

Strategy on Antibiotic Resistance Switzerland

Strategy on Antibiotic Resistance



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Schweizerische Eidgenossenschaft
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Preface

Antibiotic resistance is among the world's greatest current challenges. It affects everyone since effective antibiotics are vital to protecting human and animal health.

Since their discovery over 70 years ago, antibiotics have been an important means of treating bacterial infections in humans and animals. Thanks to antibiotics, the medical profession has access to effective drugs to cure diseases such as pneumonia and septicaemia.

However, through excessive and inappropriate use of antibiotics, humans are accelerating the development and spread of resistant bacteria. More and more antibiotics are becoming ineffective.

Antibiotic resistance can only be controlled if people involved in human medicine, veterinary medicine, agriculture and the environment work together. This is why the Federal Council has launched a broad-based national strategy to combat antibiotic resistance as part of its health policy priorities set out in «Health 2020». The strategy was put together jointly by the Federal Office of Public Health, the Federal Food Safety and Veterinary Office, the Federal Office for Agriculture, the Federal Office for the Environment, the cantons, and other partners. The aim is to achieve a coordinated and cross-sector approach and to combine resources.

We cannot stop bacteria becoming resistant to antibiotics, but we are all responsible for ensuring that this natural process of adaptation is not encouraged, for the benefit of people and animals.



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The English text is a translation. The German original applies.

Summary

Challenge	<p>The development of antibiotics is among the most important achievements of medical science. These drugs allow us to cure dangerous diseases such as pneumonia or septicaemia which often proved fatal in the past. But the excessive and sometimes inappropriate use of antibiotics has led to more and more bacteria becoming resistant to antibiotics. The rise in resistance to important groups of antibiotics, and the rise in multi-resistant organisms, are a particular cause for concern.</p>
Objective	<p>The problem of increasing antibiotic resistance affects human medicine, veterinary medicine, agriculture and the environment. A joint, cross-sector approach is vital if the associated challenges are to be faced. This is why Federal Councillors Alain Berset and Johann Schneider-Ammann have commissioned this National Antibiotic Resistance Strategy (StAR). The main objective is to ensure that antibiotics remain effective for human and animal use in the long term.</p>
Procedure	<p>StAR was developed through close cooperation among the bodies involved: the Federal Office of Public Health (FOPH), the Federal Food Safety and Veterinary Office (FSVO), the Federal Office for Agriculture (FOAG), the Federal Office for the Environment (FOEN) and the Swiss Conference of Cantonal Ministers of Public Health (CMPH). Other directly affected stakeholders have also been involved to ensure that the content is as broadly supported as possible. These include in particular universities/universities of applied science, learned societies and expert groups, representatives of various sectors, associations and other key individuals.</p> <p>Eight strategic objectives have been defined with these stakeholders in the light of the need for action. They all have the same validity for the areas affected (humans, animals, agriculture and the environment) and are directed towards achieving the primary objective. Measures have been grouped together in eight fields of activity to reflect the strategic objectives. The key issues are as follows:</p>
Fields of activity	<p><i>Monitoring:</i> All settings affected must be systematically monitored so that enough information about the sale and use of antibiotics and the development and spread of resistance is obtained. Additional data must be collected where specific problem areas are identified. A good and comprehensive set of data forms the basis for monitoring the effectiveness of the measures taken.</p> <p><i>Prevention:</i> Cutting antibiotic consumption is one of the most effective ways of reducing resistance. Preventing infections among humans and animals is critical to achieving this. Preventive measures such as improved hygiene, optimised management, farm hygiene and husbandry, and the development of effective alternatives to the use of antibiotics are essential.</p> <p><i>Appropriate use of antibiotics:</i> If antibiotics must be used, they must be administered with caution in order to minimise the development of resistance in the light of the current state of understanding. This relies on a high level of expertise among the individuals prescribing or using antibiotics. Binding rules, and restrictions where appropriate, are also necessary and must be applied consistently throughout the country.</p> <p><i>Resistance control:</i> Since even appropriate use of antibiotics cannot entirely rule out the development of resistance, care must be taken to ensure that resistance can be rapidly identified and appropriate action can be taken. The transmission and spread of resistance must be limited as far as possible.</p> <p><i>Research and development:</i> Questions that remain open about the development and spread of antibiotic resistance and the underlying causes and mechanisms must be addressed. A focused and interdisciplinary approach is vital to this.</p>

Cooperation: Interdisciplinary and inter-sector coordination in the effort to control antibiotic resistance is essential so that technical and strategic synergies can be used. If political, scientific and economic cooperation among the groups involved is still inadequate, it must be actively encouraged.

Information and education: Gaps in knowledge and information about the development of antibiotic resistance and possible preventive measures must be closed so that antibiotics are used responsibly and appropriately. This means providing targeted information to specialists such as doctors, veterinarians, pharmacists, farmers and food producers, as well as to the general public.

General conditions: The general conditions for the groups involved must be such as to ensure that effective antibiotics will continue to be available and that they will be used responsibly. At the same time there is a need to ensure that there are no political, legal or financial incentives or market mechanisms that would stand in the way of achieving the objective.

Work on implementation of the strategy will begin once the policy has been adopted by the Federal Council in early 2016. This will coincide with the entry into force of the revised Federal Act on the Control of Communicable Diseases in Humans (Epidemics Act). Detailed plans for implementation will be drawn up by the Federal Offices most closely involved (FOPH, FSVO, FOAG and FOEN).

Implementation

Key stakeholders will be involved in implementing the strategy, as they were in its creation. This process will require a cross-sector coordination body and a consultative expert group. The organisations responsible for each key measure are also required to involve other groups for particular topics.

It may be necessary for laws to be passed or ordinances to be amended so that the measures referred to in the strategy can be implemented. The exact action needed will have to be considered in the context of the implementation of individual measures. Stakeholders will be involved in accordance with the established consultation processes when changes to legislation or ordinances are being discussed.

1 Introduction

1.1 Antibiotic resistance

What are antibiotics?

Antibiotics are drugs used in human and veterinary medicine to treat bacterial diseases. They form a sub-group of substances known as anti-infective agents, a group which also includes antivirals (to control viruses), antimycotics (to control fungi) and anthelmintics (to control worms). Bactericidal antibiotics kill bacteria, while bacteriostatic antibiotics inhibit their growth. Antibiotics were originally obtained from fungi and bacteria. Nowadays many can be synthesised or genetically engineered.

What antibiotics are there?

In 1928 Alexander Fleming discovered that fungi of the *Penicillium* genus kill germs. He used this discovery to develop the antibiotic penicillin. Penicillin was the first drug available to doctors to treat bacterial infections¹.

Further classes of antibiotics were discovered and developed until the mid-1980s. Active substances discovered since then belong to these antibiotic classes. No antibiotic is effective against all bacteria. There are over 30 substance classes of these drugs, with many different active substances (see table below). Their chemical structure and so their efficacy against different bacteria vary. A distinction is also made between broad-spectrum and narrow-spectrum antibiotics, depending on the number of types of bacteria which an antibiotic affects.

Table 1: Antibiotic classes (active substances), year of launch and mode of action

Active substance class (active substances)	Year	Mode of action
Carbapenems (e.g. imipenem, meropenem, doripenem)	1985	Chemically modified natural antibiotics that prevent bacteria from forming a cell wall, causing them to burst
Fluoroquinolones (e.g. ciprofloxacin, levofloxacin, enrofloxacin)	1983	Chemically produced antibiotics which kill bacteria by preventing them from copying their genetic material
Glycopeptides (e.g. vancomycin)	1958	Natural antibiotics which kill bacteria by preventing the cell wall from growing
Cephalosporins (e.g. cefazolin)	1953	Chemically modified natural antibiotics that prevent bacteria from forming a cell wall, causing them to burst
Macrolides (e.g. erythromycin, clarithromycin)	1952	Erythromycin A and structurally similar antibiotics produced from this natural substance by chemical modification. They prevent bacterial growth by stopping protein production (bacteriostatic)
Tetracyclines (e.g. doxycycline)	1948	Natural antibiotics, nowadays produced chemically, that stop bacteria producing protein (bacteriostatic)
Aminoglycosides (e.g. streptomycin)	1944	Natural antibiotics and chemically modified natural antibiotics that prevent bacteria from producing protein and so kill them

¹ Synthetic antibiotics such as sulphonamide and Salvarsan existed before penicillin, but the discovery of penicillin can be regarded as the dawn of modern antibiotics.

Penicillins (e.g. ampicillin)	1943	Chemically modified natural antibiotics that prevent bacteria from forming a cell wall, causing them to burst
Sulphonamides (e.g. cotrimoxazole)	1936	Chemically produced antibiotics that prevent bacteria from producing folic acid, which they need to reproduce

Antibiotic resistance means bacteria becoming less sensitive and in some cases entirely insensitive to antibiotics. As a result, antibiotics become ineffective. Resistance can come about either by changes to bacterial genetic material (mutations) or be acquired as bacteria incorporate resistance genes from other bacteria. This process, known as horizontal gene transfer, occurs when an exchange of genetic material among bacteria takes place, i.e. on and among people, wild animals, livestock, pets or in the environment (waste water, farmyard manure etc.).

Antibiotic resistance

Resistance genes contain the genetic information for antibiotic resistance, for instance for the production of an enzyme that deactivates the antibiotic. They can be passed on to the next generation through reproduction, giving rise to resistant bacterial strains.

The development of resistance is actually a natural adaptation mechanism in bacteria. Resistant bacterial strains are found everywhere in the environment. However, the development of resistance is accelerated by excessive and inappropriate use of antibiotics, for instance by using them to treat viral conditions or not taking a sufficient dose of the active substance. In particular, the administration of broad-spectrum antibiotics where a narrow-spectrum antibiotic would have worked encourages the selection and spread of multi-resistance. Multi-resistant organisms are bacteria that are resistant to several antibiotics, or in very rare cases to all antibiotics.

Antibiotics accelerate the development of resistance

As standard antibiotics (first-choice antibiotics, such as penicillin) are often no longer effective against resistant pathogens, other antibiotics must be used in treatment once a clear diagnosis of a bacterial infection has been made. Sometimes these are also no longer effective, and reserve antibiotics such as carbapenems must be used. They must be used with caution in order to prevent the development of further resistance: if these reserve antibiotics lose their efficacy it may be practically impossible to treat infections. This is why new antibiotics are usually classified as reserve antibiotics.

Standard antibiotics and reserve antibiotics

The resistant bacteria types listed below are currently of particular relevance to public and animal health in Switzerland:

Relevant resistant bacteria

Methicillin-resistant *Staphylococcus aureus* (MRSA)

The particular feature of MRSA strains is that they are resistant to standard first-choice antibiotics (so-called beta-lactamase resistant penicillins) and often resistant to other classes of antibiotics as well. MRSA bacterial strains are among the most important resistant pathogens in hospital-acquired infections in the past few decades. Approximately 30% of the population have *Staphylococcus aureus* bacteria on their skin without developing any illness. However, these bacteria can cause severe infections in people whose health is impaired or who have undergone medical procedures.

MRSA also occurs in livestock, but does not normally cause disease. In Switzerland, it is particularly common in pigs raised for slaughter.

Multi-resistant gut bacteria

Increasing attention is being paid to multi-resistant gut bacteria (enterobacteri-

aceae). They include the bacterium *Escherichia coli*. *E. coli* is found in human and animal intestines. There are numerous strains, most of which do not cause disease. However, some strains are pathogenic and include the most common causes of bacterial infectious diseases in both humans and animals. Pathogenic *E. coli* can cause a range of conditions, including diarrhoea, urinary tract infection, meningitis, pneumonia and septicaemia.

Gut bacteria that have extended-spectrum beta-lactamases (ESBL) can now only be controlled by a small number of reserve antibiotics, such as carbapenems. There are increasing reports of gut bacteria that are already carbapenem-resistant, especially in the Indian sub-continent, but also, worryingly, in Italy, Greece and Cyprus. It is extremely difficult to treat infections caused by these gut bacteria.

The rate of infections by multi-resistant gut bacteria is increasing not only among patients in hospital but also in long-term care facility residents and the healthy population. This means that there are more and more healthy carriers of multi-resistant gut bacteria who can pass them on.

Gut bacteria that produce ESBL are also found in livestock, especially fattening hens but also fattening calves and pigs, and in pets, horses, zoo animals and wild animals.

Table 2: Other medically relevant bacterial species in which resistance has developed

Bacterial species	Typical diseases	Resistance to
<i>Klebsiella pneumoniae</i>	Pneumonia, blood infection, urinary tract infection	Cephalosporins (3rd generation) Carbapenems
<i>Streptococcus pneumoniae</i>	Pneumonia, meningitis, middle-ear inflammation	Penicillin
Non-typhoidal <i>Salmonellae</i>	Food-related diarrhoea, blood infection	Fluoroquinolones
<i>Shigella</i> species	Diarrhoea	Fluoroquinolones
<i>Neisseria gonorrhoea</i>	Gonorrhoea	Cephalosporins 3rd generation
Enterococci	Urinary tract infection, meningitis and pneumonia	Glycopeptides

Spread of resistant bacteria

Resistant and non-resistant bacteria are found everywhere. For example, the skin and gut of healthy people and animals naturally play host to very many bacteria (including beneficial ones) without causing illness in the carrier. Bacteria can be exchanged among carriers in different ways. The spread of resistant bacteria presents a particular problem.

Resistant bacteria are transmitted among people (healthy carriers or people who are ill) mainly via the hands, originating from faeces or infected wounds, for example. Resistant organisms can also be transmitted from humans to animals and vice versa, when people are in contact with animals. In the environment, they can be transmitted to edible plants such as fruit and vegetables, by contaminated water for example. In addition, when animals are slaughtered resistant bacteria can colonise the raw meat and be transmitted to the consumer when he or she handles it.

Infections with antibiotic-resistant bacteria can constitute a major danger and burden for sick people and animals. They are difficult (and in rare cases impossible) to treat. Resistant pathogens can cause infections with poor outcomes especially in hospitals or care facilities where people are already weakened. Reserve antibiotics or replacement therapy must be used. Alternative therapy is often more distressing for the patient, takes longer and is expensive.

Why is antibiotic resistance a problem?

1.2 Current resistance situation and effects

Antibiotic resistance is a global problem that threatens public health and the achievements of modern medicine throughout the world. It is estimated that infections due to antibiotic-resistant organisms cause 25,000 deaths a year in Europe² and 23,000 deaths in the United States³. In south-east Asia, a child dies of an infection caused by resistant bacteria every five minutes⁴. The total direct and indirect societal costs are put at \$ 35 billion³ in the USA, while in the EU pure productivity losses (excluding death-related costs) are put at € 1.5 billion a year².

Worldwide

International monitoring and the exchange of data on antibiotic resistance and resistant organisms are patchy, and the data are not uniform. Monitoring systems have developed differently in individual countries, and system designs vary. There are gaps in information about relevant pathogens, and no standards on harmonised surveillance methods, data exchange or coordination.

Despite incomplete monitoring, it is broadly true to say that worrying rates of resistance are seen in all parts of the world. For example, $\geq 25\%$ of pneumococci (*Streptococcus pneumoniae*) throughout the world are resistant to penicillin. In five out of six WHO regions, $\geq 50\%$ of *E. coli* are resistant to third-generation cephalosporins and fluoroquinolones. No standard antibiotic is now effective for gonorrhoea, and $\geq 25\%$ of *Neisseria gonorrhoea* are also resistant to third-generation cephalosporins in three out of six WHO regions. According to the WHO, gonorrhoea and many other infections will in future be impossible to treat.⁵

There is already a resistance surveillance system for zoonotic pathogens (transmitted from animals to humans), such as *Salmonellae* and *Campylobacter* spp., and so-called indicator organisms, such as *E. coli*. However, there are no global surveillance programmes for organisms that are pathogenic in livestock and pets. Although treatment failure due to resistance appears to be a less severe problem in veterinary medicine, some studies show⁶ that increasing rates of multi-resistant bacteria are also to be expected in animals.

The consequences and financial impact of antibiotic resistance are difficult to estimate since there are currently no reliable figures or comprehensive scientific studies for Switzerland. There are only a few estimates of hospital-acquired infections:

Switzerland

The Swiss expert group on infectious diseases and hospital hygiene (Swissnoso) estimates that approximately 70,000 hospital-acquired infections occur each year, with fatal outcomes in around 2,000 cases. Some of these infections are caused by

² http://ec.europa.eu/health/antimicrobial_resistance/policy/index_en.htm; ECDC/EMEA JOINT TECHNICAL REPORT The bacterial challenge: time to react

http://www.ema.europa.eu/docs/en_GB/document_library/Report/2009/11/WC500008770.pdf

³ CDC Report (2013): *Antibiotic resistance threats in the United States*

⁴ Graduate Institute Geneva (GRI, 2014): *Anti-Microbial Resistance – An Urgent Global Concern*

⁵ ECDC (Annual Report 2014, <http://ecdc.europa.eu/en/publications/Publications/antimicrobial-resistance-annual-epidemiological-report.pdf>)

⁶ Rushton, J., et al. (2014): *The Use of Antimicrobials in the Livestock Sector*

resistant pathogens, but the exact proportion is not known. Resistance monitoring work carried out by anresis.ch⁷ for human medicine and ARCH-Vet⁸ for veterinary medicine shows the following picture:

Switzerland is in the middle of the rankings in terms of the development of resistant bacterial strains in human medicine (relatively low compared to France, Italy, the UK and countries in eastern and southern Europe, for example, but higher than in Scandinavia and the Netherlands). However, observations show that resistance levels are rising in Switzerland and throughout Europe in the case of certain bacteria, especially *Klebsiella pneumoniae*, *E. coli* and *Staphylococcus aureus*.

As far as veterinary medicine goes, Switzerland is currently better placed with regard to resistance than many southern, central and eastern European countries. But some forms of resistance among livestock are much more common in Switzerland than in countries to the north, for example tetracycline-resistant *E. coli* in fattening pigs and cattle. Other grounds for concern in Switzerland are the rise in resistance to antibiotic groups that should only be used sparingly, such as fluoroquinolones, and the increase in multi-resistant organisms such as methicillin-resistant *Staphylococcus aureus* in pigs raised for slaughter.

1.3 Past efforts

Global activities

Globalisation, brought about by trade, leisure tourism and health tourism, has led to new forms of resistance being spread throughout the world very quickly. This means that all countries must make an equal commitment to controlling antibiotic resistance.

The Global Strategy for Containment of Antimicrobial Resistance published by the WHO in 2001 set out the main lines of action for surveillance, prevention and disease control. This strategy was followed by resolution WHA58.27 in which countries were called on to improve their measures to combat the growing threat of antibiotic resistance. The call to action remains valid for most WHO member states since not enough has been done since its launch in 2001. In 2011 the Regional Committee for Europe therefore defined seven strategic objectives towards which the member states should work⁹.

The latest WHO strategy on combating antibiotic resistance was published in September 2012¹⁰. The WHO advises its member states to devise and implement national action plans, dealing with human medicine, veterinary medicine and farming.

The WHO adopted a global antibiotic resistance action plan in May 2015¹¹. This global action plan was drawn up by the WHO in conjunction with the World Organisation for Animal Health (OIE) and the Food and Agriculture Organization of the United Nations (FAO). The action plan contains specific measures aimed at developing tools and standards for harmonised surveillance of infections in humans. It also plans to expand harmonised monitoring of animals to include food production and the food chain.

⁷ www.anresis.ch

⁸ <http://www.blv.admin.ch/dokumentation/04506/04518/index.html?lang=en> {N.B.: the English website contains a summary rather than the full version}

⁹ WHO Regional Office for Europe, EUR/RC61/14: *Strategic Action Plan on Antibiotic Resistance*

¹⁰ WHO (2012), *The evolving threat of antimicrobial resistance - Options for action*

¹¹ http://www.who.int/drugresistance/global_action_plan/en/

At the European level, the Council of the European Union adopted a resolution on antibiotic resistance (A Strategy Against the Microbial Threat) in 1999. In 2001 the European Commission adopted Council Recommendation 2002/77/EC on antimicrobial resistance. This document served as the basis for national strategies on antibiotic resistance¹². In the same year, the European Union prohibited the sale of antibiotics without a prescription. In the years after this, the efforts of the European Union led to the creation of various projects and institutions, such as the European Antimicrobial Resistance Surveillance Network (EARS-Net), the European Surveillance of Antimicrobial Consumption Network (ESAC-Net) and the European Committee on Antimicrobial Susceptibility Testing (EUCAST).

