

Antimicrobial resistance: revisiting the “tragedy of the commons”

When the NDM1 enzyme-containing “superbugs” struck in India, Pakistan and the United Kingdom earlier this year, media reports blamed medical tourism for its spread. But in this interview, Professor John Conly argues that the overuse and misuse of antibiotics leading to antimicrobial resistance – the theme of World Health Day 2011 – is the more important topic.

Q: What’s special about this new type of resistance labelled as NDM1?

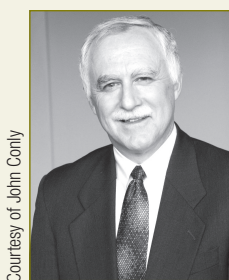
A: NDM1 is an enzyme that confers resistance to one of the most potent classes of antibiotics, known as carbapenems, but what has been observed is different in many ways to what we have seen to date. This new resistance pattern has been reported in many different types of bacteria compared to previously and at least one in 10 of these NDM1-containing strains appears to be pan-resistant, which means that there is no known antibiotic that can treat it. A second concern is that there is no significant new drug development for antimicrobials. Third, this particular resistance pattern is governed by a set of genes that can move easily from one bacterium to another. Fourth, NDM1 has been found in the most commonly encountered bacterium in the human population, *E. coli*, which is the most common cause of bladder and kidney infections. A further concern is that of the two drugs potentially capable of treating an infection due to one of these new multiresistant strains, one of them, colistin, causes toxic effects to the kidney in about a third of people.

Q: Is this the doomsday scenario of a world without antibiotics?

A: Unfortunately yes, with these new multiresistant NDM1-containing strains and their potential for worldwide spread. Doctors will face a terrible dilemma when a pregnant woman develops a kidney infection that spills over into the bloodstream with a pan-resistant strain containing NDM1 and there are no treatment options. We are essentially back to an era with no antibiotics.

Q: The World Health Organization (WHO) released a global strategy to contain antimicrobial resistance in 2001, highlighting antimicrobial overuse and misuse as the chief causes of drug resistance. What happened to it?

A: In 2000, in the report on infectious diseases series, *Overcoming antimicrobial resistance*, former WHO director-



Courtesy of John Conly

Professor John Conly

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general Dr Gro Harlem Brundtland called the rise of antimicrobial resistance a global crisis, but the subsequent release of the WHO-led global strategy and campaign coincided with the 11 September 2001 attacks. These very tragic events, as well as a shift to security and bioterrorism, overshadowed the release and implementation of this campaign and led to a complete failure of any uptake.

Q: What can World Health Day 2011 achieve in terms of containing antimicrobial resistance?

A: A focus such as this is an unparalleled opportunity for WHO to step to the fore and to bring together its personnel working in this area – those working on rational drug use, surveillance networks, laboratories, the World Health Day team, the infection prevention and control team and others – to create a cross-organizational taskforce to update and rejuvenate the excellent work produced a decade ago. In addition, individual Member States and WHO can focus on the international health regulations (IHR) with respect to these new pan-resistant strains containing NDM1. Does the spread of NDM1-containing strains of resistant bacteria constitute a public health event of international concern? In my opinion the answer is an unequivocal “yes”. We have seen such strains spread internationally. By early September this year, the United States of America (USA) had reported cases in three states and Canada, in three provinces. Australia,

Belgium, Japan, Sweden and Viet Nam have all reported cases, so it’s outside of India, Pakistan and the United Kingdom of Great Britain and Northern Ireland, where it was initially described. Engaging the IHR could help to establish common standards for surveillance and control of NDM1-containing strains.

Q: Where is antimicrobial resistance a concern?

A: It occurs everywhere but is particularly a concern in countries where prescription of antimicrobials is unregulated and where you can buy antibiotics over the counter. This is the case in many countries, including those with large populations such as China and India, where antibiotic sales appear to have increased, consistent with the growth of a more affluent middle class, as well as many countries in Africa and Central and South America. But the usage in humans pales in comparison with the use of antibiotics in the agri-food industry – in cattle, poultry and hog farming, fish farming, honeybee hives – where these agents are used as growth promoters. Some estimates suggest that antibiotic use in animals and fish is at least 1000-fold greater in terms of absolute tonnage compared with use in humans.

Q: How can governments reconcile the economic interests of farmers and the health interests of the population?

