

Excessive use of antibiotics has led to the development of resistant bacteria (superbug), which could be responsible for severe health problems in the future

## Resistance to Antibiotics

“The world is heading towards a post-antibiotic era, in which many common infections will no longer have a cure and, once again, kill unabated.”

Dr. Margaret Chan, Director General WHO, World Health Day 2011

In the pre-antibiotic era infectious diseases were the leading cause of death. In the Middle Ages devastating plague pandemics raged over Europe. In particular the outbreak from 1347 to 1352 is well known. It affected all Europe and killed 25 million people, representing about one third of the European population at that time. Other bacterial diseases which killed millions of people during the centuries are tuberculosis, cholera, leprosy, and child bed fever.

In the 1940s, the introduction of antibiotics to treat infectious diseases revolutionised medicine. Unfortunately, the use and misuse of antibiotics have also resulted in the development and spread of antibiotic resistance, which causes treatment failures and consequently more severe and longer lasting diseases, increased hospitalisation rates, more deaths, and higher costs to society.

Antibiotic resistance is a type of drug resistance through which a microorganism is able to survive exposure to an antibiotic. Any use of antibiotics can increase the selective pressure in a population of bacteria to allow the resistant bacteria to thrive and the susceptible bacteria to die off. If a bacterium carries several resistance genes it is called multidrug resistant or informally a “superbug”.

The widespread use of antibiotics both inside and outside of medicine has been playing a significant role in the emergence of resistant bacteria. Although there were low levels of pre-existing antibiotic-resistant bacteria before the routine application of antibiotics in human medicine, evolutionary pressure from their use has played a dominant role in the development of multidrug resistance varieties and the spread of resistance between bacterial species. In human

medicine the major problem of the emergence of resistant bacteria is due to misuse and overuse of antibiotics by doctors as well as by patients.

There are ongoing discussions about the role of broad antibiotic use in veterinary medicine for the development of antibiotic resistance in human medicine. One of the most comprehensive epidemiological studies in recent years found key differences between most of the bacterial communities of resistant salmonella from animals and humans. Those strains with similar resistance patterns were discovered first in humans, which lead to the conclusion that resistance in humans does not primarily come from animals. Current opinion in science is that overuse of antibiotics in veterinary medicine is a contributing factor to resistance but that there is a dominant role of use in human medicine.

In former times most people thought about tuberculosis in relation to antibiotic resistance. Even today about 580.000 new cases of multidrug resistant tuberculosis (MDR-TB) emerge annually (WHO Global Tuberculosis Report 2016). Nevertheless today headlines in newspapers and television are full with dramatic scenarios created by new superbugs. If we go back to scientific basics there are some eligible candidates that by now create severe health problems:

- Methicillin resistant staphylococcus aureus (MRSA)
- Klebsiella pneumoniae
- Enteric pathogens producing ESBL enzymes
- Vancomycin-resistant enterococci (VRE)

These developments may create substantial claims for the (re-)insurance industry. Areas at risk are contingent business interruption covers, medical malpractice, veterinary medicine, and Life & Health policies.