The European Parliament adopted a resolution on antibiotic resistance in May 2011¹³. This called on the European Commission to produce an EU-wide plan to combat antibiotic resistance. The five-year action plan addresses aspects relating to both human and veterinary medicine. The member states are called on to support the plan and to combine measures that have been taken to date.

There are twelve objectives, including encouraging the appropriate use of antibiotics in all member states, strengthening protection against and control of infection in healthcare facilities, boosting the antibiotic resistance and consumption surveillance systems in human and veterinary medicine, and strengthening and coordinating research work. The existing European monitoring networks, such as EARS-Net, are to be expanded. Antibiotic resistance is a key aspect of the 3rd EU action programme on health (2014 - 2020).

The efforts made to control antibiotic resistance vary from one European country to another. Nordic countries such as Sweden and Norway were very quick off the mark in developing their national strategies and action plans. They were followed by other EU countries such as the UK, Denmark, Germany and France. The strategies focus mainly on monitoring, prevention/control and research. Other countries have so far done little on resistance control.

Several European countries are already taking specific measures: for instance, France, the UK, Belgium and Luxembourg run public information campaigns aimed at raising awareness of the importance of antibiotics being used properly. Countries such as Spain, the Czech Republic, Greece, France and Norway have also introduced tighter rules on the prescribing of antibiotics. Other measures that have already been implemented include programmes to improve antibiotic prescribing practices and hygiene measures to combat the transmission of resistance.

In 2008 the European Centre for Disease Prevention and Control (ECDC) declared 18 November as European Antibiotic Awareness Day¹⁴.

In Switzerland, National Research Programme (NRP) 49, which ran from 2001 to 2006, mapped the antibiotic resistance situation in humans, animals and the environment for the first time. The Swiss Centre for Antibiotic Resistance (anresis.ch) was created as a result of NRP 49, and is now responsible for keeping accurate records of the resistance situation and human antibiotic consumption in Switzerland. The then Federal Veterinary Office (FVO, now FSVO) drew up an internal strategy to combat antibiotic resistance in veterinary medicine in 2012.

Other activities dealing with the problem of antibiotic resistance were also launched. For example, the system for monitoring antibiotic resistance in livestock

¹² Gerards, Marieke (2011): *International Policy Overview. Antibiotic Resistance*

¹³ European Parliament resolution of 12 May 2011 on antibiotic resistance P7_TA(2011)0238

¹⁴ <http://ecdc.europa.eu/en/eaad/Pages/Home.aspx>

and the sale of antibiotics in veterinary medicine (ARCH-Vet)¹⁵ was introduced in 2006, while in human medicine the Sentinella network existed¹⁶ from 2006 to 2013, collecting data on antibiotic prescribing in the practices of participating doctors. Building on these initiatives, learned societies and expert groups launched a pilot intervention study into antibiotic prescription guidelines in order to encourage appropriate use. This led to a move away from broad-spectrum antibiotics towards substances with a narrower spectrum of action.

All university hospitals now have internal guidelines on infection control. Swissnoso draws up and publishes corresponding recommendations. These guidelines reflect the specific features of the hospitals, but it is unclear whether smaller healthcare facilities have detailed outbreak control plans to prevent and combat outbreaks of disease caused by antibiotic-resistant organisms. In addition, the recommendations which exist are not binding.

Prohibiting the use of antibiotics as antimicrobial growth promoters in animal feed in Switzerland has helped significantly to reduce the use of antibiotics in livestock farming: since 1 January 1999, farmers who fatten animals have been banned from incorporating antibiotic additives into feed as growth promoters. Other legal requirements on the use of veterinary medicines were introduced in 2004. These include: the requirement for all uses of antibiotics to be recorded by the veterinarian and the livestock farmer; regular farm visits by the herd veterinarian when antibiotics are dispensed to provide the farmer with a stock; a prohibition on the administration of antibiotics to livestock without a prescription by a veterinarian. In addition, regular farm check-ups have been conducted since then by the cantonal veterinary offices to monitor records and the storage of antibiotics. Animal health services have stepped up their numerous activities and advisory services to encourage prevention. A number of infectious diseases have also been eradicated, such as enzootic pneumonia (EP) and actinobacillosis (APP) in pigs and Salmonella enteritidis in chickens.

Gaps remain despite these positive efforts, and there is still a great need for action. At present, there is no concerted strategy to ensure the long-term efficacy of antibiotics in preserving human and animal health. The global situation shows that isolated measures focusing on individual fields cannot provide a lasting solution to the problem of antibiotic resistance.

1.4 Strategy for Switzerland

Commission by the EAER
and the FDHA

Antibiotic resistance does not recognise national borders. Trade and travel are among the factors that contribute to the spread of resistant organisms. Switzerland, along with the international community, is called on to work to prevent the development of new forms of resistance and to restrict the transmission and spread of resistance. Science shows that the problem of resistance can be tackled if the right tools are used. For example, it has been shown that resistance rates are low in countries where comparatively few antibiotics are used¹⁷. For this reason, in July 2013 the heads of the Federal Department of Home Affairs and the Federal Department of Economic Affairs, Education and Research commissioned the competent Federal Offices for Health (FOPH), Food Safety and Veterinary Affairs (FSVO), Agriculture (FOAG) and the Environment (FOEN) to draw up a compre-

¹⁵ <http://www.blv.admin.ch/dokumentation/04506/04518/index.html?lang=en>

¹⁶ http://www.bag.admin.ch/k_m_meldesystem/00736/00817/index.html?lang=en

¹⁷ <http://jac.oxfordjournals.org/content/69/3/827.full.pdf+html>.

hensive antibiotic resistance strategy for Switzerland. They laid down the following key points:

- The primary objective is to ensure the long-term efficacy of antibiotics in preserving human and animal health.
- The strategy defines cross-sector objectives and appropriate measures for surveillance of resistance in Switzerland and for improving the situation.
- The parties responsible for achieving the objectives and implementing the measures will be defined in the context of the overall strategy.
- In view of the complex nature of the problem and the various fields affected, key stakeholders and contact groups (cantons, learned societies, expert groups, industry, sectors and associations etc.) will be consulted.
- The impact of antibiotic use on the environment (water, soil, biodiversity) and the role of the environment in spreading antibiotic-resistant bacteria will be examined.
- Work already done and processes already put in place in individual fields will have to be aligned to the overall strategy, and adjustments will be made if this is necessary to achieve the objectives.

Key points of the strategy

The primary objective of the strategy is also part of the Federal Council's health policy agenda, set out in «Health2020»¹⁸. Among other things, this programme promotes measures to reduce avoidable infections in healthcare facilities providing inpatient care (nosocomial infections) as well as measures to control and combat antibiotic resistance.

National strategy in the context of Health2020

Parliament is revising the Epidemics Act (EpidA), highlighting its intention to deal with the problem of antibiotic resistance¹⁹. When the new Act comes into force on 1 January 2016, article 5, «National programmes to protect public health» will require the FOPH and the cantons to devise national programmes on pathogen resistance and healthcare-associated infections.

Epidemics Act

Article 187d of the Agriculture Act (AgricA)²⁰, which has been in force since 1 January 2014²¹, obliges the Federal Council to take action by the end of 2014. It was required to work with the cantons and sectors to define the objectives and strategies for identifying and monitoring antibiotic resistance and reducing antibiotic use. Agricultural environmental objectives²², international recommendations and guidelines and the state of the art were to be taken into account in particular in this process.

Agriculture Act

1.5 Interfaces

The national strategy for the monitoring, prevention and control of nosocomial infections (NOSO) addresses the problem of healthcare-associated infections acquired by patients in hospital or people living in care homes. Healthcare-associated infections are a serious public health problem throughout the world, and a high priority for health policy.

The NOSO strategy

¹⁸ Federal Department of Home Affairs (2013): The Federal Council's health-policy priorities (Health2020). <http://www.bag.admin.ch/gesundheit2020/index.html?lang=en>

¹⁹ <http://www.bag.admin.ch/themen/medizin/03030/03209/03210/index.html?lang=en>

²⁰ SR 910.1

²¹ Transitional provisions relating to the amendment of 22 March 2013

²² FOEN and FOAG (2008), Umwelt-Wissen [Environmental Information] no. 0820, p 221: *Umweltziele Landwirtschaft [Agricultural environmental goals]*

As healthcare-associated infections can also be caused by antibiotic-resistant pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA), there is an obvious interface with the national antibiotic resistance strategy. However, the NOSO strategy focuses on measures to prevent and control infections in hospitals and care homes, which means that it addresses a smaller group of partners involved in implementation. Bacteria are not the only organisms which cause healthcare-associated infections. Other pathogens, such as influenza viruses, are also responsible.

Parliamentary motions

National Councillor Bea Heim has submitted two motions to underline the importance which Parliament attaches to the issue of antibiotic resistance. The Federal Council considers that these motions should be incorporated into the existing strategy:

Postulate 14.3065 «Ineffective antibiotics. Development of resistance» calls on the Federal Council, as part of its antibiotic strategy, to examine the questionable use of antibiotics for cold symptoms caused by viruses and its impact on the resistance situation. Motion 12.4052, «One-Health approach for a coherent antibiotic strategy in human and veterinary medicine», requires the Federal Council to take a consistent approach to the issue of antibiotics and resistance as part of a One-Health concept. The Federal Council was also called on to draw up any legislation required and set clear and measurable targets along with a timetable.

FSVO strategy paper

The then Federal Veterinary Office (FVO) drew up an internal strategy paper for veterinary medicine in 2012. It set out the fundamental areas for action in order to ensure that the use of antibiotics in veterinary medicine does not undermine the efficacy of antibiotics in human medicine. However, it is essential that antibiotics remain available for appropriate veterinary use in the interests of animal welfare. The aim was to reduce antibiotic use in veterinary medicine and eventually improve the resistance situation in the livestock sector.

Animal Health Strategy 2010+

The National Antibiotic Resistance Strategy intersects with the Animal Health Strategy 2010+ at various points²³. Measures to improve animal health also contribute to achieving the objectives of the antibiotic resistance strategy. There is considerable potential for synergy between the two strategies in the prevention field of activity in particular.

Agricultural environmental objectives

The document «Agricultural environmental objectives»²⁴ describes the development of antibiotic resistance as one of the unwanted side-by-products of farming. This led to the formulation of the environmental objective «No damage to the environment or health resulting from veterinary medicines used mainly in agriculture», pointing out the existing legal requirements to avoid contamination of soil and water.

NRP 72 «Antimicrobial resistance»

The Federal Council launched the national research programme (NRP) on «Antimicrobial Resistance – a One-Health Approach» on 24 June 2015. It provides 20 million CHF in funding. The Swiss National Science Foundation (SNSF) has been engaged to implement this programme. NRP 72 «Antimicrobial Resistance – a One-Health Approach» is intended as a contribution to reduce antimicrobial resistance and its damaging impact on the treatment of infectious diseases. As resistance genes move freely among people, animals and the environment, the

²³ Animal Health Strategy 2010+: http://www.blv.admin.ch/gesundheit_tiere/03007/index.html?lang=en

²⁴ FOEN and FOAG (2008), Umwelt-Wissen [Environmental Information] no. 0820, p 221: *Umweltziele Landwirtschaft [Agricultural environmental goals]*

NRP aims to take a comprehensive, multidisciplinary approach, based on the One-Health concept.²⁵

1.6 Development process

This strategy was devised through close cooperation among the Federal Offices concerned (FOPH, FSVO, FOAG and FOEN), the Swiss Conference of Cantonal Ministers of Public Health (CMPH), learned societies, expert groups, industry, various sectors and associations. The FOPH was the lead body. Broad and cross-sector consultation was crucial because of the complex nature of the problems. The stakeholders and interest groups were involved in devising the strategy from an early stage. They will play an important role in the implementation of the strategy.

Participatory approach

The stakeholders and interest groups had the opportunity to express their knowledge and experience in various expert groups and three cross-sector workshops. The first workshop concentrated on describing the need for action. Discussions and structured exchanges of views allowed the participants to describe the current challenges from their own point of view, dealing with various topics. The issue of where the strategy's priorities should lie was debated. The second workshop concentrated on formulating joint, cross-cutting strategic objectives. The third workshop focused on devising measures, based on preparatory work done by expert groups. Before further work on refining the strategy was done, the measures were subjected to a critical review. Any points that were still unclear were addressed.

Expert groups and workshops

This broad-based approach to the subject allowed links to be identified, new information to be obtained, synergies to be discovered and cross-cutting solutions to be developed. The process of devising the strategy also took account of international antibiotic strategies that are available and experience in implementing them.

The Federal Department of Home Affairs and the Federal Department of Economic Affairs, Education and Research conducted a hearing in December 2014. The feedback from this process was summarised in a report²⁶ and incorporated into this strategy.

Hearing

²⁵ <http://www.nfp72.ch/en>

²⁶ <http://www.bag.admin.ch/star> [page not available in English]

2 Objectives and principles

The primary objective of the strategy is as follows:

Primary objective

To ensure the long-term efficacy of antibiotics in preserving human and animal health.

The national antibiotic resistance strategy takes a goal-oriented, integrative and cross-sector approach, bearing the following principles in mind:

Principles

- Only a cross-sector and integrated approach is likely to succeed. Challenges in human health, animal health, agriculture and the environment must be addressed jointly. Consequently, the strategy follows the One-Health approach, taking account of human health, animal health, agriculture, food and nutrition security and the environment.
- International coordination is critical to the success of the strategy, as the issue of antibiotic resistance can only be dealt with at an international level. Prevention and control of antibiotic resistance is a high priority for the WHO and the EU. Many countries have already developed strategies aimed at taking concrete action to stem the advance of antibiotic resistance.
- Rapid action is needed given the importance and urgency of the problem of antibiotic resistance. Even if science does not yet have a conclusive answer to all questions, it is not possible to wait for more information to become available. Building on the findings of numerous Swiss experts and taking international experience into account, the proposed objectives and measures can have an impact in areas where the greatest medium- to long-term effect is expected.
- Joining forces and coordinating the implementation of measures will enable this strategy to have a broad and lasting impact. The stakeholders in the areas of human and animal health, agriculture and the environment are called on to assist in achieving the objectives that have been set. They bear responsibility for the successful implementation of the proposed measures. Sustained efforts on the part of the Confederation, the cantons and all other stakeholders will be necessary to achieve lasting success in the control of antibiotic resistance.

Strategic objectives

Eight strategic objectives have been defined with the stakeholders in the light of the need for action. They all have the same validity for the areas affected (humans, animals, agriculture and the environment) and are directed towards achieving the primary objective.

Monitoring

A cross-sector system employing standardised methods will be developed for monitoring humans, animals, agriculture and the environment. This will provide information on the distribution and use of antibiotics and on the development and spread of resistance. Additional data will be recorded where specific problem areas are identified. This will form the basis for targeted intervention and monitoring of outcomes.

Even if various monitoring systems have been set up in the four areas (humans, animals, agriculture and the environment), there are still too many gaps to allow systematic, nationwide surveillance. There is also not enough data to analyse particular problem areas. A robust and comprehensive set of data must be obtained to show whether the measures formulated in the strategy are having the desired effect.

The need for antibiotics will be reduced to the essential minimum by implementing targeted preventive measures and effective alternatives

Prevention

As the use of antibiotics encourages the development of resistance, reducing their consumption is among the most effective measures. To this end, infections that make the use of antibiotics unavoidable must be prevented where possible. The best possible use must be made of the options available in this respect, especially with a view to preventing infection by means of targeted vaccination, improving animal husbandry and taking supportive measures to improve animal health. Laboratory tests with a strong practical emphasis will help veterinarians decide whether or not to use a specific antibiotic.

Rules on the appropriate use of antibiotics will be defined in accordance with the current state of understanding. These will be binding and implemented consistently.

Appropriate use of antibiotics

If antibiotics must be used, they must be administered with caution in order to minimise the development of resistance in the light of the current state of understanding. This relies on a high level of expertise among the individuals prescribing or using antibiotics. Binding rules, and restrictions where appropriate, are also necessary and must be applied consistently throughout the country. Above-average antibiotic use must be identified and halted.

The transmission and spread of resistant organisms will be minimized in order to reduce antibiotic resistance.

Resistance control

Even if antibiotics are used correctly, it is impossible to entirely prevent the development of resistance. Care must be taken to ensure that existing forms of resistance are identified quickly and dealt with effectively. Opportunities for the transmission and spread of resistance must also be minimized. Targeted action must be taken to control outbreaks of resistant organisms.

Interdisciplinary research and development work on the emergence, transmission, spread and control of resistant bacteria will be intensified. This research will also provide the basis for the targeted development of antimicrobial substances and cost-effective diagnostic products.

Research and development

The development and spread of antibiotic resistance and the underlying cause-effect mechanisms are complex and often not yet fully understood. Targeted interdisciplinary research is essential in order to close gaps in knowledge. Where possible, research results should also lay the foundations for later product development. An interdisciplinary platform produces a snapshot of the current state of ongoing research projects and helps define focal points for research.

Cooperation among the various stakeholders at political, scientific and economic levels will be encouraged and coordinated beyond the boundaries of individual disciplines both nationally and internationally as part of the One-Health approach.

Cooperation

The cross-sector and global nature of the problem means that cooperation among the various stakeholders at political, scientific and economic levels is essential. Active encouragement and improvement will be necessary where cooperation is still inadequate. This includes cross-sector harmonisation of activities and a strong international network. A cross-sector coordination body will be set up to coordinate the implementation of the strategy, and an advisory expert group will provide additional specialist knowledge.

Information and education

Knowledge of antibiotic resistance will be improved among experts and the general public so that more responsible decisions are taken and resistance levels fall.

Our understanding and knowledge of the development and spread of antibiotic resistance remains incomplete. This must be put right so that specialists such as doctors, veterinarians, pharmacists, farmers, food producers, as well as the general public, take informed decisions on the responsible and appropriate use of antibiotics, thereby contributing to reducing resistance.

General conditions

General conditions and incentives, whether political, legal or financial in nature, will be created so that effective antibiotics are available and are used in a prudent, sensible manner.




The general conditions for the groups involved must be such as to ensure that effective antibiotics will continue to be available and that they will be used responsibly. There is a need to ensure that there are no political, legal or financial incentives or market mechanisms that would stand in the way of achieving the objective. The availability of first-choice antibiotics must be improved and the development of new antibiotics encouraged. Effective instruments must be available to support the enforcement of the regulations in place.

3 Fields of activity and measures

Measures will be put together in eight fields of activity to reflect the strategic objectives. The summary below shows the areas in which the individual measures contribute to the achievement of the strategic objectives.

Measure	Areas	Field of activity / contribution to the objective								
		Monitoring	Prevention	Appropriate use of antibiotics	Resistance control	Research and development	Cooperation	Information and education	General conditions	
Comprehensive monitoring		•	•	•	•	•	•	•	•	
Reference laboratories and quality assurance		•		•	•	•	•			
Standardised and targeted tests		•		•	•					
Healthcare-associated infections			•	•	•			•	•	
Laboratory tests with a strong practical emphasis			•	•	•					
Vaccination promotion			•					•		
Improving husbandry			•	•		•		•	•	
Improving animal health			•			•		•	•	
Advising livestock farmers			•					•	•	
Research and production facilities			•			•		•		
Prescription guidelines				•	•	•		•	•	
Restriction			•	•				•	•	
Expertise			•	•	•			•		
Above-average use of antibiotics			•	•	•			•	•	
Introduction and spread of resistance			•		•	•		•		
Targeted outbreak control			•	•	•					
Food chain			•		•	•				
Waste water purification facilities					•	•				
Interdisciplinary platform		•	•	•	•	•	•	•	•	
Basic principles for farmyard manure, soil and water		•				•				
Diagnostic methods		•	•	•	•	•				
Transport of people, animals and goods			•		•	•				
Cross-sector coordination body		•	•	•	•	•	•	•	•	
Consultative expert body			•	•	•		•			
Strengthening involvement of stakeholders			•	•	•		•	•		
Networks with other countries			•	•	•	•	•			
Support for developing countries			•	•	•		•	•		
Public information			•	•			•	•		
Raise awareness among stakeholders affected			•	•	•		•	•		
Basic and further training			•	•	•			•		
Market mechanisms and incentive systems			•	•					•	
General conditions for studies		•	•	•		•			•	
Improve the availability of antibiotics			•	•	•	•			•	
Strengthen enforcement		•		•	•				•	
Programmes to encourage appropriate use			•	•	•			•	•	

The individual fields of activity and their strategic objectives are briefly outlined below, and the measures for each field of activity are then presented. The areas in which the measures are to be carried out are indicated in each case. Animals and agriculture, though separate areas, are closely related and there are multiple synergies between them. For this reason they are dealt with as a single area.

