

ANTIBIOTIC RESISTANCE

In 1945, in his Nobel lecture "Penicillin," Alexander Fleming warned against the use of

sub-therapeutic doses of antibiotics – "bought by anyone in the shops" without a prescription:

"The time may come when penicillin can be bought by anyone in the shops. Then there is the danger that the ignorant man may easily underdose himself and by exposing his microbes to

non-lethal quantities of the drug make them resistant. Here is a hypothetical illustration. Mr.

X. has a sore throat. He buys some penicillin and gives himself, not enough to kill the streptococci, but enough to educate them to resist penicillin. He then infects his wife. Mrs. X gets pneumonia and is treated with penicillin. As the streptococci are now resistant to penicillin the treatment fails. Mrs. X dies. Who is primarily responsible for Mrs. X's death?"

Inappropriate prescribing of antibiotics has been attributed to a number of causes, including people insisting on antibiotics, doctors prescribing them as they feel they do not have time to explain why they are not necessary, and doctors not knowing when to prescribe antibiotics or being overly cautious for medical and/or legal reasons. For example, a third of people believe that antibiotics are effective for the common cold, and the common cold is the most common reason antibiotics are prescribed even though antibiotics are completely useless against viruses.

The number of persons inappropriately prescribed antibiotics is a greater factor in the increasing rates of bacterial resistance than non-compliance with antibiotic protocol among those prescribed the drugs, although the non-compliance rate is also high. A single regimen of antibiotics even in compliant patients leads to a greater risk of organisms resistant to that antibiotic in the person for a month to possibly a year.

Antibiotic resistance has been shown to increase with duration of treatment; therefore, as long as a clinically effective lower limit is observed (that depends upon the organism and antibiotic in question), the prescription by the doctors of shorter courses of antibiotics is likely to decrease rates of resistance, reduce cost, and have better outcomes due to fewer complications such as *C. difficile* infection and diarrhea. In some situations a short course is inferior to a long course. One pediatric study found that with one antibiotic a short course was more effective, but with a different antibiotic, a longer course was more effective.

A WHO (World Health Organisation) report incorporating data from 114 countries recommends people help tackle resistance by using antibiotics only when prescribed by a doctor and completing the full course as prescribed, even if they feel better. Some infections require treatment long after symptoms are gone, and in all cases, an insufficient course of antibiotics may lead to relapse (with an infection that is now more antibiotic resistant). Some researchers have found however that antibiotics can often be safely stopped 72 hours after symptoms resolve. Because patients may feel better before the infection is eradicated, doctors must provide instructions to patients so they know when it is safe to stop taking a prescription. Some researchers advocate doctors' using a very short course of antibiotics, reevaluating the patient after a few days, and stopping treatment if there are no longer clinical signs of infection.

A large number of people do not finish a course of antibiotics primarily because they feel better (varying from 10% to 44%, depending on the country). Compliance with once-daily antibiotics is better than with twice-daily antibiotics. Patients taking less than the required dosage or failing to take their doses within the prescribed timing results in decreased concentration of antibiotics in the bloodstream and tissues, and, in turn, exposure of bacteria to suboptimal antibiotic concentrations increases the frequency of emergence of antibiotic resistant organisms.