. Approximately half of antibiotics prescribed in patients are unnecessary, and agricultural output can be maintained without extensive use of antibiotics. Norway, the world's largest producer of farmed salmon, produces 1.5 million tonnes of salmon annually, using 500 times fewer antibiotics than Chile, the second-largest producer. Similarly, Denmark increased its pig production by 50 per cent despite introducing a ban on antibiotics for growth promotion in 2000.
- **Surveillance:** Tracking trends in antibiotic use and resistant bacteria in humans and animals is crucial to monitor the impact of

public health interventions and detect new strains of antibiotic-resistant bacteria.

- **Research and development:** Investment in new antibiotics and better diagnostics to help doctors prescribe antibiotics only when necessary is key to maintaining a healthy pipeline of effective drugs and extending their lifespan.
- **Education:** Studies show that misconceptions about appropriate antibiotic use and the consequences of misusing antibiotics are common. Education and behaviour change need to be a priority, to ensure doctors prescribe

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antibiotics correctly and patients use them appropriately.

In Singapore, health, veterinary and environmental agencies have formed a cross-sectoral task force to tackle antimicrobial resistance. But like all countries, Singapore is vulnerable to antibiotic-resistant bacteria that cross international borders. Bacteria with the NDM-1 gene, which makes them resistant to most commonly used antibiotics, were first detected in 2008 in a Swedish patient who had travelled to India. These bacteria have since been found in 70 countries. Another gene, MCR-1, makes bacteria resistant to colistin, a last-resort antibiotic treatment. This gene was first discovered in 2015 in bacteria from pigs in China. It is now found in at least 30 countries. International, cross-sectoral coordination is crucial for arresting the spread of antibiotic-resistant bacteria. Singapore, as a resilient economy with an advanced health system, has a key role to play, by encouraging coordinated regional action against antibiotic resistance and helping to build regional capacity for surveillance, antibiotic stewardship and research.

However, antibiotic resistance is not simply a problem for governments. Just as we all benefit from antibiotics, each of us has an obligation to preserve these life-saving medicines for future generations. As citizens and consumers, we can help reduce the demand for antibiotics by keeping up to date with vaccinations that prevent infections, and supporting agricultural practices that are not reliant on misuse of antibiotics. As patients, we can ensure that we use antibiotics only as directed by a doctor.

Responsible antibiotic use, like vaccination and wearing seat belts, is everyone's responsibility. This is reinforced by the theme of this year's World Antibiotic Awareness Week (Nov 13-19): Think twice. Seek advice. Antibiotics are not always the best treatment for infections. If we do not think twice about how we use them, the best treatment could soon be nothing.

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