-  Humans
-  Animals and agriculture
-  The environment

The measures are listed individually and a brief description of each measure is given. The current situation with regard to each measure is indicated, and further explanations are given. In accordance with the commission issued by the Federal Council, the parties primarily responsible for implementation of the proposed measures are stated at the end of each entry. This refers to responsibility for initiating and coordinating the implementation activities, but not to responsibility for funding or enforcement. The allocation of prime responsibility does not alter existing responsibility arrangements. Responsibility for enforcement and funding are determined according to existing task and responsibility arrangements in the context of implementing the proposed measures.

3.1 Monitoring








The four areas (humans, animals, agriculture and the environment) must be systematically monitored so that enough information about the sale and use of antibiotics and the development and spread of resistance is obtained. It must be possible to collect additional data where specific problem areas are identified. A good and comprehensive set of data is also essential to show whether the measures formulated in the strategy are having the desired effect. Only this will indicate how far the strategic objectives are being met.

Objective

A cross-sector system employing standardised methods will be developed for monitoring humans, animals, agriculture and the environment. This will provide information on the distribution and use of antibiotics and on the development and spread of resistance. Additional data will be recorded where specific problem areas are identified. This will form the basis for targeted intervention and monitoring of outcomes.

Measures

The following measures will make a significant contribution to achieving the objectives:

<i>Measures</i>	<i>Areas</i>
3.1.1 Develop and operate comprehensive monitoring system	  
3.1.2 Develop and expand network of reference laboratories for investigating antibiotic resistance and ensure quality assurance in all laboratories	  
3.1.3 Draw up and implement national guidelines on the standardised and targeted investigation of antibiotic resistance	



Develop and operate comprehensive monitoring system

The system for monitoring antibiotic resistance and antibiotic consumption will be designed on a cross-sector and interdisciplinary basis. Any existing gaps in monitoring will be closed. The analysis of the monitoring results from all areas will be published in a joint report. International comparability will be ensured.

Antibiotic resistance

Since 2004, anresis.ch has had central responsibility for supraregional monitoring of antibiotic resistance in the human population²⁷. National research programme 49 (NRP 49) facilitated its work. anresis.ch collects and analyses anonymised antibiotic resistance data from clinical microbiology laboratories in Switzerland. These are routine data generated in the course of medical treatments. The resistance data collected in this way cover about 60% of annual days of hospitalisation and over 30% of all patients not requiring hospital admission. In addition, since June 2014 monthly figures on selected multi-resistant microorganisms have been published in the FOPH's bulletin. Data are also reported to the WHO Europe²⁸ network.

A system to enable the continuous monitoring of resistance in farm animals, meat and dairy products in Switzerland was introduced in 2007 on the basis of the Epizootic Diseases Ordinance (EzDO)²⁹. Since then the FSVO has also been working with the Centre for Zoonotic Diseases, Bacterial Animal Diseases and Antibiotic Resistance (ZOBA) to monitor the antibiotic resistance situation among fattening poultry, fattening pigs and cattle. So far, little work has been done on meat and dairy products.³⁰ As yet there is no national set of continuously recorded and standardised data on the resistance of organisms from plant- and animal-based food samples or from veterinary pathogens.

The data will be published annually in a report³¹ and sent to the competent EU committee for further assessment. These notifications will allow Switzerland to take part in pan-European assessments of the resistance situation carried out by the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC)³², allowing resistance situations in various countries to be compared³³.

Implementation of the proposed measure will establish a cross-sector and interdisciplinary system of monitoring resistance in humans and animals, along the food chain and in the environment. Both known pathogens and threats from new forms of resistance will be addressed. The methodology and the assessment of data will be harmonised at national level and presented in such a way as to allow comparison with international data. Coordination with reference laboratories in Europe (European Antimicrobial Resistance Surveillance Network EARS-Net) and beyond

²⁷ www.anresis.ch

²⁸ CAESAR (Central Asian and Eastern European Surveillance of Antimicrobial Resistance)

²⁹ SR 916.401, article 291d

³⁰ Commission implementing decision of 12 November 2013 on the monitoring and reporting of antimicrobial resistance in zoonotic and commensal bacteria (OJ L303 of 14.11.2013, p.26). The tests will be carried out in accordance with the relevant EU requirements (Directive 2003/99; Decision 2013/65²/EU)

³¹ FSVO (2014): *ARCH-Vet Gesamtbericht [general report] 2013*

³² EFSA Journal (2013;11(5):3196 [359 pp.]: *The European Union Summary Report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2011*

³³ ECDC/EFSA/EMA first joint report on the integrated analysis of the consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals. EFSA Journal 2015;13(1):4006, 114 pp. doi:10.2903/j.efsa.2015.4006

(Pan American Health Organization PAHO) will be necessary for this. Efforts will also be made to ensure that Switzerland can play a full part in these programmes.

The desirability of introducing a reporting requirement for selected forms of resistance in both humans and animals will be examined.

In veterinary medicine and food, the previous system of monitoring antibiotic resistance in zoonotic pathogens and indicator organisms from healthy animals will be broadened to include regular tests of animal- and plant-based products in the retail trade. These additional measurements will allow more accurate assessment of the risk to consumers, and enable the success of any measures taken to reduce contamination levels in food to be ascertained. In addition, products of foreign origin on sale in retail outlets will also be tested and may show the level of contamination with resistant organisms to be different from that of domestically produced goods. A system of representative resistance monitoring for organisms causing animal disease will also be developed, introduced and centrally assessed for the most important animal species.

The surveillance results from all areas will be placed in a joint report that will be published regularly. Summaries of surveillance observations will be sent to stakeholders on a regular basis soon after the tests have been performed.

Antibiotic consumption

anresis.ch has been collecting and analysing data on antibiotic consumption since 2004. At present approximately 50 hospital dispensaries take part. These data are not publicly accessible, but are published in aggregate form on the website or summarised in individual scientific publications. This monitoring system does not cover outpatient consumption, which was specifically analysed in two studies as part of NRP 49. One of these studies used data provided by a market research institute, while the other used data from a health insurance fund. In addition, between 2006 and 2013 the Sentinella reporting system³⁴ recorded data on antibiotic prescriptions in participating doctors' surgeries.

With regard to antibiotic prescribing in veterinary medicine, the Veterinary Medicinal Products Ordinance (VMPO) requires records of veterinary medicinal products to be kept³⁵. To this end the amount of antibiotics sold by distributors (marketing authorisation holders) is recorded and assessed annually. The data are assessed in a manner similar to that used by the European Medicines Agency (EMA) and converted into figures for each type of livestock. These assessments appear in the appendices of EMA reports on the sales figures for antimicrobial active substances in veterinary medicine in the states of the EU (ESVAC report). This allows them to be compared with distribution figures of other European countries. The sales statistics give an overview of the total amounts of antibiotics used in veterinary medicine in Switzerland broken down by active substance, method of application and according to whether they are for use in pets or livestock. The statistics are published annually in a report along with the results of the livestock resistance monitoring programme, allowing trends over time to be analysed³⁶. However, sales statistics cannot provide any information as to the use of antibiotics in specific animal species or production types. It is also impossible to use them to obtain information about indications treated or frequency of treatment. Consequently, they are of no use in identifying excessive or inappropriate use, determining the effect of measures or highlighting links with the resistance situation.

³⁴ http://www.bag.admin.ch/k_m_meldesystem/00736/00817/?lang=en

³⁵ SR 812.212.27, article 36 clause 1 of the VMPO

³⁶ FSVO (2014): *ARCH-Vet Gesamtbericht [general report] 2013*

In the light of the Ordinance on the Assessment of Sustainability in Agriculture³⁷ an agricultural-environmental monitoring programme was set up by the FOAG in 2009. Since then it has conducted computerised surveys of approximately 200 farms chosen at random to monitor the consumption of veterinary medicinal products by livestock. The FOAG commissioned the Veterinary Public Health Institute of Bern University (VPHI) to assess the findings (electronic treatment log). The quality of the data obtained to date is poor. Similar systems for recording treatment in electronic logs have been developed and introduced by private-sector bodies, such as cattle breeder associations.

In the field of human medicine, implementation of the proposal to monitor antibiotic consumption among outpatients and inpatients will broaden the information base and close existing gaps. The data will be collected so that it is representative of Switzerland as a whole. International comparability will be assured, and information aimed at adults and at children will be assessed separately. Care will be taken to ensure that the relationship between the resistance situation and antibiotic consumption can be investigated and that conclusions about prescribing patterns can be drawn.

In veterinary medicine, implementation of the proposed measure will lead to the creation of a central antibiotics database to record antibiotic use at the level of distributors, veterinarians and animal owners. This will enable the assessment of the frequency of treatment in individual animal species (livestock and pets) and types of production (such as piglet rearing, calf fattening, dairy farming) and the efficacy of intervention measures. It is essential that data protection measures protect animal owners and veterinarians against abuse. A system of this kind will also enable regional, national and international comparisons of antibiotic consumption and intensity of treatment to be conducted. This will allow consumption and resistance data to be correlated and information on possible excessive or inappropriate use of antibiotics to be detected and countered as necessary.

In the environmental area, the first task will be to obtain information about the entry of antibiotics into farmyard manure and soil and their persistence and activity. Once this has been done, a monitoring system can be set up in this area as well. At present there are scarcely any systematic records of environmental levels of antibiotics, resistance genes or resistant organisms. There is one exception to this: a monitoring programme in place for fruit-growing since 2008 which records amounts of streptomycin used and the susceptibility of the fire blight pathogen to streptomycin³⁸. The environmental impact of the use of streptomycin to control fire blight in fruit growing was also monitored for three years. Though there is no systematic monitoring of antibiotics and antibiotic resistance in the environment, there are similar surveillance programmes for many other chemicals and substances, particularly with respect to soil and water contamination. It would in theory be possible to expand existing systems to cover antibiotics and antibiotic resistance as well.

A monitoring system of this type is desirable because antibiotics used in veterinary medicine and the resistant organisms, which develop are transferred to the soil in the form of slurry, manure and dung, with a proportion ending up in surface waters through leaching and erosion. The antibiotics prescribed to patients and the resistant organisms which develop here as well also end up in surface waters and so

³⁷ SR 919.118

³⁸ <http://www.blw.admin.ch/themen/00012/00519/index.html?lang=de> [website not available in English]

in the environment via the drains and sewage purification plants. Finally, they can also be ingested by humans and animals and so present a potential risk.

Prime responsibility for implementing the proposed measure lies with the Confederation and the (reference) laboratories. Partners for implementation are the cantons, communes, veterinarians, doctors, healthcare facilities, pharmacies, an-re-sis.ch, universities/universities of applied science and the Swiss Soil Monitoring Network NABO.

3.1.2 Reference laboratories and quality assurance



Develop and expand the network of reference laboratories for investigating antibiotic resistance and ensure quality assurance in all laboratories

A network will be established on the basis of the existing designated reference laboratories. The core tasks of the network will include the coordination and standardisation of laboratory investigations into antibiotic resistance and the associated research and development. Any existing gaps will be closed.

In human medicine, the existing reference laboratories monitor antibiotic resistance within their area of responsibility (tuberculosis, pneumococci, salmonellae etc.). In addition, the Swiss Society of Microbiology produces guidelines on the diagnosis of antibiotic-resistant organisms that comply with European standards (EUCAST). Both the Swiss Society of Microbiology and the Swiss Commission for Quality Assurance in Medical Laboratories (QUALAB) work to publicise these guidelines, while their implementation lies in the hands of individual laboratories. The conditions and procedure for awarding a licence are governed by the Ordinance on Microbiological and Serological Laboratories³⁹. From 2016 onwards the Swiss Agency for Therapeutic Products (Swissmedic) will be responsible for awarding licences covering quality assurance.

ZOBA is the recognised reference laboratory for antibiotic resistance in veterinary medicine. Informal contacts with laboratories working in human medicine exist but are not formalised. Antibigrams are performed in several laboratories in Switzerland apart from the reference laboratory. The resistance tests performed in small practice laboratories, such as antibiograms to detect mastitis in milk, are governed by the Containment Ordinance, but there is no requirement to report this activity and so also no systematic registration or quality control.

A network of reference laboratories will be created as a result of implementation of the proposed measure. Surveys will be performed to identify any gaps and decide whether additional reference laboratories should be designated. The reference laboratories will set up their own system of networks and coordination in a cross-thematic context, and may assign responsibilities as they deem appropriate⁴⁰.

The network is also tasked with developing quality (gold) standards. As local microbiological laboratories will also focus on these standards, laboratory methods for determining resistance will be harmonised and the results of investigations will become comparable at national and international level. The possibility of incorporating resistance tests into the analytical catalogue and of introducing a registration

³⁹ SR 818.123.1

⁴⁰ In human medicine, the Swiss Society of Microbiology (SSM) has set up a Swiss Antibiogram Committee in the context of EUCAST. The SAC has published a list of laboratories that are available to clinical-microbiological laboratories in Switzerland as reference laboratories for detecting and confirming resistance mechanisms.

requirement will also be examined as a way of ensuring that the quality standard is met.

The tasks of the reference laboratories will also include reliable diagnosis of new forms of resistance. This will allow diagnostic laboratories to contact reference laboratories for assistance when they have special queries.

Prime responsibility for implementing the proposed measure lies with the Confederation and the competent learned societies. Partners for implementation are the (reference) laboratories, learned societies, associations, Swissmedic and QUALAB.

3.1.3 Standardised and targeted tests



Draw up and implement national guidelines on the standardised and targeted investigation of antibiotic resistance

Standardised and targeted tests

National guidelines for the attention of the laboratories will be drawn up, updated regularly and applied consistently. These will show which pathogens have to be tested for which type of resistance.

No guidelines for a nationally standardised, targeted diagnostic investigation of forms of antibiotic resistance have yet been established in Switzerland. Consequently, the spectrum of laboratory diagnostic investigations can vary considerably among individual laboratories. This means that investigations are not always sufficiently comprehensive or detailed to support appropriate antibiotic prescribing, as it is not always possible to clearly identify pathogens and their forms of resistance. In addition, not all laboratories offering resistance testing are part of a quality group.

Implementation of the proposed measure will enable forms of resistance that are relevant to public health to be detected and described in a systematic and targeted manner, using suitable methods and taking existing international guidelines into account. The precise and detailed guidelines will specify the spectrum of resistance investigations that should be performed for each pathogen. In particular, the characteristics for which the samples are to be tested will be described (bacterial resistance forms, antibiogram per bacterium, qualitative and quantitative resistance testing).

Prime responsibility for implementing the proposed measure lies with the Confederation, the competent learned societies and the (reference) laboratories. Partners for implementation are the medical profession and other laboratories.

3.2 Prevention








Cutting antibiotic consumption is one of the most effective ways of reducing resistance. Preventing infections among humans and animals is critical to achieving this. Key aspects are improved hygiene, preventive measures such as vaccinations, and the development of effective alternatives to antibiotic use, especially in the areas of management, hygiene, organisation and information.

The need for antibiotics will be reduced to the essential minimum by implementing targeted preventive measures and effective alternatives

Objective

The following measures will make a significant contribution to achieving the objectives:

Measures

Measures	Areas
3.2.1 Develop and implement systems for monitoring, preventing and combating healthcare-associated infections	
3.2.2 Apply laboratory investigations with a strong practical emphasis in a targeted manner	
3.2.3 Support vaccination campaigns aimed at particular target groups and diseases	
3.2.4 Encourage improved animal husbandry processes, especially with regard to management, conditions under which animals are kept, and biosecurity	
3.2.5 Identify and promote preventive measures to improve animal health	
3.2.6 Optimise and promote the coordination and provision of advice to livestock farmers and support for farms	
3.2.7 Reduce the volume of antibiotics, resistance genes and resistant bacteria entering the environment from research and production facilities	

3.2.1 Healthcare-associated infections



Healthcare-associated infections

Develop and implement systems for monitoring, preventing and combating healthcare-associated infections

The consistent implementation of infection control and hygiene concepts in hospitals and care facilities and in veterinary hospitals and veterinary practices will be promoted. Structural and organisational measures to prevent the spread of pathogens will be assessed and implemented.

Some healthcare-associated infections are caused by antibiotic-resistant pathogens. The expert group Swissnoso conducted prevalence studies in 1999, 2002, 2003 and 2004. The results show that every year 7% - 8% of inpatients contract a healthcare-associated infection. These studies are so far the only source of information on the frequency of healthcare-associated infections in Switzerland. Targeted prevention measures and control systems would allow up to 30% of infections to be prevented⁴¹. This would cut the rate of infections requiring antibiotic treatment.

Most Swiss hospitals have already taken steps in the area of prevention and established structures to successfully tackle the problem of healthcare-associated infections. However, the scope and quality of these activities vary considerably. Hospitals often lack the financial and human resources, specifically trained staff or consistent implementation. Overall, the situation in hospitals and care homes is not yet sufficiently well defined and varies considerably. There have hardly been any

⁴¹ Harbarth et al (2003); J. Hosp. Inf. Vol. 54: [http://www.journalofhospitalinfection.com/article/S0195-6701\(03\)00150-6/abstract](http://www.journalofhospitalinfection.com/article/S0195-6701(03)00150-6/abstract)

nationwide preventive measures, apart from isolated activities such as the national hand hygiene campaign run by Swissnoso in 2005 and 2006.

Healthcare-associated infections with multi-resistant organisms can also occur in veterinary hospitals and practices. The extent of the problem is not known, and apart from a few isolated voluntary measures, no universal hygiene guidelines have been developed and introduced for veterinary hospitals and practices.

The measure being implemented seeks to prevent infections and reduce the transmission of resistant organisms within (veterinary) hospitals, care homes and (veterinary) medical practices. In human medicine, the NOSO strategy⁴² and the Confederation's quality strategy for the Swiss healthcare system⁴³ point the way. In veterinary medicine, the focus will be on the elaboration of standards for veterinary practices and hospitals, their consistent application, the coordination of existing activities and nationwide monitoring of the situation.

The prime responsibility for implementing this measure lies with the Confederation and the cantons. Partners for implementation are the veterinary and medical professions, healthcare facilities, health insurance funds, learned societies, associations and universities/universities of applied science.

3.2.2 Laboratory tests with a strong practical emphasis



Apply laboratory investigations with a strong practical emphasis in a targeted manner

Rapid laboratory investigations with a strong practical emphasis will be used in a targeted manner to identify viral and bacterial infections. These rapid laboratory procedures will prevent inappropriate use of antibiotics in an outpatient setting.

Laboratory tests with a strong practical emphasis

Antibiotics should only be used when the patient has been proven to be suffering from a bacterial infection and there are no alternative treatments. In addition, the antibiotics used should be matched as closely as possible to the specific findings. However, many diagnostic agents and procedures are currently difficult to source rapidly, are not mobile and are relatively expensive; moreover, it often takes too long to obtain a result. This is why the non-targeted use of antibiotics is often seen as safer and cheaper than conducting laboratory tests prior to treatment.

