

Fighting a global war against super-bugs

May 2 2014, by Liam Mitchell



"We need to regulate the use of antibiotics, including the proper prescription of antibiotics in patients and minimizing the use of antibiotics in animals," says Professor Jun Liu. Credit: reway 2007 via Flickr

It reads like the plot of Hollywood's next survival horror film, but it couldn't be more real. A first-of-its-kind report by the World Health Organization details the worldwide spread of drug-resistant super-bugs.

The results are startling.

"Without urgent, coordinated action by many stakeholders, the world is headed for a post-antibiotic era, in which common infections and minor injuries which have been treatable for decades can once again kill," says Dr. Keiji Fukuda, WHO's assistant director-general for health security. "Effective [antibiotics](#) have been one of the pillars allowing us to live longer, live healthier and benefit from modern medicine. Unless we take significant actions to improve efforts to prevent infections and also change how we produce, prescribe and use antibiotics, the world will lose more and more of these global public health goods and the implications will be devastating."

The report found high rates of resistance have been observed in every region of the world in bacteria that cause common infections, such as [urinary tract infections](#), wound infections, bloodstream infections and pneumonia. It also notes there are significant gaps in surveillance, and a lack of standards for methodology, data sharing and coordination. The report, titled Antimicrobial resistance: global report on surveillance 2014, is available on the WHO website.

Writer Liam Mitchell spoke with Professor Jun Liu of the Faculty of Medicine's Department of Molecular Genetics about the report's findings. Liu's research investigates the treatment of tuberculosis (TB) and the increasing drug-resistant strains of TB that have been developing.

The World Health Organization report says very high rates of resistance have been observed in common bacteria around the world. How does resistance spread?

Simply speaking, drug resistant strains spread in the same way ordinary infections do. An individual who is infected with a drug-resistant bug

can pass the resistant strain to other individuals, resulting in the spread of [drug resistance](#) throughout a population.

The report notes that over the last 30 years, no major new types of antibiotics have been developed. Would a new type of antibiotics solve the problem?

Though the use of effective vaccines is the chief method for fighting drug resistant bugs, unless effective vaccines are already in place, we will need to develop [new drugs](#). However, this has become increasingly difficult for a variety of reasons. For the new drugs to be effective, they would need to attack microorganisms at targets that have not been exploited by current drugs. This is one of the reasons why no new major type of drugs have been developed for the last 30 years, since most obvious drug targets have already been explored in the past. New drugs would help to control the current situation but would not be the ultimate solution since resistance to the new drugs will almost certainly occur.

How is U of T research contributing to a solution?

There are a number of researchers at U of T who are conducting cutting edge research in various aspects of infectious diseases, such as how certain bacteria acquire resistance genes from other species in a community, how microorganism pathogens infect host and evade host immune response and so on.

All of these fundamental understandings are crucial for identifying novel targets for the development of new drugs or for developing effective vaccines, which together, will ultimately lead to effective controls of infectious diseases.

The report states: "A post-antibiotic era - in which common infections and minor injuries can kill - far from being an apocalyptic fantasy, is

instead a very real possibility for the 21st century." Is it time to panic?

The worst-case scenario would be the pre-antibiotic era we faced nearly a century ago. However, I am cautiously optimistic of our situation today due to the fact that our knowledge on [infectious diseases](#) has improved dramatically since then. With continuing support from governments and the public, I believe it is possible to come up with effective solutions to deal with the current drug resistance problem.

What steps can be taken to reduce the development of so-called drug-resistant super-bugs?

Drug resistance occurs naturally in microorganisms only at a low frequency. However, overuse or misuse of antibiotics in humans and animals can facilitate the appearance of drug-resistant strains. For example, patients who do not correctly complete the antibiotic regimens prescribed to them have a higher chance to develop drug resistance. Additionally, there is convincing data showing a strong correlation between the frequency of drug-resistance and the amount of antibiotics used.

Therefore, to reduce the development of drug-resistant super-bugs, we need to do several things. First, we need to regulate the use of antibiotics, including the proper prescription of antibiotics in patients and minimizing the use of antibiotics in animals. Secondly, we need to develop programs that educate patients on the importance of correct drug use and ensure that patients complete drug therapy on time. For example, directly observed therapy, short-course (DOTS) is a treatment for tuberculosis that requires patient supervision and support and is effective against multi-drug-resistant tuberculosis. Finally, we need to develop an effective surveillance system which allows accurate diagnosis and rapid detection of drug resistance. This will help prevent individuals

who are infected with drug-resistant bugs from spreading it to others.

Provided by University of Toronto

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