Antibiotic resistance case study

Why are our antibiotics not working? Read on and decide what you think about this population problem

Background briefing

The arms race between humans and bacteria encourages disease-causing bacteria to evolve to evade our defences: mainly, our drugs.

The discovery of antibiotics in the 20th century helped humans to fight deadly diseases like syphilis and gangrene, but the more we use them, the greater the pressure becomes for bacteria to evolve. Any genetic mutation that helps a bacterium beat a drug very quickly gets ‘selected’ and spreads throughout the bacterial population as the cells without the mutation die off. Doctors are then left with fewer treatment options, meaning that patients take longer to recover or are less likely to survive. Inappropriate use of antibiotics – including doctors prescribing the drugs unnecessarily and patients failing to completely eliminate infections by not finishing antibiotic courses – is making the problem worse by giving bacteria a chance to develop resistance.

To keep up with bacteria, drug companies need to develop entirely new classes of antibiotics. But the drug discovery and approval process is lengthy, and there are few incentives to develop antibiotics because they start becoming ineffective within a couple of years.

Worldwide:

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis bacteria. It is curable with a combination of antibiotics over a six-month course, though there are complications. Among curable infectious diseases, it is the top killer.

In 2012 about 450,000 people developed multidrug-resistant TB, and 170,000 people died from it.

The World Health Organization has outlined a target of treating 80 per cent of all multidrug-resistant (MDR) cases by 2015, but right now less than 3 per cent receive proper treatment. Treatment usually lasts for at least 2 years and involves daily injections.

Five per cent of all cases of MDR-TB are considered extensively drug-resistant (XDR), meaning patients do not respond to first-line and some second-line drugs. Many labs are unable to even detect and diagnose this form of the disease.
Eastern Europe:

This region has the highest rate of MDR-TB, where it accounts for 20 per cent of all new TB cases. In Russia it accounts for 28 per cent.

India and China:

These countries account for over half of all MDR-TB cases.

United Kingdom:

Around 9,000 cases of TB are reported each year, with most occurring in London and Birmingham. Of the cases reported in 2012, 1.6 per cent were of MDR-TB, and there were two cases of XDR-TB. There have been efforts to improve TB treatment and control, but the incidence of the disease in the UK is high compared to other western European countries. Children in high-risk areas receive the BCG vaccination to protect against severe forms of TB.

Sources: TB Alliance, Public Health England, NHS Choices

Imagine...

You’re a doctor in a country where TB infections have reached crisis levels. Although it was once treatable, now no patients respond to the first-line medications available.

• How should these patients be treated?
• How could you – and your patients – help to slow the development of resistant bacteria?
• How can drug companies be encouraged to develop new treatments?
• What role could better diagnostic tests play in reducing resistance?
• Should antibiotic use be restricted?