This problem can be countered by the development and use of laboratory tests that have a strong practical emphasis, are rapidly available and as inexpensive as possible. This will allow reliable diagnoses to be established quickly and reduce the use, for example, of antibiotics for viral infections, which often cannot be identified on the basis of the clinical symptoms alone

Prime responsibility for implementing the proposed measure in the area of human medicine lies with the competent learned societies, the reference laboratories and industry. Partners for implementation are the medical profession, healthcare facilities and laboratories. In the area of veterinary medicine, prime responsibility lies with the Confederation. Partners for implementation are the industry, healthcare facilities, the veterinary profession and reference laboratories.

⁴² <http://www.bag.admin.ch/themen/medizin/14888/index.html?lang=de> [page not available in English]

⁴³ <http://www.bag.admin.ch/themen/berufe/14791/index.html?lang=de> [page not available in English]

**Support vaccination campaigns aimed at particular target groups and diseases**

Vaccinations which can contribute to reducing antibiotic consumption by preventing viral and bacterial infections will be promoted to specific target groups and individuals at risk of specific diseases

Targeted vaccinations can prevent people or animals from contracting infectious diseases or can otherwise mitigate the course of the disease, thus reducing the amount of antibiotics required.

In the area of human medicine, the Confederation and the cantons will promote vaccination recommendations. These recommendations will point out that vaccinations protect recipients from diseases that can have severe complications, and so avoid the use of antibiotics. Examples include vaccination against pneumococci. However, vaccination is useless against certain bacterial strains that are already resistant to many antibiotics. In addition, the development of new vaccines is often very technically complex, slow and expensive.⁴⁴

In the area of veterinary medicine, targeted and intensive vaccination programmes are carried out in poultry, for example. But in the case of calves there are no general recommendations as to the best age for vaccination. This means that vaccinations are sometimes carried out too late or are inadequate in scope. Vaccination programmes can also be more expensive than antibiotic treatment. Additional or cheap vaccines are also sometimes unavailable because the preparations are not permitted for use in Switzerland on animal health legislation grounds or because they are not licensed in Switzerland owing to cumbersome procedures, especially in the case of products containing genetically modified organisms.

Implementation of the proposed measure in the area of human medicine will, as part of the Swiss vaccination plan,⁴⁵ focus on developing vaccination recommendations for particular target groups and diseases with the aim of reducing antibiotic prescriptions and the resulting development of resistance.

In the area of veterinary medicine, the aim will be to improve animal health by coordinated and continuous vaccination. Vaccination programme recommendations for various animal species will be developed and promoted to this end. The availability of vaccines, especially inexpensive preparations, must be improved in some cases. Incentives to encourage vaccination will be considered.

Communication will be boosted to increase acceptance of human and animal vaccination.

The prime responsibility for implementing this measure lies with the Confederation and the cantons. Partners for implementation are the Institute of Virology and Immunology (IVI), the veterinary and human medical professions, pharmacists, health insurance funds and animal health services.

⁴⁴ Salgado-Pabón, Wilmara & Schlievert, Patrick M. (2014); Nature Reviews Microbiology, 12(7), 585-591: *Models matter. The search for an effective Staphylococcus aureus vaccine*

⁴⁵ <http://www.bag.admin.ch/ekif/04423/04428/index.html?lang=de> [page not available in English]

3.2.4 Improving husbandry



Improving husbandry

Encourage improved animal husbandry processes, especially with regard to management, conditions under which animals are kept, and biosecurity

Typical errors in the areas of animal husbandry and feeding, inappropriate conditions and biosecurity problems will be defined for particular animal species and production types. Attention will be drawn to remedial measures, in particular by producing information and training material for relevant specialist groups and by creating specific incentive systems.

Animals kept in conditions characterised by poor hygiene and inappropriate feeding and management are more likely to develop diseases requiring the use of antibiotics. Poor conditions are often not recognised and are masked by antibiotic use. Multiple problems occur in particular in production systems in which young animals from various sources are brought together. The immune systems of these young animals are underdeveloped, and they are confronted with pathogens that they have not encountered before, often contracting diseases such as gastrointestinal disorders and respiratory diseases.

Good husbandry takes account of animal welfare aspects. However, the stables in which cattle and pigs in particular are kept have structural defects that affect animal health, and the various systems and forms of animal housing are not adequately assessed from an animal health point of view. At present there are no harmonised guidelines on good agricultural practice with respect to animal husbandry, which would lend themselves to an inspection system.

The implementation of this measure will identify the main animal health shortcomings in the production and housing systems used for various animal species, and will evaluate opportunities for improvement from birth to slaughter. The findings will be passed on to the relevant specialist groups in the form of targeted messages. Enforcement bodies will also be made more aware of the need to investigate these shortcomings. The possibility of introducing incentive systems to improve the conditions under which animals are kept and management practices will be considered, along with the introduction of effective alternatives.

Animal health will be given greater weight in designing animal-friendly husbandry systems. Gold standards must be defined and made available to the relevant groups. Consideration will also be given to whether the definition of good agricultural practices (GAP guidelines) for each species of animal or type of production could improve the conditions under which animals are kept and enhance biosecurity. As any structural changes in the area of animal production would need to go hand in hand with incentive systems, consideration will be given to whether such incentive systems can be designed or adapted in the context of the resources available for agriculture.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are the cantons, animal health services and training institutes.

3.2.5 Supportive measures to improve animal health



Improving animal health

Identify and promote preventive measures to improve animal health

Preventive measures aimed at improving animal health will be taken before the use of antibiotics becomes necessary. Particular attention will be paid to promoting the development of alternative products and measures for treatment, metaphylaxis and prophylaxis and the implementation of health programmes. Support will also be given to the breeding of healthy, robust and disease-resistant animals.

Infectious diseases are very important to animal health and can cause severe financial problems for livestock farms. Health programmes to prevent, monitor and cure specific diseases are important aspects of animal health. Switzerland already operates various national health programmes to control animal diseases. Animal health services also support various health promotion programmes, such as the foot rot campaign run by the small ruminants' health advisory service.

Livestock are often bred with a view to putting on a considerable amount of flesh in a short time (fattening animals), producing large numbers of offspring or having high milk or egg yields. Breeding targets and management practices are sometimes not fully in tune with each other. This places excessive strains on the animals' ability to adapt; as a result, they may contract diseases, especially if the conditions under which they are kept are not commensurate with the yield expectations. However, in some areas considerable efforts are already being made to breed animals for health and robustness.

Complementary medicine methods and alternative products such as immunomodulators, prebiotics, probiotics, complementary medicine preparations and phytogetic dietary supplements that have a positive impact on animal health are already available or in development. However, there is often little or no evidence for their efficacy. Feed additives free from antibiotic substances that are licensed abroad are not sufficiently available in Switzerland because many have not been presented for or granted a licence.

The implementation of this measure will promote further targeted health programmes and their possible implementation. Furthermore, the breeding of animals which are healthy, robust and resistant to certain diseases will be promoted, and the opportunity to improve health by using alternative products such as immunomodulators, probiotics, prebiotics, feed additives, complementary medicine preparations and phytogetic dietary supplements will be supported. These measures should be implemented in the context of the funds available for agriculture.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are universities/universities of applied science, veterinarians, specialists, animal health services and the relevant associations.

3.2.6 Advising livestock farmers



Advising livestock farmers

Optimise and promote the coordination and provision of advice to livestock farmers and support for farms

Systematic and continuous herd management in order to improve animal health and the provision of advice to livestock farmers will be promoted. To this end, cooperation between farmers and veterinarians will be intensified.

The exchange of information between veterinarians and farmers is of critical importance to ensuring optimum animal health. However, nowadays veterinarians rarely have the time or the training for competent herd management. Exchange of information with other specialists such as feed advisers and service specialists rarely takes place. The acceptance and use of advice provided by animal health services varies according to animal species.

Farmers and veterinarians should be in regular contact, not leaving matters until problems arise. The herd veterinarian is the person who knows most about the situation on the farm. He or she recognises the causes of diseases and other problems and can provide timely advice and treatment. He or she calls on specialised colleagues, an animal health service, or other specialists in feeding, stable construction, milking hygiene etc. for advice if necessary. When good advice is

given, the farmer recognises the cause of diseases and other problems and is therefore able to take the appropriate action.

Implementation of the proposed measure will highlight the benefits to the farmer of regular and institutionalised herd management, and attention will be drawn to this in information campaigns. Consideration will also be given to deciding the form the advice should take and which herd management models should be supported. In addition, consideration will be given to which skills are needed, how the necessary capacities can be created and how a network of all bodies advising and supporting farmers can be created.

Systems in which veterinarians are paid irrespective of medication use (herd management for a flat-rate fee, etc.) will be assessed and consideration will be given to which incentive systems are sensible and necessary.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are universities/universities of applied science, learned societies, animal health services, association, training facilities and industry (e.g. the feed industry).

3.2.7 Research and production facilities



Research and production facilities

Reduce the volume of antibiotics, resistance genes and resistant bacteria entering the environment from research and production facilities

Information activities will ensure that the attention of companies, institutions and competent cantonal authorities concerned is drawn to resistance in the context of current enforcement of the Containment Ordinance. In addition, the competent cantonal enforcement authorities and the national bodies responsible for assessing action will examine the suitability of and compliance with measures relating to the issue of resistance in greater depth than has been done in the past.

Molecular biology research and production facilities routinely use antibiotics and resistance genes to select for and retain desired properties of the microorganisms used (generally *E. coli* bacteria and yeast strains). However, the volume of antibiotics used is a small proportion of the total volume (approximately 0.2%). The Containment Ordinance has governed the disposal of waste containing antibiotics, genes and organisms since 1999. Proper compliance with its provisions alone already ensures that practically no live resistant microorganisms enter the environment. However, very small amounts of antibiotics and resistance genes do enter waste water. Consideration must therefore be given to ascertaining whether this plays a relevant role in the development of antibiotic resistance.

Implementation of the proposed measure will draw the attention of companies, institutions and competent cantonal authorities concerned to the issue of resistance in the context of current national enforcement of the Containment Ordinance (CO). It will be emphasised that compliance with statutory measures relating to waste management and disposal is essential in order to minimise contamination from companies, institutions and authorities concerned. In addition, the competent cantonal enforcement authorities and the national bodies responsible for assessing action will examine the suitability of and compliance with resistance-related measures in greater depth than in the past.

The prime responsibility for implementing this measure lies with the Confederation and the cantons. Partners for implementation are the companies and institutions concerned working in research, development, diagnosis and production.

3.3 Appropriate use of antibiotics





If antibiotics have to be used, appropriate use minimizes the development of resistance and so reduces infections by antibiotic-resistant pathogens. This depends on the bodies involved being well trained and having practical information. It is also important that patients understand the principles underlying the use of antibiotics. In addition, it is important for there to be binding rules that are applied consistently and rigorously.

Objective

Rules on the appropriate use of antibiotics will be defined in accordance with the current state of understanding. These will be binding and implemented consistently.

Measures

The following measures will make a significant contribution to achieving the objectives:

Measures	Areas
3.3.1 Develop guidelines on the prescribing, dispensing and use of antibiotics and ensure their implementation	
3.3.2 Restrict the prescribing, dispensing and use of antibiotics	
3.3.3 Facilitate access to expertise	
3.3.4 Develop methods to deal with above-average use of antibiotics	

3.3.1 Prescription guidelines



Prescription guidelines

Develop guidelines on the prescribing, dispensing and use of antibiotics and ensure their implementation

Responsible use of antibiotics will be encouraged by the elaboration and nationwide application of uniform guidelines based on the current state of knowledge. These will define the conditions under which antibiotics are sold and will also designate the (classes of) antibiotics that should only be used in very specific situations.

In human medicine, the learned societies dealing with various disciplines, such as infectious diseases, paediatrics, internal medicine, pneumology etc., produce treatment guidelines for doctors working in hospitals and in the community, taking account of the current state of scientific understanding. Treatment guidelines are also devised by expert teams working in the infectious diseases departments of various hospitals.⁴⁶ The treatment guidelines have no official status and there is no control over whether and which guidelines are implemented.

In veterinary medicine, guidelines on the prudent use of veterinary medicines do exist (Good Veterinary Practice guidelines / GVP guidelines)⁴⁷, but they are not

⁴⁶ Institute for Infectious Diseases IFIK of Bern University & Bern University Hospital (2012). *Richtlinien für den Gebrauch von antimikrobiellen Substanzen [Guidelines on the Use of Antimicrobial Substances]. Resistenzübersicht [Summary of Resistance], only available in German.*
http://www.ifik.unibe.ch/unibe/medizin/ifik/content/e7961/e8088/e8553/e527294/Richtlinien_Antibiotika_2014-8_ger.pdf

⁴⁷ http://www.gstsvs.ch/fileadmin/media/TAM/de/TAM-Richtlinien/Sorgfaeltiger_Umgang_mit_TAM.pdf
[only available in German]

binding. Results of studies⁴⁸ show that the majority of prescriptions comply with the guidelines on the careful use of antibiotics. However, there are considerable differences among individual veterinary practices regarding the amounts of antibiotics prescribed and the active substance classes used. Consequently, it must be assumed that there is room for improvement.

The use of antibiotics as growth and performance promoters in livestock has been prohibited by law in Switzerland since 1999. The decision to use a veterinary medicinal product, and which one to use, is made by the veterinarian in charge following accurate diagnosis or evidence from laboratory tests, taking account of the specific features of the farm, including feed management. Guidelines on the appropriate use of antibiotics are drawn up by the Swiss Society of Veterinarians. The cantonal veterinary services are responsible for controlling the use of veterinary medicinal products.

Implementation of the proposed measure will lead to the elaboration and regular updating of guidelines for human and veterinary medicine, and coordination among the areas concerned. The guidelines will include information on when antibiotic prescribing is indicated, the choice of antibiotic, dose, and duration of treatment. In this way the guidelines will help the individuals administering them to choose the right antibiotics and administer the right amount. Consideration will be given to the need for amendments to the laws on the proper prescribing of both human and animal medicinal products.

In veterinary medicine, the existing GVP guidelines produced by the Swiss Society of Veterinarians (SSV) will also be revised and made binding. Information and training in the veterinary profession will publicise the treatment guidelines that will be drawn up for each animal species. Overall, a more focused use of antibiotics and a drop in consumption, especially of critical antibiotics, will be the result, and will not endanger animal welfare or animal health.

The prime responsibility for implementing this measure lies with the learned societies, with the support of the Confederation. Partners for implementation are the medical and veterinary professions, universities/universities of applied science, associations and specialists.

3.3.2 Restriction



Restriction

Restrict the prescribing, dispensing and use of antibiotics

Criteria for the prescribing, dispensing and use of antibiotics will be drawn up and regularly updated. They will be applied consistently and will relate in particular to the prescribing, dispensing and use of antibiotics recently placed on the market. Their use will be severely restricted by having them classified as reserve antibiotics.

There are at present no restrictions in Switzerland on the antibiotics which doctors can prescribe for human patients. There are also no rules for dealing with antibiotics that have been recently developed or are classified as critical. The WHO concept of Critically Important Antibacterial Agents⁴⁹ and the associated rules and restrictions have not yet been introduced. This concept considers the following criteria for deciding whether an antibiotic is to be considered critical:

⁴⁸ Regula, G., et al. (2009); *J Antimicrob Chemother* 63(4): 805-811: *Prescription patterns of antimicrobials in veterinary practices in Switzerland.*

⁴⁹ Critically Important Antibacterial Agents for Human Medicine for Risk Management Strategies of Non-Human Use, 3rd revision. http://www.who.int/foodborne_disease/resistance/cia/en/

- The antibiotic substance is the only, or one of few, treatments available for a serious human disease.
- The antibiotic substance is needed to treat diseases that are transmitted to humans from non-human sources or that are caused by pathogens that can absorb resistance genes from non-human sources.

Antibiotics that are classified as critical should in theory only be used if other antibiotics cannot be used because they are not sufficiently effective or because pathogens are known to be resistant to alternatives. In order to achieve this, it is necessary to define clear and binding criteria setting out the conditions under which they can be used, along with treatment guidelines.

The prescribing, dispensing and use of antibiotics in animals are defined in the VMPO. To date, the conditions for individual substance classes have always been the same irrespective of their importance. At present, a veterinarian is permitted under article 11, clause 2 of the VMPO to dispense stocks of veterinary medicinal products (including antibiotics) lasting for a few months to a farmer with whom he has concluded a veterinary medicinal products agreement (VMP agreement). Critical antibiotics are often used in livestock farming even though they are more expensive than first-choice antibiotics, because required doses are often lower, administration periods short and efficacy very good. In the case of some animal species (especially poultry), the only medicinal products available for some diseases are those which contain critical antimicrobial active substances.

Implementation of the proposed measure will lead in particular to restrictions on the use of active substances classified as critical antibiotics in human and veterinary medicine. To this end, antibiotics will be classified in various groups according to defined criteria. The use of antibiotics will be restricted according to their classification. Restrictions should be formulated on the basis of scientific criteria and reflect the latest findings and research results.

In the veterinary area, clear criteria should be defined as to the conditions under which critical antibiotics may be used on livestock and pets. In addition, veterinarians should no longer normally be permitted to dispense stocks of critical antibiotics to animal owners. Restrictions should be defined on the prophylactic use of antibiotics in animals. The next stage will be to ascertain whether further restrictions are needed. The criteria for the prescribing, dispensing and use of critical antibiotics should be enshrined in law. When defining the criteria, care must be taken to ensure that animal welfare and animal health are not endangered.

In agriculture, the appropriate use of the antibiotic streptomycin to control the bacterial plant disease fire blight will be assessed and amended if necessary.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are the veterinary and medical professions, pharmacists, universities/universities of applied science, the cantons and the relevant learned societies.

3.3.3 Expertise



Expertise

Facilitate access to expertise

Access to specific expertise and advice will be provided as required for specialists and for people affected by antibiotic resistance.

Specialists such as infectious diseases experts, experts in travel medicine and tropical medicine, and specially trained veterinarians have particular expertise in the field of antibiotic resistance as a result of their field of work. Individual

healthcare facilities also have consult facilities to answer infectious diseases-related questions. However, there is at present no guarantee that people affected by antibiotic resistance (doctors, veterinarians, animal owners, patients) can find an expert in a difficult situation.

Implementation of the proposed measure will ensure that stakeholders and interested parties can gain access to an expert to obtain advice. In human medicine, potential carriers of antibiotic resistance and high-risk groups⁵⁰ should be able to obtain expert advice on prevention and the risk of transmission. Preventive advice will be offered to patients at higher than normal risk of having to undergo challenging treatment because they are carriers of resistant bacteria. The population will be informed of this source of advice, and targeted messages will be sent to those concerned to inform them of a point of contact for their questions, concerns and treatments.

In the area of veterinary medicine, contact points with experts on antibiotic resistance who know the specific needs of veterinarians and animal owners will be created.

The prime responsibility for implementing the measure lies with the Confederation and the cantons. Partners for implementation are the veterinary and medical professions, learned societies, universities/universities of applied science, animal health services and the relevant associations.

3.3.4 Above-average use of antibiotics



Above-average use of antibiotics

Develop methods to deal with above-average use of antibiotics

Having established average consumption figures for antibiotics, work will be done to identify the hospitals, medical practices, veterinary practices and farms where use is above-average. Systems for a gradual process will be developed that will enable persistently high prescribers, dispensers or consumers of antibiotics to reduce the frequency of use.

Integrated monitoring already exists in the field of human medicine through the work done by anesis.ch on the consumption of antibiotics in hospitals. A benchmarking exercise is carried out every year and the anonymised results are sent to hospitals who are part of the voluntary reporting network. This enables them to compare their statistics with those of other healthcare facilities and to consider any improvements that might be necessary.

There is currently no comprehensive system for recording and assessing antibiotic consumption in the veterinary sector. As a result, there is no basis for identifying chronic above-average use of antibiotics and helping those affected.

Implementation of the proposed measure will, in the area of human medicine, lead to a concept that quantifies the frequency of above-average consumption of antibiotics and assesses its relevance for the formation of resistance. To this end the reasons for prescribing will be investigated and possible inappropriate prescribing will be assessed. Qualitative, verifiable indicators will be introduced for the prescribing of medication for certain infections, such as urinary tract infections and pneumonia. Consideration will be given to identifying areas where the existing

⁵⁰ Elderly people, infants, people with immunodeficiency, patients in intensive care, people who are about to undergo surgery or have recently had surgery, cancer patients, people who have suffered burns, people travelling to high-risk destinations, hospital staff, farmers and doctors.

benchmarking system can be improved and to deciding whether any other effective measures can be taken.