A: To stop overfishing of cod in the Atlantic Ocean on the east coasts

of Canada and the USA, governments imposed an indefinite moratorium on cod fishing in the Grand Banks. There were complaints from the fishermen, but it was a necessary decision. Unfortunately, cod stocks have yet to recover and some scientists fear that the effects of cod overfishing may be permanent. Antimicrobial resistance may be likened to this overfishing scenario, to cattle overgrazing the grass in the commons or to deforestation on Easter Island, which led to the population dying out. Antimicrobial resistance is a consequence of continued overuse of antibiotics combined with the constant growth of resistance over time. The solution is to achieve the appropriate ecological balance. There comes a time when governments and regulators must make tough decisions. The European Union (EU) has done it with the banning of antimicrobial growth promotion in livestock. It's a matter of political will and doing it over time, with a planned formulated approach.

Q: What progress have governments made in containing antimicrobial resistance?

A: France had a national public information programme to reduce antibiotic resistance called "Antibiotics are not automatic" and saw a 26.5% reduction in the use of antibiotics for flu-like syndromes (which are largely viral) over five

years. There have been others, including the "Get smart" programme in the USA to use antibiotics wisely and in Canada the "Do bugs need drugs?" programme has shown a reduction of almost 20% in antibiotic usage for respiratory tract infections at a community level. It was adopted by a number of provinces but unfortunately not by the Public Health Agency of Canada.

Q: How can we educate patients to understand that antibiotics have no effect on viral infections, like the common cold?

A: That is a very important message. Many of the campaigns I mentioned involved education of the public. Behavioural analyses show that doctors and other prescribers often give in to pressure from patients and prescribe antibiotics because they are afraid they will lose their patients. That's why governments and patient organizations need to work together. Leadership from WHO and the messages from World Health Day 2011 can play a pivotal role in emphasizing these important messages to the general public.

Q: Apart from World Health Day, what other international efforts have there been to tackle the problem?

A: There have been a number of developments. Last year, the Swedish prime minister [Fredrik Reinfeldt], who

held the EU Chair role at the time, and United States President [Barack] Obama, established a joint EU-US task-force on antimicrobial resistance and, at this year's World Health Assembly in May, the Swedish minister for health and social affairs [Göran Haggglund] urged WHO to show leadership in tackling antimicrobial resistance. So, a decade after the WHO report in 2000, we have come full circle and seen resistance raising the stakes to an even greater extent than before. In June 2010, the Center for Global Development, called on WHO in a new report to reverse what it called "a decade of neglect" of drug resistance. In September 2010, a United States Institute of Medicine report described antimicrobial resistance as "both a global public health and environmental catastrophe" and a classic example of the "tragedy of the commons". It referred to the famous 1968 essay by Garrett Hardin in *Science*, where he wrote about the grass in shared pastures being eaten up because no one was watching over them. That is the tragedy of the commons and, similarly, the tragedy of antibiotics. Who is minding the "commons" in terms of the overuse and misuse of antimicrobials in the veterinary, agri-food and human settings? Unfortunately we have reached an ecological tragedy akin to the "tragedy of the commons". ■

Recent news from WHO

- On 14 October, the World Health Organization (WHO) released the report *Working to overcome the global impact of neglected tropical diseases*, which outlines strategies for dealing with 17 **neglected tropical diseases** found almost exclusively in very poor populations. These diseases thrive where housing is substandard, environments are contaminated with filth, and disease-spreading insects and animals abound. "These are debilitating, sometimes horrific diseases that are often accepted as part of the misery of being poor," says Dr Margaret Chan, WHO Director-General. "The strategies set out in this report are a breakthrough. If implemented widely, they can substantially reduce the disease burden, breaking a cycle of infection, disability and lost opportunities that keeps people in poverty."
- **Tuberculosis (TB)** could be eliminated if governments and donors fully invest in a plan released by the Stop TB Partnership on 13 October. *The global plan to stop TB 2011–2015: transforming the fight towards elimination of tuberculosis* sets out to provide diagnosis and treatment for 32 million people over the next five years. According to the report, more research is needed to bring rapid TB tests, faster treatment regimens and a fully effective vaccine to market. The report also shows public health programmes how to drive universal access to TB care, including how to modernize diagnostic laboratories and adopt new TB tests. Some 9 million people become ill with active TB and nearly 2 million die each year.
- On 13 October, this year's **International Day for Disaster Reduction** had the theme "Making cities resilient". WHO called on governments and the international community to take measures to ensure facilities are resilient enough to survive earthquakes, floods, cyclones and other hazardous events. "Hospitals, clinics and other health facilities are the foundation of any health response to be launched to save the lives of people injured when their city is struck by a disaster," says Dr Eric Laroche, WHO Assistant Director-General for Health Action in Crises. "But we see too often that, when disasters happen, health facilities and the staff who work in them count among the casualties."
- On 7 October, WHO released simplified diagnosis and treatment guidelines for people with common, but untreated, **mental, neurological and substance use disorders**. The guidelines are to assist in the diagnosis and management of depression, alcohol-use disorders, epilepsy and other common mental disorders by non-mental health specialists.

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