In the area of veterinary medicine, a system for the comparative recording of antibiotic use among veterinarians and farmers will be developed on the basis of data from the antibiotics database. Awareness can be increased by enabling relevant agents to access information on how their consumption compares to the average. In the longer term, a system will be developed that will gradually provide for additional measures with respect to the duration and level of treatment. Particular consideration will be given to seeking veterinary advice to investigate the reasons behind high use, devising a plan and implementing measures to reduce consumption, along with enhanced inspections by cantonal enforcement authorities. Links to other databases incorporating data on morbidity, mortality, findings after slaughter and yield in their assessments may also be useful here.

Prime responsibility for implementing the proposed measure lies with the Confederation and the cantons. The gradual introduction of additional measures will take place in conjunction with the associations, veterinarians, doctors, health insurance funds, animal health services and universities/universities of applied science.

3.4 Resistance control





Since even appropriate use of antibiotics cannot entirely rule out the development of resistance, care must be taken to ensure that resistance can be rapidly identified and appropriate action can be taken. Moreover, the transmission and spread of resistance must be limited as far as possible.

Objective

The transmission and spread of resistant organisms will be minimized in order to reduce overall antibiotic resistance.

The following measures will make a significant contribution to achieving the objectives:

Measures

Measures	Areas
3.4.1 Prevent the entry of resistance into healthcare facilities and animal herds and its subsequent spread	
3.4.2 Devise and implement guidelines on the targeted outbreak control of relevant forms of resistance	
3.4.3 Assess measures to reduce the spread of antibiotic resistance throughout the food chain	
3.4.4 Reduce antibiotic resistance through the implementation of measures aimed at eliminating substance traces in waste water purification plants	

3.4.1 Prevent the introduction and spread of resistance



Prevent the introduction and spread of resistance

Prevent the introduction and spread of resistance in healthcare facilities and animal herds

Organism- and resistance-specific measures will be taken to prevent the introduction and spread of antibiotic resistance, and the efficacy of these measures will be assessed.

The major risk of introduction in the area of human medicine is when patients are admitted to a healthcare facility or transferred from one healthcare facility to another. Patients who have been treated in a country with a high risk of transmission of antibiotic-resistant organisms constitute a particular risk. Some hospitals are already introducing special screening measures when admitting certain patient groups. It is extremely important that the results of screening tests are passed on when such patients are referred to another healthcare facility or to their GP.

Implementation of the proposed measure in the area of human medicine will lead to the production of criteria for rapid identification of resistance carriers when patients are being transferred between healthcare facilities. These patients need specific management to prevent the spread of resistance. It is intended that all Swiss healthcare facilities will apply the same criteria. Before the criteria are introduced nationwide, a review will be conducted to decide how their systematic application can have the best impact at the time of hospital admission. An approach to targeted and efficient implementation will also be devised. In this area, again cooperation with other countries needs to be taken into consideration.

In the area of veterinary medicine, the emphasis lies on the import of pre-treated animals, the introduction of resistant genes to animal herds and their transmission among different herds, and reducing the risk of resistance being transmitted between animals and people as a result of contact with pets and livestock. Hygiene and biosecurity measures are critical in this context for the prevention of diseases in animal herds, and reduce the risk of resistant organisms entering an animal herd or being transferred from one herd to another.

The implementation of these measures will involve the production of information brochures for animal owners and veterinarians, explaining how best to interact with livestock and pets that are carriers of multi-resistant organisms. In addition, consideration will be given on how to prevent the import into Switzerland of eggs and chickens from lines that have undergone prophylactic antibiotic treatment.

As there are still major gaps in our understanding of how specific forms of resistance are transmitted and spread between people, pets and livestock, and among individual people, an interdisciplinary approach is essential in the first instance before specific control measures can be devised. This will also allow efficacy to be assessed.

Prime responsibility for implementing the proposed measure in the area of human medicine lies with the cantons, the healthcare facilities and their specialists. In the area of veterinary medicine, prime responsibility lies with the Confederation. Partners for implementation are the cantons, the veterinary profession and industry.

3.4.2 Targeted prevention and control of outbreaks



Devise and implement guidelines on targeted outbreak control

Targeted outbreak control

Targeted outbreak control will be devised for all relevant resistant organisms and implemented nationwide in all areas of healthcare. Pathogen-specific processes for isolation, quarantine, treatment and environmental decontamination will be standardised.

Many hospitals already have internal guidelines on infection control. These guidelines take account of the specific features of the facility and the prevalence and incidence of local pathogens. However, it is unclear whether they are implemented and whether smaller healthcare facilities in particular have sufficient expertise and detailed outbreak control plans to prevent and combat outbreaks of disease caused by antibiotic-resistant organisms. Implementation of the proposed measure

is intended to ensure that every facility in Switzerland has an infection control plan. It must be able to rapidly identify carriers of resistance, individual patients who are ill, and outbreaks of antibiotic-resistant pathogens.

In the area of veterinary medicine, it is at present almost impossible to conduct targeted outbreak management among livestock herds because of the relatively high prevalence of resistant pathogens and the high likelihood of reinfection. An assessment must be performed to identify the resistant pathogens for which outbreak control is appropriate and feasible before outbreak control guidelines can be devised for relevant pathogens. In the case of pets, outbreak control guidelines for certain resistant pathogens could be conceivable, involving isolation, quarantine, treatment and additional precautions taken by owners.

Implementation of the proposed measure will involve the creation and publication of control strategies for relevant resistant pathogens. The aim is to ensure that outbreak control in Switzerland is carried out in a consistent, efficient and standardised manner.

Prime responsibility for implementing the proposed measure lies with the Confederation and the cantons. Partners for implementation are the healthcare facilities, the veterinary and medical professions and animal health services.

3.4.3 Food chain



Food chain

Assess measures to reduce the spread of antibiotic resistance throughout the food chain

Measures aimed at minimising the spread of antibiotic-resistant bacteria throughout the plant and animal food chains will be assessed.

Food legislation requirements already ensure that food is produced in a hygienic environment and that it does not put consumers' health at risk. However, it is impossible to guarantee that food reaching consumers is completely free from resistant bacteria. Consequently, the level of antibiotic-resistant organisms in food must be kept as low as possible.

In some cases there are no effective measures that would minimise the introduction of resistant organisms to the slaughterhouse or the resulting contamination of carcasses, while in other cases the use of such measures is prohibited by law. Gaps in knowledge here must be filled, and any changes to legislation, also taking account of changes to EU legislation, must be examined. In addition, research must be conducted to ascertain how the spread of resistance or of antibiotics into the environment can be prevented (e.g. disposal of milk containing antibiotics, disposal of animal excretions).

Resistance can reach humans indirectly along the plant or animal food chains. This is why it is essential to assess multi-stage measures aimed at reducing the spread of antibiotic-resistant bacteria by this route. This also applies to imported food. Particular emphasis will be laid on developing hygiene and decontamination measures and campaigns to improve kitchen hygiene among consumers.

The practice of feeding milk containing antibiotics to calves also needs to be assessed. Although the Veterinary Medicinal Products Ordinance (VMPO) regulates the withdrawal period for animals fed on this milk and stipulates maximum permitted concentrations, the risk of calves developing resistance is not clearly understood. At present there are no practicable better alternatives for disposing of milk containing antibiotics.

Prime responsibility for implementing the proposed measure lies with the Confederation and the cantons. Partners for implementation are the consumer associations and the Food Safety Institute of Zurich University.

3.4.4 Waste water purification facilities



Waste water purification facilities

Reduce antibiotic resistance through the implementation of measures aimed at eliminating substance traces in waste water purification plants

In future, substance traces will be eliminated from waste water in Switzerland. Work will be done to clarify the extent to which existing measures aimed at eliminating antibiotics and other substance traces from waste water are also suitable for eliminating antibiotic-resistant organisms, and whether any more economical and effective alternatives are available.

Parliament has already adopted a revision to the Federal Act on the Protection of Water, which will create a special nationwide funding structure for measures to combat microcontamination in central waste water treatment plants (WWTPs).⁵¹ In a package of measures with an improved cost-benefit profile, an additional decontamination step will be included at around 100 of the more than 700 WWTPs in the country by 2040. The aim is to achieve an overall reduction in the level of microcontamination in treated waste water. Hormonoactive substances are the best-known example of such microcontamination. These are chemicals which can mimic the effect of endogenous hormones and so can be classified as harmful to health in some cases. However, the measures also appear suitable for removing any antibiotics still present in waste water at least.

Based on the WWTP selection criteria already in place, implementation of the proposed measure will also take account of the need to reduce antibiotic use and combat antibiotic-resistant organisms. A detailed examination will be carried out to ascertain whether the decontamination methods used are also capable of removing or killing resistance genes and resistant organisms. Suitable methods for detecting antibiotics, resistance genes and resistant organisms in waste water must also be developed to this end. These methods will be produced as part of the ongoing work to implement the provisions of the Federal Act on the Protection of Water with regard to the funding of WWTP measures to eliminate substance traces.

Prime responsibility for implementing the proposed measure lies with the Confederation and the cantons. Partners for implementation are the communes.

3.5 Research and development

Targeted and interdisciplinary research efforts are needed to fill any gaps that still exist in our understanding of how antibiotic resistance occurs, how it spreads and the impact this has on the epidemiology of human and animal pathogens and disease. A better understanding of the issue of antibiotic resistance will create the foundations for ensuring that targeted and efficient measures can also be taken in the future. Further research will also investigate alternative treatment methods and products.





Interdisciplinary research into the development, transmission, spread and control of resistant bacteria will be intensified. This research will also provide the basis for the targeted development of antimicrobial substances and cost-effective diagnostic products.

Objective

⁵¹ <http://www.admin.ch/opc/de/federal-gazette/2013/5549.pdf> [not available in English]

The following measures will make a significant contribution to achieving the objectives:

Measures

<i>Measures</i>	<i>Areas</i>
3.5.1 Create an interdisciplinary platform for research into antibiotic resistance and define key research areas	
3.5.2 Basic principles concerning the entry of antibiotics into farmyard manure, soil and water and their persistence and activity	
3.5.3 Promote new diagnostic methods	
3.5.4 Determine the significance of the cross-border movement of people, animals and goods on the resistance situation in Switzerland	

3.5.1 Interdisciplinary platform



Interdisciplinary platform

Create an interdisciplinary platform for research into antibiotic resistance and define key research areas

A platform will be created that will give researchers an up-to-date overview of ongoing research projects into antibiotics and antibiotic research being conducted by all those involved, and allow them to define key research areas.

Fundamental research into new resistance mechanisms, their spread and impact on the epidemiology of human and animal pathogens and diseases as well as possible methods of antimicrobial control is conducted primarily at universities. A typical example of this is an international project headed by Bern University on the development of an alternative to antibiotics based on liposomes. A patent application for the new active substance was filed in 2014⁵². In June 2015 the Federal Council launched a five-year National Research Programme (NRP), «Antimicrobial Resistance - a One-Health Approach» in order to further boost research in the field of antibiotic resistance.

The development of antibiotic resistance in persistent organisms that are pathogenic in humans and their dynamics in food production systems that are relevant to the Swiss agrifood sector are monitored by Agroscope. The FSVO supports research work that investigates connections between human and animal resistance at molecular genetic level or that assesses the impact of intervention measures on antibiotic consumption and antibiotic resistance.

Although numerous studies have investigated the development, transmission, spread and control of resistant bacteria and diagnostic methods, interdisciplinary approaches are lacking. Coordination is insufficient among researchers working in the fields of human and animal medicine and the environment. This is reflected in the frequent failure to identify links; moreover, possible synergies – such as the use of sample material and data in different projects – are seldom harnessed.

The interdisciplinary platform for antibiotic resistance established by implementation of the proposed measure will create an overview of current research projects in all areas concerned. This will allow gaps in research to be identified and the

⁵² <http://www.kommunikation.unibe.ch/unibe/rektorat/kommunikation/content/e2328/e6188/filesobject570060/AntibioticsAlternative.pdf>

need for research to achieve the objectives of the antibiotic strategy to be ascertained. This information can serve as the basis for producing a catalogue of essential research projects. These should be prioritised and addressed in a targeted fashion. The researcher network can be strengthened, and it will be possible to make better use of synergies.

In both human and animal medicine, key priorities are diagnosis to determine whether bacterial infection is present, research into alternatives to antibiotics (such as complementary medicines, phages etc.) and the development of vaccines and products that boost the immune system.

The need for research in the area of human medicine also includes assessment of data collected on the (financial) burden of disease, conducting studies on prescribing behaviour, and recording correlations between the resistance situation, prescribing patterns and the burden of disease. Focus will also be placed on clinical, patient-oriented research to improve antibiotic treatments. Another question to be addressed by research is whether, and to what extent, substances containing antibiotics that are available without prescription, such as certain throat medicines, and substances that have an antibiotic impact, such as products applied to the skin, are relevant to the development of resistance.

In the area of veterinary medicine, questions on the development, spread and transmission of resistance and resistance properties will be investigated. The assessment of conditions with the potential to avoid infections arising in the first place (management, hygiene) must not be neglected. Research in the fish-farming sector is needed as well.

In the environmental field, research must be carried out to determine which measures can reduce or prevent the entry of antibiotics and antibiotic resistance into waterways. This includes measures taken at the source, such as hospitals, treatment of waste water sub-streams and central measures at communal waste water treatment plants. Investigations must be carried out to ascertain the extent to which measures already known to be capable of eliminating antibiotics and other substance traces from waste water are also capable of eliminating antibiotic resistance.

Another aspect of coordination is prioritising research methods and developing and producing new antibiotics and other antimicrobial substances as part of the departmental research carried out by official bodies if it is not already being directed by the new National Research Programme (NRP) «Antimicrobial Resistance - a One-Health Approach». Questions on possible financial incentives, economic models and intellectual property must also be examined in order to launch and accelerate closer cooperation between industry, universities/universities of applied science and the Confederation in the development and production of new antibiotics.

The coordination of the measure will be coordinated with current and planned research projects under the new National Research Programme (NRP).

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are the cantons, universities/universities of applied science, private institutions and industry.



Set out basic principles concerning the entry of antibiotics into farmyard manure, soil and water and their persistence and activity

A feasibility study will be conducted to establish the basic principles for the long-term monitoring of antibiotics and resistance in farmyard manure, soil and water. To this end, the pathways for the entry and spread of antibiotics and resistance genes will be explored, and options developed for measuring antibiotics in the soil and resistance genes in soil bacteria. In addition, the influence of antibiotic use in fish farms and its effects on waterways and aquatic organisms will also be assessed.

The Swiss Soil Monitoring Network (NABO)⁵³ is the national body responsible for surveying, and as such has an in-depth understanding of the soils investigated and the related land-use history. Since the middle of the 1980s it has recorded all farming data from just under 50 selected farms. The information obtained indicates the inputs and outputs of typical Swiss farms. Combined with on-going soil monitoring activities and deep-frozen soil and slurry samples already held, the current plan would allow investigations to be expanded to include antibiotic residues and resistance in farmyard manures and soil.

Implementation of the proposed measure will provide a cross-sectional feasibility study that will set out the basic principles of long-term antibiotic monitoring. The focus will be on farmyard manure (dung and slurry), soil and water. The aims are to ascertain how far antibiotics can be detected and interpreted in the soil and to detect the presence of resistance genes in the bacteria. It is important to investigate the entry and spread routes (manure from stables, farmyards and fish farming, water, soil, and agricultural produce) of antibiotics and resistance genes so that an antibiotic monitoring scheme is designed as efficiently as possible. The data obtained in this way can also be analysed regarding any influence on the three levels of biodiversity (species, habitats and genetic diversity). Once the monitoring scheme has been devised and tested, it will become an instrument for ascertaining the success of measures taken to reduce antibiotic use and the spread of resistant bacteria in livestock farming.

Prime responsibility for implementing the proposed measure lies with the Swiss Soil Monitoring Network and Agroscope. Partners for implementation are the universities/universities of applied science.

3.5.3 Diagnostic methods



Promote new diagnostic methods

Research into new, cost-effective diagnostic methods for distinguishing between bacterial and viral infections and for the rapid detection of antibiotic resistance will be promoted. Newly developed methods will be incorporated in the diagnostic process promptly and in a targeted manner. Where necessary, measuring methods for detecting antibiotic resistance in the environment will also be developed.

Many diagnostic tools are currently not available locally, or the process of obtaining a result is too long or too expensive. Antibiotics are comparatively cheap. This is why there is sometimes considerable reluctance to have laboratory tests performed. As prevention, appropriate use and resistance control would be considerably enhanced by rapidly available and broadly applicable diagnostic tests, various

⁵³ <http://www.bafu.admin.ch/bodenschutz/10161/index.html?lang=en>

countries are currently examining ways of bringing such tests to market at a low cost.

By implementing the measure Switzerland is also committed to bringing diagnostic procedures to market that are faster and cheaper than those currently available. As the development of such measures is often very cost-intensive, cooperation among various stakeholders will be promoted. Examples include the development of a new method to diagnose *Mycobacterium tuberculosis* (MTB) and resistance to rifampicin, which has cut the testing time from two to eight weeks (based on a culture) to two hours (genetic diagnosis). The method was developed by a college of advanced education, and interaction between private-sector and public-sector stakeholders meant that it was quickly integrated into the relevant existing diagnostic process.

Prime responsibility for implementing the proposed measure lies with the industry, the advanced colleges of (technical) education and the (reference) laboratories. Partners for implementation are the learned societies, the Confederation and the cantons.

3.5.4 Transport of people, animals and goods



Determine the significance of the cross-border movement of people, animals and goods on the resistance situation in Switzerland

Transport of people, animals and goods

The extent to which resistance is imported and exported will be investigated, for example through medical services abroad, tourism, animals treated with antibiotics and food contaminated with resistant organisms.

Antibiotic resistance can be assumed to rise in line with increased mobility and global trade, especially because resistance is higher than average in some regions of the world. At present there is no national survey showing the effects of this on Switzerland.

According to Swiss Statistics, in 2012 Swiss citizens travelled abroad with an overnight stay around 13 million times. Over the same period, around 20 million trips were made to Switzerland by visitors from abroad. It can be assumed that some Swiss citizens travelling abroad had to make use of medical services during their trip, and that the same applies to foreigners travelling to Switzerland. These persons may have been at greater risk of exposure (medical procedures, close contact with people in countries with a high level of resistance, etc.).

In the food sector, approximately a fifth of all meat consumed in Switzerland is imported. The proportion of home-produced food varies from 2.3% (fish and crustaceans) to 97.7% (veal). However, there is no systematic method of recording differences in resistance in imported as opposed to domestically-produced meat and fish products or plant-based food. There have only been isolated studies. Animal health certificates have to be produced when animals cross the border. However, there is no requirement to document antibiotic treatment provided that withdrawal periods are respected. The extent to which resistance is imported or exported is not known.

Implementation of the measure will lead to studies being carried out to show the impact of cross-border travel of people and goods (animal- and plant-based food) on resistance. Better understanding of the source, spread or effects of these new forms of resistance on the epidemiological situation in Switzerland are an important first step to allow any measures needed to be taken.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are the cantons and the universities/universities of applied science.

3.6 Cooperation






Interdisciplinary and inter-sector national and international coordination in the effort to control antibiotic resistance is essential so that technical and strategic synergies can be used. If political, scientific and economic cooperation among stakeholders is still inadequate, it must be actively encouraged and improved. cross-sector harmonisation of activities is essential, and a common approach is desirable.

Objective

Cooperation among the various stakeholders at political, scientific and economic levels will be encouraged and coordinated beyond the boundaries of individual disciplines both nationally and internationally as part of the One-Health approach.

Measures

The following measures will make a significant contribution to achieving the objectives:

Measures	Areas
3.6.1 Create a cross-sector coordination body to implement the strategy	
3.6.2 Set up a consultative expert body on antibiotic resistance and antibiotic consumption	
3.6.3 Strengthen the involvement of learned societies, animal health services, other experts and stakeholders	
3.6.4 Strengthen links with other countries with regard to strategies, approaches and research	
3.6.5 Set up and intensify support for developing countries in combating antibiotic resistance	

3.6.1 Cross-sector coordination body



Cross-sector coordination body

Create a cross-sector coordination body to implement the strategy

A cross-sector coordination body will be created. Members will include the Confederation, the cantons, and other bodies, as required. Together they will ensure the coordinated cross-sector implementation of the antibiotic resistance strategy.

A cross-sector coordination body headed by the Confederation will be set up to ensure coordinated implementation of this strategy. This body will be responsible for ensuring that the strategy is implemented in a coordinated manner by all stakeholders and in all respects. Where difficulties in implementation arise, the process of reaching a solution will be a joint effort.

Implementation of the proposed measure will involve finding out which roles the stakeholders involved in devising the strategy (FOPH, FSVO, FOAG and FOEN as well as representatives of cantons, universities/universities of applied science, learned societies and expert groups) can play within the coordination body. Account will also be taken of the interfaces and synergies with the proposed One

Health sub-body (article 80f. of the Ordinance on the revised EpidA) of the coordination body set up under the revised Epidemics Act (article 54).

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are the cantons, stakeholders and institutions depending on how the measure is designed.

3.6.2 Consultative expert body



Consultative expert body

Set up a consultative expert body on antibiotic resistance and antibiotic consumption

A body will be set up to advise the Federal Council and the relevant federal offices on the implementation of the strategy.

A consultative expert body will be set up in tandem with the cross-sector coordination body.

It will be made up of experts from all the areas concerned. Consequently, it will be able to bring to the table expertise that is not present in the Federal administration, and at the same time ensure that stakeholders are involved.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are the experts in the specific fields.

3.6.3 Strengthening involvement of stakeholders



Strengthening involvement of stakeholders

Strengthen the involvement of learned societies, animal health services, other experts and stakeholders

The role of existing learned societies, research groups, animal health services and expert groups will be strengthened and supported. They will be involved in the production of guidelines and play a key part in the creation of networks and exchange of information.

Networks have been formed with various experts and stakeholders. In the area of human medicine, these include networks with various learned societies and their sub-groups, such as Swissnoso, and with associations such as H+, a body representing Swiss hospitals. In the area of animal medicine, the animal health services (pig health service, cattle health service, poultry health service, and the advisory and health service for small ruminants) play an important role. These are private-sector self-help groups whose objective is to maintain animal health by means of education, information and advice, to promote animal-friendly husbandry and guarantee the quality of animal-based food.

The cross-sector network of stakeholders that was created when the strategy was being devised will remain in place. Any existing local cooperation and exchange of information among different fields will be promoted and strengthened. Networking will be improved at various levels: the authorities and enforcement, as well as clinical activities, research and sectoral organisations.

As part of service level agreements, animal health services will be given specific tasks or asked to implement information and advisory activities. Discussions are currently taking place to ascertain whether and to what extent reorganisation could produce synergy effects and so improve animal health services. Any reorganisation will also be considered from the point of view of its contribution to implementing measures in the context of the antibiotic strategy.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are the learned societies and experts in particular fields.

3.6.4 Networks with other countries



Strengthen links with other countries with regard to strategic approaches and research

Experience from other national strategies will be continuously assessed and taken on board. Bilateral, international and multinational cooperation will be enhanced. The international exchange of views on research issues will be firmed up and boosted.

There are several worldwide and European initiatives and organisations that are also relevant to Switzerland. They include the Global Action Plan of the WHO⁵⁴, the Transatlantic Task Force TATFAR⁵⁵, the Central Asian and Eastern European Surveillance on Antimicrobial Resistance CAESAR⁵⁶, EARSnet⁵⁷ and the Joint Programming Initiative on Antimicrobial Resistance JPIAMR⁵⁸.

Switzerland is not linked to any European or international networks in the field of human medicine. anresis.ch would make submission of data to the EU possible, but Switzerland is not part of the European database. However, Switzerland is working towards ensuring that Swiss data are also taken into consideration in the future. The WHO CAESAR database currently publishes Swiss data.

A future health agreement with the EU would allow this cooperation to be strengthened and formalised.

International cooperation among individual stakeholders in the area of veterinary medicine is good, but there is no coordination to combine the relevant activities in this area and pass it on to interested groups. Switzerland regularly takes part in international meetings. It also takes part in EU working groups where possible. Other national strategies have been examined to see whether they are relevant to the Swiss antibiotic resistance strategy, and a wide variety of measures have been taken on board after modifying them to suit Swiss conditions. Exchanges of views via bilateral national contacts exist and are used.

It is important to Switzerland that established cooperation with the various working groups of the OIE, WHO, FAO, EFSA and the EU Commission should continue. Regular exchanges of views with other countries help us to learn from their experience and develop a joint approach.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are various national organisations, such as the learned societies and reference laboratories, and international organisations.

⁵⁴ http://www.who.int/drugresistance/global_action_plan/en/

⁵⁵ <http://www.cdc.gov/drugresistance/tatfar/>

⁵⁶ <http://www.euro.who.int/en/health-topics/disease-prevention/antimicrobial-resistance>

⁵⁷ http://www.ecdc.europa.eu/en/healthtopics/antimicrobial_resistance/database/Pages/database.aspx

⁵⁸ <http://www.jpiamr.eu/>

3.6.5 Support for developing countries



Support for developing countries

Set up and intensify support for developing countries

Support for developing and emerging countries in the area of antibiotic resistance will be enhanced, or set up where it does not yet exist.

The correct use of antibiotics and preventive measures such as improved sanitation⁵⁹ are the most effective instruments in the fight against antibiotic resistance. However, these cannot always be achieved in developing countries in particular because of a lack of resources and knowledge. Such countries often lack even the basic framework, e.g. prescription-only dispensing of antibiotics or availability of medical/veterinary services in all regions. Against a background of high population density, poor hygiene and a high incidence of infectious diseases, especially diarrhoea, indiscriminate and excessive use of antibiotics – especially broad-spectrum antibiotics – leads to new forms of resistance which quickly endanger other countries and continents. Several studies show that this worrying trend is already a reality in south Asia in particular.

Switzerland can help improve the situation by supporting projects run by multilateral organisations promoting appropriate use of antibiotics (WHO, FAO, OIE, World Bank) as part of existing development aid funding. The aim is to strengthen healthcare systems and competent national authorities in the medium to long term. Twinning projects have proven to be an excellent instrument in similar situations. Switzerland has practical experience in animal health and veterinary services, where veterinary medicinal products are also an issue. In twinning projects, a developing country and a developed country enter into a cooperation agreement with clear objectives and measures.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation will vary according to the nature of the individual projects.

3.7 Information and education

Gaps in knowledge and information about the development of antibiotic resistance must be plugged. This will enable specialists such as doctors, veterinarians, pharmacists, farmers, food producers, as well as the general public, to take informed decisions on the responsible and appropriate use of antibiotics, thereby contributing to reducing resistance.

Knowledge of antibiotic resistance will be improved among experts and the general public so that more responsible decisions are taken and resistance levels fall.

Objective

The following measures will make a significant contribution to achieving the objectives:

Measures	Areas	Measures
3.7.1 Inform the general public about the issue of antibiotic resistance and ways in which it can be prevented		

⁵⁹ The term 'sanitation' refers to secure, affordable and decent access to sanitary facilities, sustainable waste water and waste management that protects people against infection and is environmentally responsible, and awareness of necessary hygiene rules of behaviour.

3.7.2 Raise awareness among stakeholders affected



3.7.3 Enhance the basic and further training of doctors, veterinarians and animal owners



3.7.1 Public information



Public information

Inform the general public about the issue of antibiotic resistance and ways in which it can be prevented

More information will be provided to the general public about the development of antibiotic resistance, where antibiotics should and should not be used, and ways in which resistance can be prevented. This will allow individuals to take responsibility more effectively.

The public is certainly concerned about the development of antibiotic resistance, but knows little about it. What information the public does have is obtained from the general media. There are no current education or information campaigns aimed at drawing people's attention specifically to the problem of antibiotic resistance.

Implementation of the measure will give the public more information about what antibiotics are, how they work, their advantages and disadvantages, how they should be used (compliance) and why resistance can occur. The population should be aware of where antibiotics should and should not be used, of the alternatives to antibiotic treatment and of preventive measures. For example, they will be told that antibiotics are indeed a key element in the treatment of bacterial conditions but that inappropriate and unnecessary use can also have harmful consequences. This applies to antibiotic use among humans and animals.

Consumers will be informed that preventive animal health measures are the prerequisite for reduced and appropriate consumption of antibiotics. For example, they must be persuaded that vaccinations are a useful way of protecting animals from disease and so reducing the need to use antibiotics. Another aim is to increase acceptance of food that is more expensive but originates from less intensive farming.

High-risk groups will be given targeted information about the potential risk of their behaviour (including travel to parts of the world where resistance rates are high, possible infection routes such as surgery in certain countries), and told about strategies they can use to protect themselves. In the long term, this measure must be regarded as an ongoing task for all those involved.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are the cantons, healthcare facilities, pharmacists, consumer associations, learned societies and the media.

3.7.2 Raise awareness among stakeholders affected



Raise awareness among stakeholders affected

Raise awareness among stakeholders affected

Awareness of the issue of antibiotic resistance will be raised among stakeholders in all areas. Information will be tailored to specific target groups, and the specific requirements and needs of individual stakeholders will be taken into account.

In human medicine, medical students encounter the topic of antibiotic resistance during their training, and after qualification it is addressed at greater depth in specialist training for qualified doctors wishing to become consultants in infectious diseases, for example. Compulsory ongoing training ensures that doctors are

informed of the latest scientific discoveries. Various local campaigns have been launched to raise awareness among specialists, arising from the clinical setting in some cases. For example, the Swiss Society of General Internal Medicine (SGIM) has set up and runs a campaign called Smarter Medicine, which includes a list of points that specialists need to bear in mind. In May 2014 the SGIM stated that upper respiratory tract infections can be treated without antibiotics, without this leading to any serious consequences.

Stakeholders in the area of veterinary medicine have a very different fundamental understanding of antibiotic resistance, and awareness of the issue in this group varies considerably. Swiss veterinarians are considered to have relatively good knowledge of the need for caution when dealing with antibiotics, but they do not always act accordingly. There are no strategies for improving understanding of the issue. Many scientific publications do contain valuable information for animal owners. However, information is rarely presented in one of Switzerland's official languages and the level of language used is hard to understand. There is considerable room for improvement here: for example, the key findings of scientific publications could be presented more simply and made accessible to a broad audience.

Implementation of the measure will close gaps in knowledge and information. Material will be produced for specific target groups and on particular topics. Specialist journals will publish appropriate articles. In addition, a communication plan will be devised that takes account of differences among stakeholders and focuses on particular groups.

In the area of human medicine, care will be taken to ensure that the latest findings from research or arising from clinical use will be incorporated into the basic and further training of all healthcare professionals.

In the area of veterinary medicine, information about typical management mistakes, hygiene shortcomings and biosecurity problems will be produced for particular animal species and production forms. Specific guidelines will be drawn up for vocational groups (such as butchers, farmers, etc.) at higher risk of contact with bacteria originating from the environment or from animals.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are healthcare facilities, learned societies and the farming and industry associations affected.

3.7.3 Basic and further training



Enhance basic and further training of doctors, veterinarians and animal owners

Basic and further training

Training plans will be devised for professions affected in order to increase understanding of antibiotic resistance, diagnosis, preventive measures and appropriate use of antibiotics. In this context, consideration will be given to the issue of whether additional proficiency certificates are necessary and should be introduced. When stocks of veterinary medicinal products are dispensed under a veterinary medicinal products agreement, the requirement to provide training appropriate to the target group will be introduced.

The syllabus for medical studies covers the issue of the development of antibiotic resistance when treating infectious diseases. Modules on preventive measures are offered. Doctors training as specialists in infectious diseases, a specialisation recognised by the Swiss Medical Association, undergo comprehensive training in issues relating to antibiotic resistance and learn about anti-infective prophylactic, empirical and therapeutic treatments. However, antibiotic resistance is not yet

covered in separate training modules taken by doctors training for other subspecialties. The extent to which the topic is covered in further training is unknown.

In the area of veterinary medicine, students are taught about the issue of antibiotic resistance in a wide variety of courses. Veterinarians are required to keep their knowledge up to date throughout their career. Veterinarians who act as qualified persons in supervising farms that produce medicated feed on site must undergo further training and attend regular refresher courses. Antibiotic resistance is also a regular topic in on-going training courses for veterinarians. The further training requirements for veterinarians are not specified, and checks are rare.

Basic animal husbandry courses for farmers provide information about the conditions in which animals should be kept, their feeding, breeding, and diseases. Information about conditions includes various stable systems, the management of various production systems, such as climate control and ventilation, and animal welfare regulations. Courses on feeding cover different nutritional requirements according to whether animals are being reared for breeding, for fattening, etc. The information given about diseases includes hygiene (cleaning and disinfection), recognising metabolic disorders and the most common infectious diseases, and taking appropriate action. Participants also learn the correct management and use of vaccinations and veterinary medicinal products, including the VMP agreement. Farmers keeping dairy cattle receive in-depth training in the recognition and prevention of udder inflammations, including the use of antibiotics. Emphasis is to be placed on the general notion that promoting health is the key to prevention. More advanced courses could present the links between the administration of antibiotics, the development of resistance, vaccination and disinfection.

Implementation of the proposed measure will ensure that basic and further training courses transmit information about the issue of antibiotic resistance in an appropriate way, and that the information is applied. Consideration will be given in this context to identifying current gaps and deciding where the emphasis should be placed. These findings will be incorporated into training plans focussed on particular professions (doctors, veterinarians, farmers etc.)

The dispensing of stocks of prescription-only veterinary medicinal products to animal owners will be an exception that can only apply if a veterinary medicinal products agreement⁶⁰ is in place between the dispensing veterinarian and the animal owner. Veterinarians should no longer normally be permitted to dispense stocks of critical antibiotics to animal owners. As part of the work on revisions to the right of execution of the revised Therapeutic Products Act⁶¹ (of which the VMPO forms a part), consideration should be given to deciding whether farmers who hold stocks of veterinary medicinal products on their farm should be required to undergo further training.

Increasing specialisation among farmers means that veterinarians looking after livestock also need specific specialist knowledge. Specialised veterinarians should be recognised as such and be able to demonstrate their specialist status. A system should be set up to enable this for specialist qualifications relating to animal species or disciplines where this opportunity does not yet exist. Consideration will be given as to whether additional proficiency certificates in the area of human or veterinary medicine are required and should be introduced.

⁶⁰ In accordance with article 10 clause 2 of the VMPO

⁶¹ <http://www.bag.admin.ch/themen/medizin/00709/04667/04672/index.html?lang=en>. Scheduled to come into force in 2017

Prime responsibility for implementing the proposed measure lies with the Confederation together with the relevant learned societies. Partners for implementation are the cantons, training facilities and specialists.






3.8 General conditions

In addition to the fields of activity and measures described above, it is important to lay down the general framework conditions for the stakeholders in such a way that effective antibiotics will continue to be available and that they will be used responsibly. There is a need to ensure that there are no political, legal or financial incentives or market mechanisms that would stand in the way of achieving the objective. When adjusting this operating environment it will be essential to avoid counter-productive effects, such as the creation of a black market.

General framework conditions and incentives at the political, legal or financial levels will be created to ensure that effective antibiotics are available and are used responsibly.

Objective

The following measures will make a significant contribution to achieving the objectives:

Measures	Areas
3.8.1 Identify and modify market mechanisms and incentive systems	
3.8.2 Improve the general conditions for public health studies on antibiotic resistance	
3.8.3 Improve the availability of first-choice antibiotics and encourage the development of new antibiotics	
3.8.4 Strengthen consistent and harmonised enforcement	
3.8.5 Assess the introduction of targeted programmes on appropriate use of antibiotics	

Measures

3.8.1 Market mechanisms and incentive systems



Identify and modify market mechanisms and incentive systems

Market mechanisms and incentive systems that encourage antibiotic consumption will be identified and modified where possible. Key points where incentive systems help avoid the use of antibiotics or support responsible use of antibiotics will be identified.

Market mechanisms and incentive systems

There is considerable variation between the cantons as far as arrangements for self-dispensing in human medicine are concerned. In addition, hardly any research has been done to date into market mechanisms and incentive systems targeting the responsible use of antibiotics.

Some market mechanisms and incentive systems in the veterinary sector could even encourage antibiotic consumption. For example, bulk discounts on the purchase of high-margin medicinal products could affect the volume of antibiotics prescribed. Lower prices for darker-coloured veal could cause farmers to reduce the amount of added roughage and iron they feed to their calves, making the animals more susceptible to infectious diseases. Lower prices for commercial milk with a higher bacterial cell count are intended to improve health management and

milking management, but there is a risk that farmers will attempt to compensate for inappropriate husbandry by using more antibiotics.

The Confederation already encourages the breeding of livestock that is suited to local conditions, is healthy, high-yielding and robust, and that yields high-quality products through a commercially-focused and economical production system. Farmers' eligibility for direct payments depends on many factors, including compliance with animal protection standards. Farmers can also obtain more funding if they take part in animal welfare programmes, for instance by adopting more animal-friendly stabling systems or allowing their animals out of doors regularly. Livestock owners make a considerable contribution to improving the health of their animals by breeding and by keeping their animals in humane and hygienic conditions.

Implementation of the proposed measure will encourage examination of the question of whether political, legal and financial market mechanisms and incentive systems support the appropriate and cautious use of antibiotics. This examination will take account of the international context and the situation in neighbouring markets. Harmful incentives, such as inappropriate sales promotion and advertising for antibiotics and deleterious market mechanisms, will be identified and ways of reducing or eliminating them will be devised. Care will be taken to prevent counter-productive effects, such as the creation of a black market.

In the area of human medicine, proposals for healthcare facilities and primary care providers have been submitted but have yet to be examined. The emphasis will always lie on identifying and avoiding negative incentives and on creating positive incentives. For example, hospitals could be offered incentives for containing or stabilising the resistance situation. Benchmarking could enable comparisons to be made, and bonuses could offer an incentive to implement the necessary measures. For primary care providers, incentives could be linked to further training.

In the area of veterinary medicine, more information about animal health is needed in order to devise concrete incentive systems. Work must also be done to determine which incentives for farms promote animal health, reduce antibiotic use and mitigate the spread of antibiotic resistance. This process must determine the level at which each incentive (promoting advice, health passports, breeding etc.) needs to be set in order to achieve the desired objective.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are the cantons, learned societies and private stakeholders.

3.8.2 General conditions for studies



General conditions for studies

Improve the general conditions for public health studies on antibiotic resistance

Better general conditions will be created for research affecting the health of the entire population. Access to relevant, suitably anonymised data for research purposes will be made easier.

At present, data protection rules mean that researchers find it difficult or impossible to access national surveillance data. This makes it particularly difficult to conduct studies on the long-term retention of antibiotic efficacy in settings beyond that of pure scientific and medical research.

Implementation of the proposed measure will allow investigations to be carried out to ascertain how data can be made more usable, for example by anonymization or

confidentiality declarations, for research projects affecting the health of the entire population. The emphasis will lie on understanding the effects of guidelines on antibiotic prescribing and successful control of resistance, as well as information about the effects of the measures taken in the context of the strategy.

Prime responsibility for implementing the proposed measure lies with the Confederation. Partners for implementation are universities/universities of applied science and private institutions.

3.8.3 Improve the availability of antibiotics



Improve the availability of antibiotics

Improve the availability of first-choice antibiotics and encourage the development of new antibiotics

Efforts will be made to improve the availability of first-choice antibiotics on the Swiss market. This includes assessment of licensing conditions. Suitable measures will be put in place to support the development of new antibiotics and their appropriate use.

In the field of human medicine, high initial costs and the unfavourable economic situation are often cited as reasons for the slow pace of research and development of new medicinal products. At present too little is being done to create positive economic or scientific incentives to encourage the research, development and production of new medicinal products such as antibiotics, alternative medicinal products and vaccinations.

In the area of veterinary medicine, the only substances available in Switzerland for certain indications and species are classified as critical antibiotics. This is especially true of poultry. In some cases, especially diseases affecting fish and bees, no antibiotics at all are licensed. Critical antibiotics are used because of the absence of alternative products containing first-choice active substances. It is very expensive and time-consuming for an individual veterinarian to regularly obtain antibiotics from abroad for standard treatment under a special permit. There are already simplified procedures in place for licensing important veterinary medicinal products for rare diseases and rare species.

First-choice antibiotics are classified as less critical than other antibiotics as far as the development of resistance is concerned, particularly because alternative antibiotics are still available if resistance does develop. In order to improve the availability of first-choice antibiotics, consideration will be given, especially in the area of veterinary medicine, as to how the process of licensing necessary products and importing products licensed abroad can be simplified. Remedial measures for ever more frequent bottlenecks in supply must also be considered.

Even if new measures are able to reduce the development of resistance and so ensure that individual (classes of) antibiotics remain effective for longer, the development of new (classes of) antibiotics will still be an important weapon in the fight against antibiotic resistance in the future. Other countries have also taken the same view. For example, in the EU a tender has been launched for a project under the Innovative Medicines Initiative and the ND4BB programme (New drugs for bad bugs) aimed at developing new business models for the development and sale of antibacterial medication. Implementation of the measure will lead to examination of which approaches Switzerland should take in the future.

Prime responsibility for implementing the proposed measure lies with the Confederation. The partner in implementation is the industry. Swissmedic will actively support the targets set in the context of its statutory task.

3.8.4 Strengthen enforcement



Strengthen enforcement

Strengthen consistent and harmonised enforcement

More effective enforcement instruments will be created. Inspections, assessments of deviations and enforcement measures will be harmonised. The enforcement authorities will be made more aware of the issue of antibiotic resistance.

Inappropriate and excessive prescribing and dispensing of antibiotics is a violation of the duty of care of healthcare professionals (Articles 3 and 26 of the Therapeutic Products Act). Some of the measures of the strategy described here relate to the development of guidelines, concepts and criteria. A system of inspections is needed, in addition to training and awareness-raising among stakeholders, so that these rules are systematically applied.

The revised Epidemics Act specifically states that the cantons remain the main enforcement agencies in the field of human medicine. The role of the cantonal medical officer will be strengthened, and consistent enforcement of measures within the responsibility of the cantons will be improved.

In the area of veterinary medicine, implementation of the VMPO by the cantonal veterinary services will be monitored by regular inspections of animal owners and by inspections of retail outlets performed by veterinarians. Farm inspections will be carried out to monitor animal health and compliance with animal welfare standards. Harmonised checklists are available for farm inspections. Assessment of the inspections shows that there has been no decrease for years in the number of checkpoints where deficiencies are found. Some of this problem may be due to inconsistency or lack of harmonisation in enforcement.

Implementation of the proposed measure will create instruments that facilitate harmonised enforcement and ensure consistent implementation as well as risk-based and hence more targeted inspections. Recommendations to this effect will be devised. The enforcement agencies will also be made more aware of the importance of responsible use of antibiotics.

Prime responsibility for implementing the proposed measure lies with the Confederation and the cantons.

3.8.5 Programmes to encourage appropriate use of antibiotics



Programmes to encourage appropriate use

Assess the introduction of targeted programmes on appropriate use of antibiotics

Consideration will be given to whether comprehensive programmes can be established in hospitals, veterinary clinics, care facilities and veterinary and medical practices to promote the appropriate prescribing, dispensing and use of antibiotics and ensure the best possible treatment outcomes.

Antibiotics Stewardship Programmes⁶² are regarded as a systematic, sustainable effort on the part of a medical institution to improve and ensure appropriate use of antibiotics. The effective implementation of antibiotic stewardship programmes depends, among other things, on: a multidisciplinary team that is instructed by the management of the institution and has the resources it needs in order to work with users to draw up guidelines on the treatment of infectious diseases and ensure their implementation; making data on key infectious pathogens and resistance and

⁶² <http://www.antibiotic-stewardship.de>

on antibiotic consumption within the institution available; targeted training, education and information.

In the area of human medicine we do not at present know how many hospitals run antibiotic stewardship programmes or on what basis they do so. As a rule, larger hospitals are more likely to run such programmes than smaller ones. Although often interested in principle, institutions may lack the resources and necessary incentives.

The adoption of antibiotic stewardship programmes is not yet widespread in veterinary medicine.⁶³ One large-scale study on improving udder health carried out by Vetsuisse Bern and the Cattle Health Service (RGD) showed that moderated use – and, in particular, a regular dialogue among the farmers involved – significantly altered perceptions in one of the intervention groups, and that this effect lasted after the study had ended. Farmers felt better able to be part of the solution and significantly reduced their antibiotic use compared to the control group and other intervention groups.

Implementation of the measure will involve assessing which stewardship programmes should be implemented in the areas of human and veterinary medicine. The focus will lie on both outpatient and inpatient facilities. In order to identify the need for action it will be necessary to analyse the specific baseline situation with regard to antibiotic stewardship in (veterinary) hospitals, the prescribing habits of practising doctors and veterinarians, the consumption habits of the population and the use habits of animal owners. This information will be used to draw up implementation scenarios. Options in human medicine might include collating data on the resistance situation among inpatients and outpatients undergoing treatment in hospitals and at practices within a canton and among different cantons in order to benchmark the situation and allow for better assessment of measures.

Prime responsibility for implementing the proposed measure lies with the Confederation and the cantons. Partners for implementation are healthcare facilities, learned societies and the medical and veterinary professions.

⁶³ The first steps were taken in Canada in 2011, and during a conference (Antimicrobial Stewardship in Canadian Agriculture and Veterinary Medicine Conference) fields of activity were identified and responsibilities for promoting antimicrobial stewardship were assigned.

4 Aspects of implementation

4.1 Timetable and involvement of stakeholders

Work on implementation of the strategy will begin once it has been adopted by the Federal Council in early 2016. This will coincide with the entry into force of the revised Federal Act on the Control of Communicable Diseases in Humans (Epidemics Act). Detailed plans for implementation will be drawn up by the Federal Offices most closely involved (FOPH, FSVO, FOAG and FOEN).

Key stakeholders will be involved in implementing the strategy, as they were in its creation. This process will require a cross-sector coordination body (see chapter 3.6.1) and a consultative expert group (see chapter 3.6.2). The organisations responsible for each key measure are also required to involve other groups for particular topics.

4.2 Legal framework and changes to laws

It may be necessary for laws to be passed or ordinances to be amended so that the measures referred to in the strategy can be implemented. The exact action needed will have to be considered in the context of the implementation of individual measures. This review will take ongoing revisions into account. Stakeholders will be involved in accordance with the established consultation processes applicable to amendments to laws and ordinances.

The laws that are currently most relevant to the issue of antibiotic resistance are briefly described below. It is not a comprehensive list, as many other laws and ordinances contain points of reference, which are significant in some cases (e.g. animal protection legislation).

Epidemics Act

The Federal Act on the Control of Communicable Diseases in Humans (Epidemics Act, EpidA), which dates from 1970 and is still in force, does not at present deal with the problem of antibiotic-resistant organisms. This has been addressed by the total revision of the Epidemics Act, which was adopted by Parliament on 28 September 2012 and will come into force on 1 January 2016. A key part of this Act is the system for assigning powers to national and cantonal authorities. In future, the leadership role of the Confederation in particular will be strengthened in this respect. For example, it will be granted the power to determine, in cooperation with the cantons, the key national targets and strategies with regard to detection, prevention and control of communicable diseases.

While involving the cantons, the FOPH will devise national programmes on particular topics on the basis of the targets and strategies. The Act specifies, among other things, the creation of a national programme to control antibiotic-resistant pathogens. The aim of the programme is to define measures to monitor and control antibiotic-resistant pathogens, and align these measures with national and international requirements. At present Switzerland does not have a national programme for the prevention and control of antibiotic-resistant bacteria implemented by the Confederation. The revised Epidemics Act now provides the explicit legal basis for this.

Health Insurance Act

Article 24 of the Federal Act on Health Insurance of 18 March 1994 (HIA) sets out the principle that compulsory healthcare insurance covers the costs of services in the following areas, subject to certain criteria: the provision of general and healthcare services in the event of sickness, preventative medical services, congenital defects, accidents, maternity, legal abortion, dental treatments. The costs of medicinal products such as antibiotics are normally also covered. This is subject to

the provisos that the products are prescribed by a doctor, are used according to the package insert leaflet for the approved indications/uses and that they appear on the list of proprietary pharmaceutical products eligible for reimbursement (Speciality List – SL). The reimbursement of the cost of medicinal products on the SL can be limited to certain medical indications or subject to a volume cap. Health insurance also covers the costs of preparations prescribed by a doctor that are made up in the pharmacy and contain active ingredients and excipients featuring in the List of Tariff Medicinal Products (LTMP).

The purpose of the Therapeutic Products Act (TPA) is to protect the health of people and animals by ensuring that all therapeutic products on the market (pharmaceutical products and medicinal products) are high-quality, safe and effective. It is also intended to help ensure that pharmaceutical products and medicinal products on the market are used in moderation and as appropriate for their purpose. Healthcare professionals are required to comply with the current state of the art in prescribing, dispensing and administering pharmaceutical products (duty of care). The work currently taking place to revise the TPA⁶⁴ is intended to allow these rules to be described in more detail and made binding in ordinances. This new provision, which is aimed at making the use of pharmaceutical products safer, may help to reduce antibiotic resistance. The Federal Council sent its dispatch on the amendment of the Therapeutic Products Act⁶⁵ to Parliament on 7 November 2012. Parliament is now tasked with discussing the proposed legislation and its degree of detail, and making any further amendments as it sees fit. The revised TPA is expected to come into force in 2017.

Therapeutic Products Act

The revision of the TPA coincides with the revision of the Veterinary Medicinal Products Ordinance (VMPO)⁶⁶. It is aligned to the TPA and aims to ensure the proper use of veterinary medicinal products, to protect consumers from undesirable traces of veterinary medicinal products in foodstuffs of animal origin, and to safeguard animal health through the use of high-quality, safe and effective veterinary medicinal products.

Veterinary Medicinal Products Ordinance

As part of the ongoing partial revision of the VMPO, the proper use of veterinary medicinal products should be improved with a view to minimising antibiotic resistance. Any changes to legislation or new legislation that are needed in this context will be introduced during the ongoing ordinary revision of the TPA.

Under the current Epizootic Diseases Ordinance, monitoring has so far been restricted to pathogens transmitted directly from animals to humans and from humans to animals, and to indicator organisms in healthy animals. However, as resistance also plays a role in pathogenic organisms of animal origin, it may provide a valuable basis for the production of treatment guidelines. When the strategy is implemented it will be necessary to decide whether and to what extent the Epizootic Diseases Ordinance needs to be amended to allow monitoring of resistance among the main pathogens of various animal species.

Epizootic Diseases Ordinance

Under the Agriculture Act, the agricultural sector is required among other things to make a significant contribution to securing food supplies for the population, maintaining natural habitats and guaranteeing animal welfare through sustainable and market-oriented production. The Confederation is required to create a favourable general framework for production, to support the sustainable use of natural resources, to promote animal-friendly production, breeding, agricultural research and

Agriculture Act

⁶⁴ <http://www.bag.admin.ch/themen/medizin/00709/04667/04672/index.html?lang=en>

⁶⁵ <http://www.admin.ch/opc/de/federal-gazette/2013/1.pdf> [not available in English]

⁶⁶ <http://www.bag.admin.ch/themen/medizin/00709/04667/13929/index.html?lang=en>

advice, and to make direct payments to farms in return for services that benefit the community at large and contribute to land management. Payments for services relating to improved breeding, such as recording initial diagnoses in the health tests carried out according to the ICAR (International Committee for Animal Recording) system, are covered by the Animal Breeding Ordinance. Parliament has also approved funding to be made available for measures to be taken by the sector that benefit the community at large, as well as specific regional and sectoral projects to improve the sustainable use of natural resources. This funding comes under Articles 11, 77a and 77b of the Agriculture Act.

There is already a legal framework in the area of environmental protection, the scope of which could easily be widened to include antibiotics and antibiotic-resistant pathogens. The Environmental Protection Act (EPA) sets various standards for antibiotics and for resistant organisms, which are classified by law as substances or organisms respectively. Substances must be handled in such a way that they do not present a danger to the environment or (indirectly) to people (Articles 26-28). Articles 33-35 seek to protect the soil from chemical and biological dangers. Article 9 of the Waterways Protection Act (WPA) enables the Federal Council to impose requirements on the water quality of overground and underground waterways. However, these requirements still need to be specified in appendices 2 and 3 of the Waterways Protection Ordinance (WPO) with regard to antibiotics.

Article 9 of the EPA, in conjunction with article 6 of the Genetic Engineering Act (GEA) lays down further requirements on the handling of natural (EPA) or genetically modified (GEA) organisms, and so regulates their deliberate use. These requirements still have to be specified in more detail in the Containment Ordinance (CO) and the Release Ordinance (RO) and their appendices.

4.3 Resources and funding

An economic assessment (EA)⁶⁷ has been carried out to produce an initial estimate of the one-off and recurring costs to the public purse and private stakeholders. As it will only be possible to specify many aspects once the measures have been implemented, assumptions must be made regarding implementation and responsibilities which may change over the course of the implementation of the strategy. It must also be borne in mind that the EA was only able to assess measures for which the implementation procedure is already predictable. It is not yet possible to assess the cost implications of measures relating to testing, research or evaluation in particular because of insufficient information. Furthermore, some measures could generate very high and very different costs depending on how they are implemented, for instance measure 3.7.1 «Public information» or 3.6.5 «Supporting developing countries». Consequently, the figures below are rough estimates provided only for information.

In the case of the 16 measures that it was possible to assess, the EA shows the costs to be in the range of 5.2 to 9.7 million CHF (one-off costs) and 14.4 to 34.4 million CHF (annually recurring costs) for the Confederation and the cantons. It is not yet possible to assess costs to the private sector or individuals.

⁶⁷ Ecoplan, 2015; Volkswirtschaftliche Beurteilung der StAR-Massnahmen [Economic Assessment of StAR measures] (<http://www.bag.admin.ch/star>) [page not available in English]

The costs to the Confederation are associated primarily with the following measures:

The highest initial costs will be incurred by the «Improved animal husbandry» (chapter 3.2.4, > 0,5 million CHF) and «Comprehensive monitoring» (chapter 3.1.1, > 2 million CHF) measures. These two measures will also cause high recurring costs, as will the «Strengthening involvement of stakeholders» (chapter 3.6.3) and «Expertise» (chapter 3.3.3) measures. The recurring costs of all these measures will amount to over 1 million CHF, while the recurring costs of improved animal husbandry measures will exceed 7 million CHF. The initial and recurring costs of the «Reference laboratories and quality assurance» (chapter 3.1.2), «Supportive measures to promote animal health» (chapter 3.2.5), «Restriction» (chapter 3.3.2) and «Above-average antibiotic use» (chapter 3.3.4) measures are expected to be lower, at > 150,000 CHF in each case.

Confederation

It is intended that the cantons will have prime responsibility or be partners in implementation in 20 of the 35 measures of the strategy. They will be called on to act in particular in the «Monitoring», «Prevention», «Appropriate use of antibiotics», «Resistance control» and «General conditions» fields of activity. The average staff and funding requirements per canton relating to implementation of the strategy are likely to be around 50% FTE or around 120,000 CHF per year. The total annually recurring expenditure incurred in the cantons as a result of the strategy is around 3 million CHF. The cantons are responsible for implementing and scheduling the measures.

Cantons

The estimated costs depend on population levels, number of animals, etc. and can vary accordingly. The resources will be needed either in the form of staff being assigned to particular tasks or payments to third parties contracted to undertake these tasks, depending on how a canton decides to meet its obligations.

Private-sector companies are involved in or affected by the implementation of the strategy as well as the public sector. The close involvement of private-sector groups such as farmers, veterinarians, doctors, healthcare facilities, pharmacies and laboratories is of critical importance to the implementation of the strategy. The contribution of private stakeholders is vital, especially for prevention, the appropriate use of antibiotics and resistance control. The division of associated expenditure between the private sector on the one hand and the Confederation and the cantons on the other hand is not yet known. At the time of implementation it will be necessary to ascertain where changes to general conditions and incentive systems can support implementation.

Private sector

As the work continues, the question of funding the measures will undoubtedly present a challenge. The Confederation therefore believes that the following funding principles should apply:

Funding

- The financial commitment of private-sector organisations should be increased in order to improve the efficiency of implementation of the strategy. The use of national and cantonal funds and of resources of compulsory health insurance funds (CHIF) should in no way replace private funding.
- The remaining costs of individual measures will be allocated among the Confederation, the cantons and CHIF in accordance with the existing distribution of responsibilities between the two levels of government. Any shift in the burden between the Confederation and the cantons is to be avoided. After all, the principle of fiscal equivalence (beneficiary principle) must be properly reflected in cost allocation. This aspect is particularly important in relation to measures from which the CHIF and cantons are likely to obtain significant benefits.

Benefits

The funding modalities should be clarified with the cantons and with the stakeholders and organisations concerned when plans for implementation are being drawn up, on the basis of the aforementioned principles.

It is impossible to quantify the economic benefits of the strategy at present as data are not available. However, it is likely that stakeholders in all areas will eventually see a significant benefit from a reduction in levels of antibiotic-resistant organisms. For example, farmers will see their veterinary costs fall as their animals are healthier, hospitals will face lower rates of serious infections among patients, travellers will contract fewer infections, etc.

We know that resistant organisms are causing a rise in mortality rates and numbers of hard-to-treat infections in Switzerland as well as in other countries. This trend will continue in the future. According to the WHO, this will increase the financial burden on the healthcare sector and will also have financial consequences far beyond that sector, for example owing to the effects of restrictions on travel and trade. In the long term it is likely that, in the absence of intervention, the costs will exceed the investment made in implementing the strategy. This must be taken into account when deciding on the deployment of funds in the context of implementation of the strategy.⁶⁸

4.4 Evaluation

Article 81 of the revised EpidA requires the Federal Council to periodically monitor the efficacy, suitability and affordability of the measures taken under this Act. This also applies to the evaluation of this strategy. To this end an interim report will be published within five years after adoption of the strategy. This report will allow any required changes to the implementation process to be made. The interim report is intended to answer the following questions in particular:

- Can the targets be achieved?
- Were the correct implementation steps taken?
- Are the instruments and measures effective and efficient?
- What consequences can be drawn and what recommendations made in respect of any changes to the strategy, its targets and measures?

A full evaluation of enforcement and efficiency will be carried out ten years after adoption of the strategy (as defined in article 170 of the Swiss Constitution). Both the interim report and the full evaluation will take account of changes to the national and international situation in their analysis. The partners involved in implementing the strategy will be informed of the outcomes of all evaluations.

In the light of the evaluation reports a Public Health Action Cycle will be carried out to ascertain how far the targets have been met and what health gains have been achieved. Changes to implementation may be carried out in the light of these findings, and the findings may also be incorporated into a future strategy when it is formulated.

⁶⁸ WHO (2012), *The evolving threat of antimicrobial resistance – Options for action*

5 Acknowledgements

The antibiotic resistance strategy was drawn up in close cooperation with the stakeholders. The Federal Council would like to thank the institutions listed below which took part in strategy development workshops. Thanks are also due to all individuals who took part in expert groups and advisory groups, among other activities, and who are not mentioned here by name.

ACSI – Associazione consumatrici e consumatori della Svizzera italiana [Italian-speaking Switzerland Consumers' Association]
agridea - Swiss Association for Developing Agriculture and Rural Areas
Agroscope
anresis.ch – Swiss Centre for Antibiotic resistance
Aviforum / Poultry Health Service - Centre of Competence for the Swiss Poultry Industry
AWEL (Canton of Zurich) - Waste, Water, Energy and Air Authority
Bell
BGK - Advisory and Health Service for Small Ruminants
CHUV - Lausanne University Hospital
eawag - Federal Institute of Aquatic Science and Technology
SECB - Swiss Expert Committee for Biosafety
FAMH - Swiss Medical Laboratories Association
FiBL - Research Institute of Organic Agriculture
FMH - Swiss Medical Association
FRC – Fédération Romande des Consommateurs [French-speaking Switzerland Consumers' Association]
CMPH - Swiss Conference of Cantonal Ministers of Public Health
Greenpeace Switzerland
GST - Swiss Veterinary Association
HUG – Hôpitaux Universitaires de Genève, Service Prévention et Contrôle de l'Infection [Geneva University Hospitals, Infection Prevention and Control Service]
IFIK - Institute for Infectious Diseases
IG Kalbfleisch
Interlifescience
Interpharma – Association of Swiss pharmaceutical research companies
kf - Consumer forum
LDK - Conference of Cantonal Agricultural Directors
Micarna
Pharmasuisse – Association of Swiss Pharmacists
Pro Natura
Proviande
RGD – Cattle Health Service
SFU - Swiss Farmers' Union
scienceindustries – Business Association Chemistry Pharma Biotech
SGD - Pig Health Service
SKS - Consumer Protection Association
SMP - Swiss Milk Producers
SPO - Patient Protection Association
SSI - Swiss Society for Infectious Diseases
SSM - Swiss Society of Microbiology
SSP - Swiss Society of Paediatrics
STS - Swiss Animal Protection

STVT - Swiss Veterinary Association for Animal Protection
Suisseporcs – Swiss Pig-breeders' and Pig-producers' Association
SVVF - Swiss Association of Veterinary Firms
Swiss TPH – Swiss Tropical and Public Health Institute
SwissMedic
Swissnoso
Basel University Hospital, Hospital Hygiene Department
Zurich University Hospital, Clinic for Infectious Diseases and Hospital Hygiene
Fribourg University
Vetsuisse Bern
Vetsuisse Zürich
VKCS - Association of Swiss Cantonal Chemists
VKS - Association of Swiss Cantonal Medical Officers
VSKT - Association of Swiss Cantonal Veterinarians
WWF Switzerland

6 Annexes

6.1 List of abbreviations

ABS	Antibiotic Stewardship
AFC	Animal-friendly conditions
AgricA	Agriculture Act
AMR	Antimicrobial Resistance
ANQ	National Association for Quality Development in Hospitals and Clinics
anresis.ch	Swiss Centre for Antibiotic resistance
ARCH-Vet	Report on the sale of antibiotics in veterinary medicine and antibiotic resistance monitoring in livestock in Switzerland
CAESAR	Central Asian and Eastern European Surveillance of Antimicrobial Resistance
CC	Proficiency certificate (federal diploma)
CDC	Centers for Disease Control and Prevention (USA)
CDDEP	Center for Disease Dynamics, Economics and Policy
CIA	Critically Important Antibiotics
CMPH	Swiss Conference of Cantonal Health Directors
CO	Containment Ordinance
E. coli	Escherichia coli
EAAD	European Antibiotic Awareness Day
EAER	Federal Department of Economic Affairs, Education and Research
EARS-Net	Antimicrobial Resistance Interactive Database
EC	European Commission
ECDC	European Centre for Disease Prevention and Control
EFSA	European Food Safety Authority
EHEC	Enterohaemorrhagic Escherichia coli
EMA	European Medicines Agency
EPA	Environmental Protection Act
EpidA	Epidemics Act
ERA-NET	European Research Network
ESAC-Net	European Surveillance of Antimicrobial Consumption Network
ESBL	Extended Spectrum β -Lactamase
ESVAC	European Surveillance of Veterinary Antimicrobial Consumption
EU	European Union
EUCAST	European Committee on Antimicrobial Susceptibility Testing
EWRS	Early Warning Response System
EzDO	Epizootic Diseases Ordinance
FAO	Food and Agriculture Organization (UN)
FDHA	Federal Department of Home Affairs
FMH	Swiss Medical Association
FOAG	Federal Office for Agriculture
FOEN	Federal Office for the Environment
FoodA	Food Act
FOPH	Federal Office of Public Health
FP	Framework Programme
FSO	Federal Statistical Office
FSVO	Federal Food Safety and Veterinary Office
FVO	Federal Veterinary Office
GAP	Good Agricultural Practice
GHP	Good Husbandry Practice
GMO	genetically modified organism
GRI	Graduate Institute Geneva
GST	Swiss Veterinary Association

GVP	Good Veterinary Practice
HAI	Health and accident insurance
HIA	Health Insurance Act
IFIK	Institute for Infectious Diseases
IFSH	Institute for Food Safety and Hygiene
IMI	Innovative Medicines Initiative
JPIAMR	Joint Programming Initiative on Antimicrobial Resistance
MCP	Mastitis control programme
MF	Medicated feed
MPA	Medical Professions Act
MRSA	Methicillin-resistant Staphylococcus aureus
MUMS	Minor Use Minor Species
NABO	Swiss Soil Monitoring Network
NarcA	Narcotics Act
ND4BB	New Drugs for Bad Bugs
NGO	non-governmental organisations
NOSO	Nosocomial infections
NRP	National research programme
OIE	World Organization for Animal Health
PAHO	Pan American Health Organization
PIGS	Pediatric Infectious Disease Group of Switzerland
PP	Pharmaceutical premixture
PPP	Plant protection products
QUALAB	Swiss Commission for Quality Assurance in Medical Laboratories
RAUS	Programme to ensure that livestock have regular outdoor access
ReAct	Action on Antibiotic Resistance
RGD	Cattle Health Service
SCAHT	Swiss Centre for Applied Human Toxicology
SDC	Swiss Agency for Development and Cooperation
SGD	Pig Health Service
SGIM	Swiss Society of General Internal Medicine
SGM	Swiss Society of Microbiology
SNSF	Swiss National Science Foundation
SR	Classified Compilation of Federal Law
StAR	Swiss Antibiotic Resistance Strategy
SV	Specialised veterinarian
SVVLD	Swiss Association of Veterinary Laboratory Diagnosticians
Swissmedic	Swiss Agency for Therapeutic Products
Swissnoso	Swiss expert group for nosocomial infections and multi-resistant organisms
TATFAR	Transatlantic Task Force on AMR
TPA	Therapeutic Products Act
TRP	Technically responsible person
USA	United States of America
Vetsuisse Faculty	Combination of the veterinary faculties of Bern and Zurich
VMP	Veterinary medicinal products
VMPO	Veterinary Medicinal Products Ordinance
VPHI	Veterinary Public Health Institute
WHA	World Health Assembly
WHO	World Health Organization
WWTP	Waste water treatment plant(s)
ZOBA	Centre for zoonotic diseases, bacterial diseases and antimicrobial resistance

6.2 Glossary

Antibiogram	An antibiogram is the result of a laboratory testing for the sensitivity of an isolated bacterial strain to different antibiotics (source: Wikipedia). An antibiogram indicates whether the pathogen in question is resistant or sensitive to the antibiotic used in the test.
Antibiotic / antibiotics	Antibiotics are naturally occurring or artificially produced substances that can kill bacteria (bactericidal effect) or inhibit their growth (bacteriostatic effect). Antibiotics are used in human and veterinary medicine to treat bacterial diseases. They are not effective in viral diseases.
Antibiotic resistance	The phrase 'antibiotic resistance' summarises the properties of bacteria which allow them to weaken or completely neutralise the effect of antibiotics.
Anti-infective agent	Anti-infective agents are substances used to control infectious diseases. There are various types: antimycotics to control fungal infections, antiparasitics to control parasitic infection, antivirals to control viral infections and antibiotics to control bacterial infections.
Pharmaceutical premixture	Pharmaceutical premixtures are veterinary medicinal products intended for mixing with feed or drinking water for direct administration to a whole group of animals.
Outbreak	An outbreak is the term used to refer to clusters of infections in a particular place or at a particular time. Combined with the issue of resistance, outbreaks of multi-resistant bacteria are particularly problematic in hospitals, care facilities or farms.
Bacteria	<p>Bacteria are microscopically small single-cell organisms that exist everywhere in the air, water and soil.</p> <p>Bacteria also play a major role in the human body. For example, the human intestines are host to many bacteria which make up the group of intestinal flora which aid digestion. The skin of healthy people is colonised by harmless bacteria which make up the skin flora. Other bacteria are used for example in making yoghurt or cheese. However, bacteria can also cause disease.</p>
Herd management	<p>This is the term used to describe the continuous and systematic management by a veterinarian of a herd of livestock on a particular farm in order to prevent diseases and problems, independently of any treatment given to cure particular diseases.</p> <p>Shortcomings in feeding, in the conditions under which the animals are kept and in medical care are documented, targets for improvement are set, optimisation strategies are introduced and their success is monitored at regular intervals.</p>

Carbapenems	Carbapenems are antibiotics with a broad spectrum of antimicrobial action. Among other things, they are used to treat severe nosocomial infections.
Carbapenemases	Carbapenemases are enzymes that are able to divide certain antibiotics (beta-lactam antibiotics including carbapenems) and so render them ineffective. Bacteria that produce carbapenemases are therefore resistant to many antibiotics.
Cephalosporin(s)	Cephalosporins are a substance class of antibiotics use to treat bacterial infections. They are divided into generations according to their spectrum of action. The third and fourth generations are regarded as particularly important because they are the only effective antibiotics for some bacterial infectious diseases. Bacteria that produce ESBLs (see below) have become resistant to these newer generations.
Extended-Spectrum-Beta-Lactamases / ESBLs	Beta-lactamases are enzymes formed by bacteria that are able to divide certain antibiotics (beta-lactam antibiotics) and so render them ineffective. ESBLs have a broader spectrum, i.e. unlike normal beta-lactamases they can also divide more modern beta-lactam antibiotics. This means that bacteria which produce ESBLs are resistant to many antibiotics. Carbapenems remain effective against ESBL-producing bacteria.
Fluoroquinolones	Fluoroquinolones belong to the gyrase inhibitor group and so represent a newer principle of action. The more recent representatives of this class have a broad spectrum of action. In some cases, fluoroquinolones are still active on bacteria that are otherwise often resistant to antibiotics such as penicillins, cephalosporins and tetracyclines. This is why they are regarded as an important active ingredient class.
Medicated feed	Medicated feed is a ready-to-use veterinary medicinal product made up of a combination of a pharmaceutical premixture and feed or drinking water.
Health 2020	The Health 2020 report adopted by the Federal Council on 23 January 2013 sets out the priorities for Swiss health policy over the next eight years. It describes 36 measures in four priority areas for health-policy action which will be implemented in phases. They are directed at achieving a total of twelve objectives and are intended to align the Swiss health system optimally with current and future challenges.
Immune system	The immune system is the biological defence system of an organism that prevents pathogens or substances from outside the body damaging the organism. It is also able to destroy cells within the body that have become defective, such as cancer cells.

Vaccination	A vaccination is a preventive measure against infectious diseases. Administration of dead or weakened pathogens or parts of pathogens mimics a natural infection. This triggers the body's immune system to produce defensive substances that subsequently protect the person who has received the vaccination against the disease in question for a certain time.
Infection	The term 'infection' refers to the process by which pathogens enter, remain and then reproduce in the body.
Infectious diseases	The science of researching and treating infectious diseases.
Critical antibiotics	The World Health Organization (WHO) and the International Organization for Animal Health (OIE) assess substance classes of antibiotics for their efficacy in treating bacterial infections in humans and animals. As part of this strategy, antibiotics from the most relevant substance classes are designated as critical antibiotics, equivalent to the WHO class of «critically important antibiotics of highest priority».
Metaphylaxis / metaphylactic use of medicinal products	<p>Livestock farmers use veterinary medicinal products for treatment, metaphylaxis and prophylaxis.</p> <p>Treatment means targeted administration to animals which are already sick, and prophylaxis means administering medicinal products to prevent a disease. Metaphylaxis describes the situation in which some animals in the herd have become ill and as a result the entire group is treated to prevent the disease spreading. Antibiotics are mixed with feed or drinking water when used to treat groups or herds.</p>
Microorganisms	Microorganisms are microscopic creatures which can usually not be seen by the naked eye. They include some fungi, single-cell parasites, bacteria and viruses.
Monitoring	Monitoring is a continuous process of recording, administering, analysing, summarising and reporting data on the status, for instance the resistance situation, in a population over a given time. The purpose is to identify changes in the situation in order, for example, to check the effect of measures.
Methicillin-resistant Staphylococcus aureus / MRSA	MRSA is the term used to refer to a variation of the Staphylococcus aureus bacterium which is resistant to beta-lactam antibiotics and other classes of antibiotics. MRSA strains are further classified into groups according to where they are most frequently found, i.e. 'hospital-associated', 'community-associated' and 'livestock-associated'.
Multi-resistance	Bacteria are defined as multi-resistant if they are resistant to various antibiotics from different substance classes.
One Health principle / approach	The One Health principle is an integrative approach in which national and international cooperation among various disciplines is intended to achieve the best possible effect on human and animal health and the environment.
Pathogenic organisms	A pathogen is defined as an organism that causes disease.

Penicillin	In 1928 Alexander Fleming discovered that fungi of the <i>Penicillium</i> genus kill germs. The antibiotic developed as a result, penicillin, is the oldest antibiotic in clinical use. Penicillin was the first drug available to doctors to treat infectious diseases. It has a relatively narrow spectrum of action, and many bacteria are naturally resistant to penicillin. However, it can still be used successfully to treat various diseases. A number of derivatives have been developed from this active ingredient. They all belong to the penicillins class.
Prevalence	The frequency of a disease or symptom in a population at a given time.
Prevention	Preventing or minimising future disorders, impairments or damage in order to prevent problems. The aim of disease prevention is to apply targeted measures in order to prevent the occurrence of disease.
Prophylactic use of medicinal products	Medicinal products are used as prophylaxis in order to prevent the development of a potential disease before clinical symptoms are present. This preventive use takes place at times when experience shows that there is a higher than usual risk of infection.
Reserve antibiotic(s)	Reserve antibiotics are special antibiotics that should only be used to treat infections caused by resistant pathogens.
Secondary infection	A secondary infection, also known as «superinfection», is an infection in which a second pathogen, different from the first pathogen, attacks an organism which already has an infection («primary infection») caused by another pathogen. For example, a viral infection of the respiratory tract can make it easier for bacterial pathogens to colonise mucous membranes which are already damaged.
Selection pressure	This is the term used to describe a situation in which certain environmental factors affect the survival of a population. When bacteria come into contact with a certain antibiotic, only those which are resistant to that antibiotic survive and reproduce. This means that the antibiotic leads to selection of resistant organisms.
Sentinella reporting system	The Sentinella reporting system is a human health co-project between GPs and the Federal Office of Public Health. It involves 150 to 200 general practitioners, internal medicine specialists and paediatricians with a practice focusing on general medicine. It collects epidemiological data and monitors communicable and other acute conditions, and carries out research in general medicine. The Sentinella reporting system also looks into issues relating to the use of antibiotics, whether they are being used appropriately, and the development of resistance.
Stakeholder	A stakeholder is defined as an individual or group with a justified interest in the course or outcome of a process or project.

Streptomycin	Streptomycin is a broad-band antibiotic in the aminoglycoside class. It is an old antibiotic that is hardly ever used in humans nowadays. However, it is still used to control fire blight in apples and pears.
Surveillance	Surveillance is a three-stage process, the first of which consists of identifying and recording diseases (monitoring). In the second stage the data obtained are assessed. After this, consideration is given to what measures need to be taken to contain or prevent a medical problem such as an infectious disease.
Tetracycline(s)	Tetracyclines belong to the category of antibiotics that inhibit the growth of bacteria. They are a relatively old class of antibiotics and have a broad spectrum of action. Their efficacy is particularly important in controlling certain problem organisms, including some MRSA strains.
Substance class	Antibiotics are placed in certain classes according to their mechanisms of action and chemical structure.
Zoonosis	Zoonoses are infectious diseases that can be transmitted between humans and animals.

6.3 Overview of prime responsibilities and partners in implementation

Proposed measure	Prime responsibility⁶⁹	Partners in implementation
Comprehensive monitoring	The Confederation, (reference) laboratories	The cantons, communes, the veterinary and medical professions, healthcare facilities, pharmacies, anresis.ch, universities/universities of applied science and the Swiss Soil Monitoring Network (NABO).
Reference laboratories	The Confederation, learned societies	(Reference) laboratories, learned societies, associations, Swissmedic, QUALAB
Standardised and targeted antibiotic resistance tests	The Confederation, learned societies, reference laboratories	The medical profession, laboratories
Healthcare-associated infections	The Confederation, cantons	The veterinary and medical professions, healthcare facilities, health insurance funds, learned societies, associations and universities/universities of applied science.
Laboratory tests with a strong practical emphasis	The Confederation, learned societies, reference laboratories, industry	The veterinary and medical professions, healthcare facilities, reference laboratories, industry
Vaccination promotion	The Confederation, cantons	The Institute for Virology and Immunology (IVI), the veterinary and medical professions, pharmacists, health insurance funds, animal health services
Improving husbandry	The Confederation	Associations, animal health services, training facilities
Improving animal health	The Confederation	universities/universities of applied science, the veterinary profession, specialists, animal health services, associations
Advising livestock farmers	The Confederation	universities/universities of applied science, learned societies, associations, animal health services, education facilities, industry
Research and production facilities	The Confederation, cantons	Companies and institutions concerned
Prescription guidelines	Learned societies with the support of the Confederation	The veterinary and medical professions, universities/universities of applied science, associations, specialists

⁶⁹ This refers to responsibility for initiating and coordinating the implementation activities, but not to responsibility for funding or enforcement. The allocation of prime responsibility does not alter existing responsibility arrangements. Responsibility for enforcement and funding are determined according to existing task and responsibility arrangements in the context of the implementation of the proposed measures.

Restriction	The Confederation	The cantons, the veterinary and medical professions, pharmacists, universities/universities of applied science, learned societies
Expertise	The Confederation, cantons	universities/universities of applied science, the veterinary and medical professions, learned societies, animal health services, associations
Above-average use of antibiotics	The Confederation, cantons	The veterinary and medical professions, associations, health insurance funds, animal health services, universities/universities of applied science
Prevent the introduction and spread of resistance	The cantons (human medicine), the Confederation (veterinary medicine), healthcare facilities, specialists	The cantons, industry, the veterinary profession
Targeted outbreak control	The Confederation, cantons	Healthcare facilities, the veterinary and medical professions, animal health services
Food chain	The Confederation, cantons	Consumer associations, the Food Safety Institute of Zurich University
Waste water purification facilities	The Confederation, cantons	Communes
Interdisciplinary platform	The Confederation	The cantons, universities/universities of applied science, private institutions, industry
Creating the terms of reference	NABO, Agroscope	universities/universities of applied science
New diagnostic methods	Industry, universities/universities of applied science, reference laboratories	The cantons, learned societies, the Confederation
Transport of people, animals and goods	The Confederation	The cantons, universities/universities of applied science
cross-sector coordination body	The Confederation	The cantons, stakeholders concerned and institutions
Consultative expert body	The Confederation	Specialists
Strengthening involvement of stakeholders	The Confederation	Learned societies, specialists
Networks with other countries	The Confederation	National (learned societies, reference laboratories etc.) and international organisations
Support for developing countries	The Confederation	Will vary according to the nature of the individual projects
Public information	The Confederation	The cantons, healthcare facilities, pharmacists, consumer associations, learned societies, the media
Raise awareness among stakeholders affected	The Confederation	Healthcare facilities, learned societies, agricultural and sectoral associations affected

Basic and further training	The Confederation, learned societies	The cantons, training facilities, specialists
Market mechanisms and incentive systems	The Confederation	The cantons, associations, learned societies, private stakeholders
General conditions for studies	The Confederation	Universities/universities of applied science, private institutions
Improve the availability of antibiotics	The Confederation	Industry, Swissmedic
Strengthen enforcement	The Confederation, cantons	
Targeted programmes	The Confederation, cantons	Learned societies, healthcare facilities, the veterinary and medical professions

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